

FALCONBRIDGE CANADA



INTER-OFFICE MEMORANDUM

To: T. J. Desanti

Subject: Review of the U.S. Arsenic Market and
Determination of Price for Giant Yellowknife
White Arsenic to be Purchased by Koppers.

Date: July 5, 1978

From: D. N. Zeraldo

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1. ARSENIC MARKET:

Please find in Appendix 1 a compilation of statistics relating to the U.S. Arsenic Market as provided by the:

- a) U.S. Supply/Demand Balance for Arsenic,
- b) Summary of average annual prices for Arsenic Trioxide, and
- c) Graphical comparison of the U.S. White Arsenic prices and the U.S. Arsenic balance.

It should be noted that Arsenic is a minor metal and as such its statistics are not fully detailed. As well, the U.S. Bureau of Mines which is the primary source of statistical data for this report is unwilling to publish the U.S. supply/demand data for the years 1974-1977. Hence statistics for this period are unavailable.

Arsenic is recovered as a by-product from the smelting of certain non-ferrous ores and consequently, production is not geared to demand. As a result, annual production normally remains constant with prices tracking the fluctuations in demand. Virtually all arsenic produced, imported, and consumed in the United States is in the form of white arsenic (Arsenic Trioxide). Apparently the latest and highest growth rate use for arsenic trioxide is in the manufacture of wood preservatives.

Prices for white arsenic remained fairly constant between 1965 and 1973. However, following the 1973 U.S. arsenic deficit, prices were raised during 1974 and again in 1975. Prices then tended to level off until the second quarter of 1978 when notable increases again took place.

Two factors which could influence the U.S. arsenic market balance in the near future are; (a) environmental restrictions on the Asarco Tacoma Copper Smelter, and (b) construction of a copper smelter in the Philippines. The Tacoma smelter's ability to comply with the air quality standards of the various local, state and federal regulatory agencies will determine its future and hence its ability to manufacture arsenic products. The upcoming Philippine Lepanto Smelter will consume its own high arsenic copper concentrates which are currently treated by Asarco at Tacoma, and thereby remove a source of arsenic to the U.S. market. Hence, there is the potential of a shortage developing in the U.S. over the next several years.

2. PRICE FOR GIANT YELLOWKNIFE WHITE ARSENIC

Koppers Inc. have approached Giant Yellowknife offering to purchase their 92% As_2O_3 for a price of 3¢U.S./lb. Giant is currently disposing of the material as mine fill at a cost of \$CDN 33/ST or 1.65¢ CDN/lb.

Koppers have proposed taking delivery of the material f.o.b. the mine where they will build all necessary storage and handling facilities at their own expense. Koppers' capital, operating, and opportunity costs for delivery of the material f.o.b. their Georgia plant have been itemized in Tables 1 and 2 found in Appendix 2.

In determining what is a fair price for Giant's arsenic trioxide material, a comparison of total costs on a f.o.b. Koppers' plant delivery basis for Giant material and the two lowest cost alternate sources of material has been done. This calculation found in Table 2 of Appendix 2 shows that if 5¢U.S./lb is charged for Giant material the Koppers' saving is 2.2¢U.S./lb of contained As_2O_3 at minimum on a 5 year 3000 ST/year contract, and 4.3¢U.S./lb of contained As_2O_3 at maximum on a 5 year 3000 ST/year contract.

In an effort to estimate Koppers' profit on this project, a comparison of direct costs to Koppers for the Giant venture against costs of purchasing arsenic trioxide from Asarco at Tacoma has been done. The differential between these two costs is Koppers' gross profit on the Giant project.

Employing the profit estimate, the capital cost estimate, and assuming a 5 year 3000 ST per year contract and a 50% corporate tax rate, an internal rate of return calculation has been computed. The direct cost comparison and the internal rate of return calculation are located on Tables 3 and 4 respectively in Appendix 2.

