THE WAROX PROJECT UPDATE

Presented By:

The Giant WAROX Project Team

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JULY 1989

Introduction

Mining operations at Giant began in 1948 but prior to this, metallurgical testwork showed that the complex ore would require special treatment to liberate the gold from the arsenopyrite with which it was intimately associated. In those days, the most practical treatment for refractory sulphide ores was autogenous roasting of the concentrate followed by calcine cyanidation. This was the process that was selected for Giant and, though equipment modifications have been made over the years, this is still the preferred method.

Roasting of arsenopyrite concentrates results in the formation of impure arsenic trioxide vapours which are subsequently condensed and captured as a byproduct in fabric filters. Arsenic bearing dust from roaster exhaust gas has been stored in underground chambers at Giant since 1951 and today there are some 214,000 tons of dust in storage, containing approximately 127,000 oz. Au and 166,000 tons arsenic trioxide.

Using current arsenic trioxide and gold prices, it is evident that the baghouse dust reserves have a considerable revenue potential. In recent years, other benefits of reclaiming baghouse dust from underground storage have been recognized and a number of activities have been undertaken that will now permit Giant to take advantage of its particularly favourable position as a major source of arsenic trioxide.

Some benefits that are expected from the reclaim program, despite the current soft market conditions, are as follows:

Sale of arsenic trioxide.

Sale of gold contained in baghouse dust.

Sale of gold contained in crown pillars in area surrounding arsenic storage chambers.

Eliminate necessity of providing storage for baghouse dust.

Eliminate what could be a long term environmental concern and an expensive abandonment project.

During the early 1980's, a serious effort was made to market a portion of the crude arsenic trioxide being produced at the time and a surface storage and bulk loading facility was built for the purpose. However, it was found that the product was incompatible with the client's process and shipments were stopped after a period of intermittent operation.

Prior to this, there was a major testing program done in 1979-80 to determine a practical means of upgrading the product to render it marketable and to recover the gold contained in the resulting residue. The testing program was quite comprehensive and involved pilot testing of the hot water leach/crystallization process that was subsequently installed at what is now the Nerco Con mine, as well as a series of fuming/condensation tests in lab scale done by Falconbridge Metallurgical Laboratory.

Both methods worked quite well on currently produced Giant baghouse dust, achieving product grades exceeding 99.4% As_2O_3 in the case of HWL and 99.7% using the fuming method.

Project Feasibility

Marketing

Before detailed planning of the process plant could begin, a marketing study to determine optimum production rates and to estimate project cash flow was necessary. Giant retained a marketing consultant with many years of experience in arsenic trioxide marketing and a comprehensive study was conducted. Terms of reference for the study were:

a) List of producers and capacities
b) List of major consumers and consumption quantities
c) Price history in USA and 5 year forecast for feasibility purposes
d) Delivered customers works price analysis
e) Market specifications
f) Transportation methodologies and costing
g) F.O.B. Giant price determinations
h) North American consumption history and 5 year projection of Giant's sales volumes for feasibility purposes.

Armed with information provided by the study, a detailed mining plan was produced that will permit Giant to most effectively reclaim dust from underground storage and permit access to the valuable crown pillar ore.

Naturally the wood preservative and pesticide markets, which are by far the largest users of As_2O_3, cannot absorb 166,000 tons of As_2O_3 all at once, but marketing studies indicate that it is possible to enter the market at a production rate of 7000 stpy, increasing to 15,000 stpy as market conditions permit.

Purification Process Development

Development of the fuming process for purification of baghouse dust has been the result of a thorough examination of alternative processes and market conditions. Giant has tested the hot water leach process and is familiar with the ammonia leach process used by at least one chemical manufacturer. It is Giant's opinion that, in most respects, the fuming process is superior; for example capital and operating costs are lower, operation is simplified, overall recoveries are better and gold bearing residues can be treated without fouling conventional leach circuits.

Fuming Process

In 1980, Giant approached Falconbridge Metallurgical Labs to conduct laboratory scale testwork to investigate the technical feasibility of fuming of baghouse dust to produce a high purity arsenic trioxide product.

A sample of baghouse dust of the following composition was provided for the test.

Wt%			
As_2O_3	Fe	SiO_2	Sb
91.5	1.8	3.4	0.14

FML Fuming Tests

Seven fuming tests were carried out with modifications following each test. In general, nitrogen was preheated indirectly to 600-700 deg C in a stainless steel heat exchanger and passed through a 1" stainless steel fluid bed reactor. A perforated S.S. sheet was used as a hearth plate. The arsenic bearing dust was fed with a fluidized bed feeder or pocket feeder into the fuming reactor. The off gases and entrained dust from the reactor were passed through a flanged copper cannister 6" dia X 12" long. At the flange there was a fibreglass cloth backed by a "Fibrefrax" felt filter paper, 1/8" thick.

In carrying out the tests, the furnace for the preheater was turned on and air was passed through the heat exchanger until the input air to the fuming reactor was at a constant maximum temperature, 600-700 deg.C. Nitrogen was then used to replace this for the final run. The dust was added batchwise to the feeder, which was then sealed and the feeding was begun.

Some conclusions determined from the testwork were as follows:

1. The fuming of arsenious oxide from Giant Yellowknife baghouse dust in a fluid bed reactor appears to be technically feasible

2. Product purity is excellent at 99.7% As_2O_3. Fe ranged from 0.006 to 0.009%, Zn <0.001 to 0.002% and Sb 0.06%

3. The fluidizer was quite clean after each test showing no signs of deposits in and around the dust entry point. The sand bed was virtually the same after each run as at the beginning with no sign of ash fusing to the bed.

4. Pressure drop across the hot filter rose continuously throughout the tests, partially through intermittent overfeeding of the reactor and partially through condensation of arsenic trioxide between the "Fibrefrax" filter and the S.S. support plate. Temperatures maintained at >300 deg.C appear to be adequate to prevent condensation of As_2O_3 in the hot filter.

5. Elutriation tests showed that even at 0.50 m/sec space velocity, only 50% of the dust is lost in 10 minutes, from a -14 + 65 m sand bed.

Research Productivity Council - Pilot Fuming Test

Following the FML testing, a rudimentary design and flowsheet for a 100 lb/hr pilot plant was produced. This design formed the basis for pilot testing performed by RPC during the summer of 1988.

Research and Productivity Council is a commercial testing facility in Fredericton, N.B. that was set up in 1962 and originally funded by the provincial government. It now operates independently and recovers operating costs by charging fees for its work. RPC has developed an expertise in fluid bed technology over the past 15 years and now has a number of various sized fluid bed reactors available for pilot testing. In addition to roasting of complex base metal sulphides, RPC has examined a number of other fluid bed processes including removal of arsenic from copper concentrates and roasting of antimony sulphide to produce an upgraded antimony oxide product.

In August of 1987, Giant examined the feasibility of building and staffing a pilot plant on site. It quickly became apparent that a pilot plant with the degree of sophistication required would be very expensive. It would also be difficult to staff with full time professionals. In considering alternatives, RPC was contacted and discussions indicated that pilot testing in RPC's facility would be preferable to building and operating a plant on site. Details for doing the testwork were ironed out and approximately 12 tons of baghouse dust collected from various locations underground were sent to New Brunswick as feed for the plant.

Pilot Plant Description

One of the fluosolids reactors at RPC, a 6" dia. model, was just the right size for the test program, capable of operating at a 1.2 ft/sec space velocity and a 20 - 30 lb/hr feed rate. Major modifications to the plant were required however and as a consequence, a rather lengthy delay to permit design, fabrication and installation of the specialized equipment was experienced.

Eventually plant modifications were complete and shakedown testing began in May, 1988. The plant equipment consisted of the following:

A 1 ton feed bin equipped with a vibrating bottom and a variable speed screw feeder

A fluosolids reactor with a 6" dia X 60" deep bed section and a 8" dia. X 96" freeboard. A selection of bed overflow heights was available

A propane burner to provide a hot, relatively inert gas stream to the windbox of the reactor

A hot baghouse equipped with 3M "Nextel" bags capable of operating at temperatures up to 1250 deg. F..

A condenser consisting of a S.S. cylinder through which the hot gas was introduced axially at one end, blending with cold air injected tangentially at several points along the length of the cylinder

A cold baghouse of conventional design

A rotary vacuum blower downstream of the baghouse

A wet gas scrubber using ferric sulphate solution as the scrubbing medium.

Pressure and temperature sensors throughout the system

Fuming Process Pilot Plant Results

Operation of the pilot plant was very successful, product grades exceeding 99.5% As_2O_3 being consistently achieved regardless of feed grade. Arsenic recoveries ranged from 99.6 to 99.9% with arsenic trioxide concentrations in the hot baghouse residue ranging from 1% to 5%.. After some initial shakedown problems with hot baghouse leaks, reactor feed line plugging and accretions of arsenic forming in the condenser, the plant proved to be very flexible and forgiving, permitting a wide range of operating conditions with few circuit upsets.

Testwork on gold bearing residues from the HWL pilot plant yielded recoveries of approximately 85% but these should not be directly compared with what recoveries might be expected from fuming plant residues. Gold recovery was not included in the FML lab scale fuming testwork but RPC pilot testwork indicates that recoveries in the high 80's can be expected.

Shipping

The largest markets for the product (which will be marketed as WAROX, an acronym for White ARsenic OXide) are in the southeastern United States, and to deliver large quantities of product to these locations, shipping costs are a major consideration.

Upon investigating various shipping alternatives, it became clear that bulk rail shipments are the most economical alternative. Not all customers are set up to receive rail shipments but most of the large plants can do so.

For this reason, Giant has included a truck to rail transfer facility in the arsenic reclaim project. Ideally, the transfer should take place as close to the railhead as possible and for Giant, this location is near the community of Enterprise, about 280 miles from Yellowknife. A drum packaging plant has also been included in the design to serve customers not prepared to take delivery of bulk shipments.

Marketing studies

Results of the various studies have been extremely encouraging, the marketing study indicating that a ready market for high grade product exists and is expected to improve, the fuming testwork proving the superiority of the methodology over alternate purification techniques.

To test the market for purified As_2O_3, samples of the product were sent to potential clients throughout the United States for evaluation purposes. The excellent quality of the product (>99.5% As_2O_3) combined with the reliability of the source and the low cost of production, has provided Giant with a marketing advantage not enjoyed by other suppliers.

