

Table and Figure
for
SUMMARY, CONCLUSION AND RECOMMENDATIONS

Table 2-1-1 to Table 2-4-8
and
Figure 2-1-1 to Figure 2-3-8

Table 2-1-1 CONSUMPTION OF FERTILIZER IN ZAMBIA, 1972-1985

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
COMPOUND	66,490	50,721	48,402	74,784	78,272	90,225	77,140	80,136	110,428	115,978	128,666	92,606	79,298	112,260
STRAIGHT N	44,980	32,554	50,846	56,956	65,487	75,503	50,421	61,270	82,949	93,447	82,239	69,174	58,377	91,537
STRAIGHT P	498	280	351	1,472	2,076	1,610	1,896	1,725	2,568	2,217	807	1,445	467	1,060
STRAIGHT K	832	1,226	2,751	327	39	169	149	202	219	230	108	171	214	144
TOTAL	112,800	84,781	102,350	133,695	150,774	167,507	130,077	145,368	196,363	218,791	217,868	165,798	143,894	211,180
Total in Nutrient	21,922	16,325	19,473	33,044	39,828	45,283	31,100	38,263	53,170	57,766	54,396	43,616	38,144	55,729
N	6,761	5,107	4,875	12,211	13,784	15,584	13,397	14,243	18,884	20,370	21,731	15,799	12,298	19,647
P2O5	4,152	3,476	4,239	5,238	4,644	5,499	5,442	4,645	5,678	6,316	8,008	6,265	4,585	7,876
K2O														

Source: NAMBOARD

Table 2-1-2 SUPPLY AND CONSUMPTION OF FERTILIZER IN ZAMBIA,
1983-1986

(Unit: 1,000 ton of product)

	Production	Imports		Total Supply	Consump- tion
	(A)	End Products (B)	Raw Materials		
1983	72.6	132.9	25.5	205.5	165.8
1984	77.8	195.2	23.1	273.0	143.9
1985	19.9	30.5	-	50.4	211.2
1986	59.5	143.6	N.A.	203.1	153.8

Sources: NCZ and NAMBOARD

Table 2-1-3 SALES PRICE AND PURCHASE PRICE OF FERTILIZER BY NAMEBOARD

	(Unit: K./ton)						
	1980	1981	1982	1983	1984	1985	1986
Compound D							
Sales Price (A1)	232.0	235.0	299.0	482.0	535.0	535.0	1,600.0
Purchase Price from NCZ (B1)	-	-	612.0	611.0	611.0	664.0	1,860.0
(A1/B1) (%)	-	-	48.9	78.9	87.6	80.6	86.0
Landed Cost of Imported Fertilizer (C1)	304.0	446.0	269.0	439.3	492.3	N.I.	3,825.0*
(A1/C1) (%)	76.3	52.7	111.2	109.7	108.7	-	41.8
(B1/C1) (%)	-	-	227.5	133.1	124.1	-	48.6
Urea							
Sales Price (A2)	233.0	219.0	299.0	482.0	535.0	535.0	1,300.0
Landed Cost of Imported Fertilizer (C2)	400.0	406.0	268.0	462.6	697.4	N.A.	2,775.0*
(A2/C2) (%)	58.3	53.9	111.6	104.2	76.7	-	46.8
Ammonium Nitrate							
Sales Price (A3)	158.6	202.6	281.0	464.0	517.0	517.0	1,120.0
Purchase Price from NCZ (B3)	378.8	424.0	531.0	564.0	617.0	710.0	1,860.0
(A3/B3) (%)	41.9	47.8	52.9	82.3	83.8	72.8	60.2

Notes: A = Ex-NAMEBOARD depot: Price in October in each year.

B = Ex-factory

C = C.I.F. Lusaka

N.I. = No import

N.A. = Not available

- = No production

* = As of April, 1987. (K.15/US\$)

Table 2-1-4 PROJECTED DEMAND FOR PHOSPHATE FERTILIZER IN ZAMBIA

(Unit: '000 P205 ton)

	Total	Central	Copper- belt	Eastern	Luapula	Lusaka	North- ern	North- western	South- ern	Western
Actual										
=====										
1982	21.7	4.20	0.73	3.46	0.17	3.29	2.42	0.19	7.18	0.08
1983	15.8	3.44	0.52	3.58	0.33	1.69	1.54	0.13	4.31	0.16
1984	12.3	3.02	0.70	1.23	0.29	1.37	1.45	0.03	4.07	0.14
1985	19.6	4.29	0.97	4.95	0.32	1.63	1.42	0.22	5.47	0.39
Projected										
=====										
1986	22.9	3.9	1.3	3.5	0.4	2.7	2.9	0.2	7.8	0.2
1987	24.4	4.0	1.5	3.4	0.5	2.8	3.2	0.2	8.5	0.3
1988	25.8	4.0	1.7	3.4	0.5	3.0	3.4	0.2	9.3	0.3
1989	27.3	4.1	1.9	3.4	0.6	3.1	3.6	0.2	10.1	0.3
1990	28.8	4.2	2.0	3.4	0.6	3.3	3.8	0.2	10.9	0.4
1991	30.1	4.3	2.1	3.4	0.7	3.4	3.9	0.2	11.7	0.4
1992	31.3	4.4	2.2	3.4	0.7	3.6	4.0	0.2	12.4	0.4
1993	32.4	4.5	2.3	3.5	0.7	3.7	4.0	0.2	13.1	0.4
1994	33.7	4.7	2.3	3.6	0.7	3.8	4.1	0.2	13.8	0.5
1995	34.8	4.8	2.4	3.6	0.8	4.0	4.1	0.2	14.4	0.5
1996	36.0	5.0	2.4	3.7	0.8	4.1	4.2	0.2	15.1	0.5
1997	37.1	5.1	2.5	3.8	0.8	4.2	4.3	0.2	15.6	0.6
1998	38.1	5.3	2.5	3.9	0.8	4.3	4.3	0.2	16.2	0.6
1999	39.2	5.5	2.6	4.0	0.8	4.4	4.4	0.2	16.7	0.6
2000	40.2	5.7	2.6	4.1	0.8	4.6	4.4	0.2	17.2	0.6
2001	41.2	5.8	2.6	4.2	0.8	4.7	4.5	0.3	17.7	0.6
2002	42.3	6.0	2.7	4.3	0.8	4.8	4.6	0.3	18.1	0.7
2003	43.4	6.2	2.7	4.5	0.9	4.9	4.6	0.3	18.6	0.7
2004	44.4	6.4	2.8	4.6	0.9	5.0	4.7	0.3	19.0	0.7
2005	45.3	6.6	2.8	4.7	0.9	5.1	4.8	0.3	19.4	0.7
2006	46.1	6.8	2.8	4.8	0.9	5.2	4.8	0.3	19.8	0.7
2007	47.1	7.0	2.9	5.0	0.9	5.3	4.9	0.3	20.1	0.7
2008	48.0	7.2	2.9	5.1	0.9	5.4	5.0	0.3	20.5	0.7
2009	49.3	7.4	3.0	5.3	1.0	5.5	5.1	0.3	20.9	0.8
2010	50.1	7.6	3.0	5.4	1.0	5.6	5.1	0.3	21.3	0.8

Table 2-1-5 SALES VOLUME OF FMP IN ZAMBIA

(Unit: '000 P205 ton)

	Total	Central	Copper- belt	Eastern	Luapula	Lusaka	North- ern	North- western	South- ern	Western
1986	9.5	1.3	1.3	1.2	0.4	0.0	2.9	0.2	2.0	0.2
1987	10.2	1.3	1.5	1.1	0.5	0.0	3.2	0.2	2.1	0.3
1988	10.8	1.3	1.7	1.1	0.5	0.0	3.4	0.2	2.3	0.3
1989	11.6	1.4	1.9	1.1	0.6	0.0	3.6	0.2	2.5	0.3
1990	12.2	1.4	2.0	1.1	0.6	0.0	3.8	0.2	2.7	0.4
1991	12.7	1.4	2.1	1.1	0.7	0.0	3.9	0.2	2.9	0.4
1992	13.2	1.5	2.2	1.1	0.7	0.0	4.0	0.2	3.1	0.4
1993	13.6	1.5	2.3	1.2	0.7	0.0	4.0	0.2	3.3	0.4
1994	14.1	1.6	2.3	1.2	0.7	0.0	4.1	0.2	3.5	0.5
1995	14.4	1.6	2.4	1.2	0.8	0.0	4.1	0.2	3.6	0.5
1996	14.8	1.7	2.4	1.2	0.8	0.0	4.2	0.2	3.8	0.5
1997	15.3	1.7	2.5	1.3	0.8	0.0	4.3	0.2	3.9	0.6
1998	15.6	1.8	2.5	1.3	0.8	0.0	4.3	0.2	4.1	0.6
1999	15.9	1.8	2.6	1.3	0.8	0.0	4.4	0.2	4.2	0.6
2000	16.2	1.9	2.6	1.4	0.8	0.0	4.4	0.2	4.3	0.6
2001	16.5	1.9	2.6	1.4	0.8	0.0	4.5	0.3	4.4	0.6
2002	17.0	2.0	2.7	1.4	0.8	0.0	4.6	0.3	4.5	0.7
2003	17.5	2.1	2.7	1.5	0.9	0.0	4.6	0.3	4.7	0.7
2004	17.8	2.1	2.8	1.5	0.9	0.0	4.7	0.3	4.8	0.7
2005	18.2	2.2	2.8	1.6	0.9	0.0	4.8	0.3	4.9	0.7
2006	18.4	2.3	2.8	1.6	0.9	0.0	4.8	0.3	5.0	0.7
2007	18.7	2.3	2.9	1.7	0.9	0.0	4.9	0.3	5.0	0.7
2008	19.0	2.4	2.9	1.7	0.9	0.0	5.0	0.3	5.1	0.7
2009	19.7	2.5	3.0	1.8	1.0	0.0	5.1	0.3	5.2	0.8
2010	19.8	2.5	3.0	1.8	1.0	0.0	5.1	0.3	5.3	0.8

Table 2-1-6 SALBS VOLUME OF SSP IN ZAMBIA

(Unit: '000 P205 ton)

	Total	Central	Copper- belt	Eastern	Luapula	Lusaka	North- ern	North- western	South- ern	Western
1991	9.03	1.29	0.63	1.02	0.21	1.02	1.17	0.06	3.51	0.12
1992	9.39	1.32	0.66	1.02	0.21	1.08	1.20	0.06	3.72	0.12
1993	9.72	1.35	0.69	1.05	0.21	1.11	1.20	0.06	3.93	0.12
1994	10.11	1.41	0.69	1.08	0.21	1.14	1.23	0.06	4.14	0.15
1995	10.44	1.44	0.72	1.08	0.24	1.20	1.23	0.06	4.32	0.15
1996	10.80	1.50	0.72	1.11	0.24	1.23	1.26	0.06	4.53	0.15
1997	11.13	1.53	0.75	1.14	0.24	1.26	1.29	0.06	4.68	0.18
1998	11.43	1.59	0.75	1.17	0.24	1.29	1.29	0.06	4.86	0.18
1999	11.76	1.65	0.78	1.20	0.24	1.32	1.32	0.06	5.01	0.18
2000	12.06	1.71	0.78	1.23	0.24	1.38	1.32	0.06	5.16	0.18
2001	12.36	1.74	0.78	1.26	0.24	1.41	1.35	0.09	5.31	0.18
2002	12.69	1.80	0.81	1.29	0.24	1.44	1.38	0.09	5.43	0.21
2003	13.02	1.86	0.81	1.35	0.27	1.47	1.38	0.09	5.58	0.21
2004	13.32	1.92	0.84	1.38	0.27	1.50	1.41	0.09	5.70	0.21
2005	13.59	1.98	0.84	1.41	0.27	1.53	1.44	0.09	5.82	0.21
2006	13.83	2.04	0.84	1.44	0.27	1.56	1.44	0.09	5.94	0.21
2007	14.13	2.10	0.87	1.50	0.27	1.59	1.47	0.09	6.03	0.21
2008	14.40	2.16	0.87	1.53	0.27	1.62	1.50	0.09	6.15	0.21
2009	14.79	2.22	0.90	1.59	0.30	1.65	1.53	0.09	6.27	0.24
2010	15.03	2.28	0.90	1.62	0.30	1.68	1.53	0.09	6.39	0.24

Table 2-2-1 MAJOR FACILITIES OF NITROGEN CHEMICALS OF ZAMBIA LTD AT KAFUE

Construction Phase	Process Plant and Design Capacity, TPD										Raw Materials and Utilities Plant				Completion Date	Contractors
	NH ₃	NA	SA	AN	AS	CF	MeOH	CO ₂	Coal TPD	Pyrite TPD	Water TPD	Electricity MW	Steam TPH			
1. Plant I	30,000	50,000	-	60,000	-	-	-	-	65,000	-	6,000	13.0	27.0		Kobe Steel Ltd., Japan	
- Original	(95.3)	(172.4)		(205.5)					(Stand-by)							
				ANBA: 20,000												
				Pert: 40,000												
2. CO ₂ Plant	-	-	-	-	-	-	-	1,000	-	-	-	-	-		Ube Industries Ltd., Japan	
							(3)									
3. Plant II	66,000	70,000	-	80,000	50,000	142,320	1,650	-	191,700	-	12,000	40.0	44.0		Klockner Industrie	
- Expansion	(220)	(212)		(242)	(151)	(432)	(5)								-Anlagen GmbH,	
					CF "A"	1,220									(Krupp-Koppers, Spie-	
					"C"	11,200									Batignolles, Tublin,	
					"D"	48,000									Indumont and Cdf	
					"R"	22,600									Chimie), Federal	
					"V"	4,900									Republic of Germany	
					"X"	54,400										
4. SA Plant	-	-	60,000	-	-	-	-	-	-	40,000	3,600	3.0	-		Kobe Steel Ltd., Japan	
			(182)												September 28, 1983	
5. Rehabilitation of Plant I	-	-	-	-	-	-	-	-	-	-	-	-	-		Kobe Steel Ltd., Japan	
6. Renovation of Plant II	-	-	-	-	-	-	-	-	-	-	-	-	-		Klockner Industrie	
															-Anlagen GmbH, Federal Republic of Germany	
Total	96,000	120,000	60,000	140,000	50,000	142,320	1,650	1,000	191,700	40,000	21,600	46.0	71.0			
	(315.3)	(384.4)	(182)	(447.5)	(151)	(432)	(5)	(3)								

Notes: 1) Coal (C: 69.4%, VM: 21.7%, Ash: 17.1%) from Maamba Collieries Ltd., Maamba is supplied by railways of ZR at NCZ.
 2) Pyrite (S: 45%) from ZCCM, Nampundwe is supplied by truck on road at NCZ but occasionally by railways of ZR transshipped at Lusaka siding.

Table 2-2-2 COMPOUND FERTILIZERS PRODUCTION AT NITROGEN CHEMICALS OF ZAMBIA LTD IN KAFUE

Product Code	Nutrient Analysis, %										Raw Material Consumption, kg/Ton										Major Crops
	T-N	AV-P ₂ O ₅	S-K ₂ O	T-S	S-B	Moisture	NH ₃	AN	SA	AS	DAP	TSP	SSP	MOP	SOP	Borax	Coating	Total			
"A"	G* 2.0 C* 2.1	18.0 18.0	15.0 15.2	9.0 12.0	0.1 0.1	3	Wt 8 NPK 6.6 SB -	29 10.0	-	21	-	213 90.0	455 80.5	-	296 152.4	9	10	1,041 352.9 121.4	Tabacco		
"C"	G* 6.0 C* 6.3	18.0 18.0	12.0 12.2	9.0 10.5	0.1 0.1	3	Wt 6 NPK 4.9 SB -	87 30.0	-	126 28.5 30.9	-	275 127.9 5.5	288 51.0 37.4	50	178 91.7 31.2	9	10	1,029 364.5 106.0	Tabacco (Virginia, Burley), Cotton (B Deficient Soil)		
"D"	G* 10.0 C* 10.3	20.0 19.7	10.0 10.2	11.0 11.2	0.0 0.0	1	Wt - NPK - SB -	145 50.0	32	237 49.8 58.1	15 2.7/7.0 0.5	408 189.7 8.2	-	-	197 101.5 34.5	-	10	1,044 400.7 111.7	Maize, Cotton Potatoes, Vegetables, Tabacco Seed Bed		
"R"	G* 20.0 C* 21.4	20.0 19.7	0.0 0.0	11.0 12.6	0.0 0.0	1	Wt - NPK - SB -	116 40.0	-	463 97.2 113.4	423 77.4/197.0 12.7	-	-	-	-	-	-	1,012 411.6 126.1	Maize (Kafue Basin, K2O Sufficient Soil), Cotton, Irrigated Lucerne		
"V"	G* 4.0 C* 4.1	18.0 17.9	15.0 15.3	9.0 10.6	0.1 0.1	3	Wt 6 NPK 4.9 SB -	58 20.0	-	76 16.0 18.6	-	259 120.4 5.2	331 58.6 43.0	63	222 114.3 38.9	9	10	1,034 372.6 106.7	Tabacco (Virginia, Turkish), Fruit (Orchards)		
"X"	G* 20.0 C* 20.8	10.0 9.9	5.0 5.1	11.0 12.8	0.0 0.0	1	Wt - NPK - SB -	261 90.0	-	427 89.7 104.6	153 28.0/71.1 4.6	59 27.4 1.2	-	-	99 51.0 17.3	-	10	1,009 357.2 127.7	Maize, Cotton		

Notes: 1) G* = Guaranteed, C* = Calculated analysis assuming no loss during production.

