007872

INTERNAL CORRESPONDENCE

DATE 84 03 14 (YEAR MONTH DAY)

To J. H. McKIBBON, R. BUCKLEY

FROM H. M. Visagie

Business Development
DEPARTMENT OR FIELD OFFICE

COST CENTRE OR AFE No.

FILE No. CCF 03

SUBJECT

Re: FARO MINEABLE RESERVES

Prior to the June, 1982 shutdown, the practice at CAMC was to state mineable reserves in the Faro pit as being the same as the geological reserves calculated by blocks using the Mintec computer program except that grades were reduced 5%. The blocks were calculated on the mine's bench plans and were contained in the pit. The 5% reduction in grade was based on historical relationship.

After shutdown, a new policy was introduced by the Faro geologists. Besides reducing the grade by 5%, it was decided to reduce the tonnage by 15% for the NA phase and by 5% for all other phases. This change was based on the 1981 operating experience (Exhibit 1) where a short fall in tonnage (7.8%) and grade (5.0%) was experienced. This was also supposedly reinforced by a sectional calculation done by G. Simpson on the NA phase that indicated a reduction in tonnage was expected. This reduction of tonnage assumption effectively reduces the ore reserve by 5% or 1.2 MM tonnes, increases the stripping ratio and accelerates the stripping in the early years.

I do not think the reduction of tonnage in absence of a grade adjustment is valid because:

- The actual results in 1981 are from the mining of pit 2 which is on the margin of the deposit. Most of pit 3 ore is closer in grades and thickness to pit 1 rather than pit 2. A 5% tonnage adjustment does not appear to have been used on pit 1.

- How the grades and tonnages are determined within the mineralized zone depends a lot on the technique the geologists uses to set the composite grade for a section. The higher grade materials tend to be in the center of the zone and the lower grade material on the outside. However, there are often sections within the zone containing either very low grade mineralization or no mineralization. Variances in how these grades are calculated can result in tonnage and grade trade-offs.

- The reduction in tonnage due based on G. Simpson's sectional calculation of reserves, can be explained by dilution whether internal or external within the composite used for the computer calculation. A back calculation of potential dilution indicates that 566 M tonnes of 3.14% combined grade of low grade material would have to be added to the sectional calculation to equal the F3 model as shown below:

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NA Reserves	Cutoff %	Total M Tons	Lead %	Zinc %	Combined %
- Rationalization					
Sectional	4.0	1,490	3.20	5.20	8.40
Dilution	-	566	1.51	1.63	3.14
- F3 Model	4.0	2,046	2.74	4.23	6.97

o As part of the Cox evaluation of CAMC, D. W. Asbury, P.Eng., reviewed the Mining Reserves in Zone 3 of the Faro Open Pit. In his report, he made the following observations:

- The practice of reducing the computer grades by 5% is appropriate.
- From a sectional calculation of 3 benches (Exhibit 2) he calculated the grades to be 6% lower than the computer model but that the tonnage was 11% greater. The overall increase in metal content was about 4.8%. (Once again it appears a case of defining composite grades and cutoffs used for ore grade calculations.)
- The amount of cubic yards of ore plus waste in the three benches appears to be overstated by 3.8% in the computer.

Besides the above observations, Mr. Asbury stated that "a manual estimate of total reserves is not easy because assays and specific gravities of drill hole samples are not plotted on plans and sections, but are computer stored". In order to get a feeling for the reserve, he conducted a manual spot check of the reserves that would provide initial mill feed. His observations relate to only 30% of the NA phase and may or may not be applicable to the rest of the deposit.

As a result of the above, a new mining schedule based on the Mintec model with no tonnage deduction is proposed. A plan using the grade averages for each phase and includes the oxide stockpile ramp zone and low grade stockpile as well as the main ore body is proposed (Exhibit 3). The new plan contains about 5% more metal content than the previous plan (Exhibit 4).

The change in the tonnage deduction and the inclusion of the ramp zone lowering of the annual stripping required (Exhibit 5) and an increase of $15.5 MM PVAT 16% (Exhibit 6) for the Faro only case.

Comments

o Recently reserves estimation and hence mining reserve calculations are functions of the computer. The geologist inputs the data and the sectional interpretation and the computer calculates the reserve.

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If the reserve was of a simple form and drill spacing adequate, then this approach may be reasonable. However, the Faro deposit is complex and many judgements which do not lend themselves to computerization must be made.

o Computer calculation of reserves while a nice concept has the following problems in its use at the Faro ore body.

1) Ownership of the reserve calculation is neither the responsibility of the geology department nor the engineering department. It is the computer's.