Purification of crude baghouse dust has been thoroughly examined over the past 10 years and there is now little doubt that fuming technology provides a very efficient means of purification while liberating gold values from the feed. This has been clearly demonstrated in lab scale testwork followed by large scale pilot testing. The pilot plant, even though testing a brand new technology, proved to be a very flexible, very smooth operation, achieving good quality product right from startup. Though some design problems were experienced, these were easily corrected and it is expected that scaleup of the plant to full size will result in a plant equally efficient and forgiving.

Reserves

Inventory of crude dust in storage underground is shown in the following table: The table is in order of increasing gold content.

Stope	Tons Dust	As %	Au oz/t	Tons As_2O_3	Ounces Gold
B2-30/36	64,157	45.69	1.22	38,705	78,272
B2-12/13/14	65,355	61.75	0.452	53,287	29,540
B2-08	32,369	65.66	0.354	28,063	11,459
C-12	18,679	65.15	0.172	16,068	3,213
B-11	3,084	68.42	0.134	2,786	413
C-10	10,548	66.00	0.133	9,172	1,403
C-9	20,276	67.48	0.124	18,066	2,514
Total				166,168	126,814

Reserves shown do not include the estimated 3500 tons of As_2O_3 and 280 oz Au to be produced annually as long as the mine is in operation.

In response to a recent query, Giant is presently preparing a proposal for shipment of this crude product to European markets.

Preproduction Schedule

Assuming that the project is approved during September, 1989, the preproduction schedule anticipates full scale production of purified product by Jan 1, 1991.

Construction of the Transfer Facility cannot begin until a suitable site has been leased. Negotiations with the Government of NWT, are proceeding and it is expected that early approval will be forthcoming. A number of meetings were held with residents of the community of Enterprise and a majority of the residents are in favour of the transfer facility being built near their community.

Mining Plan

In order to take best advantage of gold values in the crown pillars while maximizing returns from gold values contained in the baghouse dust, a number of factors must be considered. Probable mine life is one important consideration. Though the arsenic project is designed as a stand alone project, mining of the crown pillars must take place while the mine is still in operation, preferably within 5 or 6 years to be reasonably certain. At the same time, it is important to reclaim the dust containing the very high gold values first, to maximize cash flow during the early years of the operation. Fortunately these objectives will both be achieved under the current mining plan.

Metallurgical Testing

Metallurgical testing has been exceptionally comprehensive, beginning with a stope drilling/sampling program in 1981 to identify reserves and culminating in a large scale pilot purification test to prove the technical feasibility of the fuming process. As a result, very few questions regarding the treatment process remain to be answered.

From the drilling program, quality of baghouse dust in storage was determined through collection and assay of more than 40 samples, summarized in the following table.

The gold values obtained from the sampling program were confirmed by a review of the gold assays for the periods during which the baghouse dust was placed.

Stope Number	Depth Sampled	Number of Samples
B2-08	64 ft	5
B2-30	52 ft	3
B2-33	109 ft	6
B2-34	82 ft	7
B2-35	108 ft	5
B2-36	93 ft	4
C-9	133 ft	12

In addition, samples of baghouse dust from current production and from stopes B2-14 and B2-35 were tested, current production dust only in lab scale while the pilot test used dust from all three sources. In all cases, operation of the plant was trouble free, yielding high purity product at good gold and arsenic recoveries.

Production Schedule

As indicated earlier, preproduction scheduling anticipates plant production by January, 1991. Once the plant is in operation, optimization will take place over the next several months, though it is expected that the plant will be capable of exceeding demand right from the beginning. As Giant's market share increases, product demand and plant production will increase until plant capacity is achieved at about 7,000 tpa.

Process Description and Design Criteria

Fuming Process Description

The flowsheet that has been developed as a result of FML laboratory testing and RPC's pilot test is quite simple, the key component being the hot baghouse in which a highly efficient vapour/solids separation takes place.

Crude baghouse dust, either from current production or from underground storage (fig.6), is fed dry into the freeboard of the fuming reactor via a conveyor belt and slinger feeder. Feedrate can vary from 25 to 50 lbs/min without equipment modification.

The fluid bed fuming reactor consists of a firing chamber producing combustion gases at 1650 deg F by burning propane introduced via the tuyeres into the sand bed. The hot combustion gases serve as a fluidizing medium and a heat carrier to supply the necessary heat for fuming. The temperature in the fluid bed is maintained in the range of 800 to 900 deg F by modulating the feed input.

The flue gases leaving the fluidizer pass through a cyclone to recycle the sand fluid bed media and then to a high temperature filter equipped with heat resistant sintered metal filter elements to capture the fine residue. The purified gas containing the arsenic oxide vapours are cooled by direct contact with ambient air of sufficient quantity to cool the gases to 220 deg F and condense the arsenic trioxide. The cooled gases carrying the solid arsenic trioxide pass through a baghouse to collect the dust, while the clean gases are exhausted to the stack. The purified arsenic trioxide is then removed to the pelletizing plant for further processing and finally to the product silo for delivery to market.

The fine dust collected in the hot filter is removed and directed to an existing mill cyanidation circuit for gold recovery. Since the quantity of this dust is normally quite small, only intermittent dumping is required.

Gold Recovery

The residue collected in the hot filter contains at least 99% of the gold originally contained in the dust, along with particulates of iron, silica, etc.. The weight of residue collected is inversely proportional to the As_2O_3 concentration in the baghouse dust, which can vary from

<60% to >90%. Gold concentrations in the residue can range from 1.5 to 6.0 oz./t. and is processed in the existing Cottrell dust CIL circuit without further treatment.

Civil Works and Utilities

Plant design utilizes existing equipment wherever possible and location of the purification plant takes advantage of the proximity of feedstock reserves and environmental control equipment. Electrical power requirements are relatively minor and the largest energy consumer in the plant is the fuming reactor, which uses fuel oil or propane as a heat source.

Very little water is used in the plant, domestic requirements being the major consumer. A small amount of water is used to slurry the gold bearing hot baghouse product in preparation for pumping to the mill for further processing.

Capital and Operating Cost Estimates

The following cost estimates were prepared by Fenco Engineering from data obtained from Giant during a site visit in late 1988.

Capital Costs

Underground Reclaim	*$860,000
Purification Plant	6,100,000
Transfer Facility	2,500,000
Total	$9,460,000

* Does not include underground development (est $600,000)

10,000,000

Operating Costs

Underground Reclaim	$0.018
Purification Plant	0.111
Transfer Facility	*0.039
Total	$0.168

* Does not include shipping costs (est. $0.066/lb)

23.4

Appendix A

Capital and Operating

Cost Summaries

7.0 CAPITAL COSTS

7.1 Estimating Methodology

Equipment prices for the three project areas were assembled based on vendor quotes and in-house data. Equipment lists are shown in Tables 7.1, 7.2, and 7.3.

Civil structural take-offs from layouts were used for building costs. Factors were then developed for the other areas in the estimates to produce capital costs for the three project areas.

The following exclusions apply:

i) Roads, other than 1.3 km road to Transfer Facility
ii) WAROX tanker trucks
iii) Underground development
iv) Interest during construction
v) Working capital
vi) Loss of production related to construction
vii) Environmental investigations or hearings
viii) Permits and approvals
ix) Expanded mill facilities to recover gold from WAROX plant, if required
x) Pre-production marketing expenses
xi) Costs for testwork
Xii) Land
xiii) Owner's Project Team costs

~~7.2~~ ~~Cost Estimates~~

~~The~~ factored cost ~~estimates~~ are ~~shown in Tables~~ 7.4, 7.5 and 7.6. ~~Costs for the three areas are as follows~~:

i)	Underground Reclaim	=	0.86 million dollars
ii)	Process Plant	=	6.10 million dollars
iii)	Transfer Facility	=	2.5 million dollars
	TOTAL:		9.46 million dollars

7.2 Cost Estimates

The factored cost estimates are shown in Tables 7.4, 7.5 and 7.6. Costs for the three areas are as follows:

i)	Underground Reclaim	=	0.86 million dollars
ii)	Process Plant	=	6.10 million dollars
iii)	Transfer Facility	=	2.5 million dollars
	TOTAL:		9.46 million dollars

TABLE 7.1
UNDERGROUND RECLAIM EQUIPMENT LIST

EQUIPMENT NO.	DESCRIPTION	DIMENSIONS	MATERIAL	CAPACITY	H.P.	$ CAN	COMMENTS
30-21-01	F-K PUMP BLOWER		C.S.		125	$0	INCL W/E 30-37-01
30-22-01	PNEUMATIC LIFT HOSE/REEL		C.S./RUBBER		0	$25,000	
30-22-02	LIVE BOTTOM FEEDER		C.S.	7.5 STPH	0	$10,000	
30-22-03	SCREW CONVEYOR		C.S.	7.5 STPH	10	$7,000	
30-22-04	DRAG CONVEYOR		C.S.	7.5 STPH	15	$98,000	
30-22-05	SCREW TRANS CONVEYOR		C.S.	7.5 STPH	15	$12,000	
30-24-01	ROTARY VALVE	10 x 11.5	C.S.	10 STPH	2	$0	INCL W/E 30-37-01
30-30-01	CLAMSHELL/CRANE		C.S.	5 TON	15	$62,000	QUOTATION PENDING
30-30-02	WINCH SET		C.S.	2000 LB	3	$12,400	SET OF TWO UNITS
30-32-01	AERATION COMPRESSOR		C.S.		100	$0	INCL W/E 30-37-01
30-32-02	VACUUM PUMP		C.S.		100	$0	INCL W/E 30-37-01
30-34-01	FILTER RECEIVER		C.S.		0	$0	INCL W/E 30-37-01
30-37-01	FULLER-KINYON PUMP		C.S.	10 STPH	50	$212,000	