The calculations show that Koppers' after-tax rate of return on its \$U.S. 450,000 investment is 24% on a price of 5¢U.S./lb for Giant material and 40% on a price of 3¢U.S./lb for Giant material based on a 5 year 3000 ST/year contract. On a larger annual tonnage and/or contract life, Koppers' profit and rate of return on investment would naturally increase. Therefore, a price of 5¢U.S./lb for Giant's 92% As_2O_3 is not unreasonable.

3. RECOMMENDATION

Based on what appears to be an optimistic outlook for the North American Arsenic Market over the next couple of years and an estimate of Koppers' rate of return on this investment of its capital for handling and storage facilities required to purchase Giant's white arsenic, it is recommended that we ask for 4¢U.S./lb for Giant material. At 4¢U.S./lb, Koppers' would still realize a healthy rate of return (about 32%) on its investment and Giant Yellowknife would earn \$U.S. 240,000/year on the sale and save \$U.S. 90,000/year on disposal of the material for gross annual earnings of \$U.S. 330,000/year.

Review of the U.S. Arsenic Market and
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Produced by Koppers.

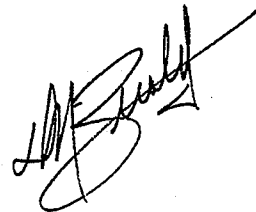
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Because all of the above calculations have been based on the assumption of constant As₂O₃ prices and constant costs, a provision for price participation for the mine on an As₂O₃ price increase should be included in the contract. It is recommended that the mine obtain 50% of any increase in the U.S. producer Tacoma price (for minimum 99% As₂O₃ f.o.b. Tacoma) as quoted in Metals Week.

Below is a summary of the netback to the mine on a price of 3¢-5¢U.S./lb.

	<u>3¢U.S./lb</u>	<u>5¢U.S./lb</u>
Net Realization from Koppers on 3000 ST/year	\$U.S. 180,000.	\$U.S. 300,000.
Savings on Mine Fill -\$CDN 33/ST	<u>\$U.S. 90,000.</u>	<u>\$U.S. 90,000.</u>
	\$U.S. 270,000/yr	\$U.S. 390,000/yr



APPENDIX 1

ARSENIC MARKET STATISTICS

U.S.A. ARSENIC SUPPLY & DEMAND (In terms of Short Tons of Arsenic)

	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
U.S. Production	12300	9400	5000	6100	10300	10900	7500	10300	10200			
Imported As As ₂ O ₃	12000	14400	20800	19300	14000	14400	13300	10500	8850	8200	7200	2600
Imported As As	<u>180</u>	<u>180</u>	<u>300</u>	<u>400</u>	<u>400</u>	<u>500</u>	<u>540</u>	<u>670</u>	<u>640</u>	<u>710</u>	<u>480</u>	<u>290</u>
Total U.S. Supply	24480	23980	26100	25800	24700	25800	21340	21470	19690			
U.S. Demand	<u>24680</u>	<u>24280</u>	<u>26700</u>	<u>23900</u>	<u>20600</u>	<u>20300</u>	<u>19640</u>	<u>18970</u>	<u>24190</u>	<u> </u>	<u> </u>	<u> </u>
Metal Surplus / (Deficit)	(200)	(300)	(600)	1900	4100	5500	1700	2500	(4500)			
Industry Stocks	1300	1000	400	2300	6400	11900	13600	16100	11600			
White Arsenic Prices (As ₂ O ₃) ¢U.S./lb												
1. Imported ¹	5.7	5.5	5.9	6.2	6.5	6.5	6.5	6.5	6.5	12.7	21.5	20.5
2. Laredo ²					6.0	6.0	6.0	6.0	6.8	9.5	15.4	16.7
3. Tacoma ³											13.1	13.1

NOTE: Statistics for 1974 onward withheld by U.S.B.M.