2) Assumed analysis of raw materials (N - P₂O₅ - K₂O - S - B) in percentage.

NH₃ = (82.2 - 0 - 0 - 0 - 0) / TSP = (0 - 46.5 - 0 - 2.0 - 0)

AN = (34.5 - 0 - 0 - 0 - 0) / SSP = (0 - 17.7 - 0 - 13.0 - 0)

SA = (0 - 0 - 0 - 32.6 - 0) / MOP = (0 - 0 - 61.0 - 0 - 0)

AS = (21.0 - 0 - 0 - 24.5 - 0) / SOP = (0 - 0 - 51.5 - 17.5 - 0)

DAP = (18.3 - 46.5 - 0 - 3.0 - 0) / Borax = (0 - 0 - 11.3)

Compound fertilizer plant capacity is 142,320 TPD (24 TPH or 576 TPD but 20 TPH or 480 TPD for "C"). The dimension of major equipment: drum granulator (3.0mD x 6.0mL, 150 TPH, 75 kWh, 7RPM) and drum dryer (3.3mD x 25.0mL, 150 TPH, 160kWh, 3RPM). The plant was designed by CDF Chimie, France.

Major product grades at NCZ are "D", "R" and "X", but "A" and "V" have never been produced up to 1987.

The standard method of NPK analysis at NCZ is CDF Chimie Central Lab Methods [T-N, A-N, N-N, T-P₂O₅, S-P₂O₅, C-P₂O₅, W-P₂O₅, S-K₂O, Free Moisture] and AOAC Method-12th Edition, 1975 [T-N, A-N, N-N, T-P₂O₅, W-P₂O₅, S-P₂O₅, C-P₂O₅, S-K₂O, T-S (SO₃), Free Acidity, Free Moisture]. The rapid methods at NCZ are for A-N, N-N, T-P₂O₅ and K₂O.

The particle size is 95% (2/4 mm) and 5% (1/2 mm) and packaging is 50 kg net in PP woven and PE inter bag.

Table 2-2-3 FERTILIZER CONTROL REGULATION IN ZAMBIA (1/3)

Regulation and Authority	Scope	Specification
1. The Agriculture (Fertilizers and Feed) Act ... Chapter 351 of the Law of Zambia, January 1, 1970, Zambia	The regulation and control of : Agricultural Fertilizers and Farm Feed on : Manufacture, Processing, Importation and Sales for: Minimum Standards of Effectiveness and Purity	Fertilizer : Improvement or maintenance of plant growth or soil productivity Fertilizer Control : Minister, Registering, Officer, Analyst, Inspector, Lab and Plant Sub-Standard Fertilizer : Detention
2. The Agriculture (Fertilizers) Regulations ... Subsidiary Legislation, 1966, Zambia	The regulation on : Fertilizers for: Plant, Analyst and Lab, Search and Seizure, Sampling and Analysis, Limit of Variation	Sampling : One package/Ton-Bags and two samples/ Ton-Bulk Analysis and Statements : - Moisture (100°C, 3 hours) - T-N, A-N, A-N(+) N-N, U-N - W-P ₂ O ₅ as P (Sample 100g/400ml H ₂ O, shaking for 0.5 hour) - T-K ₂ O as K in Chloride or Sulfate (Sample 10g/incinerated at 500°C, dissolved in diluted HCl) - T-S - T-B - Free Acid in Ammonium Sulfate Maximum Variation : - N : 1/10N, % (0.3/1.0%) - W-P ₂ O ₅ as P: 1/20P, % (0.2/0.9%) - T-K ₂ O as K : 1/20K, % (0.6/1.7%) - Cl : 1/20 Cl, % - B : 1/5 B, % - S : No variation is allowed below minimum
3. Customs and Excise Act ... Chapter 662 of the Law of Zambia, July 1, 1955	Customs duty and surtax payable on fertilizer	Classification of Fertilizer: Heading Fertilizer Duty Rate (%) 31.01 Guano and others 0.0 31.02 SN,AN,CAN,AC,ASN, Urea, CMN, CCN and others 0.0 31.03 Basic slag, Thermophos, Fused Phosphate, Al Ca Phosphate, SSP,DSP, TSP and others 0.0 31.04 MOP, SOP, KMGs and others 0.0 31.05 MAP and DAP 30.0

Table 2-2-3 FERTILIZER CONTROL REGULATION IN ZAMBIA (2/3)

Regulation and Authority

4. Zambia Bureau of Standards (ZABS) ... Ministry of Commerce and Industry (MCI), Lusaka, Zambia

Specification, Testing, Requirements, Codes, Unit, Symbols for Industrial and Agricultural Products (43 Items)

Major Coverage

None standards so far published or studied for fertilizers at ZABS (December, 1986)

5. Tender Document for Fertilizer ...

- National Agricultural Marketing Board of Zambia (NAMBOARD), Lusaka, Zambia
- MF/PSE/125, March 17, 1986
- No. 2/86, April 7, 1986
- No. 3/86, May 30, 1986

Fertilizer Tender

- Pricing (net weight) in US\$, CIF, Free on Rail; Kasama, Livingston, Lusaka, Mkushi or Mpika; Dar-es-Salaam, Beira or East London Liner Shipment Terms at 90 days usance basis (interest free)
- Shipping Tolerance: ± 5%
- Spare Bag: - 2%
- Bid Bond: 10%
- SGS's Inspection
- Agriculture Act
- Size: (+)2.0mm 11% max (-)3.8mm 3% max

Fertilizer Specification:

W-	Analysis, (%)					Biuret:
	N	P ₂ O ₅	K ₂ O	S	B Mo Zn Other	
Urea	46	-	-	-	-	1.0
AN	34	-	-	-	-	-
Mixture						
"C"	6*	18	12**	8-10	0.1	-
"D"	10*	20	10***	10-12	-	-
"R"	20*	20	0***	10-12	-	-
"y"	4*	18	15**	8-10	0.1	-
"X"	20	10	5***	10-12	-	-
Solubor	-	-	-	-	20.5	-
Sodium Molybdate	-	-	-	-	-	39
Zn Sulfate	-	-	-	-	-	46

Note: * A-N/T-N = 0.75, N-N/T-N = 0.25

** K₂O(SO₃)/K₂O = 0.75, K₂O (Cl)/K₂O = 0.25

*** K₂O(SO₃)/K₂O = 1.00

Bag Specification:

- Outer Bag: PP Woven Bag (50kg Net, 2.6 oz/sq. yd)
- Liner : PE Bag (4 mil)

6. Tender Document for Fertilizer ... Nitrogen Chemicals of Zambia Ltd. (NCZ), Kafue, Zambia

- NCZ/64/86, December 8, 1986
- Pricing
- FOB Unit Price
- Ocean Freight to Dar-es-Salaam
- Road Freight to Kafue
- C&F, Dar-es-Salaam

Fertilizer Specification:

Fertilizers	Analysis, (%)			Size #, mm
	N	P ₂ O ₅	K ₂ O Moisture	
DAP	16-18	46-48	-	95(1.4-3.3)
MOP	-	-	61	95(0.6-3.0)

Bag Specification:

- Outer Bag: PP Woven Bag (50kg Net, 0.56 x 1.04 120 g min)
- Liners : PE (0.61 x 1.17m, 0.06mm - LDPE, 0.03mm - LDPE + LLDPE, 0.025mm - HDPE)

Table 2-2-3 FERTILIZER CONTROL REGULATION IN ZAMBIA (3/3)

Regulation and Authority		Major Coverage	
7. Product Guide Nitrogen Chemicals of Zambia Ltd., (NCZ) Kafue, Zambia, March 14, 1985	Product Marketing	Fertilizer Specification:	
		Analysis, (%)	
		Fertilizer N	P ₂ O ₅ K ₂ O S
		AN	34.5 - - - 0.3
		AS	20.5 - - - 0.2
		Compound Fertilizer	
		"C"	6 18 12 - 0.1 3.0 2-4
		"D"	10 20 10 - - 1.0 2-4
		"R"	20 20 - - - 1.0 2-4
		"V"	4 18 15 - 0.1 3.0 2-4
		"X"	20 10 5 - - 1.0 2-4
		Fertilizer Bag:	50 kg Net PP Woven/PE Liner
9. Standard Analytical Method ... Nitrogen Chemicals of Zambia Ltd., (NCZ), Kafue Zambia	The fertilizer analytical method are adopted from	Analytical Method:	
	(1) CdF Chemie's Method, France (NFU) and	- N : T-N, A-N, N-N	
	(2) Official Methods of Analysis of the Association of Official Analytical Chemists, 12th Edition, 1970, Association of Official Analytical Chemists, Washington DC, The USA	- P ₂ O ₅ : T-P ₂ O ₅ , W-P ₂ O ₅ , AV-P ₂ O ₅ (pH 7, Sp Gr 1.05, Agitation at 65°C for 1.0 hour) S-P ₂ O ₅ (Joulje Citrate), C-P ₂ O ₅ (NF U 42 212)	
		- K ₂ O : W-K ₂ O (Water soluble at boiling temperature for 0.25 hour)	
		- S : Acid soluble sulfate	
		- Free Acidity : Acetone soluble as P ₂ O ₅	
		- Free Moisture: Vacuum drying or Karl Fisher titration	
9. Rapid Analytical Method ... Nitrogen Chemicals of Zambia Ltd., (NCZ), Kafue, Zambia	The rapid analytical methods for plant control	Analytical Methods:	
		- N : T-N, A-N, N-N	
		- P ₂ O ₅ : (H ₂ SO ₄ soluble and AgNO ₃ titration)	
		- K ₂ O : T-K ₂ O	
10. Process Design Study for the Beneficiation of Chilembwe Phosphate Ore ... Dr. Wilfred C. Lombe, School of Mines, University of Zambia (UNZA), September 1985	Solubility of P ₂ O ₅ in Chilembwe Phosphate Concentrate	Analytical Results :	
		- AV-P ₂ O ₅ : 1.3%	
		- F-P ₂ O ₅ : 3.5%	
		Not useful for direct application	

Table 2-2-4 ZAMBIAN RAW MATERIAL ANALYSIS SUMMARY

Items	Phosphate Ore, Chilembwe, Zambia	Phosphate Concentrate, Chilembwe, Zambia,	Serpentine, Mkushi, Zambia	Dolomite, Lusaka, Zambia	Silica Sand, Kapiri Mposhi, Zambia	
Sampling Date	November 28, 1986	January 19, 1987 (Beneficiation)	December 01, 1986	December 03, 1986	December 02, 1986	
Present Ownership	MINEX/ZIMCO	-	MINEX/ZIMCO	CSSL/INDECO/ ZIMCO	Kapiri Glass Product Ltd./ INDECO/ZIMCO	
Chemical Analysis, %						
- P ₂ O ₅	18.60	33.69	-	-	-	
- SO ₃	-	0.23	-	-	-	
- CO ₂	-	0.04	-	-	-	
- F	0.92	1.89	-	-	-	
- Cl	-	0.03	-	-	-	
- CaO	29.95	46.18	0.02	32.56	0.03	
- MgO	1.82	0.41	38.45	20.27	0.03	
- FeO	-	0.32	-	-	-	
- Fe ₂ O ₃	1.66	0.57	5.36	0.45	0.21	
- Al ₂ O ₃	2.36	2.23	1.76	-	0.13	
- SiO ₂	38.63	12.49	41.44	0.26	98.38	
- Na ₂ O	-	0.21	-	1.16	-	
- K ₂ O	-	0.14	-	0.12	-	
- Cd, ppm	-	1.0 (-)	-	-	-	
- As	-	3.1	-	-	-	
- F/Cl Adjustment, %	-	(-) 0.803	-	-	-	
- NiO	-	-	0.19	-	-	
- Cr ₂ O ₃	-	-	0.03	-	-	
- Ignition Loss	2.21	0.54	11.96	44.79 (CO ₂)	0.23	
- Free Moisture	-	0.13	-	-	-	
Total	98.05	98.297	99.21	99.61	99.01	
Particle Size, %	Flotation Feed	Flotation Product/ FMP Test	SSP Test	FMP Test	(Block)	(Block)
(+) 6 Mesh	-	-	-	-	-	-
(+) 12	-	0.0	0.0	10.0	-	-
(+) 32	0.0	0.7	0.0	80.0	-	-
(+) 60	5.0	14.5	0.0	95.0	-	-
(+) 80	50.0	31.2	0.0	100.0	-	-
(+) 100	75.0	42.2	1.9	-	-	-
(+) 200	90.0	68.0	12.8	-	-	-
(-) 200	10.0	32.0	87.2	0.0	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0
Density, g/cm ³						
- True	3.03	3.08	3.08	2.57	2.84	-
- Bulk	1.80	1.80	1.54	1.6	1.6	-
Work Index, kWh/Ton	12.0	12.0	-	11.0	10.0	-
Angle of Repose, Degree	33.0	45.0	48.0	41.0	41.0	41.0

Notes:

- 1) Phosphate concentrate (60 kg) is prepared at Central Research Center of Nippon Mining Co., Ltd. in Toda-Shi, Saitama, Japan during January, 1987, with P₂O₅ recovery of 97.2% and 12% free moisture by flotation (one batch of 1.0 kg feed) and is dried by hot air prior analysis and testing. Principle minerals in phosphate concentrate are judged as mixture of fluorapatite and hydroxyapatite by X-ray diffraction analysis and chemical analysis.
- 2) Principle mineral in Serpentine is identified as antigorite by X-ray diffraction analysis and chemical analysis.

Table 2-3-1 PRODUCTION TEST RESULTS OF FUSED MAGNESIUM PHOSPHATE

Items	Raw Materials				Product	
	Phosphate Concentrate		Serpentine		Fused Magnesium Phosphate (FMP)	
	Chilembwe, Zambia	Florida, USA	Mkushi, Zambia	Maizuru, Japan	Zambian	Japanese
1. Chemical Analysis, %						
P ₂ O ₅	33.69	34.18	-	-	20.28	20.30
F	1.89	3.77	-	-	0.72	1.41
CO ₂	0.04	-	-	-	-	-
CaO	46.18	48.55	0.02	0.36	29.09	30.20
MgO	0.41	0.31	38.45	38.67	18.79	15.80
Fe ₂ O ₃	0.89	0.79	5.36	8.19	-	-
Al ₂ O ₃	2.23	0.98	1.76	1.02	-	-
SiO ₂	12.49	4.26	41.44	38.93	26.53	23.50
Ignition Loss	0.59	5.41	11.96	11.01	-	-
Free Moisture	0.50	0.50	4.50	4.50	0.50	0.50
Unit Consumption, TPT	0.618	0.599	0.470	0.518	(-)1.000	(-)1.000
2. Fertilizer Nutrients, %						
T-P ₂ O ₅	33.69	34.18	-	-	20.28	20.30
C-P ₂ O ₅ (pH: 2, Sp Gr: 1.09)	6.05	13.16	-	-	20.11	20.20
F-P ₂ O ₅ (pH: 1.75, Sp Gr: 1.01)	7.14	15.03	-	-	20.03	19.83
C-P ₂ O ₅ (pH: 4, Sp Gr: 1.02)	2.00	7.61	-	-	20.09	20.15
AV-P ₂ O ₅ (pH: 7, Sp Gr: 1.09)	2.25	7.05	-	-	14.38	17.02
S-P ₂ O ₅ (pH: 9.6, Sp Gr: 1.08)	0.86	3.56	-	-	14.25	13.92
W-P ₂ O ₅ (pH: 7, Sp Gr: 1.00)	0.08	0.15	-	-	0.04	0.03
S-SiO ₂	-	-	-	-	26.19	23.20
C-MgO	-	-	-	-	18.70	15.50
Total Alkaline	-	-	-	-	54.07	53.50
3. Physical Property - Dry						
Bulk Density	1.80	1.57	1.60	1.60	1.46	1.47
Angle of Repose, Degree	35.0	33.0	41.0	41.0	36.0	36.0
Size Distribution, %						
(+) 12 Mesh	0.0	1.5	10.0	17.0	1.1	1.3
(+) 32	0.7	17.3	80.0	98.0	55.6	52.6
(+) 100	42.2	94.7	100.0	100.0	94.9	92.7
(+) 200	68.0	97.6	100.0	100.0	96.9	95.4
(-) 200	32.0	2.4	0.0	0.0	3.1	4.6

Notes:

- Zambian FMP was produced at Hinode Kagaku Kogyo KK, Maizuru, Japan using Chilembwe phosphate concentrate and Mkushi serpentine on February 10, 1987 at experimental electric furnace (one batch of 7.0 kg). Stamping of experimental furnace by magnesia makes a higher analysis of MgO in product than commercial continuous operation product.
- Japanese FMP was produced at Hinode Kagaku Kogyo KK, Maizuru, Japan using Florida phosphate rock and Maizuru serpentine on February 10, 1987 at commercial open hearth furnace using oil coke as fuel (design capacity of 80,000 TPY).
- Fluorine losses during FMP production are 36.7% for Zambian and 37.0% for Japanese, respectively.