PAGE TOTAL $438,400

TABLE 7-2
WARDX PLANT EQUIPMENT LIST

EQUIPMENT NO.	DESCRIPTION	DIMENSIONS	MATERIAL	CAPACITY	H.P.	$ CAN	COMMENTS
31-20-01	DUST QUENCH TANK AGITATOR		C.S.		1	$1,500	INCL. MOTOR
31-21-01	FEED BIN AERATION BLOWER		C.S.	1200 CFM	75	$28,000	PAD AIR SOURCE
31-21-02	PROD. BIN AERATION BLOWER		C.S.		0	$0	EXISTING
31-22-01	CRUDE FEED BIN CONVEYOR	6'' D	POLYPROP./C.S.	7.5 STPH	3	$64,000	TUBULAR CONVEYOR
31-22-02	ROASTER FEED BIN CONVEYOR	6'' D	POLYPROP./C.S.	4.5 STPH	3	$52,000	TUBULAR CONVEYOR
31-22-03	U.G. MASS WEIGH FEEDER		C.S.	4.5 STPH	1	$32,100	
31-22-04	BAGHS MASS WEIGH FEEDER		C.S.	3.5 STPH	1	$32,100	
31-22-05	RSTR SCREW FEEDER	4''Dx 10'	C.S.	1.5 STPH	3	$31,000	
31-22-06	BAGHSE As TRANSF. SCREW	6''Dx 20'	C.S.	1 STPH	5	$4,700	
31-22-07	COMPACTOR BUCKET ELEVATOR	6''X14''	C.S.	2 STPH	1	$0	INCL W/E 31-47-02
31-22-08	COMPAC. MIXER SCREW FDR.		C.S.	1.5 STPH	1	$0	INCL W/E 31-47-02
31-22-09	COMPACTOR MIXER		C.S.	1.5 STPH	15	$0	INCL W/E 31-47-02
31-22-10	COMPACTOR SCREW FEEDER		C.S.	1.5 STPH	6	$0	INCL W/E 31-47-02
31-22-11	GRANUL. ASENIC CONVEYOR	3'' D	C.S.	1.0 STPH	2	$28,000	TUBULAR CONVEYOR
31-22-12	PROD. SILO CONVEYOR	3'' D	C.S.	1.0 STPH	2	$42,000	TUBULAR CONVEYOR
31-22-13	TRUCK LOADING CONVEYOR		C.S.		5	$0	EXISTING
31-22-14	FEED BLENDER		C.S.	4.5 STPH	3	$23,000	
31-22-15	BIN DISCHARGER	12'D	C.S.		8	$20,000	
31-22-16	BIN DISCHARGER	8'D	C.S.		3	$12,000	
31-22-17	BIN DISCHARGER	8'D	C.S.		3	$12,000	
31-23-01	U.G. ARSENIC STG. BIN	18'Dx30'S.S	C.S.	200 TON	0	$102,000	60 DEG CONE
31-23-01A	AERATION PADS	10''x10' L	C.S.		0	$3,000	SET OF 4
31-23-02	BGHSE. ARSENIC STG. BIN	16'Dx22'S.S	C.S.	100 TON	0	$75,000	60 DEG CONE
31-23-02A	AERATION PADS	10''x10' L	C.S.		0	$3,000	SET OF 4
31-23-05	RSTR FEED DAY BIN	12'Dx16'	C.S.	40 TON	0	$30,000	
31-23-06	COMPACTOR SURGE BIN	8'Dx 6'	C.S.	6.5 TON	0	$7,000	

PAGE TOTAL $602,400

TABLE 7-2
WARDX PLANT EQUIPMENT LIST

EQUIPMENT NO.	DESCRIPTION	DIMENSIONS	MATERIAL	CAPACITY	H.P.	$ CAN	COMMENTS
31-23-07	COMPAC. MIXER FD. HOPPER		C.S.		0	$0	INCL W/E 31-47-02
31-23-08	COMPACTOR FEED HOPPER		C.S.		0	$0	INCL W/E 31-47-02
31-23-09	PACKING BIN	8'Dx12'	C.S.	20 TON	0	$15,000	
31-23-10	PRODUCT SILO		C.S.	700 TON	0	$0	EXISTING
31-24-01	RSTR FEED ROTARY VALVE	6''D	C.S.	1.5 STPH	1	$5,000	
31-24-02	U.S.STG BIN ISOLA'N VALVE	10''	S.S.		0	$3,800	AIR OPERATED
31-24-03	PACKING BIN ROTARY VALVE	6'' D	C.S.	3 STPH	1	$5,000	
31-24-04	BGHS STG BIN ISOLA'N VALV	10''	S.S.		0	$3,800	AIR OPERATED
31-24-05	RSTR DAY BIN ISOLA'N VALV	6''	S.S.		0	$1,400	AIR OPERATED
31-24-06	HOT BAGHSE ROTARY VALVE	6''D	C.S.	0.6 STPH	1	$5,000	
31-24-07A	HOT ESP ISOLATION VALVE	10''	S.S.		0	$0	EXCLUDED
31-24-07B	HOT ESP ISOLATION VALVE	10''	S.S.		0	$0	EXCLUDED
31-24-08A	HOT ESP BY-PASS VALVE	10 ''	S.S.		0	$0	EXCLUDED
31-24-08B	HOT ESP BY-PASS VALVE	10 ''	S.S.		0	$0	EXCLUDED
31-24-09	CONDENSER FAN DAMPER	16'' FLUE	C.S.		0	$0	INCL W/E 31-26-02
31-24-10	STACK FAN DAMPER	16'' DUCT	C.S.		0	$0	INCL W/E 31-26-03
31-24-11	COMPACT. SURGE BIN VALVE	6''	S.S.		0	$1,400	AIR OPERATED
31-24-12	COMPACT. PRODUCT DIVERTER	6''	C.S.	1 STPH	0	$2,500	AIR OPERATED
31-24-13	PACKING BIN ISOLA'N VALVE	6''	C.S.		0	$1,400	AIR OPERATED
31-24-14	CYCLONE ROTARY VALVE	6''D	C.S.	0.3 STPH	1	$5,000	
31-26-01	FEED AREA VENT FAN		C.S.	2000 ACFM	8	$4,700	-9 ''W.C.
31-26-02	CONDENSER AIR FAN		C.S.	6000 ACFM	10	$11,500	4'' W.C.
31-26-03	STACK FAN		C.S.	5600 ACFM	50	$15,000	AT 107 C. -25'' W.C.
31-26-04	COMPAC. AREA BAGHOUSE FAN		C.S.	1000 ACFM	5	$3,400	-9'' W.C.
31-27-01	ROASTER HOT GAS GENERATOR		C.S./REFRACTORY	3600 ACFM	20	$55,000	AT 5 PSIG, 800 C
31-28-01	WET FEED DRYER		C.S.	7.5 STPH	10	$200,000	QUOTATION PENDING
				PAGE TOTAL		$338,900	

TABLE 7-2
WAROX PLANT EQUIPMENT LIST

EQUIPMENT NO.	DESCRIPTION	DIMENSIONS	MATERIAL	CAPACITY	H.P.	$ CAN	COMMENTS
31-28-02	FLUID BED REACTOR		C.S./REFRACT	1.5 STPH	0	$105,900	HOT GAS SUP 31-27-01
31-28-03	COMPRESSED AIR DRYER		C.S.	100 CFM	0	$0	INCL W/E 31-32-02
31-30-01	CRANE		C.S.	5 TON	11	$20,000	
31-32-02	UTILITY AIR COMPRESSOR		C.S.	100 CFM	25	$25,000	100 PSIG
31-34-01	GRANULATED ARSENIC SCREEN	24''x72''	C.S.		2	$0	INCL W/E 31-47-02
31-37-01	DUST TANK SLURRY PUMP		C.S./RUBBER	15 USGPM	3	$3,500	INCL. MOTOR
31-37-02	SUMP PUMP		DURIRON	15 USGPM	3	$1,900	
31-41-01	FEED AREA BAGHOUSE		C.S.	2800 ACFM	0	$12,000	QUOTATION PENDING
31-41-02	HOT BAGHOUSE		C.S.	1800 ACFM	0	$168,000	TWIN LINE
31-41-03	HOT ELECT'TIC PRECIP.		C.S.	1800 ACFM	0	$0	EXCLUDED
31-41-04	COLD (As) BAGHOUSE		C.S.	5500 ACFM	0	$20,000	QUOTATION PENDING
31-41-05	COMPACTOR AREA BAGHOUSE		C.S.	1000 ACFM	0	$6,000	QUOTATION PENDING
31-41-07	VACUUM CLEANER PACKAGE		C.S.		0	$5,500	
31-41-08	CYCLONE	18'' D	C.S.	1800 ACFM	0	$4,700	INSULATED
31-44-01	HOT GAS As CONDENSER		C.S.		0	$0	EXCLUDED
31-44-02	HOT DUST QUENCH TANK		C.S.	370 US GAL	0	$1,200	COVERED
31-45-01	AIR COMPRESSOR RECEIVER	30''D x84''	C.S.	35 CU FT	0	$0	INCL W/E 31-32-02
31-45-02	PROPANE STORAGE BULLET	9'Dx28'	C.S.	13,000 IGAL	0	$37,000	ASME VESSEL
31-47-01	RSTR FEED WEIGHTOMETER		C.S.	1.5 STPH	0	$7,000	
31-47-02	COMPACTOR		C.S.	1.5 STPH	15	$415,000	
31-47-03	GRANULATOR		C.S.	1.5 STPH	5	$0	INCL W/E 31-47-02
31-47-04	DRUM PACKING LINE		C.S.		10	$150,000	
31-47-05	TRUCK SCALE		C.S.		0	$0	EXISTING
31-48-01	PROPANE EVAPORATOR	3'x3'x12' H	C.S.	66 LB/HR	0	$80,000	ASME DESIGN

PAGE TOTAL $1,064,700

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GRAND TOTAL $2,006,000

88-11-25
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TABLE 7.3
TRANSFER PLANT EQUIPMENT LIST

EQUIPMENT NO.	DESCRIPTION	DIMENSIONS	MATERIAL	CAPACITY	H.P.	$ CAN	COMMENTS
32-22-01	BOOT LIFT	24''	C.S.		0	$6,400	
32-22-02	VIB. FEEDER		C.S.	10 STPH	5	$0	INCL W/E 32-22-03
32-22-03	TRANSFER CONVEYOR	18'' W	C.S.	10 STPH	10	$45,200	
32-22-04	BIN DISCHARGER	12'D	C.S.	80 STPH	8	$20,000	
32-22-05	FLEX. SCREW CONVEYOR		C.S.		3	$3,000	
32-23-01	DUMP HOPPER		C.S.		0	$0	
32-23-01	DUMP HOPPER		C.S.		0	$1,000	
32-23-02	RAIL LOAD-OUT BIN	12'Dx22' SS	C.S.	100 TON	0	$45,000	
32-24-01	KNIFE GATE	12 ''D	S.S.	80 STPH	0	$4,000	AIR OPERATED
32-24-02	LOADING SPOUT		C.S./POLY	80 STPH	1	$8,100	
32-24-03	ROT [illegible]IRLOCK	6''	C.S.		1	$5,000	
32-26-01	VENTILATION BAGHOUSE FAN		C.S.	2500 ACFM	5	$3,400	
32-30-01	CAR PULLER		C.S.	5000 LB	3	$5,700	
32-32-01	AIR COMPRESSOR		C.S.	25 CFM	10	$10,000	
32-37-01	OIL PUMPS		C.S.	10 USGPM	1	$2,500	
32-38-01	DIESEL GENERATOR		C.S.	250 KW	0	$55,000	
32-38-02	MOBILE VACUUM CLEANER		C.S.		0	$98,000	C/W P/U TRUCK
32-38-03	DIESEL GENERATOR		C.S.	25 KW	0	$15,000	
32-41-01	VENTILATION BAGHOUSE		C.S.	2500 ACFM	0	$12,000	
32-44-01	OIL TANK		C.S.	5000 USGAL	0	$3,500	API DESIGN
32-47-01	TRACK SCALE		C.S.	100 TON	0	$80,000	