2) Cost to produce the computer model which can accurately define the Faro reserve is expensive both in manpower and the required drill holes to produce meaningful results.

3) It is not easy for anyone to check the results of the computer and to know if the results are reasonable.

4) And finally, results are very difficult to duplicate.

o A sectional model is an acceptable method of calculating reserves and is the one most universally favored by geologists. It is easy for any geologist to quickly check the reserve calculation and understand the parameters that went into the calculation.

o The new model's ore sequencing was roughly done and should be calculated in greater detail based on the bench plans.

o The low grade material which dilutes the higher grade tends to be 2A. Some of this material has difficult metallurgy and may not be economic. Work is required to determine the effect of 2A material on overall economics.

<u>Recommendation</u>

o Since there is no compelling reason to reduce tonnages from the Mintec forecast unless grades are increased, it is recommended that mining plans at the mine be based on the tonnages forecasted in the Mintec Model.

o The present emphasis on having the computer calculate the reserve be given a lesser priority until a proper sectional model for the deposit is developed. The sectional model should be used for determining basic reserves and the computer can be used to sequence the mining of those reserves.

o Once the sectional model is developed, a comparison of it to the computer models be made and then the differences should be rationalized.

HMV/rdp
Attach.

EXHIBIT 1

FARO MINEABLE RESERVES

CYPRUS ANVIL MINING CORPORATION

TONNAGE AND GRADE COMPARISONS FOR 1981 MILLFEED

	SHORT TONS 000's	%Pb	%Zn	% Combined Pb-Zn	GMS/Mt Ag
Mine Model	3,231	3.0	5.1	8.1	35.05
Blast Hole	3,028	3.0	4.8	7.8	40.27
Met. Balance from Daily Production Record	2,980	2.9	4.9	7.8	34.27
Calculated Met. Balance	2,980	2.9	4.8	7.7	37.67
Calculated Met. Balance as % of Mine Model	92.2	96.7	94.1	95.1	107.5

Notes:

- o Above table taken from D. W. Ashury's section of the Cox Report.
- o Presumably the above met. balance is for pit ore only and does not include stockpile feed.
- o Most of the 1981 feed was from pit 2 where both the geology and drilling was poorly done prior to mining. Pit 2 is also on the margin on the main deposit. Consequently, Pit 2 results may not be predictive for the main deposit.

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84-03-14

CYPRUS ANVIL MINING CORPORATION

COMPARISON OF MODEL F3 COMPUTER ESTIMATE AND MANUAL ESTIMATE OF ORE AND WASTE IN THREE REPRESENTATIVE BENCHES OF PHASE NA OF THE FARO PIT USING A 3.0% COMBINED LEAD-ZINC CUT-OFF

		ORE						WASTE		RATIO
BENCH	ESTIMATE	CUBIC YARDS	SHORT DRY TONS	%Pb	%Zn	COMBINED Pb-Zn	GMS/METRIC TONNE AG	CUBIC YARDS	SHORT DRY TONS	YARDS WASTE TO YARDS ORE
3870	F3	66,667	205,506	3.671	4.969	8.640	51.055	781,766	1,811,817	11.7
	Manual	73,481	237,711	3.582	4.760	8.342	49.270	748,822	1,738,016	10.2
3790	F3	100,000	292,784	3.198	4.694	7.892	48.985	403,375	934,861	4.0
	Manual	108,844	307,867	2.646	4.211	6.857	35.774	380,726	891,660	3.5
3710	F3	55,326	164,625	1.969	3.613	5.582	30.703	163,789	379,598	3.0
	Manual	59,130	192,261	2.099	3.878	5.977	29.871	140,993	329,360	2.4
Combined	F3	221,993	662,915	3.039	4.511	7.550	45.087	1,348,930	3,126,276	6.1
	Manual	241,455	737,839	2.805	4.301	7.106	38.584	1,270,541	2,959,036	5.3

RESULTS FROM THE MANUAL ESTIMATE FOR THE COMBINED BENCHES AS A PERCENTAGE OF RESULTS FROM THE F3 MODEL

Cubic yards of ore	108.8	Contained lead	102.7
Short tons of Ore	111.3	" zinc	106.1
Lead grade	92.3	" lead & zinc	104.8
Zinc grade	95.3	" silver	95.2
Lead & zinc grade	94.1	Cubic yards of waste	95.8
Silver grade	85.6	Short tons of waste	95.9