Table 2-3-2 PRODUCTION TEST RESULTS OF SINGLE SUPER PHOSPHATE

Items	Raw Materials				Product	
	Phosphate Concentrate		Sulfuric Acid		Single Super Phosphate (SSP)	
	Chilembwe, Zambia	Florida, USA	Ube, Japan	Ube, Japan	Zambian	Japanese
1. Chemical Analysis, %						
P ₂ O ₅	33.69	30.39	-	-	19.12	19.16
F	1.89	3.72	-	-	0.65	1.76
CO ₂	0.04	2.71	-	-	-	-
CaO	46.18	44.73	-	-	26.12	28.33
MgO	0.41	0.31	-	-	0.25	0.18
Fe ₂ O ₃	0.89	1.79	-	-	0.47	1.19
Al ₂ O ₃	2.23	0.95	-	-	1.24	0.62
SiO ₂	12.49	4.76	-	-	6.99	2.87
Ignition Loss	0.59	1.97	-	-	-	-
Sulfuric Acid Consumption						
- Stoichiometric, H ₂ SO ₄	100	100	65.34	61.90	-	-
- Experimental, H ₂ SO ₄	100	100	60.06	55.72	-	-
Consumption, TPT	0.580	0.600	0.367 (72% H ₂ SO ₄)	0.356 (70% H ₂ SO ₄)	(-)1.000	(-)1.000
2. Fertilizer Nutrients, %						
T-P ₂ O ₅	33.69	30.39	-	-	19.12	19.16
C-P ₂ O ₅ (pH: 2, Sp Gr: 1.09)	6.05	7.81	-	-	18.05	18.20
F-P ₂ O ₅ (pH: 1.75, Sp Gr: 1.01)	7.14	7.62	-	-	17.88	17.96
C-P ₂ O ₅ (pH: 4, Sp Gr: 1.02)	2.00	2.60	-	-	.	.
Av-P ₂ O ₅ (pH: 7, Sp Gr: 1.09)	2.25	2.79	-	-	17.79	17.83
S-P ₂ O ₅ (pH: 9.6, Sp Gr: 1.08)	0.86	1.07	-	-	17.50	17.26
W-P ₂ O ₅ (pH: 7, Sp Gr: 1.00)	0.08	0.07	-	-	16.38	15.72
Free Acid as P ₂ O ₅	-	-	-	-	4.04	2.90
Free Moisture	-	-	-	-	10.54	10.66
pH of 10% Solution	-	-	-	-	2.65	2.86
3. Physical Property						
Bulk Density	1.54	1.28	-	-	1.10	0.97
Angle of Repose, Degree	48.0	48.0	-	-	46.0	49.0
Size Distribution, %						
(+) 12 Mesh	0.0	0.0	-	-	0.0	0.0
(+) 32	0.0	0.0	-	-	29.2	34.6
(+) 100	1.9	10.0	-	-	53.4	59.1
(+) 200	12.8	30.0	-	-	75.9	80.4
(-) 200	87.2	70.0	-	-	24.1	19.6

Notes:

- Zambian SSP was produced at Ube Industries Ltd., Ube, Japan using Chilembwe phosphate concentrate on February 20, 1987 at experimental apparatus (one batch of 0.2 kg). Analysis is made after 4 weeks aging conditioning.
- Japanese SSP was produced at Ube Industries Ltd., Ube, Japan using Florida phosphate rock on February 20, 1987 at commercial continuous mixing plant (design capacity of 45,000 TPY). Analysis is made after 4 weeks aging conditioning for both products.
- Stoichiometric sulfuric acid consumption (H₂SO₄ gr/100 g Phos Rock) = 1.75 CaO% + 1.84 Fe₂O₃% + 2.88 Al₂O₃% - 0.69 P₂O₅% - 1.23 SO₃%.
- Fluorine losses during SSP production are 39.4% for Zambian and 25.0% for Japanese, respectively.

Table 2-3-3 SITE CONDITIONS FOR PHOSPHATE FERTILIZER PLANT AND RAW MATERIAL SUPPLY IN ZAMBIA (1/2)

	Potential Site for Phosphate Fertilizer Plant			Site for Raw Material Supply		
	Kabwe	Ndola	Kitwe	Chilembwe	Muloa, Mkushi	
Industrial Estate (Plot No.6)	Chimanimani Village	General Area	General Area	Phosphate Rock Supply	Serpentine Supply	
1. Province/Location	Lusaka Province E28°10', S15°46'	Central Province E28°27', S14°24'	Copperbelt Province E28°40', S12°58'	Copperbelt Province E28°12', S12°50'	Eastern Province E31°4', S13°59'	Central Province E29°00', S13°41'
2. General Description						
- Vegetation	Short Weeds	Very Short Weeds	Weeds	Weeds	Bush	Bush
- Undulation, m	4	2.5	3	3	10	30
- Adjacent Township and Urban Population - 1980	Kafue-29,794	Kabwe-143,635	Ndola-282,439	Kitwe-314,794	Katate- 5,504, Petauke-7,531	Mkushi-4,104 Kapiri Mposhi- 13,677
3. Site Data						
- Soil Bearing Capacity, Ton/m ²	5	(5)	(5)	(5)	3+	(5)
- Available Area, m ²	60,000	120,000	50,000+	50,000+	100,000+	100,000+
- Site Filling, m	2	2	-	-	-	-
- Lease (14 Year), ZK/m ²	0.62+1.44/Year	(0.62+1.44/Year)	(0.62+1.44/Year)	(0.62+1.44/Year)	(0.62+1.44/Year)	(0.62+1.44/Year)
- Mean Sea Level, meter	988	1,194	1,250	1,250	910	1,227
- Atmospheric Pressure, mbar	898	877	870	870	915	870
- Wind, m/sec						
- Maximum Velocity	31.3	32.6	29.9	29.9	31.2	29.9
- Design Velocity	30.0	30.0	30.0	30.0	30.0	30.0
- Prevailing Direction	-	-	-	-	-	-
4. Climatic Conditions						
- Temperature, °C						
- Maximum	38.3	36.7	35.0	35.0	37.8	35.0
- Minimum	3.9	0.0	(-12.2)	(-12.2)	2.8	(-12.2)
- Average	20.2	20.2	20.3	20.3	20.3	20.3
- Relative Humidity, %						
- Maximum	87	83	78	78	78	78
- Minimum	37	25	39	39	41	39
- Rainfall, mm						
- Maximum Hourly	-	-	-	-	-	-
- Maximum Daily	113	102	125	125	126	125
- Mean Annual - 30 Years	803	952	1,212	1,212	1,014	1,212
5. Earthquake						
- Seismic Zone	-	-	-	-	-	-
- Design Seismic Factory, -	0.05	0.05	0.05	0.05	0.05	0.05

Table 2-3-3 SITE CONDITIONS FOR PHOSPHATE FERTILIZER PLANT AND RAW MATERIAL SUPPLY IN ZAMBIA (2/2)

	Potential Site for Phosphate Fertilizer Plant			Site for Raw Material Supply	
	Kabwe		Kitwe	Chilembwe	Muloba, Mkushi
	Industrial Estate (Plot No.6)	Chimanimani Village	General Area	Phosphate Rock Supply	Serpentine Supply
6. Transport Infrastructure					
- Road Condition, (km)	Good (0.5) to the Great North Road	Good (0.5) to the Great North Road	Good (0.5) to the Great North Road	Poor (35) to the Great East Road	Poor (15) to the Great North Road
- Railway Connection, km	0.05 to ZR	0.1 to ZR	0.1 to ZR	None	21 to Lunsemfwa Station, TAZARA
- Air Transport, (km)	Lusaka, (44)	Ndola, (4)	Kitwe, (10)	Chipata, (220)	Ndola, (200)
- River and Ocean Transport	None	None	None	None	None
7. Utilities					
- Water Supply					
- Source, (km)	Kafue River, (3)	Mulungushi Dam, (10)	Kafue River, (40)	Mankwala Dam, (8)	None
- Availability	Available	Depend on Project	Available	Limited	-
- Quality	High	High	High	High	-
- Pricing, Month*	Free of Charge	ZK60 + ZK0.44/m ³	NA	Free of Charge	-
- Electric Power					
- Sub-Station, (km)	ZESCO, (0.6)	ZESCO, (5.0)	ZESCO (CPC), (5.0)	ZESCO, (40-Ketete)	ZESCO, (10)
- Voltage, kV	33, 11	33, 11	66, 33, 11	33, 11	11
- Frequency, Hz	50	50	50	50	50
- Pricing by ZESCO-Tariff**	D3	D3	D3	D2	D1
- Fixed Charge, ZK/Month	13,250	13,250	13,250	1,325	70
- Demand Charge, ZK/kVA/Month	9.08	9.08	9.08	10.62	11.87
- Unit Charge, ZK/kWh	0.027	0.027	0.027	0.041	0.053
- Fuel Oil/Coal	Available	Available	Available	Available	Available
8. Labour					
- Availability	Available	Available	Available	Available	Available
- Skill Level	High	Middle	High	Low	Middle
9. Physical Distribution					
- Raw Materials transport, ZK/Ton, (km)					
- Phos Concentrate, Chilembwe, Road	541 (453)	635 (528)	818 (674)	-	-
- Serpentine, Mkushi, Road/Railways	299 (173)	131 (155)	191 (160)	-	-
- Product Distribution, km on Road/Railway					
- Ndola	356	187	0	-	-
- Kasama	864	696	756	-	-
- Lusaka	48	120	308	-	-
- Monze	108	277	464	-	-
- Mongu	627	624	807	-	-

Notes: Pricing is as of January 01, 1987 and foreign exchange rate is assumed as ZK8.00/US\$1.00 for financial and economic calculation

* ; ZK60 for the initial monthly consumption of 45 Ton of water

** ; Government sales tax of 15% on the tariff is charged additionally

Table 2-3-4 UTILITY SUPPLY AND PROJECT INFRASTRUCTURES IN ZAMBIA

	Potential Site for Phosphate Fertilizer Plant								Site for Raw Material Supply				
	Kafue								Chilembwe	Maloba, Mkushi			
	Independent from NCZ		Integration with NCZ		Kabwe		Ndola			Kitwa		Phos Rock	Serpentine
	FMP	Others	FMP	Others	FMP	Others	FMP	Others	FMP	Others			
1) Electricity Supply													
- Distribution and Substation													
- Distance, km	0.6	0.6	0.6	0.6	5.0	5.0	5.0	5.0	5.0	5.0	40.0	10	
- Capacity, MW	10	1.5-	55+10	55+1.5-	10	1.5-	10	1.5-	10	1.5-	1.0	0.1	
- Voltage, KV	33	11	33	33	33	11	66	11	66	11	11	11	
- Investment, ZK, MM	9.50	2.83	9.50	1.00	13.75	4.85	11.32	4.85	11.32	4.85	3.75	2.88	
- Tariff*, ZK/kWh (MW)													
- FMP-EF (7.7)	0.0462		0.0423		0.0462		0.0462		0.0462		-	-	
- FMP-OHP (1.1)	0.0624		0.0423		0.0624		0.0624		0.0624		-	-	
- SSP (0.5)	0.0644		0.0423		0.0644		0.0644		0.0644		-	-	
- TSP (0.3)	0.0668		0.0423		0.0668		0.0668		0.0668		-	-	
- DAP (0.3)	0.0668		0.0423		0.0668		0.0668		0.0668		-	-	
- NP (1.4)	0.0620		0.0423		0.0620		0.0620		0.0620		-	-	
- Phos Rock (0.9)	-		-		-		-		-		0.0657	-	
- Serpentine (0.1)	-		-		-		-		-		-	0.0754	
2) Raw Water Supply													
-In-Take and Distribution													
- Source	Kafue River				Mulungushi Dam		Kafue River		Kafue River		Mankwala Dam		Wells
- Distance, km	3				10		40		10		7.8		0.0
- Capacity, TPD	1,000				1,000		1,000		1,000		855**		100
- Electricity, MW	0.05				0.10		0.10		0.10		0.05		0.0
- Investment, ZK, MM	0.40				1.10		1.10		1.10		0.84**		0.10
+US\$, MM	0.058				0.184		0.184		0.184		0.000		0.000
- Tariff, ZK/Ton													
- Initial 45 Ton/Month	Free				1.33		NA		NA		Free		-
- Over 45 Ton/Month	Free				0.44		NA		NA		Free		-
3) Road Expansion/Construction													
- Distance, km	0.5				0.5		0.5		0.5		Mine 35 4.5		Dam 15
- Width, m	6				6		6		6		5 3		3
- Bridge	1				0		0		0		14 0		0
- Investment, ZK, MM	1.08				0.46		0.46		0.46		0.91**		0.30
4) Railway Siding Construction													
- Direct Distance, km	0.05				0.1		0.1		0.1		-		-
- Track	2				2		2		2		-		-
- Total Length, km	1.50				1.50		1.50		1.50		0.00		0.00
- Investment, ZK, MM	1.13				1.13		1.13		1.13		0.00		0.00
5) Investment Total,													
ZK, MM	11.75	5.44	11.75	3.61	16.44	7.54	14.01	7.54	14.01	7.54	5.50	3.28	
+US\$, MM	0.058	0.058	0.058	0.058	0.184	0.184	0.184	0.184	0.184	0.184	0.000	0.000	
US\$, MM	1.037	0.511	1.037	0.359	1.554	0.812	1.352	0.812	1.35	0.912	0.458	0.273	

Notes: 1) * Basic electricity contracting and consumption factors are assumed as follows:

	Power Factor	Load Factor	Coincidence Factor	Diversity Factor
Fertilizer Plant	0.90	0.83	0.909	1.10
Raw Material Supply	0.90	0.72	0.909	1.10

Government sales tax of 15% on the tariff is charged additionally

2) Price estimate is as of January 01, 1987 and foreign exchange rate is assumed as ZK8.00/US\$ for financial and economic calculation

Table 2-3-5 FINANCIAL AND ECONOMIC PRICINGS OF ELECTRICITY IN ZAMBIA

Items	Electricity Pricings, ZK/kWh										Notes
	Domestic Sale					Export Sale					
	Industrial Bulk SFC/ZCCM	D3	Industrial D2	D1	Commercial E4	E3	Household E2	E1	Zimbabwe	Zambia	
0. Assume Load, MW	-	8.0	1.0	0.1	0.01	0.01	0.004	0.001	-	-	-
1. Financial Price											
- Tariff of ZESCO (August, 1986)	0.0377	0.0461	0.0624	0.0760	0.0776	0.0721	0.0717	0.0735	0.0168	0.0168	- Lead Factor = 0.75 - Power Factor = 1.00 - Export Contract (1984/July 1987) is based on exchange rate of ZK1.756/US\$
- Government Sales Tax (Chapter 663 of the Law of Zambia, Sales Tax - 1975: 15%)	0.0057	0.0069	0.0094	0.0114	0.0116	0.0108	0.0108	0.0110	0.0000	0.0000	- Study Report by Electricite de France (EDF), 1984/5 - Self Financing = 50% (Domestic) - ROI = 8% - DSCR = 1.5 - Exchange Rate = ZK6.00/US\$ - Period = 1986/7-1993/4
Total	0.0434	0.0530	0.0718	0.0874	0.0892	0.0829	0.0825	0.0845	0.0168	0.0168	
2. Economic Price											
- Short Run Marginal Cost	-	-	-	-	-	-	-	-	-	-	
- Long Run Marginal Cost	0.1166	0.2407	0.2608	0.2579	-	0.2254	0.3142	0.3756	0.0633	0.0633	
- Government Sales Tax (Chapter 663 of the Law of Zambia, Sales Tax - 1975: 15%)	0.0000	0.0000	0.0000	0.0000	-	0.0000	0.0000	0.0000	0.0000	0.0000	
Total	0.1166	0.2407	0.2608	0.2579	-	0.2254	0.3142	0.3756	0.0633	0.0633	
3. Economic/Financial Prices Ratio											
- Before Tax	3.1	5.2	4.2	3.4	-	3.1	4.4	5.1	3.8	3.8	
- After Tax	2.6	4.5	3.6	2.9	-	2.7	3.8	4.4	3.8	3.8	
4. Annual Sales, MW kWh/Year											
- 1984	4,274					1,840			3,168	3,168	
- (Ratio)	(46%)					(20%)			(34%)	(34%)	

Notes: 1) Annual Report of ZESCO-1984
 2) Mr. D.K. Kundu, Engineering Services Manager, ZESCO, March 12, 1987
 3) Pure long run marginal cost is formulated by EDF for the year 1993/4 at 1986/7 price level, according to the ZESCO's financial requirements for the expansion of Kariba North Hydro Power Generation Station in 1993/4.