PAGE TOTAL $422,800

TABLE 7.4

FACTORED CAPITAL COST ESTIMATE

UNDERGROUND RECLAIM

	THOUS. $
Purchased Equipment Costs	438
Equipment Installation	95
Process Piping (Materials and Labour)	65
Electrical (Materials and Labour)	80
Instrumentation (Materials and Labour)	35
Plant Services	25
Site Improvements (Allowance)*	-
Field Expenses Related To Construction Management	26
Project Management (Including Engineering and Construction)	86
Fixed Capital Cost	865
Contingency**	-
TOTAL:	865
	Say 860

* Underground development is excluded as discussed in Section 7.1

** Estimate is ±25% hence a contingency is not included.

TABLE 7.5

FACTORED CAPITAL COST ESTIMATE

WAROX PLANT

	THOUS. $
Purchased Equipment Costs	2,006
Equipment Installation	301
Process Piping (Materials and Labour)	281
Electrical (Materials and Labour)	401
Instrumentation (Materials and Labour)	361
Process Buildings (Including Mechanical Services)	1,930
Auxiliary Buildings (Including Mechanical Services and Lighting)	40
Plant Services	Incl.
Site Improvements	46
Field Expenses Related To Construction Management	120
Project Management (Including Engineering and Construction)	610
Fixed Capital Cost	6,095
Contingency*	-
TOTAL:	6,095
	Say 6,100

* Estimate is ±25% hence a contingency is not included.

TABLE 7.6

FACTORED CAPITAL COST ESTIMATE

TRANSFER PLANT

	THOUS. $
Purchased Equipment Costs	423
Equipment Installation	63
Process Piping (Materials and Labour)	34
Electrical (Materials and Labour)	42
Instrumentation (Materials and Labour)	34
Process Buildings (Including Mechanical Services)	920
Plant Services	Incl.
Site Improvements	750
Field Expenses Related To Construction Management	25
Project Management (Including Engineering and Construction)	254
Fixed Capital Cost	2,545
Contingency*	-
TOTAL:	2,545
	Say 2,500

* Estimate is ±25% hence a contingency is not included.

8.0 OPERATING COSTS

8.1 Methodology

Operating costs are estimated based on the unit rates shown in Table 8.1. Personnel required to staff the project areas are included and supervision factored on the cost of operators.

Indirect costs covering corporate overheads are excluded. Depreciation is also excluded.

8.2 Costs

Costs to operate the three project areas are separated into Tables 8.2, 8.3 and 8.4.

The direct operating cost for the three areas totals 18 cents per pound at a production rate of 7000 s.ton per year.

TABLE 8.1

UNIT RATES FOR OPERATING COSTS

Propane (¢/L)	21
Fuel Oil (¢/L)	24
Electricity (¢/kWh)	7
Labour ($/hr. salary)	17
Payroll Overhead (% of salary)	35
Maintenance Labour (% of capital)	2
Maintenance Materials (% of capital)	2
Taxes (% of capital)	1
Insurance (% of capital)	1

TABLE 8.2

ESTIMATED DIRECT ANNUAL OPERATING COST - UNDERGROUND RECLAIM

Item	Annual Cost Thou. $	Cost per Pound Product $
Process Material Cost:		
Raw Materials:	N/C	
Utilities:		
Electric Power @ ¢7 kWh	71	
Direct Labour:		
Labour @ $17/h (ID/S)	35	
Supervision, 15% of labour	5	
Sub-total:	40	
Plant Maintenance:		
Labour	30	
Supervision, 20% of maint. labour	6	
Materials	30	
Sub-total:	66	
Payroll Overhead:		
35% of above payroll	29	
Operating Supplies:		
20% of plant maintenance	13	
Sub-total:	42	
Indirect Costs:	EXCLUDED	
Other Costs:		
Taxes, 1% of total plant cost	15	
Insurance, 1% of total plant cost	15	
Sub-total:	30	
TOTAL UNDERGROUND OPERATING COST:	249	1.8

TABLE 8.3

ESTIMATED DIRECT ANNUAL OPERATING COST - WAROC PROCESS PLANT

Item	Annual Cost Thou. $	Cost per Pound Product $
Process Material Cost:		
Raw Materials:	N/C	
Utilities:		
Electric Power @ ¢7 kWh	136	
Propane @ $.21/L (plant heating & drying)	30	
Propane @ $.21/L (process)	102	
Sub-total:	268	
Direct Labour:		
Labour @ $17/h, 1 on D/S, 4x2 per shift	431	
Supervision, 15% of labour	65	
Sub-total:	496	
Plant Maintenance:		
Labour, 2% of capital	160	
Supervision, 20% of maint. labour	32	
Materials, 2% of capital	160	
Sub-total:	352	
Payroll Overhead:		
35% of above payroll	241	
Operating Supplies:		
20% of plant maintenance (incl. drums)	70	
Sub-total:	352	
Indirect Costs:*	EXCLUDED	
Other Costs:		
Taxes, 1% of total plant cost	60	
Insurance, 1% of total plant cost	60	
Sub-total:	120	
TOTAL PROCESS PLANT OPERATING COST:	1,547	11.1

*Note: Processing of additional arsenic in tails is reported as $98,000 per year by GYML.

TABLE 8.4

ESTIMATED DIRECT ANNUAL OPERATING COST - TRANSFER STATION

Item	Annual Cost Thou. $	Cost per Pound Product $
Process Material Cost:		
Raw Materials Delivery:		
Transfer @ $31.80/st.	223	
Utilities:		
Diesel Fuel Oil at $.12/kWh (250 kW)	88	
Diesel Fuel Oil at $.14/kWh (25 kW)	31	
Sub-total:	119	
Direct Labour:		
Labour @ $20/h (1 Operator/Custodian)	50	
Supervision, 15% of labour	8	
Sub-total:	58	
Plant Maintenance:		
Labour	30	
Supervision, 20% of maint. labour	6	
Materials	30	
Sub-total:	66	
Payroll Overhead:		
35% of above payroll	33	
Operating Supplies:		
20% of plant maintenance	13	
Sub-total:	46	
Indirect Costs, Corporate Overheads	EXCLUDED	
Other Costs:		
Taxes, 1% of total plant cost	15	
Insurance, 1% of total plant cost	15	
Sub-total:	30	
TOTAL TRANSFER OPERATING COST:	542	3.9

Appendix B

WAROX PROJECT

Economic Analysis

MEMORANDUM

TO: J. S. McAlpine, K. Blower

COPIES TO: G. Wolfe, K. Morton

FROM: Barbara Mossop, Planning Engineer

DATE: June 27, 1989

TOPIC: WAROX Project Economic Analysis @ $465/oz. Au

Two economic analyses have been performed on the WAROX Project for the condition of refining the dust at a rate of 7000 tons per year, although only selling 4500 tons of WAROX in the first year. The difference between the two analyses is that with the first analysis the transfer facility is not built at all, whereas in the second analysis it is built in the 1992/93 Fiscal Year. The Project is assumed to begin construction in January 1990 and production is assumed to begin in January 1991.

The following is a list of conditions used for both scenarios:

1. Arsenic trioxide production rate is 7000 tons per year.
2. WAROX sales: 1991 = 4500 tons
   1992 = 5000 tons
   1993 = 5500 tons
   1994 = 6000 tons
   1995 = 6500 tons
   1996+ = 7000 tons per year.
3. The arsenic trioxide not sold is stored underground.
4. The arsenic dust is removed from underground in the order of decreasing gold grades.
5. 2200 tons of current production is used for the plant start up.
6. The value of the antimony produced is not considered.
7. The value of gold is $465/oz. Cdn.
8. The value of As_2O_3 is $0.333/lb. Cdn.

The following table summarizes the results of these analyses:

	No Transfer Facility	Build Transfer Facility in 1992/93
Before Tax	(BUDGET3)	(BUDGET4)
NPV (9.5 Years)	$13,920,000	$14,889,000
Payback Period	1.1 Years	1.1 Years
IRR	84.8 %	81.0 %
After Tax		
NPV (9.5 Years)	$ 8,553,000	$ 8,969,000
Payback Period	1.3 Years	1.3 Years
IRR	61.7 %	58.0 %

3M

GIANT YELLOWKNIFE MINES LIMITED
WAROX PLANT
PRELIMINARY ECONOMIC STUDY (4500 - 7000 TPY AS2O3 SALES)

SUMMARY OF RESULTS

YEAR	1989/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/2000	TOTAL
PRODUCTION												
Tons Feed From Mill	0	2,305	0	0	0	0	0	0	0	0	0	2,305
Tons Feed From U/G	0	2,211	14,738	12,257	9,979	9,979	9,979	9,438	8,156	8,156	8,156	93,049
Tons Feed Processed	0	4,516	14,738	12,257	9,979	9,979	9,979	9,438	8,156	8,156	8,156	95,354
Tons As2O3 Produced	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
Tons As2O3 Sold	0	2,250	4,750	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	59,000
Ounces Gold Produced	0	3,655	26,885	13,605	6,506	6,506	6,506	4,595	2,454	2,454	2,454	75,620
REVENUES ($1,000)												
Revenue Arsenic	0	1,499	3,164	3,497	3,830	4,163	4,496	4,662	4,662	4,662	4,662	39,294
Revenue Gold	0	1,700	12,501	6,326	3,025	3,025	3,025	2,137	1,141	1,141	1,141	35,163
Total Revenue	0	3,198	15,665	9,823	6,855	7,188	7,521	6,799	5,803	5,803	5,803	74,457
Revenues/ton Feed	0	708	1,063	801	687	720	754	720	712	712	712	7,588
Revenues/ton As2O3	0	914	2,238	1,403	979	1,027	1,074	971	829	829	829	11,094
OPERATING ($1,000)												
Total Operating	0	1,674	3,595	3,774	3,953	4,132	4,311	4,400	4,400	4,400	4,400	39,038
Operating/Ton Feed	0	371	244	308	396	414	432	466	540	540	540	4,249
Operating/Ton Sold	0	744	757	719	687	661	639	629	629	629	629	6,721
Total Capital	3,780	3,780	0	69	0	0	95	75	0	0	0	7,799
Cash Flow Before Tax	(3,780)	(2,256)	12,070	5,980	2,902	3,056	3,115	2,324	1,403	1,403	1,403	27,620
Total Taxes	0	4	3,100	1,727	702	851	966	734	406	432	449	9,371
Net Cash Flow	(3,780)	(2,260)	8,970	4,253	2,200	2,206	2,149	1,589	997	971	954	18,249
Discount Rate	15.0%											
Aft Tax Discounted Cash Flow	(3,780)	(1,965)	6,783	2,797	1,258	1,097	929	598	326	276	236	8,553
Cum. Discounted Cash Flow	(3,780)	(5,745)	1,038	3,834	5,092	6,189	7,118	7,715	8,041	8,317	8,553	

BEFORE TAX

Net Present Value $13,920 of first 9.5 years of operation.

