

3.5 ORE RESERVES3.5.1 Area Reserves and Resources

Constrained by the shortage of time, Kilborn has not verified the Faro pit ore reserve calculations, but has used the information compiled in Cyprus Anvil's computerized mine model. Nevertheless, Kilborn is satisfied that the reserves have been calculated in accordance with sampling, assaying and reserve calculation procedures which are well-proven and accepted in the industry. The close agreement achieved historically between predicted plant feed grades, and those actually received attests to the validity and the accuracy of the procedures used by Cyprus Anvil.

A summary of the Anvil District Reserves is shown in Table 3.5-1.

3.5.2 Faro Deposit - Mining Reserves

The mineable ore reserve remaining in the Faro open-pit is 23,763,000 tonnes containing; 2.9 percent lead, 4.4 percent zinc and 36.3 grams per tonne silver, at a cut-off grade of 4 percent combined lead plus zinc. Table 3.5-2 gives the mineable reserves at a cut-off grade of 4 percent combined lead-zinc grade [4.0 (Pb + Zn) percent] for the different ore types. The in-place grades have been reduced by 5 percent to conform with historical results in producing mineable ore reserves. Table 3.5-3 gives the mineable reserves at a cut-off grade of 6 percent combined lead-zinc grade.

TABLE 3.5-1

ANVIL DISTRICT GEOLOGICAL RESERVES AND GRADE

Deposit	Geological Reserves ('000) Tonnes	Cut-Off (Pb + Zn)%	Metal Content				
			Lead %	Zinc %	Copper %	Silver g/mt	Gold g/mt
<u>Faro</u>							
Proven - Pit	33,000	--	3.0	4.6	0.16	35.7	0.16
- Ramp	203	4	3.7	4.5	*	60.0	*
Probable - Southwest	<u>1,950</u>	7	<u>5.2</u>	<u>7.3</u>	<u>*</u>	<u>73.8</u>	<u>*</u>
TOTAL	35,153		3.1	4.7	0.16	38.0	0.18
<u>Grum</u>							
Proven - 62-86 W	35,400	3	3.32	5.43	0.15	56.0	0.84
Probable - 51-62 W	<u>1,700</u>	4	<u>3.51</u>	<u>4.28</u>	<u>*</u>	<u>46.0</u>	<u>*</u>
TOTAL	37,100		3.33	5.38	0.15	55.5	0.84
Possible - 86-100 W	8,000	7	10.0 (Pb + Zn)%		--	--	--
<u>Vangorda</u>							
Proven - 2 W-12 E	6,200	3	3.0	4.0	*	44.0	0.77
- 12-28 E	2,500	3	3.3	3.5	*	46.0	0.78
Probable - 28-38 E	<u>400</u>	4	<u>2.4</u>	<u>4.8</u>	<u>*</u>	<u>50.0</u>	<u>0.78</u>
TOTAL	9,100		3.1	3.9	*	45.0	0.78
<u>Dy</u>							
Probable - A2	13,612	7	5.9	6.1	0.14	86.0	1.06
- A3	960	7	5.0	5.8	0.16	64.0	0.59
- B2	<u>6,487</u>	7	<u>4.9</u>	<u>8.1</u>	<u>0.08</u>	<u>83.0</u>	<u>0.76</u>
TOTAL	21,059		5.5	6.7	0.12	84.0	0.95
<u>Swim</u>							
Probable	4,300	6	3.8	4.7	*	47.0	*

*Grades Exist but have not been calculated.

TABLE 3.5-2

FARO PIT MINEABLE ORE RESERVES
CUT-OFF GRADE 4.0 (PB + ZN) PERCENT
IN-SITU GRADES REDUCED BY 5.0 PERCENT

<u>Ore Type</u>	<u>Tonnage</u>	<u>Grade</u>		
		<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/mt</u>
A	1,602,000	1.93	3.70	33.1
BCD	5,467,000	2.43	3.91	35.1
EC	2,651,000	2.73	4.26	32.0
EF	10,970,000	3.06	4.49	32.8
G	1,531,000	4.66	5.44	62.3
H	<u>1,542,000</u>	<u>3.68</u>	<u>5.07</u>	<u>50.0</u>
TOTAL	23,763,000 =====	2.94 =====	4.37 =====	36.2 =====

Mineable reserves for a 6 percent combined lead-zinc grade are given in Table 3.5-3.

TABLE 3.5-3

FARO PIT MINEABLE ORE RESERVES
CUT-OFF GRADE 6.0 (PB + ZN) PERCENT
IN-SITU GRADES REDUCED BY 5.0* PERCENT

<u>Ore Type</u>	<u>Tonnage</u>	<u>Grade</u>		
		<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/t</u>
A	583,000	2.67	4.61	39.6
BCD	3,419,000	2.83	4.41	40.3
EC	1,753,000	3.12	4.99	34.6
EF	8,509,000	3.34	4.99	34.9
G	1,493,000	4.74	5.51	63.5
H	<u>1,423,000</u>	<u>3.83</u>	<u>5.24</u>	<u>51.9</u>
TOTAL	17,180,000 =====	3.36 =====	4.93 =====	40.0 =====

*The above does not include the ramp zone.