Table 2-3-6 PHOSPHATE FERTILIZER RAW MATERIALS AND PRODUCT PHYSICAL DISTRIBUTION COSTS COMPARISON (1/2)

Product Material Alternatives Movement TPY	Potential Phosphate Fertilizer Plant Sites																					
	Kafue				Kabwe				Ndola				Kitwe									
	RD km	ZR km	TZR km	HDL km	TTL km	RD km	ZR km	TZR km	HDL km	TTL km	RD km	ZR km	TZR km	HDL km	TTL km	RD km	ZR km	TZR km	HDL km	TTL km	Annual Costs ZK, MM	
- Raw Materials, Bulk	541	-	-	2	541	635	-	-	2	635	818	-	-	2	818	856	-	-	2	856	21.108	
- Phosphate Rock from Chilembwe	433	-	-	20	453	508	-	-	20	528	654	-	-	20	674	685	-	-	20	705	26.945	
- Serpentine from Mkushi	21	232	46	4	299	21	64	46	4	131	21	124	46	4	191	21	190	46	4	257	3.204	
- Product, Bagged and Destination to:	17	56	60	40	173	17	38	60	40	155	17	43	60	40	160	17	49	60	40	166	30.149	
- Monze	108	-	-	2	108	-	277	-	2	277	-	464	-	2	464	-	530	-	2	530	1.810	
- Lusaka	18,849	-	-	20	45	0.848	-	53	-	20	73	-	76	-	20	96	-	84	-	20	104	1.960
- Ndola	5,846	-	-	20	48	0.234	-	120	-	2	120	-	308	-	2	308	-	374	-	2	374	0.450
- Kabwe	2,117	-	-	2	356	0.178	-	187	-	2	187	-	-	-	0	0	-	66	-	20	86	0.503
- Mkushi	5,544	-	-	2	168	0.310	-	39	-	0	0	-	187	-	2	187	-	253	-	2	253	0.085
- Solwezi	3,931	-	-	232	46	0.491	-	64	46	2	110	-	124	46	2	170	-	190	46	2	236	0.327
- Chipata	8,972	-	-	40	259	0.078	-	20	60	20	100	-	28	60	20	108	-	39	60	20	119	0.425
- Mongu	504	-	-	2	627	4.576	-	705	-	2	705	-	888	-	2	888	-	926	-	2	926	0.063
- Mansa	1,008	-	-	20	510	0.263	-	584	-	2	584	-	710	-	2	730	-	741	-	2	761	6.550
- Kasama	3,327	-	-	40	260	0.262	-	624	-	2	624	-	807	-	2	807	-	845	-	2	845	0.335
- Sub-Total	50,400	-	-	232	632	7.822	-	64	632	2	696	-	124	632	2	756	-	190	632	2	822	10.698
- Total (Ratio)	110,401	-	-	45	110	29.396	-	20	110	20	150	-	28	110	20	158	-	39	110	20	169	40.847
																						(1.390)
																						Maximum ... (1.459)

Notes: 1) RD = Road, ZR = Zambia Railways Ltd., TZR = Tanzania Zambia Railway Authority, HDL = Loading and Unloading Handling (ZK10/Ton), TTL = Total Transport Distance and Cost
 2) Cost estimates are as of January 01, 1987 and foreign currency exchange rate is assumed as ZK8.00/US\$

Table 2-3-6 PHOSPHATE FERTILIZER RAW MATERIALS AND PRODUCT PHYSICAL DISTRIBUTION COSTS COMPARISON (2/2)

Product Alternatives Movement Tpy	Material	Potential Phosphate Fertilizer Plant Sites																
		Kafue				Kabwe				Ngola				Kitwe				
		RD km ZK/T	ZR km ZK/T	HDL km TTU Times ZK/T	Annual Costs ZK, MM	RD km ZK/T	ZR km ZK/T	HDL km TTU Times ZK/T	Annual Costs ZK, MM	RD km ZK/T	ZR km ZK/T	HDL km TTU Times ZK/T	Annual Costs ZK, MM	RD km ZK/T	ZR km ZK/T	HDL km TTU Times ZK/T	Annual Costs ZK, MM	
-	Phosphate Rock from Chilembwe	541	-	2	541	-	2	635	818	-	2	818	856	-	2	856	28,184	
-	39,978	433	-	20	453	18,110	508	21,108	654	-	20	674	26,945	585	-	20	705	
-	Sulfuric Acid	-	-	1	0	0.203	36	1.135	356	-	2	356	1,682	-	422	2	422	
-	- from NCZ Kafue	20,255	-	10	10	0.203	36	1.135	63	-	20	83	1,682	-	70	20	90	
-	Sub-Total	60,233	-	-	-	18,313	-	22,243	-	-	-	28,627	-	-	-	-	30,007	
-	Product, Bulk and Destination to:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	Kafue	-	-	1	1	0.057	168	3.147	356	-	2	356	4,749	-	422	2	422	
-	Monze	57,205	-	10	10	0.057	35	3.147	63	-	20	83	4,749	-	70	20	90	
-	Lusaka	-	-	2	108	-	277	-	464	-	2	464	-	-	530	2	530	
-	Ngola	-	-	25	45	-	53	-	76	-	20	96	-	-	84	20	104	
-	Kabwe	-	-	48	2	48	120	-	308	-	2	308	-	-	374	2	374	
-	Mkushi	-	-	20	40	-	28	-	57	-	20	77	-	-	66	20	86	
-	Solvezi	-	-	356	-	356	187	-	-	-	-	-	-	-	20	20	40	
-	Chipata	-	-	64	20	84	39	-	187	-	2	187	-	-	253	2	253	
-	Mongu	-	-	36	20	56	-	-	39	-	20	59	-	-	49	20	69	
-	Mansa	-	-	232	46	278	64	-	124	-	46	170	-	-	190	46	236	
-	Kasama	-	-	45	60	135	20	-	28	-	60	108	-	-	39	60	119	
-	Sub-Total	57,205	-	4	663	-	173	-	134	-	4	307	-	-	173	68	4	241
-	Minimum ...	117,438	-	138	81	-	138	-	30	-	40	208	-	-	138	20	40	198
-	Maximum ...	35,157	-	612	-	612	705	-	888	-	2	888	-	-	926	2	926	
-	Total	117,438	-	490	-	490	564	-	710	-	20	730	-	-	741	-	20	761
-	(Ratio)	18,370	-	627	-	627	624	-	807	-	2	807	-	-	845	-	2	845
-	Minimum ...	0.057	-	502	-	502	499	-	646	-	20	666	-	-	676	-	20	696
-	Maximum ...	18,370	-	175	488	-	175	-	132	-	4	307	-	-	175	66	4	241
-	Total	18,370	-	140	80	-	140	-	140	-	40	209	-	-	140	20	40	200
-	(Ratio)	0.057	-	232	632	-	64	-	124	-	632	2	756	-	190	632	2	822
-	Minimum ...	0.057	-	45	110	20	175	-	28	-	110	20	158	-	39	110	20	169
-	Maximum ...	18,370	-	-	-	18,370	-	3,147	-	-	-	-	4,749	-	-	-	-	5,150
-	Total	18,370	-	-	-	25,390	-	33,376	-	-	-	-	33,376	-	-	-	-	35,157
-	(Ratio)	0.057	-	Minimum ...	1.000	1.382	-	1.817	-	-	-	-	1.817	-	-	-	-	1.914

Notes: 1) RD = Road, ZR = Zambia Railways Ltd., TZR = Tanzania Zambia Railway Authority, HDL = Loading and Unloading Handling (ZK10/Ton), TTU = Total Transport Distance and Cost

2) Cost estimates are as of January 01, 1987 and foreign currency exchange rate is assumed as ZK8.00/US\$

Table 2-3-7 RAW MATERIAL CONSUMPTION CALCULATION FOR FUSED MAGNESIUM PHOSPHATE PRODUCTION (1/2)

1. Raw Material Supply for Fused Magnesium Phosphate Production

Phosphate Concentrate, Chilembwe, Zambia			Serpentine, Mkushi, Zambia		
Item	Experimental	Design Base	Item	Experimental	Design Base
Specification, %			Specification, %		
- P ₂ O ₅	33.69	30.00	- MgO	38.45	38.45
- CaO	46.18	41.11	- SiO ₂	41.44	41.44
- F	1.89	1.68	- Others	7.36	7.36
- Other	<u>17.70</u>	<u>26.67</u>	- Ignition Loss	<u>11.96</u>	<u>11.96</u>
Solid Sub-Total	99.46	99.46	Solid Sub-Total	99.21	99.21
- Free Moisture	<u>0.54</u>	<u>13.56(12%)</u>	- Free Moisture	<u>0.79</u>	<u>4.78(4.5%)</u>
Total Weight	100.00	113.02	Total Weight	100.00	103.99
Production, TPY			Production, TPY		
- Wet Material	-	39,978	- Wet Material	-	20,023
- Dry Material	-	35,181	- Dry Material	-	19,103
- P ₂ O ₅	-	10,554	- MgO	-	7,345
Transportation from Chilembwe Concentration Plant to FMP Plant, Kafue, Zambia			Transportation from Mkushi Mine to FMP Plant, Kafue, Zambia		
- Road, km	-	541	- Road, km	-	21
- Railway, km	-	<u>0</u>	- Railway, km	-	<u>278</u>
- Total, km	-	541	- Total, km	-	299
- Transportation Charges, ZK/Ton-1987	433		- Transportation Charges, ZK/Ton-1987	133	
- Loading and Unloading		<u>20</u>	- Loading and Unloading		<u>40</u>
		453			173

2. Product Specification of Fused Magnesium Phosphate

Chemical Analysis, %

- T-P ₂ O ₅	20.31 (100.0%)
- T-MgO	14.15
- T-F	0.72 (54.6%)
- T-S	0.06
- Free Moisture	0.50

Fertilizer Nutrient, %

- C-P ₂ O ₅	20.11 (99.0%)
- F-P ₂ O ₅	20.03 (98.6%)
- AV-P ₂ O ₅	14.38 (70.8%)
- S-P ₂ O ₅	14.25 (70.2%)
- W-P ₂ O ₅	0.04 (0.2%)
- S-SiO ₂	26.19
- C-MgO	14.05
- Total Alkalinity	42.00

Physical Property, %

- Size, (+) 32 Mesh	55.6
(+) 100 Mesh	94.9

Packaging, kg Net 50.0 in PP Woven Bag/PE Inner Sack

Table 2-3-7 RAW MATERIAL CONSUMPTION CALCULATION FOR FUSED MAGNESIUM PHOSPHATE PRODUCTION (2/2)

3. Raw Material and Utility Consumption for Fused Magnesium Phosphate Production

Items	Product Design of FMP TPT	Conceptual Design for FMP Plant Production		
		Unit	Daily	Annual
		TPT	TPD	TPY
Raw Material, Ton				
- Phosphate Concentrate, Dry (P ₂ O ₅ : 30.00%, CaO : 41.11%)	0.677	0.698*	117.27	35,181
- Serpentine, Dry (MgO : 38.45%, SiO ₂ : 41.44%)	0.368	0.379*	63.67	19,103
- Electrode	-	0.005	0.84	252
- Calcium Hydroxide (Ca(OH) ₂ : 100%)	-	0.010	1.68	504
- Other Chemicals, \$	-	0.100	16.80	5,040
Utility, Ton				
- Raw Water	-	6.250	1,050.00	315,000
- Fuel Oil (10,000 kcal/kg, S: 0.5%)	-	0.028	4.70	1,411
- Electricity, kWh	-	910	152,880	45.87 MM
Packaging				
- PP Woven/PE Inner Sack, 50 kg Net	-	20.200	3,394	1.018 MM

4. Production and Outputs for Fused Magnesium Phosphate Production

Fused Magnesium Phosphate, Bags, Ton	1.000	1.000	168.00	50,400
Calcium Fluoride (CaF ₂ : 100%), Bulk, Ton	-	0.015	2.52	756
Exhaust Gas (50°C, F : 2 mg/Nm ³ , Dust : 30 mg/Nm ³), Nm ³	-	-	-	-
Waste Water (35°C, F : 10 ppm, P ₂ O ₅ : 1.0 ppm), Ton	-	3.000	504.00	151,200

- Notes: 1) * Losses for transportation (1.0%), processing (1.0%) and in-plant material handlings (1.0%) are assumed total 3.0% from ex-mines of raw materials to salable product loading of FMP at the FMP plant.
- 2) Annual operation of 300 DPY is assumed.
- 3) Calcium fluoride is recovered as thickener slurry of 5% CaF₂, others are 2.1% of SiO₂ and 92.9% of free moisture. Physical property of solid; bulk density; 1.70 and angle of repose; 41°.

Table 2-3-8 RAW MATERIAL CONSUMPTION CALCULATION FOR SINGLE SUPER PHOSPHATE PRODUCTION (1/2)

1. Raw Material Supply for Single Super Phosphate Production

Chilembwe Phosphate Concentrate, Zambia			Sulfuric Acid NCZ, Kafue, Zambia		
Item	Experimental	Design Base	Item	Experimental	Design Base
Specification, %			Specification, %		
- P ₂ O ₅	33.69	30.00	- H ₂ SO ₄	98.0	98.0
- CaO	46.18	41.11	Sub-Total	98.0	98.0
- F	1.89	1.68	- Free Moisture	2.0	2.0
- Other	17.70	26.67	Total Weight	100.0	100.0
Solid Sub-Total	99.46	99.46			
- Free Moisture	0.54	13.56(12%)			
Total Weight	100.00	113.02			
Production, TPY			Supply from NCZ, Kafue, TPY		
- Wet Material	-	39,978	- Wet Material (98%)		20,255
- Dry Material	-	35,181	- Dry Material (100%)		19,850
- P ₂ O ₅	-	10,553	- Sulfur		6,483
Transportation from Chilembwe Concentration Plant to SSP Plant, Kafue, Zambia			Transportation from NCZ, Kafue to SSP Plant, Kafue, Zambia		
- Road, km	-	541	- Pipeline, km		1
- Railway, km	-	0	- Transportation Charge, ZK/Ton-1987		0
- Total, km	-	541	- Loading and Unloading		10
- Transportation Charges, ZK/Ton-1987		433			10
- Loading and Unloading Charges		20			
		453			

2. Product Specification of Single Super Phosphate

Chemical Analysis, %	
- T-P ₂ O ₅	17.91 (100.0%)
- T-MgO	0.23
- T-F	0.79 (70.0%)
- T-S	11.10
- Free Moisture	8.40
Fertilizer Nutrient, %	
- C-P ₂ O ₅	17.46 (97.5%)
- F-P ₂ O ₅	17.40 (97.2%)
- Av-P ₂ O ₅	17.20 (96.0%)
- S-P ₂ O ₅	17.10 (95.5%)
- W-P ₂ O ₅	15.15 (84.6%)
- Free Acid (P ₂ O ₅)	3.70 (20.7%)
Physical Property, %	
- Size, (+) 12 Mesh	35.0
(+) 60 Mesh	80.0
Packaging, kg Net	Bulk

Table 2-3-8 RAW MATERIAL CONSUMPTION CALCULATION FOR SINGLE SUPER PHOSPHATE PRODUCTION (2/2)

3. Raw Material and Utility Consumption for Single Super Phosphate Production

Items	Product Design of SSP TPT	Conceptual Design for SSP Plant Production		
		Unit TPT	Daily TPD	Annual TPY
Raw Material, Ton				
- Phosphate Concentrate, Dry (P ₂ O ₅ : 30.00%, CaO : 41.11%)	0.597	0.615*	117.27	35,181
- Sulfuric Acid (H ₂ SO ₄ : 100.0%)	0.340	0.347*	66.17	19,850
- Calcium Hydroxide (Ca(OH) ₂ : 100%)	-	0.010	1.91	572
- Other Chemicals, \$	-	0.100	19.07	5,722
Utility, Ton				
- Raw Water	-	5.500	1,048.74	314,628
- Fuel Oil (10,000 kcal/kg, S: 0.5%)	-	0.010	1.91	572
- Electricity, kWh	-	45.000	8,580.60	2,575 MM
Packaging				
- PP Woven/PE Inner Sack, 50 kg Net	-	-	-	-

4. Production and Outputs for Single Super Phosphate Production

Single Super Phosphate, Bulk, Ton	1.000	1.000	190.68	57,205
Calcium Fluoride (CaF ₂ : 100%), Bulk, Ton	-	0.012	2.288	687
Exhaust Gas (50°C, F : 2 mg/Nm ³ , Dust : 30 mg/Nm ³), Nm ³	-	1,185	0.226 MM	67.8 MM
Waste Water (35°C, F : 10 ppm, P ₂ O ₅ : 1.0 ppm), Ton	-	5.240	999.17	299,754

Notes: 1) * Losses for transportation (1.0%), processing (1.0%) and in-plant material handlings (1.0%) are assumed total 3.0% from ex-mines of raw materials to salable product loading of SSP at the SSP plant.

2) In-plant losses for sulfuric acid is assumed 2.0%.

3) Annual operation of 300 DPY is assumed.

4) Calcium fluoride is recovered as thickener slurry of 5% CaF₂, others are 2.1% of SiO₂ and 92.9% of free moisture. Physical property of Solid: bulk density; 1.70 and angle of repose; 41°.