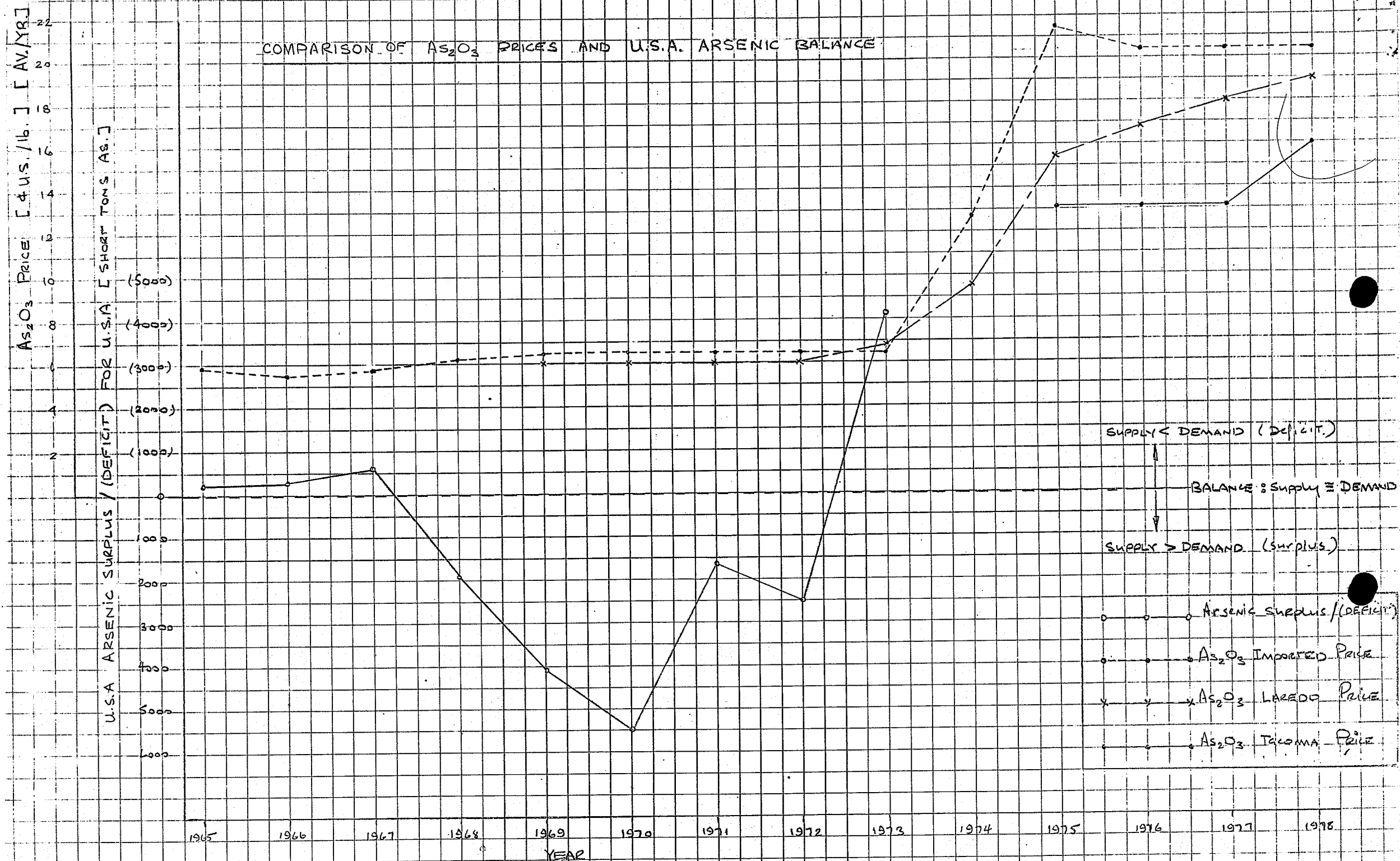
AVERAGE ANNUAL PRICES

<u>YEAR</u>	<u>WHITE ARSENIC</u>			<u>METAL</u>
	<u>IMPORTED</u> ¹ ¢/lb.	<u>LAREDO</u> ² ¢/lb.	<u>TACOMA</u> ³ ¢/lb.	<u>U.S. PRODUCER</u> ⁴ \$/lb.
1965	5.7			
1966	5.5			
1967	5.9			
1968	6.2			
1969	6.5	6		
1970	6.5	6		
1971	6.5	6		
1972	6.5	6		
1973	6.5	6.8		
1974	12.7	9.5		
1975	21.5	15.4	13.1	1.60
1976	20.5	16.7	13.1	1.71
1977	20.5	18.0	13.1	1.90
Current 1978	20.5	19.0	16.0	1.90