In addition to the open-pit reserves, there are additional geological reserves which can be mined by underground methods after completion of open-pit mining. These reserves are approximately 2,000,000 tonnes containing; 4.70 percent lead, 7.55 percent zinc, and 71 grams per tonne silver, using a cut-off grade of 7.0 (Pb + Zn) percent. There are approximately 3 to 4 million tonnes of ore in the northeast sector of the pit which will be investigated later.

3.5.3 Reserve Calculations - Source of Data

The reserve estimates used for Kilborn's mine planning purposes are obtained from Cyprus Anvil's computerized data base.

Using the Mintec modelling program Cyprus Anvil has developed 3 mine models. In addition, a hand calculated model based upon geological sections has been prepared. The principal features of each model are highlighted in Table 3.5-4.

TABLE 3.5-4

FARO PIT MINE MODELS

<u>Model Designation</u>	<u>Principal Features</u>
F-3	Computer block model; complete remaining reserves, latest drilling included in model is 1981, no geological control in interpolation, used by Pincock, Allen and Holt.
T-3	Computer block model; complete remaining reserves, latest drilling included in model is 1981, geological control on interpolation, improvement on F-3 Model, used by Kilborn.

<u>Model Designation</u>	<u>Principal Features</u>
F-4	Computer block model; incomplete, only southern half of remaining reserves, latest drilling included in model is 1982, geological control on interpolation, superior modeling technique to F-3 and T-3 Models.
Dome	'Hand calculated' section model; complete remaining reserves, latest drilling included 1984, geological control in interpolation.

Kilborn has elected to use the T-3 Model since it is the only program which encompasses most of the remaining reserves and imposes geological constraints on the process of interpolation. The F-3 Model does not incorporate such geologic controls.

The F-4 Model is at present incomplete and therefore, of no immediate value to this study. This Model should be completed and used in later work when it is available. While the hand calculated model includes all the recent drilling results, the data is not in a format which could be used to meet Kilborn's requirements. It is noted that the results of the 1982, 1983 and 1984 diamond drill programs did not materially affect the total ore reserve inventory.

3.5.4 Method of Calculation for T-3 Model

The drilling grid over the Faro Deposit is rotated 45 degrees to north-south with section lines 140 feet apart running close to strike and dip direction of the ore body. Diamond drill hole (DDH) spacing varies over the deposit from a close of 140 feet to a maximum of 280 feet.

Many drill holes have been surveyed with a Sperry-Sun single shot camera to determine their down hole paths. Diamond drill core recoveries have averaged 95 percent in the mineralized zone. Samples of core, approximately 1.5 metres in length, are examined and logged for structure and lithology.

The geological interpretation of the deposit has been modified since preparation of the T-3 Model. These modifications are being used to develop the F-4 Model.

The T-3 Model incorporates 6 different ore rock types with respective statistically determined average densities. DDH data is composited over 20-foot bench intervals using sample length and density weighting. DDH composites are assigned predominant geology codes.

The interpolation method used is an elliptical inverse distance squared method requiring matching of DDH composite geology codes to the block geology codes. The block size carried in the model is 50 feet by 50 feet by 20 feet high.

In some cases blocks are not assigned a grade in the first pass interpolation because no matching geology codes are located in the search area. In those cases, a second pass is made with relaxed matching rules in order to assign grades to these blocks.

This overall process gives a realistic assignment of grade according to ore type and is a definite improvement over the F-3 modeling process (The F-4 interpolation method is a further improvement on the T-3 method.)

The T-3 Model at this time provides the most comprehensive estimates of the remaining reserves. Grade estimates from the F-3 and T-3 Models are normally reduced by 5 percent of their value by Cyprus Anvil to compensate for historically

determined differences between model grades and actual mill feed assays.

3.5.5 Reserve Accountability

Comparisons of model reserve estimates to past production data are generally the best methods of estimating the reliability of ore reserve models. Since past production data has only been compared to the F-3 Model it was necessary to compare the T-3 to the F-3 Model.

The T-3 Model is compared with the F-3 Model in Table 3.5-5.

The F-3 Model predicted results are compared with the actual 1980 and 1981 measured values in Tables 3.5-6 and 3.5-7, respectively.

The production, in future, will be from Zone 3 which appears to be a downfaulted portion of Zone 1. Tables 3.5-8 and 3.5-9 show comparisons between in-situ T-3 reserves and blasthole grades on a selected area of 120 metres by 140 metres on three benches in Zone One.

T-3 or F-3 ??

A further comparison of the F-4 and T-3 Models is given in Table 3.5-10.

These comparisons indicate that the T-3, F-3 and F-4 Models are comparable within normal ore reserve estimating accuracy. The F-3 Model is slightly biased above actual mill feed grades but with 5.0 percent adjustment, provides the basis for meaningful deposit grade predictions. The Models are comparable to blasthole drilling results and, therefore, are suitable for quarterly production projections.