Total cubic yards of ore plus waste in the three benches

F3 Model	1,570,923	
Manual	1,511,996	96.2%

D. W. ASBURY
April, 1982

BASE MINING SEQUENCE

1. ORE SEQUENCE

	Phase	Tonnes	Metal Content: Zinc (%)	Lead (%)	Silver (Gm/DMT)
1984	Oxide	411	4.7	2.9	37.6
1985	Oxide	889	4.7	2.9	37.6
	Ramp	203	4.3	3.5	57.0
	NA	1910	4.0	2.6	42.2
	OA	1071	3.6	2.4	35.2
1986	OA	161	3.6	2.4	35.2
	PA	1229	4.5	2.8	36.5
	7D	1857	4.6	2.9	35.0
	UB	826	4.0	2.8	37.0
1987	UB	4073	4.0	2.8	37.0
1988	UB	518	4.0	2.5	37.0
	WA	3567	4.5	3.2	45.2
1989	WA	4073	4.5	3.2	45.2
1990	WA	2344	4.5	3.2	45.2
	YA	1729	4.4	2.7	34.5
1991	YA	3183	4.4	2.7	34.5
	Low Grade	890	2.3	1.4	28.5

2. MINING PLAN

1984	Oxide	411	4.7	2.9	37.6
1985	Oxide/R/NA/OA	4073	4.06	2.66	40.1
1986	OA/PA/7D/UB	4073	4.40	2.82	35.9
1987	UB	4073	4.00	2.80	37.0
1988	UB/WA	4073	4.43	3.15	44.0
1989	WA	4073	4.50	3.20	45.2
1990	Wa/YA	4073	4.46	2.98	40.6
1991	YA/LG	4073	3.94	2.41	33.1

Notes:

- o Ore tonnages and grades are based on the Mintec F3 model. Grades are reduced 5% and there is no adjustment to tonnage as per historical practice.
- o Phases are mined sequentially.

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84-03-14

EXHIBIT 4 FARO MINEABLE RESERVES

COMPARISON OF CHANGES IN PLANS

Proposed Plan vs. M Nov. 8430 Plan

1. Change in Annual Mining Sequence

CHANGES IN FARO MINEABLE RESERVES

GEOLOGICAL RESERVES

	Proposed Plan						MAPR 84/8530 Plans						Change in Reserves					
SEC.	TONNES	ZN o/o	PB o/o	AG GR.	AU GR.	CU o/o	TONNES	ZN o/o	PB o/o	AG GR.	AU GR.	CU o/o	TONNES	ZN o/o	PB o/o	AG GR.	AU GR.	CU o/o
1984	411	4.70	2.90	37.6	0.0	0.00	411	4.70	2.90	37.6	0.0	0.00	0	0.00	0.00	0.0	0.0	0.0
1985	4073	4.06	2.66	40.1	0.0	0.00	3949	4.30	2.70	36.5	0.0	0.00	0	-0.24	-0.04	3.6	0.0	0.0
1986	4073	4.40	2.82	35.9	0.0	0.00	4073	4.24	2.71	31.5	0.0	0.00	0	0.16	0.11	4.4	0.0	0.0
1987	4073	4.00	2.80	37.0	0.0	0.00	4073	4.05	2.84	35.4	0.0	0.00	0	-0.05	-0.04	1.6	0.0	0.0
1988	4085	4.43	3.15	44.0	0.0	0.00	4085	4.54	3.42	46.4	0.0	0.00	0	-0.11	-0.27	-2.4	0.0	0.0
1989	4073	4.50	3.20	45.2	0.0	0.00	4073	4.60	3.07	37.9	0.0	0.00	0	-0.10	0.13	7.3	0.0	0.0
1990	4073	4.46	2.98	40.6	0.0	0.00	4073	4.43	2.91	33.5	0.0	0.00	0	0.03	0.07	7.1	0.0	0.0
1991	4073	3.94	2.41	33.1	0.0	0.00	2873	3.39	1.95	26.9	0.0	0.00	1200	0.55	0.46	6.2	0.0	0.0
0	28934	4.26	2.86	39.4	0.0	0.00	27734	4.26	2.84	35.8	0.0	0.00	0	0.00	0.00	0.0	0.0	0.0

2. Change in Metal Content

Zinc $\frac{28934 \times 4.26}{27734 \times 4.26} = 1.043\%$

Lead $\frac{28934 \times 2.86}{27734 \times 2.84} = 1.05\%$

Silver $\frac{28934 \times 39.4}{27734 \times 35.8} = 1.15\%$

Notes:

o Both plans are based on a 4% cutoff.

o Details on copper and gold are not available.

o Proposed plan has been roughly worked and should be revised at the minesite.

o Reserve mined breakdown:

	Proposed Plan	Nov. 8430 Plan
Oxide	1300	1300
Ramp	203	-
Pit	26541	25334
Low Grade	890	1100
	28934	27734

EXHIBIT 5 FARO MINEABLE RESERVES

COMPARISON OF STRIPPING PLANS

CHANGE IN MINING RATES? (MBCM/year.