Table 2-4-1 FOREIGN CURRENCY EXCHANGE RATE TREND IN ZAMBIA

Effective Date	Auction Week	Set Rate ZK/US\$	Foreign Currency		Bids Range		Bids Number		Note
			Fund US\$,MM	Demand US\$,MM	Low ZK/US\$	High ZK/US\$	Successful	Total	
End, 1980	-	0.80	-	-	-	-	-	-	Monthly Bulletin of Statistics, United Nations
End, 1981	-	0.88	-	-	-	-	-	-	
End, 1982	-	0.93	-	-	-	-	-	-	
End, 1983	-	1.51	-	-	-	-	-	-	
End, 1984	-	2.20	-	-	-	-	-	-	
October, 1985									
11	1	5.01							Weekly Auction - Marginal Rate
End, 1985	12	5.70							
August, 1986									
02	43	5.00							Weekly Auction - Dutch Rates
September, 1986									
06	48	7.00	15.0	24.3	5.00	7.99	571	674	
October, 1986									
04	52	7.64	7.1	23.8	5.04	8.11	172	712	
11	53	8.30	6.5	24.3	5.00	8.56	128	769	
18	54	9.20?	-	-	-	-	-	-	
25	55	10.32	5.5	16.5	5.50	11.51	84	493	
		(Av. 8.87)							
November, 1986									
01	56	11.51			6.00	12.50	119	421	
08	57	12.30		14.2	6.00	13.15	111	439	
15	58	13.48		11.3	6.00	14.41	383	407	
25	59	14.48	5.5	9.9	6.00	15.15	123	324	
29	60	15.25		7.2	6.00	16.52	140	273	
		(Av. 13.40)							
December, 1986									
06	61	12.10		5.0	6.00	18.00	130	221	
13	62	11.90	5.5	12.4	6.00	16.00	280	333	
20	63	12.50	5.5	9.9	6.00	13.77	116	310	
27	64	12.71	5.6	8.0	6.00	14.20	141	285	
		(Av. 12.30)							
End, 1986	-	12.71	-	-	-	-	-	-	
January, 1987									
03	65	12.97	5.6	7.3	6.00	13.76	118	192	
10	66	13.51	5.5	11.4	6.00	13.98	55	232	
17	67	14.12	5.5	9.4	6.00	15.00	111	257	
24	68	14.92	-	-	6.00	15.31	109	250	Controlled Auction - Re-peg within Range
31	69	9.00/12.50	-	-	-	-	-	-	
		(Av. 13.25)							
March 27, 1987	-	15.17	-	-	-	-	-	-	Ranged Official and Auction Private Rates
		(9.00/12.50)							
April 4, 1987	-	16.99	-	-	-	-	-	-	
11	-	18.75	6.0	-	13.00	20.75	135	370	
25	-	21.01	-	-	-	-	-	-	
May 01, 1987	-	8.00	-	-	-	-	-	-	Fixed Rate System

- Notes:
- 1) January 31, 1974; ZK0.714/US\$ (ZK1.0/Sterling Shillings 10)
 - 2) March, 1978 ; ZK1.024/SDR (IMF Agreement)
 - 3) January 06, 1983; ZK1.280/SDR
 - 4) July, 1983 ; ZK1.1/US\$, Managed floating (crawling) and currency basket (US\$, Sterling Pound, Mark, Franc and Yen) system
 - 5) January, 1985 ; ZK2.25/US\$, Free exchange policy
 - 6) October 09, 1985; ZK5.01/US\$, Weekly Auction - Marginal rate system
 - 7) August 02, 1986 ; ZK5.00/US\$, Weekly Auction - Dutch rates system
 - 8) January 28, 1987; ZK9.00 (Floor)/12.50 (Ceiling)/US\$, Re-pegged to currency basket within a range and allocated by auction. Interest rate at the BOZ and maximum lending rate are reduced to 15.00 (from 30.00) and to 20.00 (from 32.00)%, respectively.
 - 9) March 27, 1987 ; ZK15.17 (Auction)/9.00-12.50 (Official)/US\$, Re-opened the auction and the official rate is applied governmental transaction and repayment
 - 10) May 01, 1987 ; ZK8.00/US\$, Re-introduction of fixed foreign exchange rate. Interest rate at BOZ and maximum lending rate are reduced to 15.00 (from 20.00) and to 20.00 (from 25.00)%, respectively. Interest for State Bond is reduced to 15.50% from 18.00%.

Table 2-4-2 CORPORATE INCOME TAX LAW AND DEPRECIATION PRACTICE IN ZAMBIA

1. Income Tax Law (Chapter 668 of the Laws of Zambia, May 26, 1967)

1) Capital Allowance

Items	Capital Allowance for Income Tax Calculation	
	Initial Allowance, %	Wear and Tear Allowance, %/Year
Buildings		
- Low Cost Industrial Housing	-	10.0
- Industrial Building	10.0	5.0
- Commercial Building	-	2.0
Implements, Machinery and Plant		
- Prime Moving Machinery	20.0	30.0

2) Tax Rates

Items	Annexure	Allowance, ZK	Tax Rate, %, (Income in ZK)
Individuals who do not remit	A, B	Single : 1,800	5.0 (2,000)
		Married : 4,600	11.0 (5,000)
		Child : 330	17.5 (10,000)
		Life Insurance	28.5 (20,000)
		Premiums: 800	42.5 (40,000)
Other than Individuals			
- Farming	C	-	15.0
- Manufacturing		-	35.0
- Other Sources		-	45.0
Trusts	D	-	35.0
Entertainment Fee	E	-	15.0
Management and Consultant Fee	F	-	15.0
Royalties	G	-	10.0
Dividends	H	-	15.0

2. General Depreciation Practise in Zambia

Items	Major Corporations				
	NCZ	ZSCL	NAMBOARD	ZIMCO	INDECO
Year of Annual Report	1986	1985/6	1984	1985	1985
Method	Straight Line	Straight Line	Straight Line	Straight Line	Straight Line
Depreciation Rate, %/Year					
- Land and Buildings					
- Freehold	-	-	-	2.5	-
- Leasehold					
- Industrial	2.5	2.5	2.0	1.0/ 2.5	2.0
- Commercial	2.0	2.0	-	2.0/ 2.5	-
- Residential	-	2.0	-	2.0/ 2.5	-
- Plant and Machinery	7.5	10.0	10/20	10.0/33.3	7.2/10.0
- Furnace and Relining	-	-	-	-	25.0
- Vehicles	25.0	25.0	25.0	10.0/33.3	25.0
- Furniture	25.0	25.0	-	-	10.0/25.0
- Water System	-	7.5	-	-	-
- Mining Assets	-	-	-	4.0(-)	-
- Capital Work in Progress	0.0	-	0.0	0.0	0.0

Notes: Tax law in Zambia is under reforming processes in 1987

Table 2-4-3 CAPITAL COST ESTIMATE FOR PROJECT (1/5)

Project : Phosphate Mining and Concentrate Project
 Product : Phosphate Concentrate, Bulk, Wet
 Capacity: 35,181 TPY as Dry
 Location: Chilembwe, Zambia

Unit: US\$, Millions

	Foreign Currency	Local Currency	Total Project Cost
1. Site Acquisition/Preparation (779,000 m ²)	0.000	0.189	0.189
2. Plant Direct Cost			
- Equipment, Materials and Spare Parts (2 years)	5.096	0.000	5.096
- Civil and Erection Works	0.000	2.073	2.073
3. Construction Equipment	0.149	0.018	0.167
4. Freight, Insurance and Local Handlings (3,000 Freight Ton)	1.529	0.000	1.529
5. Know How/Engineering Services (48 Man·Months)	0.481	0.000	0.481
6. Project Management (20 Man·Months)	0.000	0.178	0.178
Plant Cost - Estimate Date	7.255	2.458	9.713
7. Contingencies			
- Physical Contingency	0.363	0.246	0.609
- Price Contingency (Foreign: 14.23%, Local: 14.23% from Estimate to Production Dates)	1.032	0.350	1.382
Plant Cost - Commercial Production Date	8.650	3.054	11.704
8. Taxes and Duties (5%)	0.000	0.585	0.585
9. Pre-operational Expenses	0.216	0.076	0.292
10. Working Capital	0.000	0.739	0.739
11. Interest during Construction (12%/Year)	1.244	0.000	1.244
Total Financing Required - Commercial Production Date, (Ratio, %)	10.110 (69.41)	4.454 (30.58)	14.564 (100.00)

Notes: 1) Equity + Loan = Total, \$,MM (%) : 3.641 (25) + 10.923 (75) = 14.564 (100)
 2) Annual Escalation, %/Year : Foreign Currency; 3.0, Local Currency; 3.0
 3) Interest for Long Term Loan : 12.0%/Year
 4) Estimate Date : January 01, 1987
 5) Plant Construction Contract : July 01, 1989
 6) Commercial Production Date : July 01, 1991
 7) Exchange Rate at Estimate Date : ZK8.00/US\$

Table 2-4-3 CAPITAL COST ESTIMATE FOR PROJECT (2/5)

Project : Fused Magnesium Phosphate Project
 Product : Fused Magnesium Phosphate, Bags
 Capacity: 50,400 TPY
 Location: Kafue, Zambia

Unit: US\$, Millions

	Foreign Currency	Local Currency	Total Project Cost
1. Site Acquisition/Preparation (27,000 m ²)	0.000	0.136	0.136
2. Plant Direct Cost			
- Equipment, Materials and Spare Parts (2 years in general, 0.5 years for electrode)	5.233	0.000	5.233
- Civil and Erection Works	3.387	1.537	4.924
3. Construction Equipment	0.400	0.058	0.458
4. Freight, Insurance and Local Handlings (5,000 Freight Ton)	0.820	0.136	0.956
5. Know How/Engineering Services (130 Man·Months)	1.867	0.051	1.918
6. Project Management (40 Man·Months)	0.533	0.058	0.591
Plant Cost - Estimate Date	12.240	1.976	14.216
7. Contingencies			
- Physical Contingency	0.612	0.198	0.810
- Price Contingency (Foreign: 14.23%, Local: 14.23% from Estimate to Production Dates)	1.741	0.281	2.022
Plant Cost - Commercial Production Date	14.593	2.455	17.048
8. Taxes and Duties (5%)	0.000	0.426	0.426
9. Pre-operational Expenses	0.306	0.061	0.367
10. Working Capital	0.000	1.915	1.915
11. Interest during Construction (12%/Year)	1.764	0.000	1.764
Total Financing Required - Commercial Production Date, (Ratio, %)	16.663 (77.43)	4.857 (22.57)	21.520 (100.00)

Notes: 1) Equity + Loan = Total, \$,MM (%) : 5.380 (25) + 16.140 (75) = 21.520 (100)
 2) Annual Escalation, %/Year : Foreign Currency; 3.0, Local Currency; 3.0
 3) Interest for Long Term Loan : 12.0%/Year
 4) Estimate Date : January 01, 1987
 5) Plant Construction Contract : July 01, 1989
 6) Commercial Production Date : July 01, 1991
 7) Exchange Rate at Estimate Date : ZK8.00/US\$

Table 2-4-3 CAPITAL COST ESTIMATE FOR PROJECT (3/5)

Project : Single Super Phosphate Project
 Product : Single Super Phosphate, Bulk
 Capacity: 57,205 TPY
 Location: Kafue, Zambia

Unit: US\$, Millions

	Foreign Currency	Local Currency	Total Project Cost
1. Site Acquisition/Preparation (20,800 m ²)	0.000	0.098	0.098
2. Plant Direct Cost			
- Equipment, Materials and Spare Parts (2 years)	4.160	0.000	4.160
- Civil and Erection Works	3.020	1.373	4.393
3. Construction Equipment	0.400	0.058	0.458
4. Freight, Insurance and Local Handlings (4,000 Freight Ton)	0.740	0.127	0.867
5. Know How/Engineering Services (121 Man·Months)	1.613	0.048	1.661
6. Project Management (36 Man·Months)	0.480	0.058	0.538
Plant Cost - Estimate Date	10.413	1.762	12.175
7. Contingencies			
- Physical Contingency	0.521	0.176	0.697
- Price Contingency (Foreign: 14.23%, Local: 14.23% from Estimate to Production Dates)	1.481	0.251	1.732
Plant Cost - Commercial Production Date	12.415	2.189	14.604
8. Taxes and Duties (5%)	0.000	0.365	0.365
9. Pre-operational Expenses	0.620	0.030	0.650
10. Working Capital	0.000	2.631	2.631
11. Interest during Construction (12%/Year)	1.544	0.000	1.544
Total Financing Required - Commercial Production Date, (Ratio, %)	14.579 (73.65)	5.215 (26.35)	19.794 (100.00)

Notes: 1) Equity + Loan = Total, \$,MM (%) : 4.949 (25) + 14.845 (75) = 19.794 (100)
 2) Annual Escalation, %/Year : Foreign Currency; 3.0, Local Currency; 3.0
 3) Interest for Long Term Loan : 12.0%/Year
 4) Estimate Date : January 01, 1987
 5) Plant Construction Contract : July 01, 1989
 6) Commercial Production Date : July 01, 1991
 7) Exchange Rate at Estimate Date : ZK8.00/US\$

Table 2-4-3 CAPITAL COST ESTIMATE FOR PROJECT (4/5)

Project : Phosphate Mining and Concentrate Project and
 Fused Magnesium Phosphate Project
 Product : Fused Magnesium Phosphate, Bags
 Capacity: 50,400 TPY
 Location: Chilembwe and Kafue, Zambia

Unit: US\$, Millions

	Foreign Currency	Local Currency	Total Project Cost
1. Site Acquisition/Preparation (806,000 m ²)	0.000	0.325	0.325
2. Plant Direct Cost			
- Equipment, Materials and Spare Parts (2 years in general, 0.5 years for electrode)	10.329	0.000	10.329
- Civil and Erection Works	3.387	3.610	6.997
3. Construction Equipment	0.549	0.076	0.625
4. Freight, Insurance and Local Handlings (8,000 Freight Ton)	2.349	0.136	2.485
5. Know How/Engineering Services (178 Man·Months)	2.348	0.051	2.399
6. Project Management (60 Man·Months)	0.533	0.236	0.769
Plant Cost - Estimate Date	19.495	4.434	23.929
7. Contingencies			
- Physical Contingency	0.975	0.444	1.419
- Price Contingency (Foreign: 14.23%, Local: 14.23% from Estimate to Production Dates)	2.773	0.631	3.404
Plant Cost - Commercial Production Date	23.243	5.509	28.752
8. Taxes and Duties (5%)	0.000	1.011	1.011
9. Pre-operational Expenses	0.522	0.137	0.659
10. Working Capital	0.000	2.654	2.654
11. Interest during Construction (12%/Year)	3.008	0.000	3.008
Total Financing Required - Commercial Production Date, (Ratio, %)	26.773 (74.20)	9.311 (25.80)	36.084 (100.00)

Notes: 1) Equity + Loan = Total, \$,MM (%) : 9.021 (25) + 27.063 (75) = 36.084 (100)
 2) Annual Escalation, %/Year : Foreign Currency; 3.0, Local Currency; 3.0
 3) Interest for Long Term Loan : 12.0%/Year
 4) Estimate Date : January 01, 1987
 5) Plant Construction Contract : July 01, 1989
 6) Commercial Production Date : July 01, 1991
 7) Exchange Rate at Estimate Date : ZK8.00/US\$

Table 2-4-3 CAPITAL COST ESTIMATE FOR PROJECT (5/5)

Project : Phosphate Mining and Concentrate Project and
 Single Super Phosphate Project
 Product : Single Super Phosphate, Bulk
 Capacity: 57,205 TPY
 Location: Chilembwe and Kafue, Zambia

Unit: US\$, Millions

	Foreign Currency	Local Currency	Total Project Cost
1. Site Acquisition/Preparation (799,800 m ²)	0.000	0.287	0.287
2. Plant Direct Cost			
- Equipment, Materials and Spare Parts (2 years)	9.256	0.000	9.256
- Civil and Erection Works	3.020	3.446	6.466
3. Construction Equipment	0.549	0.076	0.625
4. Freight, Insurance and Local Handlings (7,000 Freight Ton)	2.269	0.127	2.396
5. Know How/Engineering Services (169 Man·Months)	2.094	0.048	2.142
6. Project Management (56 Man·Months)	0.480	0.236	0.716
Plant Cost - Estimate Date	17.668	4.220	21.888
7. Contingencies			
- Physical Contingency	0.884	0.422	1.306
- Price Contingency (Foreign: 14.23%, Local: 14.23% From Estimate to Production Dates)	2.513	0.601	3.114
Plant Cost - Commercial Production Date	21.065	5.243	26.308
8. Taxes and Duties (5%)	0.000	0.950	0.950
9. Pre-operational Expenses	0.836	0.106	0.942
10. Working Capital	0.000	3.370	3.370
11. Interest during Construction (12%/Year)	2.788	0.000	2.788
Total Financing Required - Commercial Production Date, (Ratio, %)	24.689 (71.86)	9.669 (28.14)	34.358 (100.00)

Notes: 1) Equity + Loan = Total, \$,MM (%) : 8.590 (25) + 25.768 (75) = 34.358 (100)
 2) Annual Escalation, %/Year : Foreign Currency; 3.0, Local Currency; 3.0
 3) Interest for Long Term Loan : 12.0%/Year
 4) Estimate Date : January 01, 1987
 5) Plant Construction Contract : July 01, 1989
 6) Commercial Production Date : July 01, 1991
 7) Exchange Rate at Estimate Date : ZK8.00/US\$