Payback Period 1.1 Years

IRR 84.81%

AFTER TAX

Net Present Value $8,553 of first 9.5 years of operation.

Payback Period 1.3 Years

IRR 61.7%

\WAROX\ECONOMIC\BUDGET3
NO TRANSFER FACILITY

GIANT YELLOWKNIFE MINES LIMITED
WAROX PLANT
PRELIMINARY ECONOMIC STUDY (4500 - 7000 TPY AS2O3 SALES)
PRODUCTION RATES AND PRODUCT PRICES

YEAR	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/1998	1998/99	1999/2000	TOTAL
VOLUME PARAMETERS												
Tons As2O3 Produced	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
Tons As2O3 Sold	0	2,250	4,750	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	59,000
Feed Grade As	73.00%	59.29%	36.33%	43.69%	53.66%	53.66%	53.66%	56.74%	65.66%	65.66%	65.66%	
Feed Grade As2O3	96.39%	78.29%	47.97%	57.69%	70.85%	70.85%	70.85%	74.92%	86.70%	86.70%	86.70%	
As Recovery	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	
Tons Feed	0	4,516	14,738	12,257	9,979	9,979	9,979	9,438	8,156	8,156	8,156	95,354
PRODUCTION DATA												
ARSENIC												
Feed % As2O3	96.39%	78.29%	47.97%	57.69%	70.85%	70.85%	70.85%	74.92%	86.70%	86.70%	86.70%	
Recovery (%)	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	
Tons As2O3	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
GOLD												
Feed Grade (oz/ton)	0.137	0.952	2.146	1.306	0.767	0.767	0.767	0.573	0.354	0.354	0.354	
Recovery (%)	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	
Ounces Gold	0	3,655	26,885	13,605	6,506	6,506	6,506	4,595	2,454	2,454	2,454	75,620
PRODUCT PRICES												
As2O3 / lb CDN	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	
Gold / oz CDN	465	465	465	465	465	465	465	465	465	465	465	
REVENUES												
As2O3	0	1,499	3,164	3,497	3,830	4,163	4,496	4,662	4,662	4,662	4,662	39,294
Gold	0	1,700	12,501	6,326	3,025	3,025	3,025	2,137	1,141	1,141	1,141	35,163
TOTAL REVENUES	0	3,198	15,665	9,823	6,855	7,188	7,521	6,799	5,803	5,803	5,803	74,457

Date Printed: 26-Jun-89

Engineering Department,Yellowknife Division.

\WAROX\ECONOMIC\BUDGET3
NO TRANSFER FACILITY

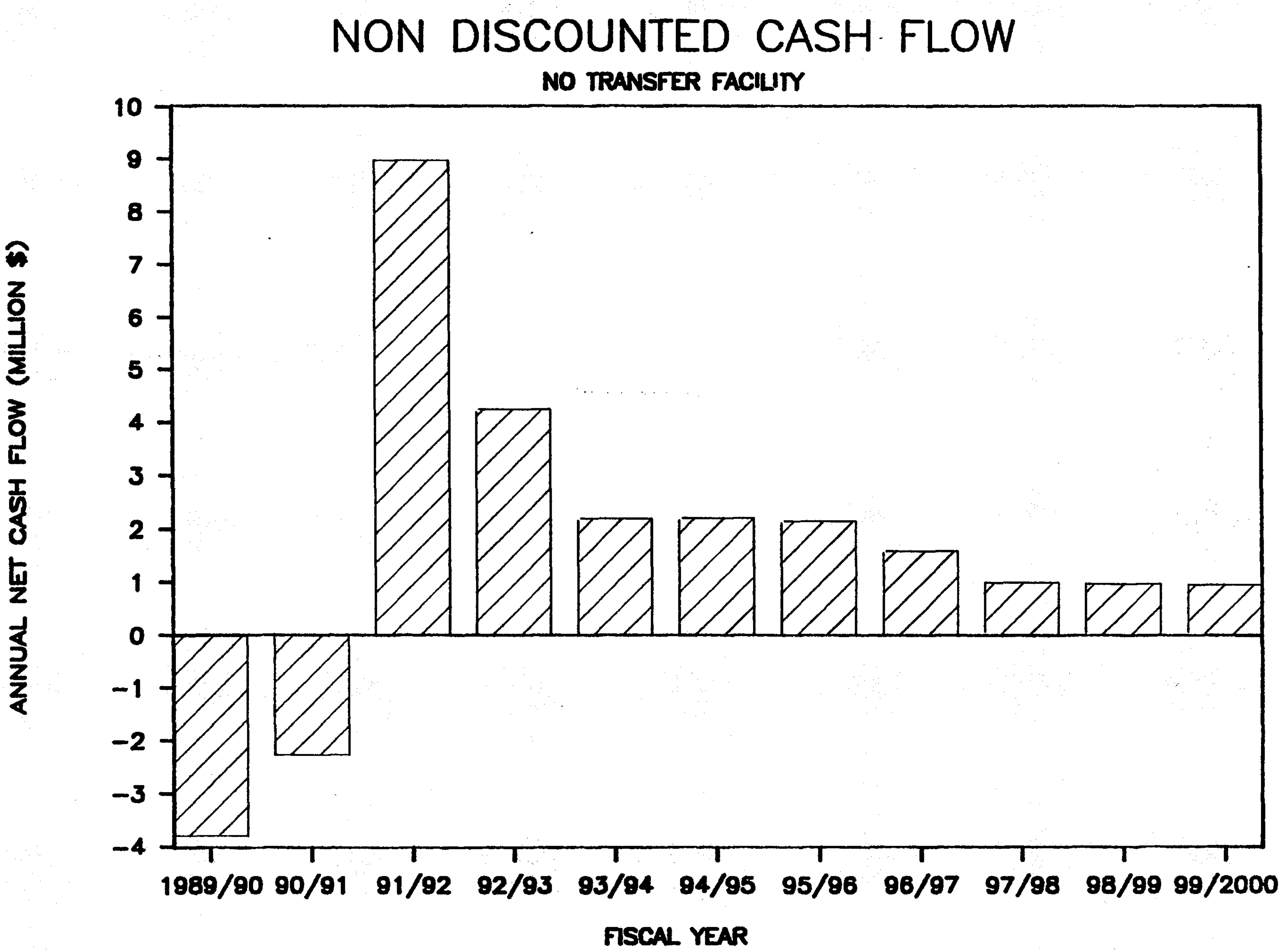
GIANT YELLOWKNIFE MINES LIMITED
WAROX PLANT
PRELIMINARY ECONOMIC STUDY (4500 - 7000 TPY As_2O_3 SALES)
OPERATING COSTS