	New Plan				Old Plan				
	Waste	Ore	tonnes	Total	Waste	Ore	tonnes	Total	Change Total
1984	7050	130	411 (3.16)	7180	7050	130	411	7180	-
1985	7604	1068	4073 (3.81)	8672	8165	1033	3939	9198	(526)
1986	7608	947	4073 (4.30)	8555	8165	947	4073	9112	(557)
1987	7608	1039	4073 (3.92)	8647	8165	1039	4073	9204	(557)
1988	3836	1059	4085 (3.86)	4895	2526	1059	4073	3585	1310
1989	785	1225	4073 (3.32)	2010	940	1225	4073	2165	(155)
1990	393	934	4073 (4.36)	1327 ?	420	934	4073 (4.36)	1354	(27)
1991	284	873	4073 (4.66)	1152	172	273	2873 (10.52)	445	717
Total	35168	7275	28922 (3.98)	42443	35603	6640		42243	200

Notes:

- o New plan has not been calculated using bench modeling. New plan includes ramp zone and 5% more reserves than old plan. Incremental stripping for ramp zone is estimated at 1 BCM per tonne ore.
- o Old plan is based on November 84 start-up with high stripping required in 1984.
- o Both plans include oxide volumes as being mined, not simply transported.

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EXHIBIT 6 FARO MINEABLE RESERVES

INCREMENTAL VALUE OF NEW PLAN

A. Change Based on Faro Deposit Only

CYPRUS ANVIL

FARO DEPOSIT ONLY--BASE CASE
CHANGE IN CASH FLOW
THOUSANDS OF DOLLARS

YEAR	REVENUE	OPERATING COSTS	ROYALTIES PRIVATE	ROYALTIES GOVERNMENT	INTEREST	TAXES	CAPITAL	DEBT	WORKING CAPITAL	CASH FLOW
1984										
1985	(6 419)	(8 178)								1 759
1986	16 002	3 611		78						12 313
1987	(1 113)	(4 318)		611						2 594
1988	(17 320)	(2 679)		173						(14 814)
1989	(5 710)	(978)		(1 228)		(246)				(3 258)
1990	16 127	2 298		(409)		4 689				9 549
1991	155 701	87 146		1 262		23 652				43 642
PV 0	157,267	76,902		486		28,095				51,784
PV16	51,132	21,076		222		9,448				20,386

2707589 PRESENT 2707589 FAROB
BUSDEV 1984 03 15

BASE CASE IS:
2707589 FAROB

CYPRUS ANVIL

FARO DEPOSIT ONLY--BASE CASE
REVENUE STATISTCS
THOUSANDS OF DOLLARS

YEAR	$US/LB ZN	$US/LB PB	$US/OZ AG	$US/OZ AU	EXCHANGE CDN/US	MM LBS ZN	MM LBS PB	M OZ AG	M OZ AU	REVENUE--$MM(CDN) ZN	REVENUE--$MM(CDN) PB	REVENUE--$MM(CDN) AG	REVENUE--$MM(CDN) AU	TOTAL	PRODUCT M TONNES	VALUE $/TONNE
1984	0.46	0.30	10.00	400	0.81	26	17	230	0	15	6	3	0	24	43	560
1985	0.54	0.31	13.65	488	0.81	252	182	2893	3	167	71	49	2	288	407	708
1986	0.56	0.33	14.33	513	0.81	280	198	2624	3	194	81	46	2	323	447	723
1987	0.59	0.35	15.05	538	0.81	261	200	2824	3	190	86	52	2	330	427	772
1988	0.63	0.37	15.95	571	0.81	288	224	3319	2	222	102	65	1	391	479	816
1989	0.66	0.39	16.91	605	0.81	292	227	2629	2	240	109	55	2	405	484	838
1990	0.70	0.41	17.92	641	0.81	290	209	3007	3	251	107	67	2	427	465	918
1991	0.75	0.44	19.00	680	0.81	256	167	2412	4	235	90	57	3	385	402	959

PRICE INFLATION
0 0.05 0.05 0.05 0.06 0.06 0.06 0.06

B. Adjustment in PV for other deposits ($M)

20,386 - (100,000 x .16 x 1200 ÷ 4,000) = 15,586

Notes:

o Increment is calculated for the change in mining plans.
o Adjustment is made to account for delayed development of other deposits.