NOTE:

1. Crude - 99.5% - Bulk Carloads delivered f.o.b. plant or Mexican Border.
2. U.S. Producer Tacoma - Ton lots, f.o.b. Tacoma, min. 99%, .40¢/lb premium per lb. under 1 ton.
3. Imported Steel Drums C.I.F. U.S. main port.

COMPARISON OF As_2O_3 PRICES AND U.S.A. ARSENIC BALANCE



APPENDIX 2

PRICE FOR GIANT YELLOWKNIFE As_2O_3 :

TABLE 1

SUMMARY OF ESTIMATED KOPPERS' COSTS FOR PURCHASE, HANDLING
AND TRANSPORTATION OF GIANT YELLOWKNIFE'S 92% As₂O₃ PRODUCT.

	<u>3000 SDT OF 92% As₂O₃ Purchased/Yr.</u>	<u>5000 SDT OF 92% As₂O₃ Purchased/Yr.</u>
A. <u>Estimated Capital Costs:</u>		
1. Construction of storage PAD at Yellowknife	\$U.S. 250000	\$U.S. 250000
2. Construction of Handling facilities at Highlevel Alberta:	\$U.S. 200000	\$U.S. 200000
	\$U.S. 450000	\$U.S. 450000
Write-off over 5 year contract	\$U.S. 30/ST	\$U.S. 18/ST
B. <u>Estimated Transportation Costs:</u>		
1. Truck from Yellowknife to Highlevel Alberta	\$U.S. 50/ST	\$U.S. 50/ST
2. Railfreight from Highlevel to Edmonton	\$U.S. 10	\$U.S. 10
3. Railfreight from Edmonton to Georgia	\$U.S. 88	\$U.S. 88
4. Lease a) four 75 ton cars for 3000 ST/Yr, b) six 75 ton cars for 5000 ST/Yr, @ \$U.S. 600 / car / month.	\$U.S. 10	\$U.S. 9
Sub Total Transportation	\$U.S. 158/ST	\$U.S. 157/ST
C. <u>Interest Cost on \$U.S. 450000 Invested</u> (10% interest over 5 years is \$U.S. 135000)	\$U.S. 9/ST	\$U.S. 5/ST
D. <u>Cost of 92% As₂O₃ from Giant</u>	\$U.S. 60-100/ST	\$U.S. 60-100/ST
E. <u>Waste Disposal Costs</u> (@\$U.S. 75/ST Waste & 8% Waste in Giant product)	\$U.S. 6/ST	\$U.S. 6/ST
F. <u>Total Costs F.O.B. Koppers' Plant</u>	\$U.S. 263-303/ST	\$U.S. 246-286/ST
	= 13.2¢-15.2¢ /lb	= 12.30¢-14.3¢ /lb

TABLE 2

COMPARISON BETWEEN KOPPERS' TOTAL COSTS FOR GIANT YELLOWKNIFE 92% As_2O_3 , ASARCO MIN..99% As_2O_3 , IMPORTED 99.9% As_2O_3 ON A DELIVERED TO PLANT BASIS