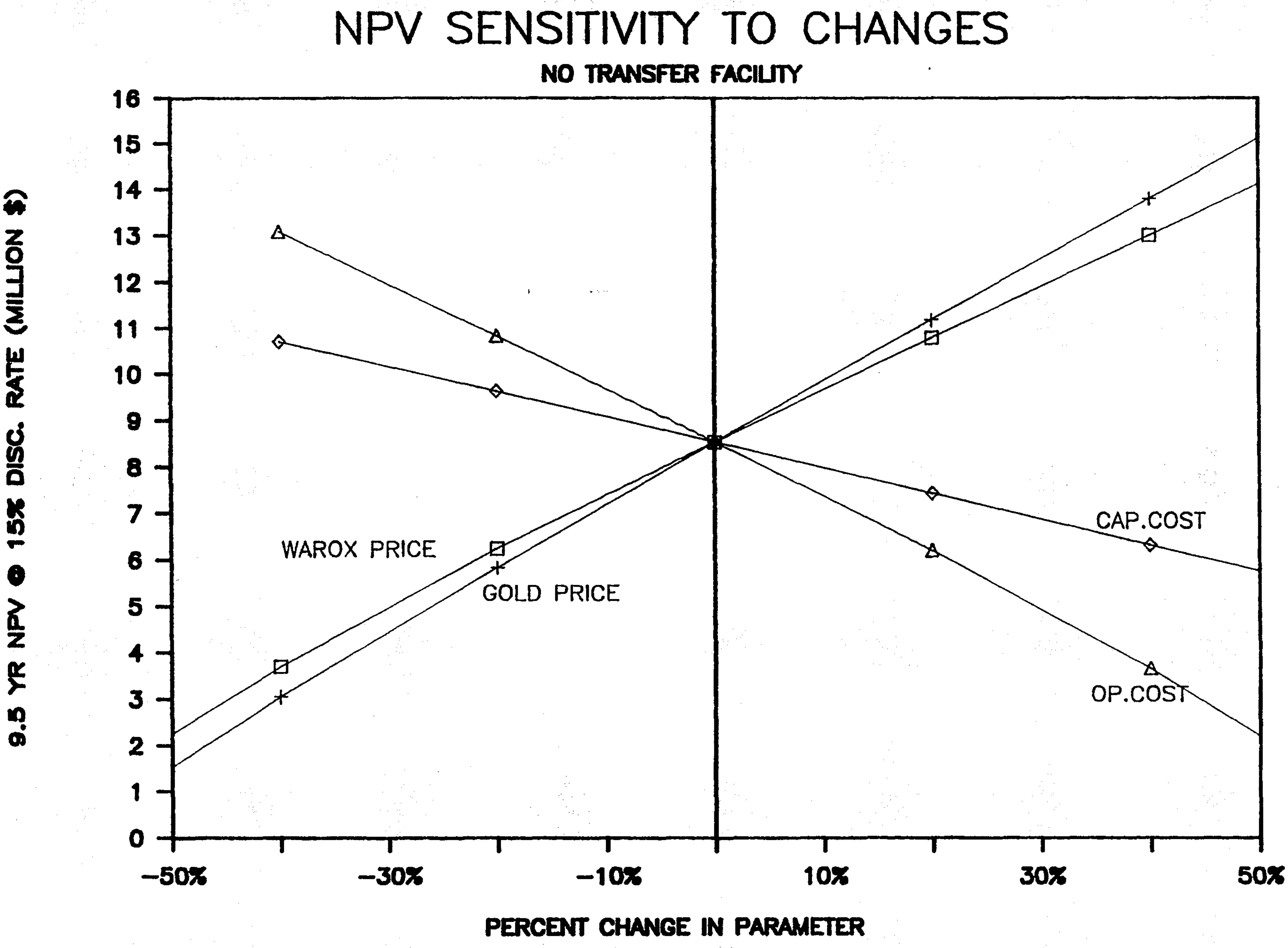
YEAR		1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/1998	1998/99	1999/2000	TOTAL
UNIT COSTS	U/G $/ton As2O3	N/A	36	36	36	36	36	36	36	36	36	36	
	Plant $/ton As2O3	N/A	221	221	221	221	221	221	221	221	221	221	
	Plant $/ton Residue	N/A	0	0	0	0	0	0	0	0	0	0	
	Transfer $/ton As2O3	N/A	0	0	0	0	0	0	0	0	0	0	
	Freight $/ton As2O3	N/A	358	358	358	358	358	358	358	358	358	358	
	Tails $/ton As2O3	N/A	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	
UNITS (Tons)	U/G As2O3	0	1,300	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
	Plant As2O3	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
	Residue	0	0	0	0	0	0	0	0	0	0	0	0
	Transfer	0	0	0	0	0	0	0	0	0	0	0	0
	Freight	0	2,250	4,750	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	59,000
	As2O3 to Tails	0	35	70	70	70	70	70	70	70	70	70	665
COSTS	U/G	0	47	249	249	249	249	249	249	249	249	249	2,288
	Plant	0	773	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	14,696
	Residue	0	0	0	0	0	0	0	0	0	0	0	0
	Transfer	0	0	0	0	0	0	0	0	0	0	0	0
	Freight	0	806	1,701	1,880	2,059	2,238	2,417	2,506	2,506	2,506	2,506	21,122
	Tails	0	49	98	98	98	98	98	98	98	98	98	932
	Additional Operating	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL OPERATING COSTS		0	1,674	3,595	3,774	3,953	4,132	4,311	4,400	4,400	4,400	4,400	39,038
NET OPERATING PROFIT		0	1,524	12,070	6,049	2,902	3,056	3,210	2,399	1,403	1,403	1,403	35,419
CAPITAL	U/G RECLAIM	480	480	0	69	0	0	95	75	0	0	0	1,199
	SURFACE PLANT	3,050	3,050	0	0	0	0	0	0	0	0	0	6,100
	TRANSFER FACILITY	0	0	0	0	0	0	0	0	0	0	0	0
	EXTRA CAPITAL	250	250	0	0	0	0	0	0	0	0	0	500
	TOTAL CAPITAL	3,780	3,780	0	69	0	0	95	75	0	0	0	7,799
CASH FLOW BEFORE TAX		(3,780)	(2,256)	12,070	5,980	2,902	3,056	3,115	2,324	1,403	1,403	1,403	27,620
TOTAL TAXES		0	4	3,100	1,727	702	851	966	734	406	432	449	9,371
NET CASH FLOW		(3,780)	(2,260)	8,970	4,253	2,200	2,206	2,149	1,589	997	971	954	18,249
CUMULATIVE NET CASH FLOW		(3,780)	(6,040)	2,930	7,184	9,383	11,589	13,738	15,327	16,324	17,295	18,249	
DISCOUNT RATE		15.00%											
BEF TAX DISCOUNTED CASH FLOW		(3,780)	(1,962)	9,127	3,932	1,659	1,519	1,347	874	459	399	347	13,920
CUMUL DISCOUNTED		(3,780)	(5,742)	3,385	7,317	8,976	10,496	11,842	12,716	13,175	13,573	13,920	
AFT TAX DISCOUNTED CASH FLOW		(3,780)	(1,965)	6,783	2,797	1,258	1,097	929	598	326	276	236	8,553
CUMUL DISCOUNTED		(3,780)	(5,745)	1,038	3,834	5,092	6,189	7,118	7,715	8,041	8,317	8,553	

PAYBACK: 1.3 YEARS IRR: 61.67%

Date Printed: 26-Jun-89

Engineering Department,Yellowknife Division.


NON DISCOUNTED CASH FLOW
NO TRANSFER FACILITY
ANNUAL NET CASH FLOW (MILLION $)
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
1989/90
90/91
91/92
92/93
93/94
94/95
95/96
96/97
97/98
98/99
99/2000
FISCAL YEAR


NPV SENSITIVITY TO CHANGES
NO TRANSFER FACILITY
9.5 YR NPV @ 15% DISC. RATE (MILLION $)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
-50%
-30%
-10%
10%
30%
50%
PERCENT CHANGE IN PARAMETER
WAROX PRICE
GOLD PRICE
CAP.COST
OP.COST

\WAROX\ECONOMIC\BUDGET4
BUILD TRANSFER FACILITY IN 1992/93

GIANT YELLOWKNIFE MINES LIMITED
WAROX PLANT
PRELIMINARY ECONOMIC STUDY (4500 - 7000 TPY AS2O3 SALES)

SUMMARY OF RESULTS

YEAR	1989/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/2000	TOTAL
PRODUCTION												
Tons Feed From Mill	0	2,305	0	0	0	0	0	0	0	0	0	2,305
Tons Feed From U/G	0	2,211	14,738	12,257	9,979	9,979	9,979	9,438	8,156	8,156	8,156	93,049
Tons Feed Processed	0	4,516	14,738	12,257	9,979	9,979	9,979	9,438	8,156	8,156	8,156	95,354
Tons As2O3 Produced	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
Tons As2O3 Sold	0	2,250	4,750	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	59,000
Ounces Gold Produced	0	3,655	26,885	13,605	6,506	6,506	6,506	4,595	2,454	2,454	2,454	75,620
REVENUES ($1,000)												
Revenue Arsenic	0	1,499	3,164	3,497	3,830	4,163	4,496	4,662	4,662	4,662	4,662	39,294
Revenue Gold	0	1,700	12,501	6,326	3,025	3,025	3,025	2,137	1,141	1,141	1,141	35,163
Total Revenue	0	3,198	15,665	9,823	6,855	7,188	7,521	6,799	5,803	5,803	5,803	74,457
Revenues/ton Feed	0	708	1,063	801	687	720	754	720	712	712	712	7,588
Revenues/ton As2O3	0	914	2,238	1,403	979	1,027	1,074	971	829	829	829	11,094
OPERATING ($1,000)												
Total Operating	0	1,674	3,595	3,774	3,149	3,238	3,327	3,360	3,360	3,360	3,360	32,198
Operating/Ton Feed	0	371	244	308	316	324	333	356	412	412	412	3,488
Operating/Ton Sold	0	744	757	719	548	518	493	480	480	480	480	5,698
Total Capital	3,780	3,780	0	2,569	0	0	95	75	0	0	0	10,299
Cash Flow Before Tax	(3,780)	(2,256)	12,070	3,480	3,706	3,950	4,099	3,364	2,443	2,443	2,443	31,961
Total Taxes	0	4	3,100	1,584	779	1,024	1,218	1,007	750	790	818	11,074
Net Cash Flow	(3,780)	(2,260)	8,970	1,896	2,927	2,926	2,881	2,356	1,693	1,653	1,625	20,887
Discount Rate	15.0%											
Aft Tax Discounted Cash Flow	(3,780)	(1,965)	6,783	1,247	1,674	1,455	1,245	886	554	470	402	8,969
Cum. Discounted Cash Flow	(3,780)	(5,745)	1,038	2,284	3,958	5,412	6,658	7,543	8,097	8,567	8,969	

BEFORE TAX

Net Present Value $14,889 of first 9.5 years of operation.

Payback Period 1.1 Years

IRR 81.03%

AFTER TAX

Net Present Value $8,969 of first 9.5 years of operation.

Payback Period 1.3 Years

IRR 58.0%

GIANT YELLOWKNIFE MINES LIMITED
WAROX PLANT
PRELIMINARY ECONOMIC STUDY (4500 - 7000 TPY AS2O3 SALES)
PRODUCTION RATES AND PRODUCT PRICES