Table 2-4-4 OPERATING COST ESTIMATE AND PROJECTION FOR THE PROJECTS

Items	Basic Data for Estimate January 01, 1987		Base Estimate January 01, 1987		Projection July 01, 1991	
	Unit Cost	Annual Throughput	Unit Cost	Annual Cost	Unit Cost	Annual Cost
	ZK/Ton	TPY	\$/Ton	\$/MM/Year	\$/Ton	\$/MM/Year
0. Basis of Projection						
- Foreign Currency Exchange Rate, ZK/\$	12.00		8.00		8.00	
- Escalation, 1991/1987						
- Foreign Currency Portion	-		-		1.1423	
- Local Currency Portion	-		-		1.1423	
- Electricity	-		-		2.0000	
1. Transport Cost of Phosphate Concentrate on Road	453	39,978-Wet 35,181-Dry	56.63 64.35	2.264	64.68 73.50	2.586
- Chilembwe/Kafue: 541 km						
2. Serpentine Mining Cost, Mkushi	136.1	20,023-Wet 19,103-Dry	17.01 17.83	0.340	19.41 20.34	0.389
- Project Capital Cost: \$0.960 MM						
- Personnel : ZK10,489 x 20/MY						
- Consumable : \$0.088 MM/Year						
3. Transport Cost of Serpentine on Road and Railway	173.0	20,023-Wet 19,103-Dry	21.63 22.67	0.433	24.70 25.89	0.495
- Mkushi/Kafue: 297 km						
4. Sulfuric Acid from NCZ, Kafue by Pipeline	901	19,850-Dry	112.63	2.236	128.64	2.554
- Kafue/Kafue: 1 km						
- Selling Price of NCZ	1,130					
- Handling Cost	10					
	1,140					
- Production Cost, September, 1986						
- Capacity Utilization: 42%	944					
: 90%	652					
- Assumed Price for Project	(1,130+652)/2+10=901					
5. Electricity,						
- ZESCO Tariff plus 15% Sales Tax	ZK/kwh	kwh, MM/Year	\$/kwh		\$/kwh	
- Phosphate Mining and Concentrate Project, Chilembwe	0.0657x1.15	3.318	0.00944	0.0313	0.0189	0.063
- Phosphate Fertilizer Projects, Jointly with NCZ Contract						
- FMP Project, Kafue	0.0423x1.15	45.870	0.00608	0.2789	0.0122	0.558
- SSP Project, Kafue	0.0423x1.15	2.575	0.00608	0.0157	0.0122	0.031
6. Fuel						
- ZIMCO						
- Diesel Oil, kl	1,900	-	237.50	-	271.27	-
- Fuel Oil, Ton	1,300	-	162.50	-	185.61	-
7. Electrode for FMP Production	Import	252	3,500	0.882	3,988.00	1.008
8. Calcium Hydroxide, Ton	223	-	27.88	-	31.83	-
9. Fertilizer Bag, Bag (50 kg Net)	6	-	0.75	-	0.86	-
10. Personnel	ZK/Man-Year	Man-Year	\$/Man-Year		\$/Man-Year	
- Phosphate Mining and Concentrate Project, Chilembwe	11,726	117	1,465.75	0.171	1,674.19	0.195
- FMP Project, Kafue	10,072	83	1,259.00	0.1045	1,438.02	0.120
- SSP Project, Kafue	10,324	74	1,290.50	0.0955	1,474.00	0.110

Table 2-4-5 RAW MATERIAL AND PRODUCT IMPORT SUBSTITUTE PRICE ESTIMATE AND PROJECTION

Items	Importing Raw Material and Product Prices					
	Phosphate Rock (0-33.4-0)		Triple Super Phosphate (0-46.4-0)		Diammonium Phosphate (18.2-46.4-0)	
1. Historical Export Price Trend¹⁾, 1974/1987						
Price Standard Location	FOB, Bulk, USA		FOB, Bulk, USA		FOB, Bulk, USA	
Price, \$/Ton						
- Highest	50.0 - 1980		370.0 - 1974		410.0 - 1974	
- Lowest	25.0 - 1977		80.0 - 1976		100.0 - 1976	
- Average	35.0 - 1974/87		150.0 - 1974/87		185.0 - 1974/87	
- Price Estimate Date, January 01, 1987	35.0 - 1987		105.0 - 1987		145.0 - 1987	
- The Latest, March 01, 1987	35.0 - 1987		135.0 - 1987		165.0 - 1987	
2. Realization Price²⁾, \$/Ton-1982						
- FAO/UNIDO/World Bank:	40.4 - High Grade Ore		236.7		340.2	
- New Developing Site (Capacity)	48.5 - Low Grade Ore (3,000,000 TPY)		(356,400 TPY)		(356,400 TPY)	
3. Present Price for Export to Zambia¹⁾						
Price Standard Location	FOB, Bulk, North Africa		FOB, Bulk, North Africa		FOB, Bulk, North Africa	
Price, \$/Ton						
- Price Estimate Date, January 01, 1987	35.0		125.0		160.0	
- The latest, March 01, 1987	35.0		145.0		180.0	
- Assumed Price for Financial Analysis	35.0		150.0		185.0	
- Unit Nutrient (N + P ₂ O ₅)	104.8		323.3		286.4	
- Nutrient Price Ratio	1.000		3.085		2.733	
4. Price Projection, CIF, Kafue, Zambia, \$/Ton						
	Escalation for 1987/1991, %		January 01, 1987		July 01, 1991	
FOB, Bulk, North Africa	14.23	35.0	40.0	150.0	171.3	185.0
Packaging and Loading	14.23	20.0	22.8	20.0	22.8	20.0
Ocean Freight to Dar-es	14.23	35.0	40.0	35.0	40.0	35.0
-Salaam, 5,000 Tonner						
Unloading/Transshipment	14.23	20.0	22.8	20.0	22.8	20.0
Railway to Kafue	14.23	55.0	62.8	55.0	62.8	55.0
Interest/Insurance/Shrinkage	14.23	12.4	14.2	21.0	24.0	23.6
Import Tax	14.23	-	-	-	-	-
Sales Tax	14.23	-	-	-	-	-
CIF, Before Tax and Duty, Bags, Kafue, Zambia		177.4	202.8	301.0	343.7	338.6
- Unit Nutrient (N + P ₂ O ₅)		531.1	606.6	648.7	740.7	524.2
- Nutrient Price Ratio		1.000	1.000	1.221	1.221	0.987
5. Import Substitute Pricing for Zambian Product, \$/Ton						
Price Standard Specification	Chilembwe Phosphate Concentrate, Bulk/Bags (0-30.00-0)		Fused Magnesium Phosphate, Bulk/Bags (0-20.03-0-0-14.1)		Single Super Phosphate, Bulk/Bags (0-17.20-0-11.1-0)	
Annual Production, TPY	35,188-Dry		50,400-Bulk/Bags		57,205-Bulk/Bags	
Ex-Factory Price, Kafue						
- P ₂ O ₅ Equivalent ³⁾	159.3		182.0		111.6	
- Sulfur Credit, (Gypsum-15% S, \$40/Ton-1987)	-		-		29.6	
- Magnesia Credit, (Dolomite-20% MgO, \$30/Ton-1987)	-		21.2		-	
- Alkaline and Others Credit (Lime -53%, \$20/Ton-1987)	-		18.9		-	
	159.3		182.0		141.2	
- Unit Nutrient Price, \$/Ton-P ₂ O ₅	531.1		606.6		820.9	
- Nutrient Price Ratio	1.000		1.000		1.546	
Farmer's Gate Price, Zambia as Average						
- Transport Cost Adjustment ⁴⁾	-		-		(-)32.9	
- Inventory Time Cost Adjustment ⁵⁾	-		-		(-)11.4	
	-		-		98.3	
- Unit Nutrient Price, \$/Ton-P ₂ O ₅	-		-		571.5	
- Nutrient Price Ratio	-		-		1.000	

Notes: 1) Fertilizer International, The British Sulfur Corp. Ltd., England
2) Current World Fertilizer Situation and Outlook, 1980/81 - 1986/87, FAO/UNIDO/World Bank Working Group on Fertilizer, FAO, Italy, September, 1982
3) Pricing assumption: Av-P₂O₅ in SSP = Av-P₂O₅ in TSP and C-P₂O₅ in PMP = Av-P₂O₅ in TSP
4) Domestic average transport cost of \$155.2-1987 (\$19.40-1987/\$22.16-1991)/Ton is assumed for TSP from Kafue
5) Inventory average time factor between domestic production and import of 4.0 months at annual interest rate of 20% is assumed: $1 - (1-0.20)^{4/12} = 7.10\%$

Table 2-4-6 FINANCIAL ANALYSIS SUMMARY FOR PROJECT INTEGRATION

	Individual Projects			Integrated Projects		
	Phosphate Mining and Concentrate Project, Chilembwe, Zambia [II]	Fused Magnesium Phosphate Project, Kafue, Zambia [III]	Single Super Phosphate Project, Kafue, Zambia [III]	Phosphate Mining and Concentrate Project and Fused Magnesium Phosphate Project, Chilembwe/Kafue, Zambia [I] + [III]	Phosphate Mining and Concentrate Project and Single Super Phosphate Project, Chilembwe/Kafue, Zambia [II] + [III]	Base Case
	Low Case	Base Case	Low Case	Base Case	Low Case	Base Case
	4.0	12.0	4.0	12.0	4.0	12.0
1. Long Term Loan Interest Rate, %/Year	13.71	14.56	18.73	19.79	34.02	36.08
2. Project Cost, \$, MM - 1991	130	130	130	130	120.3	120.3
3. Transfer Price of Phosphate Concentrate, \$/Ton, Bulk, Dry, Kafue	[130] (433) - Bulk	180 (899) - Bags	150 (872) - Bulk	150 (872) - Bulk	180 (899) - Bags	150 (872) - Bulk
4. Product Price, \$/Ton, Kafue, (Nutrient Price, \$/Ton-P ₂ O ₅)-Packaging	(-)4.29	(-)4.27	(-)3.53	(-)3.52	(-)8.04	(-)8.00
5. ROI, DCF, Constant Price, After Tax, %	0.85	0.16	0.93	0.18	0.50	0.10
6. Debt Service Ratio	0.94	(-)0.05	1.00	0.09	0.48	(-)0.12
- 1991	1.26	(-)0.46	1.26	(-)0.26	0.68	(-)0.59
- 3	0.58	(-)1.21	0.58	(-)0.89	0.20	(-)1.42
- 5	0.44	(-)2.44	0.61	(-)1.91	(-)0.15	(-)2.78
- 7	0.35	(-)2.76	0.64	(-)2.18	(-)0.51	(-)3.12
- 9	0.00	0.00	0.00	0.00	0.00	0.00
Project Life Average	0.01	2.42	0.00	1.65	0.00	5.16
Short Term Loan, \$, MM (Interest Rate; 20%/Year)	0.00	6.59	0.00	6.57	0.16	16.28
- 1991	0.00	12.08	0.00	12.97	1.50	31.08
- 3	0.76	19.58	0.00	21.63	5.46	51.39
- 5	5.14	65.07	2.49	73.56	29.02	175.45
- 7						
- 9						
- 2005, Project Life						

Notes: 1) Equity/Long Term Loan = 25/75
 2) Project Life/Depreciation = 15 years/15 years (1991 to 2005)
 3) Loans: Interest Rate 12.0% Grace Period 2.5 years Repayment 15 years
 - Long Term - Base Case 4.0 7.5 20
 - Low Case 20.0 0.0 1
 - Short Term

4) Cut-Off Rate for Project Evaluation at INDECO, Zambia
 - Financial Analysis: 12%
 - Economic Analysis: 18%

Table 2-4-7-1 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (1/5)

1. Project

Title : Phosphate Mining and Concentrate Project
 Location : Chilembwe, Zambia
 Executing Agency : State Owned Corporation
 Project Case : Base
 Product : Phosphate Concentrate, Bulk, Wet
 Maximum Operable Days : 290 DPY
 Rated Capacity (100%) : 121.31 TPD x 290 DPY = 35,181 TPY as Dry
 Production Start Year : July 01, 1991
 Monetary Unit : US\$ in terms of current price at the commercial production start date

2. Schedule

Pricing Estimate : January 01, 1987
 Project Approval : July 01, 1988
 Contract Award : July 01, 1989
 Mechanical Completion : March 31, 1991
 Commercial Production : July 01, 1991
 Project Phase Out : June 30, 2006
 Project Life : 15 Years (Effective Production for 14.6 Years)
 Construction and Commissioning : 2 Years

3. Financing Required and Financing Plan on Commercial Production Date

<u>Financing Required</u>	<u>\$, MM</u>	<u>Financing Plan</u>	<u>\$, MM</u>
Land/Site Preparation	0.189	Equity : 25%	3.641
Erected Plant Cost	12.100	Long Term Loan: 75%	10.923
Pre-Operational Expense	0.292	- Interest 12.0%	
Interest during Construction	1.244	Short Term Loan/Local	Balanced
		- Interest 20.0%	
Fixed Capital Cost	13.825		
Initial Working Capital	0.739	Financing Plan	14.564
Financing Required	14.564		

Table 2-4-7-1 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (2/5)

4. Inputs and Pricing (CIF at the Plant in Chilembwe on Commercial Production Date)

Inputs	Unit		Per Product Mix		Annual	
	Unit	Cost \$/Unit	Consumption Unit	Cost \$	Consumption Unit	Cost \$, MM
Raw Material						
- Raw Ore	Ton	0.000	2.956	0.000	104,000	0.000
- Chemicals/Catalysts/ Consumables	\$	-	-	21.347	-	0.751
	-	-	2.956	(21.347)	104,000	(0.751)
Utility and Transport						
- Transport	Ton	73.50	1.000	73.500	35,181	2.586
- Raw Water	Ton	0.00	8.871	0.000	312,075	0.000
- Diesel Oil	kl	271.27	0.007	1.876	244	0.066
- Electricity	kWh	0.0189	94.293	1.782	3.318MM	0.0627
	-	-	-	(77.172)	-	(2.715)
Personnel	Man·Year	1,674	-	5.571	117	0.196
Overhead	Man·Year x 30%		-	1.677	-	0.059
Maintenance	Plant Cost x 2.00%		-	6.907	-	0.243
Insurance/ Local Tax	Plant Cost x 0.50%		-	1.734	-	0.061
Sales Expense/ Administration	Annual Sales x 1.50%		-	1.961	-	0.069
	-	-	-	(17.851)	-	(0.628)
Total/Average	-	-	-	116.369	-	4.094

5. Outputs and Pricing (CIF at the Plant in Kafue on Commercial Production Date)

Outputs	Unit		Per Product Mix		Annual	
	Unit	Price \$/Unit	Production Unit	Price \$	Production Unit	Sales \$, MM
Product Mix						
- Phosphate Concentrate, Dry, Bulk	Ton	130.00	1.000	130.00	35,181	4.574
Total/Average	-	130.00	1.000	130.00	35,181	4.574

Note: Assumed Transfer Price of Phosphate Concentrate Price-Dry;
 \$56.50/Ton - FOB, Chilembwe
 73.50 - Transport Cost
 130.00 - CIF, Kafue

Table 2-4-7-1 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (3/5)

6. Operation Schedule

	Year								(Unit: %)
	(-)2 89	(-)1 90	1 91	2 92	3 93	4 94	5 95	... 16 2006	Average
- Financing Disbursement	15	70	15						
- Production									
- Capacity Utilization			35	80	90	100	100	50	1,460
- Inventory Increase			5	5	0	0	0	(-)10	0
- Inventory			5	10	10	10	10	0	0
- Sales			30	75	90	100	100	60	1,460
- Depreciation/Salvage Value	15 years straight line/Zero salvage value								
- Debt Service									
	<u>Loan Type</u>	<u>Maximum Grace plus Maturity</u>						<u>Annual Interest Rate</u>	
		Year						%	
- Development/Foreign									
- Base Case (Relending)		2.5 + 15.0						12.0	
- Low Interest Rate Case		7.5 + 20.0						4.0	
- Development/Local		0 + 1						20.0	
- Corporate Income Tax, %/Tax Holiday, Year		35.0/5.0							
- Minimum Cash Reserve		\$0.10 MM							
- Escalation/Deflator Rate, %/Year		0.0/0.0							

7. Financial Analysis by Discounted Cash Flow Method

	Constant Price		
	<u>Before Tax</u>	<u>After Tax</u>	
	%	%	
- Return on Investment, FIRROI-DCF			
- Base Case	(-)4.27	(-)4.27	
- Sensitivity Analysis			
- Product Price (+20%)	5.74	5.74	
- Raw Material Cost (-20%)	(-)2.24	(-)2.24	
- Investment Cost (-20%)	(-)1.68	(-)1.68	
- Utility and Transport Cost (-20%)	2.29	2.29	
- Cash Flow			
	<u>Year</u>	<u>Debt Service Ratio</u>	<u>Short Term Loan, \$, MM</u>
	1991	0.16	0.00
	1993	(-)0.05	2.42
	1995	(-)0.46	6.60
	1997	(-)1.21	12.08
	1999	(-)2.44	19.58
	Project Life Average	(-)2.76	65.07-2005

Table 2-4-7-1 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (4/5)