TABLE 3.5-5

T-3/F-3 MODEL COMPARISONOPEN-PIT MINEABLE RESERVESCUT-OFF GRADE 6.0 (PB + ZN) PERCENT

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/mt</u>
F-3 (Minus 5 Percent Off Grades)	18,445*	3.3	4.8	39.8
T-3 (Minus 5 Percent Off Grades)	17,180**	3.3	4.9	39.9
Percent Variance $\left(\frac{T-3 - F3}{F3} \times 100\right)$	-6.9	0	+2.0	+0.2

Both the F-3 and T-3 Models create 'unknown' tonnage which refers to tonnage geologically interpreted to be sulphide-bearing, however, not assigned grades in interpolation.

*The F-3 Model estimate does not include 126,000 DMT of 'unknown' tonnage.

**The T-3 Model estimate does not include 563,000 DMT of 'unknown' tonnage.

In general, the T-3 Model estimates lower tonnage similar or slightly higher grades.

TABLE 3.5-6

MODEL F-3

1981 PRODUCTION COMPARISON

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/mt</u>
F-3 (Unadjusted)	2931	3.0	5.1	35.1
Blastholes (BH)	2747	3.0	4.8	40.3
Metallurgical Balance (MB)	2703	2.9	4.9	34.3
Percent Variance F-3 Versus BH $\left(\frac{F-3 - BH}{BH} \times 100\right)$	6.7	0	5.9	-14.8
Percent Variance F-3 Versus MB $\left(\frac{F-3 - MB}{MB} \times 100\right)$	7.8	3.3	3.9	2.3

Sources of production for 1981 were from Zone 2 until May and from the main deposit for the remainder of the year.

TABLE 3.5-7

MODEL F-3

1980 PRODUCTION COMPARISON

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/mt</u>
F-3 (Unadjusted)	3096	3.0	4.6	43.7
Blastholes (BH)	3043	2.9	4.4	44.2
Metallurgical Balance (MB)	2825	3.0	4.5	42.5
Percent Variance F-3 Versus BH $\left(\frac{F-3 - BH}{BH} \times 100\right)$	1.7	3.3	4.3	-1.1
Percent Variance F-3 Versus MB $\left(\frac{F-3 - MB}{MB} \times 100\right)$	8.8	0	2.2	2.7

Source of production for 1980 was mainly from Zone 2.

F3 ?
TABLE 3.5-8IN-SITU T-3/BLASTHOLE GRADE COMPARISON ZONE ONECUT-OFF GRADE 4.0 (PB + ZN) PERCENT

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>
T-3 (Unadjusted)	1273	2.66	4.49
Blastholes (BH)	1261	2.64	4.35
Percent Variance T-3 Versus BH $\left(\frac{T-3 - BH}{BH} \times 100\right)$	+1.0	+0.8	+3.2

TABLE 3.5-9IN-SITU T-3/BLASTHOLE GRADE COMPARISON ZONE ONECUT-OFF GRADE 6.0 (PB + ZN) PERCENT

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>
T-3 (Unadjusted)	957	2.92	4.75
Blastholes (BH)	914	2.99	4.89
Percent Variance T-3 Versus BH $\left(\frac{T-3 - BH}{BH} \times 100\right)$	+4.7	-6.7	-2.4

TABLE 3.5-10

F-4/T-3 COMPARISONSOUTHERN AREA OF ORE BODYCUT-OFF GRADE 4.0 (PB + ZN) PERCENT

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/mt</u>
F-4	3940	2.7	4.4	35.4
T-3	3945	2.6	4.1	33.7
Percent Variance T-3 Versus F-4 $\left(\frac{F-4 - T-3}{T-3} \times 100\right)$	0.1	+3.8	+7.3	+5.0

3.5.6 Recent Drilling

A total of 78 holes have been drilled in the Faro Deposit since completion of the T-3 Model. The F-4 Model incorporates the 28 holes drilled in 1982. Table 3.5-10 gives a comparison of T-3 and F-4 Models. The results of the drilling do not materially change the reserve. The 22 drill holes in 1983 are outside the pit limits and only affect underground reserves. The 28 drill holes in 1984 had given little change as shown in Table 3.5-11.

TABLE 3.5-11

DOME MODEL BEFORE AND AFTER 1984 DRILLING

OPEN-PIT IN-PLACE RESERVES

CUT-OFF GRADE 4.0 (PB + ZN) PERCENT

<u>Model</u>	<u>Tonnage DMT ('000)</u>	<u>% Pb</u>	<u>% Zn</u>	<u>Ag g/mt</u>
Dome Model Before 1984 Drilling (DB) (Unadjusted)	22,738	3.2	4.9	40.8
Dome Model After 1984 Drilling (AD) (Unadjusted)	22,610	3.2	4.9	41.3
Percent Variance $\left(\frac{DA - DB}{DB} \times 100\right)$	-1	0	0	+1

Based on this information, the 1984 drilling indicates a slight decrease in tonnage and similar overall grades.