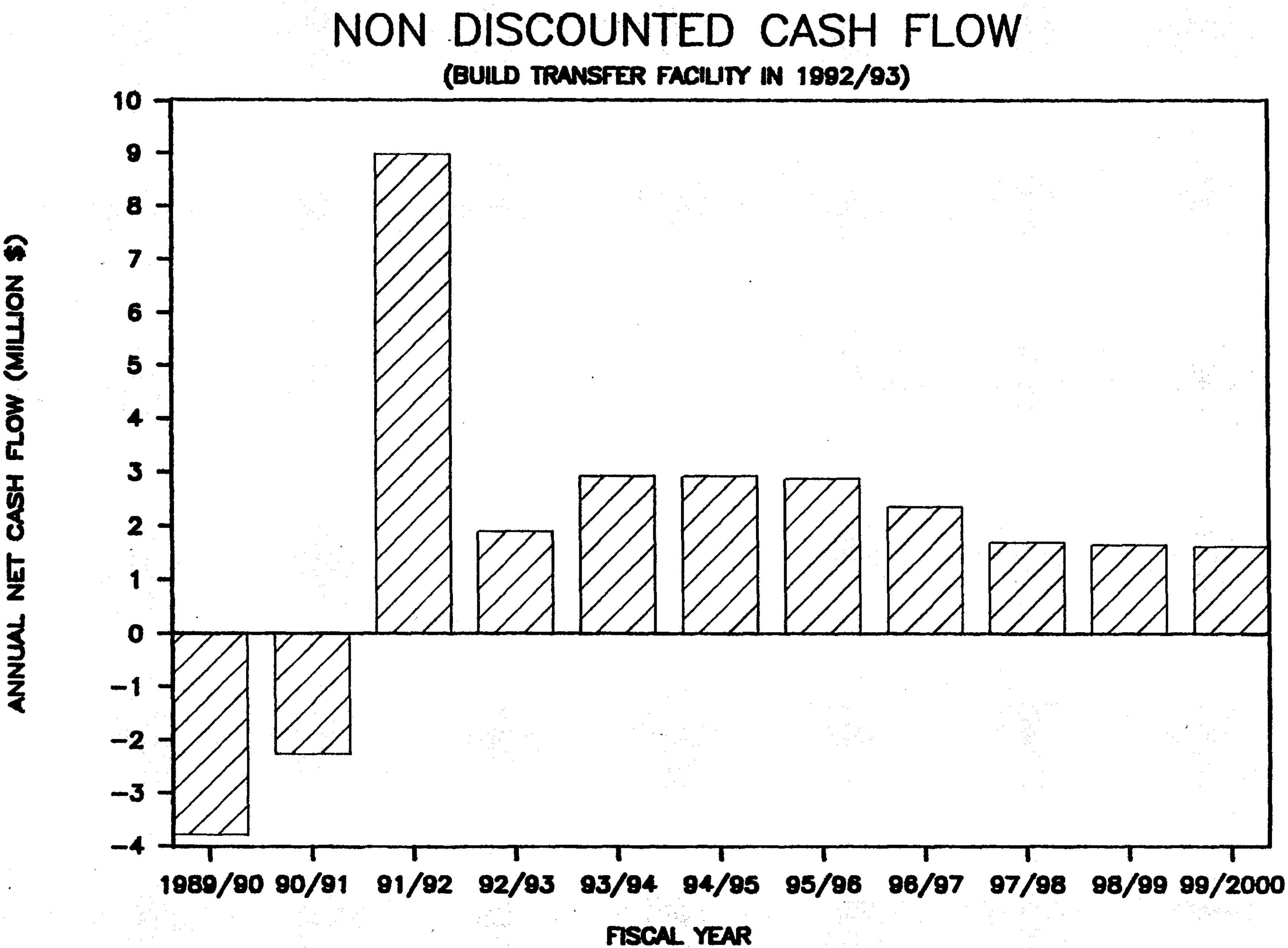
YEAR	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	TOTAL
VOLUME PARAMETERS												
Tons As2O3 Produced	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
Tons As2O3 Sold	0	2,250	4,750	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	59,000
Feed Grade As	73.00%	59.29%	36.33%	43.69%	53.66%	53.66%	53.66%	56.74%	65.66%	65.66%	65.66%	
Feed Grade As2O3	96.39%	78.29%	47.97%	57.69%	70.85%	70.85%	70.85%	74.92%	86.70%	86.70%	86.70%	
As Recovery	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	
Tons Feed	0	4,516	14,738	12,257	9,979	9,979	9,979	9,438	8,156	8,156	8,156	95,354
PRODUCTION DATA												
ARSENIC												
Feed % As2O3	96.39%	78.29%	47.97%	57.69%	70.85%	70.85%	70.85%	74.92%	86.70%	86.70%	86.70%	
Recovery (%)	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%	
Tons As2O3	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
GOLD												
Feed Grade (oz/ton)	0.137	0.952	2.146	1.306	0.767	0.767	0.767	0.573	0.354	0.354	0.354	
Recovery (%)	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	85.00%	
Ounces Gold	0	3,655	26,885	13,605	6,506	6,506	6,506	4,595	2,454	2,454	2,454	75,620
PRODUCT PRICES												
As2O3 / lb CDN	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	
Gold / oz CDN	465	465	465	465	465	465	465	465	465	465	465	
REVENUES												
As2O3	0	1,499	3,164	3,497	3,830	4,163	4,496	4,662	4,662	4,662	4,662	39,294
Gold	0	1,700	12,501	6,326	3,025	3,025	3,025	2,137	1,141	1,141	1,141	35,163
TOTAL REVENUES	0	3,198	15,665	9,823	6,855	7,188	7,521	6,799	5,803	5,803	5,803	74,457

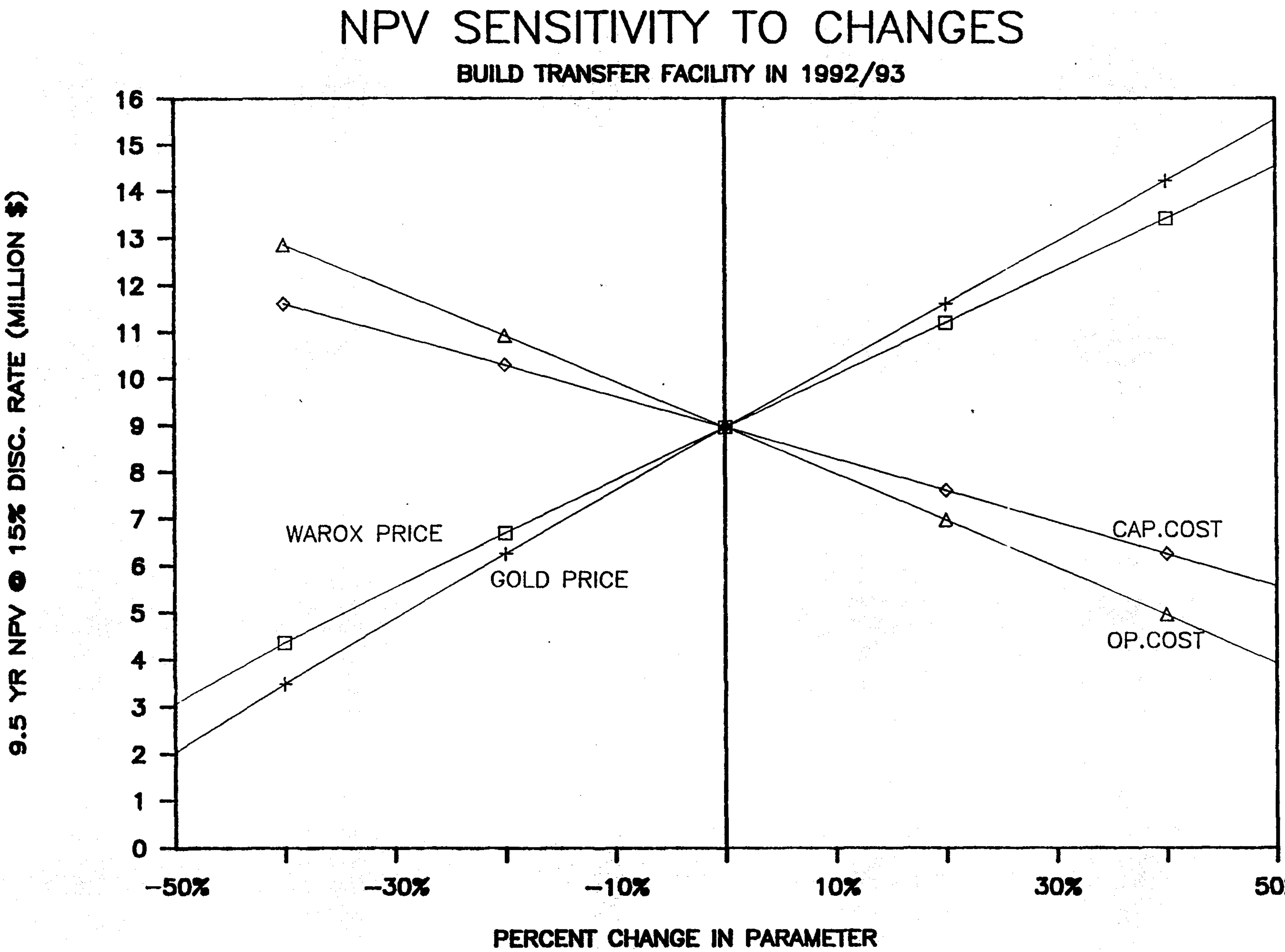
\WAROX\ECONOMIC\BUDGET4
BUILD TRANSFER FACILITY IN 1992/93

GIANT YELLOWKNIFE MINES LIMITED
WAROX PLANT
PRELIMINARY ECONOMIC STUDY (4500 - 7000 TPY AS203 SALES)
OPERATING COSTS

YEAR		1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	TOTAL
UNIT COSTS	U/G $/ton As203	N/A	36	36	36	36	36	36	36	36	36	36	
	Plant $/ton As203	N/A	221	221	221	221	221	221	221	221	221	221	
	Plant $/ton Residue	N/A	0	0	0	0	0	0	0	0	0	0	
	Transfer $/ton As203	N/A	0	0	0	86	83	80	77	77	77	77	
	Freight $/ton As203	N/A	358	358	358	132	132	132	132	132	132	132	
	Tails $/ton As203	N/A	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	
UNITS (Tons)	U/G As203	0	1,300	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
	Plant As203	0	3,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	66,500
	Residue	0	0	0	0	0	0	0	0	0	0	0	0
	Transfer	0	0	0	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	52,000
	Freight	0	2,250	4,750	5,250	5,750	6,250	6,750	7,000	7,000	7,000	7,000	59,000
	As203 to Tails	0	35	70	70	70	70	70	70	70	70	70	665
COSTS	U/G	0	47	249	249	249	249	249	249	249	249	249	2,288
	Plant	0	773	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547	14,696
	Residue	0	0	0	0	0	0	0	0	0	0	0	0
	Transfer	0	0	0	0	496	519	542	542	542	542	542	3,725
	Freight	0	806	1,701	1,880	759	825	891	924	924	924	924	10,557
	Tails	0	49	98	98	98	98	98	98	98	98	98	932
	Additional Operating	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL OPERATING COSTS		0	1,674	3,595	3,774	3,149	3,238	3,327	3,360	3,360	3,360	3,360	32,198
NET OPERATING PROFIT		0	1,524	12,070	6,049	3,706	3,950	4,194	3,439	2,443	2,443	2,443	42,260
CAPITAL	U/G RECLAIM	480	480	0	69	0	0	95	75	0	0	0	1,199
	SURFACE PLANT	3,050	3,050	0	0	0	0	0	0	0	0	0	6,100
	TRANSFER FACILITY	0	0	0	2,500	0	0	0	0	0	0	0	2,500
	EXTRA CAPITAL	250	250	0	0	0	0	0	0	0	0	0	500
	TOTAL CAPITAL	3,780	3,780	0	2,569	0	0	95	75	0	0	0	10,299
CASH FLOW BEFORE TAX		(3,780)	(2,256)	12,070	3,480	3,706	3,950	4,099	3,364	2,443	2,443	2,443	31,961
TOTAL TAXES		0	4	3,100	1,584	779	1,024	1,218	1,007	750	790	818	11,074
NET CASH FLOW		(3,780)	(2,260)	8,970	1,896	2,927	2,926	2,881	2,356	1,693	1,653	1,625	20,887
CUMULATIVE NET CASH FLOW		(3,780)	(6,040)	2,930	4,826	7,753	10,679	13,559	15,916	17,609	19,262	20,887	
DISCOUNT RATE		15.00%											
BEF TAX DISCOUNTED CASH FLOW		(3,780)	(1,962)	9,127	2,288	2,119	1,964	1,772	1,265	799	694	604	14,889
CUMUL DISCOUNTED		(3,780)	(5,742)	3,385	5,673	7,792	9,756	11,528	12,792	13,591	14,285	14,889	
AFT TAX DISCOUNTED CASH FLOW		(3,780)	(1,965)	6,783	1,247	1,674	1,455	1,245	886	554	470	402	8,969
CUMUL DISCOUNTED		(3,780)	(5,745)	1,038	2,284	3,958	5,412	6,658	7,543	8,097	8,567	8,969	