8. Sensitivity Analysis

Sensitivity Analysis		FIRROI-DCF, Constant Price	
		Before Tax	After Tax
- Base Case		(-) 4.27%	(-) 4.27%
- Product Price	(+)40%	12.91	11.76
	(+)20	5.74	5.74
	(±)0	(-) 4.27	(-) 4.27
	(-)20	-	-
	(-)40	-	-
- Raw Material Cost	(+)40%	(-) 9.18	(-) 9.18
	(+)20	(-) 6.56	(-) 6.56
	(±)0	(-) 4.27	(-) 4.27
	(-)20	(-) 2.24	(-) 2.24
	(-)40	(-) 0.39	(-) 0.39
- Investment Cost	(+)40%	(-) 7.95	(-) 7.95
	(+)20	(-) 6.30	(-) 6.30
	(±)0	(-) 4.27	(-) 4.27
	(-)20	(-) 1.68	(-) 1.68
	(-)40	1.89	1.89
- Utility and Transport Cost	(+)40%	-	-
	(+)20	(-)14.57	(-)14.57
	(±)0	(-) 4.27	(-) 4.27
	(-)20	2.29	2.29
	(-)40	7.42	7.42

Notes:

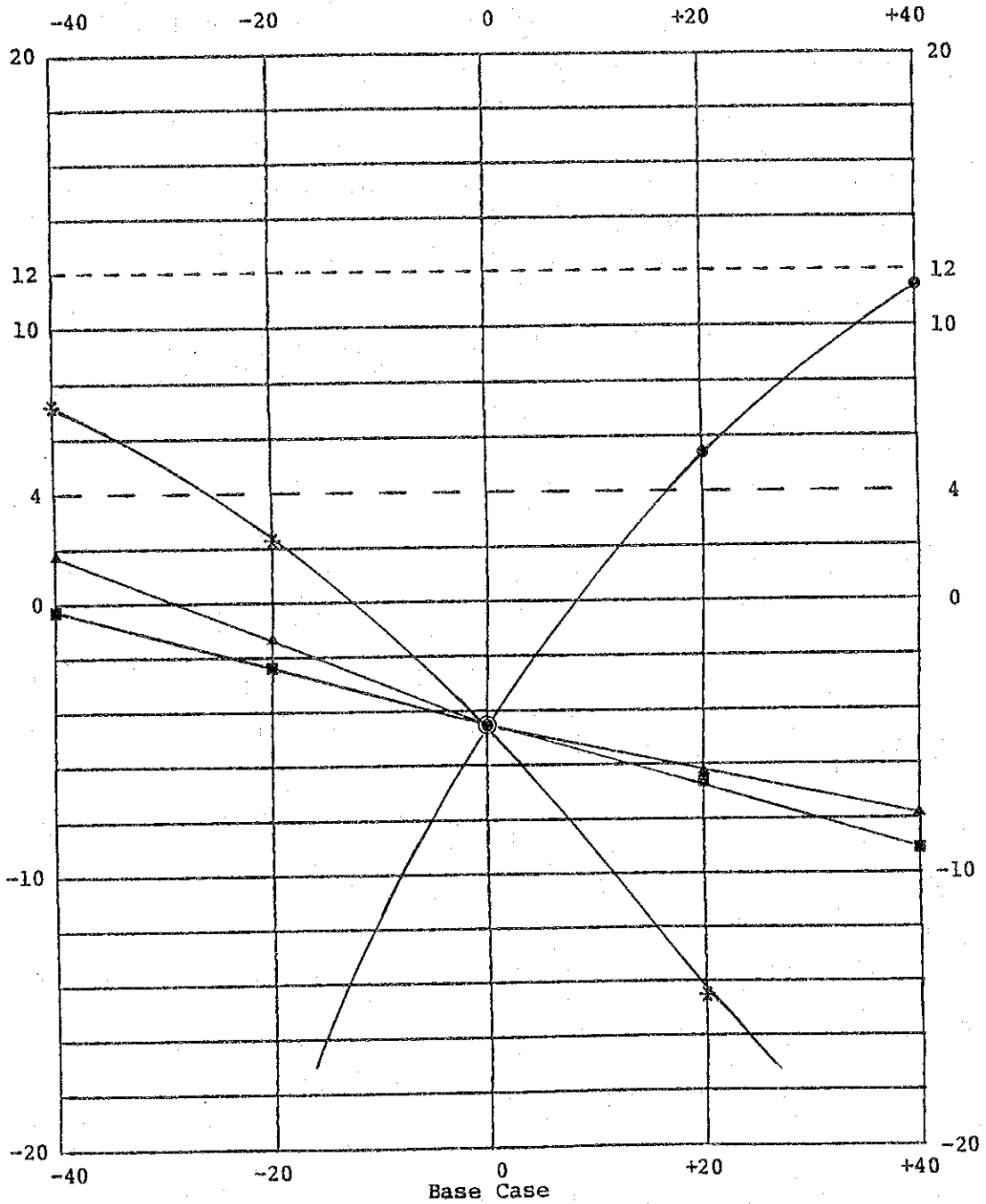
- Long Term Loan/Equity, % = 75/25
- Interest Rate; Long/Short Term Loan, % = 12.0/20.0
- Annual Escalation/Deflator Rate, % = 0.0/0.0
- Corporate Income Tax Rate, % = 35.0

Table 2-4-7-1 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (5/5)

9. Sensitivity Analysis Figure

Return on Investment

- FIRROI/After Tax/Constant Price/DCF, %/Year



Legend:

- - Product Price
- - Raw Material Cost
- ▲ - Investment Cost
- * - Utility and Transport Cost
- - ROI, Before Tax for Base Case
- - - Long Term Loan Interest Rate (Base Case: 12%/Year)
- - - Long Term Loan Interest Rate (Low Interest Rate Case: 4%/Year)

Table 2-4-7-2 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (1/5)

1. Project

Title : Fused Magnesium Phosphate Project
 Location : Kafue, Zambia
 Executing Agency : State Owned Corporation
 Project Case : Base
 Product : Fused Magnesium Phosphate, Bags
 Maximum Operable Days : 300 DPY
 Rated Capacity (100%) : 168.0 TPD x 300 DPY = 50,400 TPY
 Production Start Year : July 01, 1991
 Monetary Unit : US\$ in terms of current price at the commercial production start date

2. Schedule

Pricing Estimate : January 01, 1987
 Project Approval : July 01, 1988
 Contract Award : July 01, 1989
 Mechanical Completion : March 31, 1991
 Commercial Production : July 01, 1991
 Project Phase Out : June 30, 2006
 Project Life : 15 Years (Effective Production for 14.6 Years)
 Construction and Commissioning : 2 Years

3. Financing Required and Financing Plan on Commercial Production Date

Financing Required	\$, MM	Financing Plan	\$, MM
Land/Site Preparation	0.136	Equity : 25%	5.380
Erected Plant Cost	17.338	Long Term Loan: 75%	16.140
Pre-Operational Expense	0.367	- Interest 12.0%	
Interest during Construction	1.764	Short Term Loan/Local	Balanced
		- Interest 20.0%	
Fixed Capital Cost	19.605		
Initial Working Capital	1.915	Financing Plan	21.520
Financing Required	21.520		

Table 2-4-7-2 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (2/5)

4. Inputs and Pricing (CIF at the Plant on Commercial Production Date)

Inputs	Unit		Per Product Mix		Annual	
	Unit	Cost \$/Unit	Consumption Unit	Cost \$	Consumption Unit	Cost \$, MM
Raw Material						
- Phosphate Concentrate, Dry	Ton	130.00	0.698	90.754	35,181	4.574
- Serpentine, Dry	Ton	46.23	0.379	17.520	19,103	0.883
- Calcium Hydroxide	Ton	32.00	0.010	0.317	504	0.016
- Electrode	Ton	3,998	0.005	19.980	252	1.007
- Chemicals/Catalysts/ Consumables	\$	-	-	0.100	-	0.005
- Packaging	Bags	0.86	20.20	17.380	1.018MM	0.876
				(146.05)		(7.361)
Utility and Transport						
- Transport	Ton	-
- Raw Water	Ton	0.00	6.250	0.000	0.315MM	0.000
- Fuel Oil	Ton	185.61	0.028	5.198	1,411	0.262
- Electricity	kWh	0.0122	910.000	11.111	45.87MM	0.560
				(15.222)		(0.822)
Personnel	Man·Year	1,438	-	2.381	83	0.119
Overhead	Man·Year x 30%		-	0.714	-	0.036
Maintenance	Plant Cost x 2.00%		-	6.905	-	0.348
Insurance/ Local Tax	Plant Cost x 0.50%		-	1.726	-	0.087
Sales Expense/ Administration	Annual Sales x 1.50%		-	2.857	-	0.144
				(14.583)		(0.734)
Total/Average				165.148		8.917

5. Outputs and Pricing (FOB at the Plant on Commercial Production Date)

Outputs	Unit		Per Product Mix		Annual	
	Unit	Price \$/Unit	Production Unit	Price \$	Production Unit	Sales \$, MM
Product Mix						
- Fused Magnesium Phosphate, Bags	Ton	180.00	1.000	180.00	50,400	9.072
- Calcium Fluoride	Ton	0.00	(0.015)	(0.00)	(756)	0.000
Total/Average		180.00	1.000	180.00	50,400	9.072

Note: Serpentine Price-Dry;
 \$20.34/Ton - FOB, Mkushi
 25.89 - Transport Cost
 46.23 - CIF, Kafue

Table 2-4-7-2 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (3/5)

6. Operation Schedule

	Year								(Unit: %)	
	(-)2 89	(-)1 90	1 91	2 92	3 93	4 94	5 95	... 16 2006	Average	
- Financing Disbursement	15	70	15							
- Production										
- Capacity Utilization			35	80	90	100	100	50	1,460	
- Inventory Increase			5	5	0	0	0	(-)10	0	
- Inventory			5	10	10	10	10	0	0	
- Sales			30	75	90	100	100	60	1,460	
- Depreciation/Salvage Value	15 years straight line/zero salvage value									
- Debt Service										
	<u>Loan Type</u>	<u>Maximum Grace plus Maturity</u>					<u>Annual Interest Rate</u>			
		Year					%			
- Development/Foreign										
- Base Case (Relending)		2.5 + 15.0					12.0			
- Low Interest Rate Case		7.5 + 20.0					4.0			
- Development/Local		0 + 1					20.0			
- Corporate Income Tax, %/Tax Holiday, Year		35.0/5.0								
- Minimum Cash Reserve		\$0.10 MM								
- Escalation/Deflator Rate, %/Year		0.0/0.0								

7. Financial Analysis by Discounted Cash Flow Method

	Constant Price		
	<u>Before Tax</u>	<u>After Tax</u>	
	%	%	
- Return on Investment, FIRROI-DCF			
- Base Case	(-)10.06	(-)10.06	
- Sensitivity Analysis			
- Product Price (+20%)	5.74	5.74	
- Raw Material Cost (-20%)	3.71	3.71	
- Investment Cost (-20%)	(-)7.87	(-)7.87	
- Utility and Transport Cost (-20%)	(-)7.92	(-)7.92	
- Cash Flow			
	<u>Year</u>	<u>Debt Service Ratio</u>	<u>Short Term Loan, \$, MM</u>
	1991	0.06	0.00
	1993	(-)0.19	3.33
	1995	(-)0.73	10.47
	1997	(-)1.63	20.05
	1999	(-)3.13	33.26
	Project Life Average	(-)3.50	114.37-2005

Table 2-4-7-2 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (4/5)

8. Sensitivity Analysis

<u>Sensitivity Analysis</u>		<u>FIRROI-DCF, Constant Price</u>	
		<u>Before Tax</u>	<u>After Tax</u>
- Base Case		(-)10.06%	(-)10.06%
- Product Price	(+)40%	15.35	13.94
	(+)20	5.74	5.74
	(±)0	(-)10.06	(-)10.06
	(-)20	-	-
	(-)40	-	-
- Raw Material Cost	(+)40%	-	-
	(+)20	-	-
	(±)0	(-)10.06	(-)10.06
	(-)20	3.71	3.71
	(-)40	12.44	11.41
- Investment Cost	(+)40%	(-)13.23	(-)13.23
	(+)20	(-)11.79	(-)11.79
	(±)0	(-)10.06	(-)10.06
	(-)20	(-) 7.87	(-) 7.87
	(-)40	(-) 4.96	(-) 4.96
- Utility and Transport Cost	(+)40%	(-)15.40	(-)15.40
	(+)20	(-)12.51	(-)12.51
	(±)0	(-)10.06	(-)10.06
	(-)20	(-) 7.92	(-) 7.92
	(-)40	(-) 6.02	(-) 6.02

Notes:

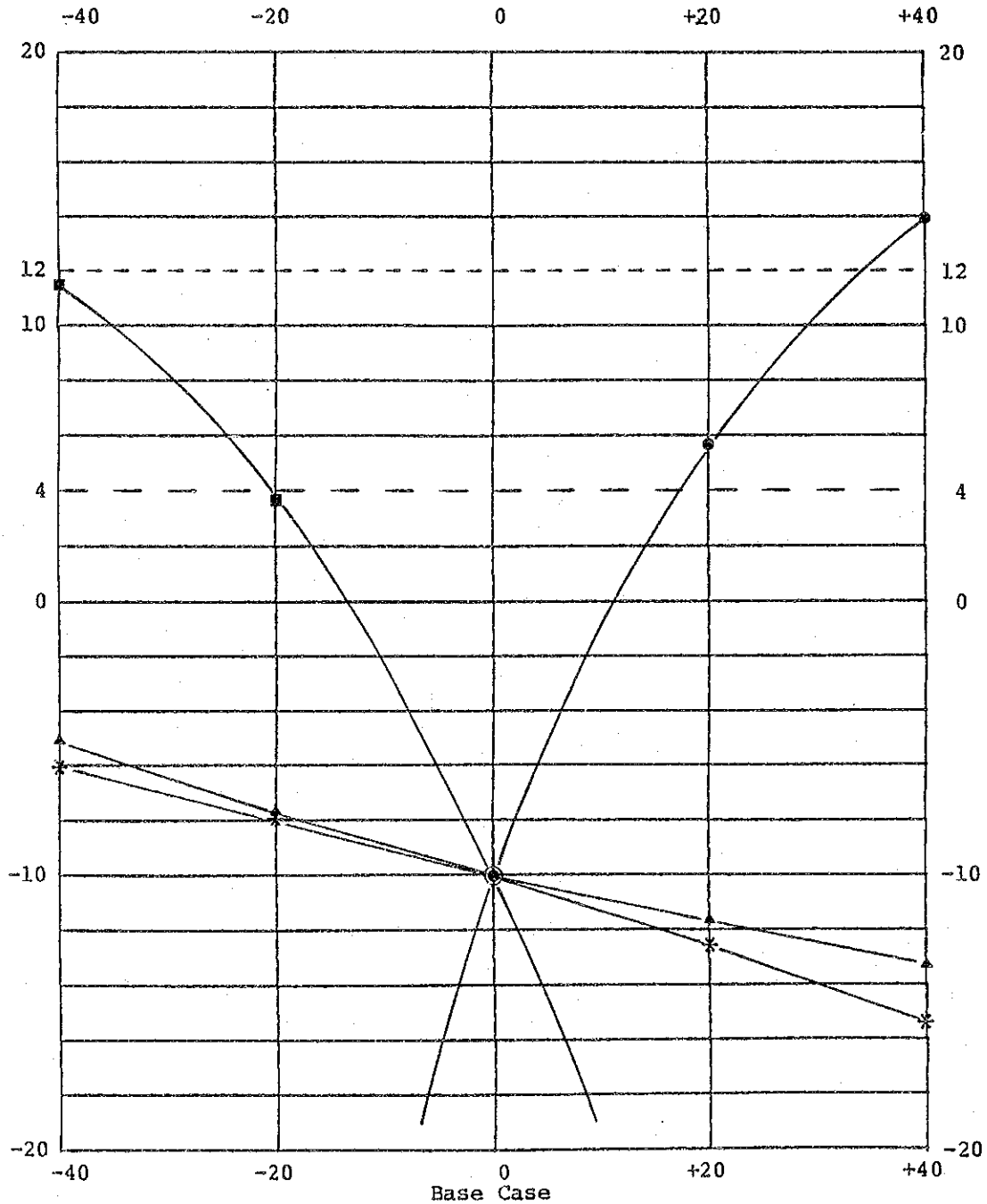
- Long Term Loan/Equity, %	=	75/25
- Interest Rate; Long/Short Term Loan, %	=	12.0/20.0
- Annual Escalation/Deflator Rate, %	=	0.0/0.0
- Corporate Income Tax Rate, %	=	35.0

Table 2-4-7-2 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (5/5)

9. Sensitivity Analysis Figure

Return on Investment

- FIRROI/After Tax/Constant Price/DCF, %/Year



Legend:

- - Product Price
- - Raw Material Cost
- ▲ - Investment Cost
- * - Utility and Transport Cost
- - ROI, Before Tax for Base Case
- - - - Long Term Loan Interest Rate (Base Case: 12%/Year)
- - - - Long Term Loan Interest Rate (Low Interest Rate Case: 4%/Year)

Table 2-4-7-3 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (1/5)

1. Project

Title : Single Super Phosphate Project
 Location : Kafue, Zambia
 Executing Agency : State Owned Corporation
 Project Case : Base
 Product : Single Super Phosphate, Bulk
 Maximum Operable Days : 300 DPY
 Rated Capacity (100%) : 190.68 TPD x 300 DPY = 57,205 TPY
 Production Start Year : July 01, 1991
 Monetary Unit : US\$ in terms of current price at the commercial production start date

2. Schedule

Pricing Estimate : January 01, 1987
 Project Approval : July 01, 1988
 Contract Award : July 01, 1989
 Mechanical Completion : March 31, 1991
 Commercial Production : July 01, 1991
 Project Phase Out : June 30, 2006
 Project Life : 15 Years (Effective Production for 14.6 Years)
 Construction and Commissioning : 2 Years