	<u>¢U.S./lb GROSS MATERIAL</u>			
	<u>ASARCO</u>	<u>IMPORTED</u>	<u>GIANT YELLOWKNIFE</u>	
	99.5% As_2O_3	99.9% As_2O_3	3000 SDT/Yr 92% As_2O_3	5000 SDT/Yr 92% As_2O_3
1. Purchase Price (Asarco: f.o.b. Tacoma, Imported: CIF port New York, Giant: f.o.b. mine)	16¢	20-21¢	3-5¢	3-5¢
2. Waste Disposal Costs from treatment of lower grade Giant material (Say \$75/Ton Waste)	0	0	.3¢	.3¢
3. Capital Cost Write-Off on Giant Venture over 5 Year period.	0	0	1.5¢	.9¢
4. Interest Cost on \$U.S. 450000 Investment over 5 years (@10% interest is \$135,000.)	0	0	.5¢	.3¢
5. Transportation Cost to Koppers' Georgia Plant (Imported: CIF Philadelphia)	2.6¢	4¢	7.9¢	7.8¢
6. Cost of Material f.o.b. Koppers' Plant	18.6¢	24-25¢	13.2-15.2¢	12.3-14.3¢
7. Cost of contained As_2O_3 Delivered f.o.b. Koppers' Plant in Georgia	18.7¢	24.0-25.0¢	14.4-16.5¢	13.4-15.5¢

TABLE 3

COMPARISON OF DIRECT COSTS TO KOPPERS FOR PURCHASING
GIANT YELLOWKNIFE 92% As_2O_3 AND ASARCO 99.5% As_2O_3
(3000 ST/YR)

	<u>ASARCO</u>	<u>GIANT YELLOWKNIFE</u>
1. Purchase Price	16¢U.S./lb	3¢-5¢U.S./lb
2. Transportation (f.o.b. Koppers' plant)	2.6¢U.S./lb	7.9¢U.S./lb
3. Waste Product Disposal	<u>NONE</u>	<u>.3¢U.S./lb</u>
4. Total Direct Cost	18.6¢U.S./lb	11.2¢-13.2¢U.S./lb
5. Total direct Cost of Contained As_2O_3	<u>18.7¢U.S./lb</u>	<u>12.2¢-14.4¢U.S./lb</u>
6. Gross Savings to Koppers by purchasing Giant.		6.5¢-4.3¢U.S./lb

TABLE 4

INTERNAL RATE OF RETURN TO KOPPERS ON GIANT INVESTMENT

Since the gross savings/profit to Koppers is estimated at 6.5¢U.S./lb of contained As₂O₃ for Giant material priced at 3¢U.S./lb and 4.3¢U.S./lb of contained As₂O₃ for Giant material priced at 5¢U.S./lb an annual cash flow and hence internal rate of return to Koppers can be calculated for this project.

- a) ANNUAL CASH FLOW: $(3000 \text{ ST/YR of } 92\% \text{ As}_2\text{O}_3 \times .92 \text{ ST As}_2\text{O}_3 \times \frac{2000 \text{ lb}}{1 \text{ ST}} \times \frac{4.3\text{¢} - 6.5\text{¢}}{1 \text{ lb As}_2\text{O}_3})$
 (1 year 1ST 92% As₂O₃ 1ST 1 lb As₂O₃)
 = \$U.S. 237,000 to 359,000/Year for 5 years.
- b) INTERNAL RATE OF RETURN: (\$U.S.)

	<u>Year 0</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>PROJECT TOTAL</u>
Capital Cost	(450000)	-	-	-	-	-	(450000)
Cash Flow @5¢/lb	-	237000	237000	237000	237000	237000	1185000
@3¢/lb	-	359000	359000	359000	359000	359000	1795000
Less: Write-offs	-	90000	90000	90000	90000	90000	450000
Less: Taxes @50% @ 5¢/lb	-	74000	74000	74000	74000	74000	370000
@ 3¢/lb	-	135000	135000	135000	135000	135000	675000
Plus: Write-offs	-	90000	90000	90000	90000	90000	90000
Net Profit after taxes.							
@5¢/lb		163000	163000	163000	163000	163000	365000
@3¢/lb	(450000)	224000	224000	224000	224000	224000	670000
Internal Rate of							
Return after Tax @5¢/lb	-	24%					
@3¢/lb	-	40%					