PAYBACK: 1.3 YEARS IRR: 57.98%


NON DISCOUNTED CASH FLOW
(BUILD TRANSFER FACILITY IN 1992/93)
ANNUAL NET CASH FLOW (MILLION $)
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
1989/90
90/91
91/92
92/93
93/94
94/95
95/96
96/97
97/98
98/99
99/2000
FISCAL YEAR


NPV SENSITIVITY TO CHANGES
BUILD TRANSFER FACILITY IN 1992/93
9.5 YR NPV @ 15% DISC. RATE (MILLION $)
PERCENT CHANGE IN PARAMETER
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-50%
-30%
-10%
10%
30%
50%
WAROX PRICE
GOLD PRICE
CAP.COST
OP.COST

Appendix C

WAROX PROJECT

Sensitivity Analysis

MEMORANDUM

TO: J.S. McAlpine, K. Blower, A. Fleming

COPIES TO: G. Wolfe, K. Morton

FROM: Barbara Mossop, Planning Engineer

DATE: June 27, 1989

TOPIC: WAROX Project Sensitivity Analysis

This sensitivity analysis shows the effects of changing one parameter in the economic analysis while holding all the other parameters constant. The four parameters which have been varied in this analysis are the warox price, the gold price, the operating costs and the capital costs. The impact on the net present value (over 9.5 years), the rate of return and the payback period have been tabulated. This analysis does not reflect the probability of occurance of changes in any of the parameters.

The accompanying graphs visually represent the impact of the changes on the net present value. The sensitivity of the parameter is directly correlated with the steepness of the line representing that parameter. A flat line would indicate that the net present value is insensitive to changes in the parameter whereas a close to vertical line would indicate extreme sensitivity to changes in the parameter.

For the case study in which the transfer facility is not built the 9.5 year NPV is most sensitive to the gold price, followed by the operating costs, the warox price and then the capital costs. A 20% reduction in either the warox or gold prices will reduce the NPV by 27% and 33% respectively. A 20% increase in either the operating or capital costs results in a respective 28% and 14% reduction in the NPV. The NPV is sensitive to all four parameters, however even a 50% change in any one of the parameters will still result in a positive NPV.

For the case study in which the transfer facility is built in 1992/93, the 9.5 year NPV is most sensitive to the gold price, followed by the warox price, the operating costs and then the capital costs. A 20% reduction in either the warox or gold prices will reduce the NPV by 26% and 30% respectively. A 20% increase in either the operating or capital costs results in a respective 22% and 16% reduction in the NPV. Again the NPV is sensitive to all four parameters and a 50% change in any one of the parameters will still result in a positive NPV.

BM

TABLE 1:

NO TRANSFER FACILITY

Warox Price ($/lb)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
.133	0.8	26.9	1.8
.200	3.7	43.0	1.6
.267	6.3	53.2	1.4
.333	8.6	61.7	1.4
.400	10.8	69.3	1.3
.466	13.0	76.0	1.2
.533	15.2	82.5	1.2

Gold Price ($/oz)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
186	0.0	15.2	9.2
279	3.1	31.5	2.8
372	5.8	46.9	1.7
465	8.6	61.7	1.4
558	11.2	75.5	1.2
651	13.8	88.4	1.1
744	16.4	100.8	1.0

Operating $ (% of base)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
60	13.1	77.1	1.2
80	10.8	69.8	1.3
100	8.6	61.7	1.4
120	6.2	52.6	1.4
140	3.7	41.9	1.6
160	0.7	24.8	2.0

Capital $ (% of base)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
60	10.7	106.9	1.0
80	9.6	79.5	1.2
100	8.6	61.7	1.4
120	7.4	64.2	1.6
140	6.3	40.2	2.0
160	5.2	33.3	2.5

TABLE 2:

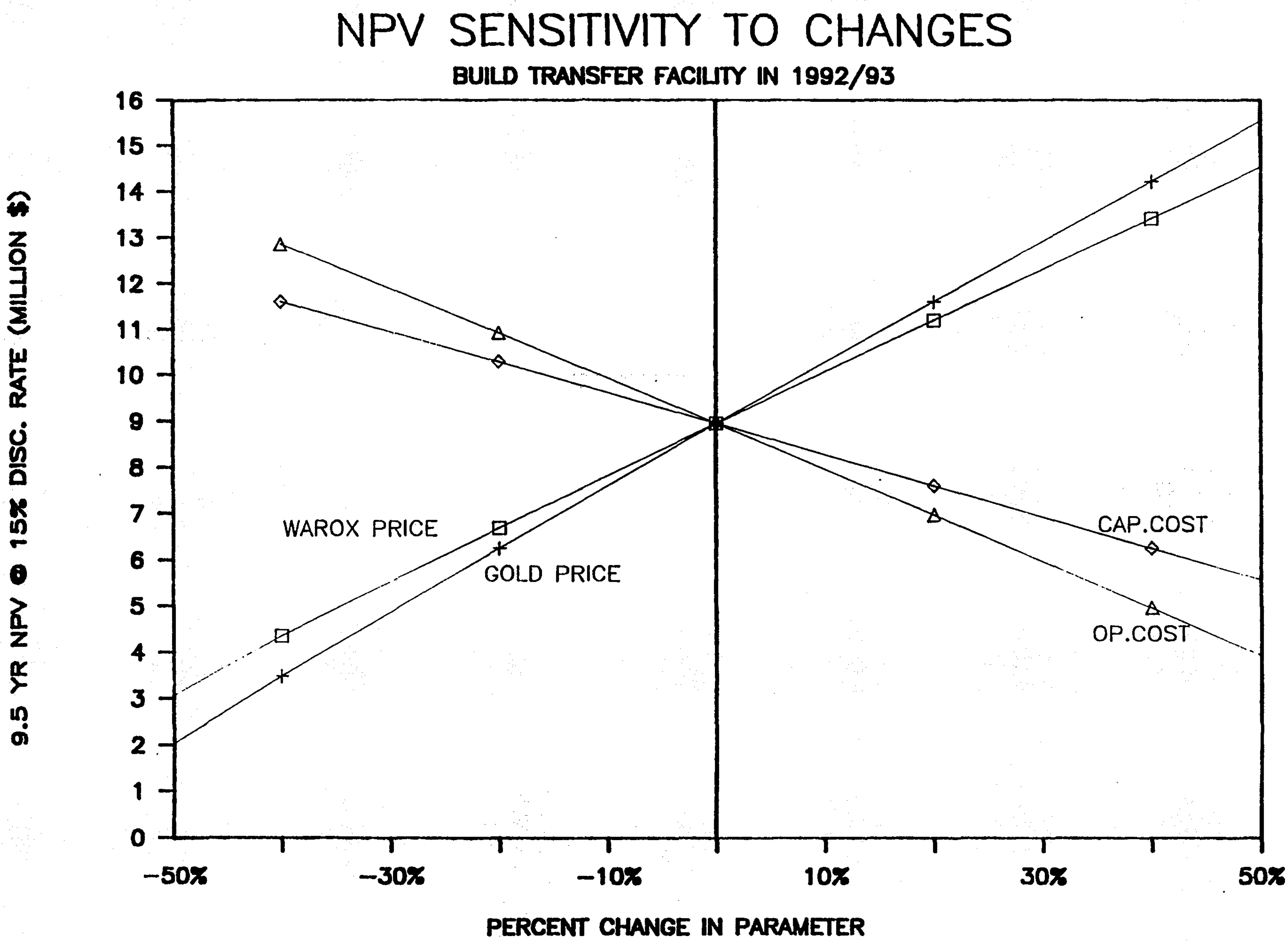
BUILD TRANSFER FACILITY IN 1992/93

Warox Price ($/lb)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
.133	1.7	28.4	2.7
.200	4.4	40.6	1.6
.267	6.7	49.8	1.4
.333	9.0	58.0	1.4
.400	11.2	65.5	1.3
.466	13.4	72.2	1.2
.533	15.7	78.6	1.2

Gold Price ($/oz)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
186	0.6	17.4	7.7
279	3.5	30.4	4.0
372	6.3	44.1	2.1
465	9.0	58.0	1.4
558	11.6	71.5	1.2
651	14.2	84.3	1.1
744	16.8	96.8	1.0

Operating $ (% of base)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
60	12.9	72.4	1.2
80	10.9	65.5	1.3
100	9.0	58.0	1.4
120	7.0	49.9	1.4
140	5.0	41.4	1.8
160	2.9	31.9	3.0

Capital $ (% of base)	NPV (9.5 Years) (Million $)	IRR %	Payback (Years)
60	11.6	103.9	1.0
80	10.3	76.0	1.2
100	9.0	58.0	1.4
120	7.6	45.6	1.8
140	6.3	36.6	2.9
160	4.9	29.9	3.8


NPV SENSITIVITY TO CHANGES
BUILD TRANSFER FACILITY IN 1992/93
9.5 YR NPV @ 15% DISC. RATE (MILLION $)
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
WAROX PRICE
GOLD PRICE
CAP.COST
OP.COST
-50%
-30%
-10%
10%
30%
50%
PERCENT CHANGE IN PARAMETER

NPV SENSITIVITY TO CHANGES