3. Financing Required and Financing Plan on Commercial Production Date

Financing Required	\$, MM	Financing Plan	\$, MM
Land/Site Preparation	0.098	Equity : 25%	4.949
Erected Plant Cost	14.871	Long Term Loan: 75%	14.845
Pre-Operational Expense	0.650	- Interest 12.0%	
Interest during Construction	1.544	Short Term Loan/Local	Balanced
		- Interest 20.0%	
Fixed Capital Cost	17.163		
Initial Working Capital	2.631	Financing Plan	19.794
Financing Required	19.794		

Table 2-4-7-3 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (2/5)

4. Inputs and Pricing (CIF at the Plant on Commercial Production Date)

Inputs	Unit		Per Product Mix		Annual	
	Unit	Cost \$/Unit	Consumption Unit	Cost \$	Consumption Unit	Cost \$, MM
Raw Material						
- Phosphate Concentrate, Dry	Ton	130.00	0.615	79.958	35,181	4.574
- Sulfuric Acid, 100% H ₂ SO ₄	Ton	128.64	0.347	44.646	19,850	2.554
- Calcium Hydroxide	Ton	32.00	0.010	0.315	572	0.018
- Chemicals/Catalysts/Consumables	\$	-	-	0.105	-	0.006
	-	-	-	(125.024)	-	(7.152)
Utility and Transport						
- Raw Water	Ton	0.00	5.500	0.000	314,628	0.000
- Fuel Oil	Ton	185.61	0.010	1.853	572	0.106
- Electricity	kWh	0.0122	45.000	0.549	2.575MM	0.0314
	-	-	-	(2.402)	-	(0.1374)
Personnel	Man·Year	1,474	-	1.923	74	0.110
Overhead	Man·Year x 30%		-	0.559	-	0.032
Maintenance	Plant Cost x 2.00%		-	5.209	-	0.298
Insurance/ Local Tax	Plant Cost x 0.50%		-	1.294	-	0.074
Sales Expense/ Administration	Annual Sales x 1.50%		-	2.552	-	0.146
	-	-	-	(11.537)	-	(0.660)
Total/Average	-	-	-	156.339	-	8.9434

5. Outputs and Pricing (FOB at the Plant on Commercial Production Date)

Outputs	Unit		Per Product Mix		Annual	
	Unit	Price \$/Unit	Production Unit	Price \$	Production Unit	Sales \$, MM
Product Mix						
- Single Super Phosphate, Bulk	Ton	150.00	1.000	150.00	57,205	8.581
- Calcium Fluoride, Bulk	Ton	0.00	(0.012)	(0.00)	(687)	(0.000)
Total/Average	-	150.00	1.000	150.00	57,205	8.581

Table 2-4-7-3 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (3/5)

6. Operation Schedule

	Year							(Unit: %)		
	(-)2 89	(-)1 90	1 91	2 92	3 93	4 94	5 95	... 16 2006	Average	
- Financing Disbursement	15	70	15							
- Production										
- Capacity Utilization			35	80	90	100	100	50	1,460	
- Inventory Increase			5	5	0	0	0	(-)10	0	
- Inventory			5	10	10	10	10	0	0	
- Sales			30	75	90	100	100	60	1,460	
- Depreciation/Salvage Value	15 years straight line/Zero salvage value									
- Debt Service										
	<u>Loan Type</u>	<u>Maximum Grace plus Maturity</u>					<u>Annual Interest Rate</u>			
		Year					%			
- Development/Foreign										
- Base Case (Relending)		2.5 + 15.0					12.0			
- Low Interest Rate Case		7.5 + 20.0					4.0			
- Development/Local		0 + 1					20.0			
- Corporate Income Tax, %/Tax Holiday, Year		35.0/5.0								
- Minimum Cash Reserve		\$0.10 MM								
- Escalation/Deflator Rate, %/Year		0.0/0.0								

7. Financial Analysis by Discounted Cash Flow Method

	Constant Price		
	<u>Before Tax</u>	<u>After Tax</u>	
	%	%	
- Return on Investment, FIRROI-DCF			
- Base Case	(-)3.52	(-)3.52	
- Sensitivity Analysis			
- Product Price (+20%)	9.92	9.33	
- Raw Material Cost (-20%)	8.32	8.30	
- Investment Cost (-20%)	(-)0.91	(-)0.91	
- Utility and Transport Cost (-20%)	(-)3.22	(-)3.22	
- Cash Flow			
	<u>Year</u>	<u>Debt Service Ratio</u>	<u>Short Term Loan, \$, MM</u>
	1991	0.18	0.00
	1993	0.09	1.65
	1995	(-)0.26	6.57
	1997	(-)0.89	12.97
	1999	(-)1.91	21.63
	Project Life Avarate	(-)2.18	73.56-2005

Table 2-4-7-3 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (4/5)

8. Sensitivity Analysis

Sensitivity Analysis		FIRROI-DCF, Constant Price	
		Before Tax	After Tax
- Base Case		(-)3.52%	(-)3.52%
- Product Price	(+)40%	19.20	17.46
	(+)20	9.92	9.33
	(±)0	(-)3.52	(-)3.52
	(-)20	-	-
	(-)40	-	-
- Raw Material Cost	(+)40%	-	-
	(+)20	-	-
	(±)0	(-)3.52	(-)3.52
	(-)20	8.32	8.30
	(-)40	16.79	15.29
- Investment Cost	(+)40%	(-)7.23	(-)7.23
	(+)20	(-)5.56	(-)5.56
	(±)0	(-)3.52	(-)3.52
	(-)20	(-)0.91	(-)0.91
	(-)40	2.66	2.66
- Utility and Transport Cost	(+)40%	(-)4.13	(-)4.13
	(+)20	(-)3.82	(-)3.82
	(±)0	(-)3.52	(-)3.52
	(-)20	(-)3.22	(-)3.22
	(-)40	(-)2.93	(-)2.93

Notes:

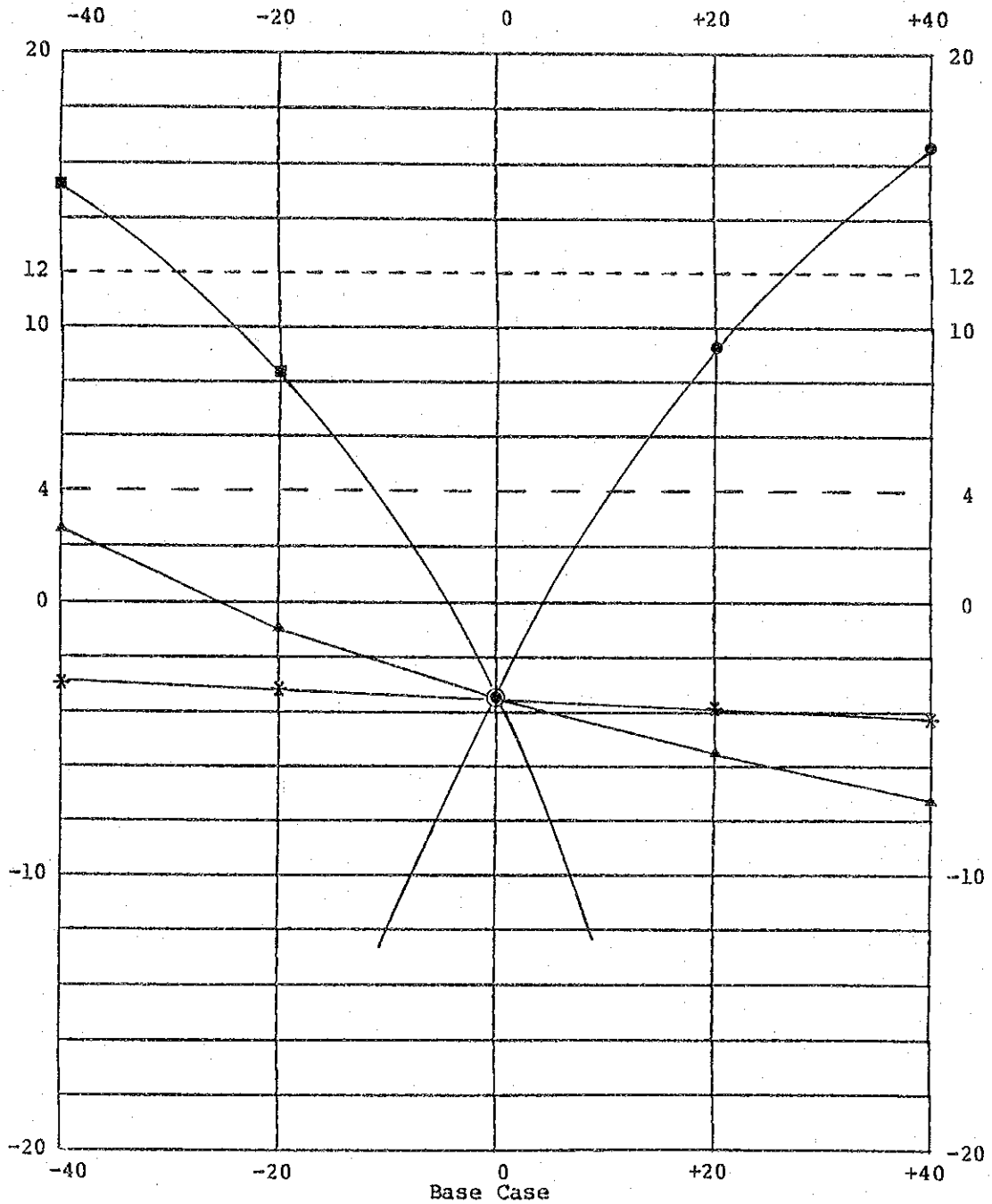
- Long Term Loan/Equity, % = 75/25
- Interest Rate; Long/Short Term Loan, % = 12.0/20.0
- Annual Escalation/Deflator Rate, % = 0.0/0.0
- Corporate Income Tax Rate, % = 35.0

Table 2-4-7-3 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (5/5)

9. Sensitivity Analysis Figure

Return on Investment

- FIRROI/After Tax/Constant Price/DCF, %/Year



Legend:

- - Product Price
- - Raw Material Cost
- ▲ - Investment Cost
- * - Utility and Transport Cost
- - ROI, Before Tax for Base Case
- - - - Long Term Loan Interest Rate (Base Case: 12%/Year)
- - - - Long Term Loan Interest Rate (Low Interest Rate Case: 4%/Year)

Table 2-4-7-4 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (1/5)

1. Project

Title : Phosphate Mining and Concentrate Project and Fused Magnesium Phosphate Project
 Location : Chilembwe and Kafue, Zambia
 Executing Agency : State Owned Corporation
 Project Case : Base
 Product : Fused Magnesium Phosphate, Bags
 Maximum Operable Days : 300 DPY
 Rated Capacity (100%) : 168.0 TPD x 300 DPY = 50,400 TPY
 Production Start Year : July 01, 1991
 Monetary Unit : US\$ in terms of current price at the commercial production start date

2. Schedule

Pricing Estimate : January 01, 1987
 Project Approval : July 01, 1988
 Contract Award : July 01, 1989
 Mechanical Completion : March 31, 1991
 Commercial Production : July 01, 1991
 Project Phase Out : June 30, 2006
 Project Life : 15 Years (Effective Production for 14.6 Years)
 Construction and Commissioning : 2 Years

3. Financing Required and Financing Plan on Commercial Production Date

Financing Required	\$, MM	Financing Plan	\$, MM
Land/Site Preparation	0.325	Equity : 25%	9.021
Erected Plant Cost	29.438	Long Term Loan: 75%	27.063
Pre-Operational Expense	0.659	- Interest 12.0%	
Interest during Construction	3.008	Short Term Loan/Local	Balanced
		- Interest 20.0%	
Fixed Capital Cost	33.430		
Initial Working Capital	2.654	Financing Plan	36.084
Financing Required	36.084		

Table 2-4-7-4 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (2/5)

4. Inputs and Pricing (CIF at the Plant on Commercial Production Date)

Inputs	Unit		Per Product Mix		Annual	
	Unit	Cost \$/Unit	Consumption Unit	Cost \$	Consumption Unit	Cost \$, MM
Raw Material						
- Raw Ore, Dry	Ton	0.00	2.063	0.000	104,000	0.000
- Serpentine, Dry	Ton	46.23	0.379	17.520	19,103	0.883
- Calcium Hydroxide	Ton	32.00	0.010	0.317	504	0.016
- Electrode	Ton	3,998.00	0.005	19.980	252	1.007
- Chemicals/Catalysts/ Consumables	\$	-	-	15.000	-	0.756
- Packaging	Bags	0.86	20.20	17.381	1.018MM	0.876
	-	-	-	(70.198)	-	(3.538)
Utility and Transport						
- Transport	\$	73.480	0.698	51.310	35,181	2.586
- Raw Water	Ton	0.000	12.440	0.000	0.627MM	0.000
- Fuel/Diesel Oil	kl/Ton	231.420	0.033	7.508	1,655	0.328
- Electricity	kWh	0.01266	975.952	12.355	49.188MM	0.623
	-	-	-	(70.179)	-	(3.537)
Personnel	Man·Year	1,575	-	6.269	200	0.315
Overhead	Man·Year x 30%		-	1.885	-	0.095
Maintenance	Plant Cost x 2.00%		-	11.706	-	0.590
Insurance/ Local Tax	Plant Cost x 0.50%		-	2.936	-	0.148
Sales Expense/ Administration	Annual Sales x 2.22%		-	4.841	-	0.213
	-	-	-	(27.004)	-	(1.361)
Total/Average	-	-	-	167.381	-	8.436

5. Outputs and Pricing (FOB at the Plant on Commercial Production Date)

Outputs	Unit		Per Product Mix		Annual	
	Unit	Price \$/Unit	Production Unit	Price \$	Production Unit	Sales \$, MM
Product Mix						
- Fused Magnesium Phosphate, Bags	Ton	180.00	1.000	180.00	50,400	9.072
- Calcium Fluoride	Ton	0.00	(0.015)	0.00	(756)	(0.000)
Total/Average	-	180.00	1.000	180.00	50,400	9.072

Table 2-4-7-4 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (3/5)

6. Operation Schedule

	Year										(Unit: %)	
	(-)2 89	(-)1 90	1 91	2 92	3 93	4 94	5 95	...	16 2006	Average		
- Financing Disbursement	15	70	15									
- Production												
- Capacity Utilization			35	80	90	100	100		50		1,460	
- Inventory Increase			5	5	0	0	0		(-)10		0	
- Inventory			5	10	10	10	10		0		0	
- Sales			30	75	90	100	100		60		1,460	

- Depreciation/Salvage Value 15 years straight line/zero salvage value

- Debt Service

Loan Type	Maximum Grace plus Maturity Year	Annual Interest Rate %
- Development/Foreign		
- Base Case (Relending)	2.5 + 15.0	12.0
- Low Interest Rate Case	7.5 + 20.0	4.0
- Development/Local	0 + 1	20.0
- Corporate Income Tax, %/Tax Holiday, Year	35.0/5.0	
- Minimum Cash Reserve	\$0.10 MM	
- Escalation/Deflator Rate, %/Year	0.0/0.0	

7. Financial Analysis by Discounted Cash Flow Method

	Constant Price		
	Before Tax %	After Tax %	
- Return on Investment, FIRROI-DCF			
- Base Case	(-)8.00	(-)8.00	
- Sensitivity Analysis			
- Product Price (+20%)	2.00	2.00	
- Raw Material Cost (-20%)	(-)3.36	(-)3.36	
- Investment Cost (-20%)	(-)5.58	(-)5.58	
- Utility and Transport Cost (-20%)	(-)3.30	(-)3.30	
- Cash Flow			
	Year	Debt Service Ratio	Short Term Loan, \$, MM
	1991	0.10	0.00
	1993	(-)0.12	5.16
	1995	(-)0.59	16.28
	1997	(-)1.42	31.08
	1999	(-)2.78	51.39
	Project Life Average	(-)3.12	175.45-2005

Table 2-4-7-4 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (4/5)

8. Sensitivity Analysis

Sensitivity Analysis		FIRROI-DCF, Constant Price	
		Before Tax	After Tax
- Base Case		(-) 8.00%	(-) 8.00%
- Product Price	(+)40%	8.80	8.72
	(+)20	2.00	2.00
	(±)0	(-) 8.00	(-) 8.00
	(-)20	-	-
	(-)40	-	-
- Raw Material Cost	(+)40%	-	-
	(+)20	(-)14.51	(-)14.51
	(±)0	(-) 8.00	(-) 8.00
	(-)20	(-) 3.36	(-) 3.36
	(-)40	0.36	0.36
- Investment Cost	(+)40%	(-)11.45	(-)11.45
	(+)20	(-) 9.90	(-) 9.90
	(±)0	(-) 8.00	(-) 8.00
	(-)20	(-) 5.58	(-) 5.58
	(-)40	(-) 2.29	(-) 2.29
- Utility and Transport Cost	(+)40%	-	-
	(+)20	(-)14.62	(-)14.62
	(±)0	(-) 8.00	(-) 8.00
	(-)20	(-) 3.30	(-) 3.30
	(-)40	0.45	0.45

Notes:

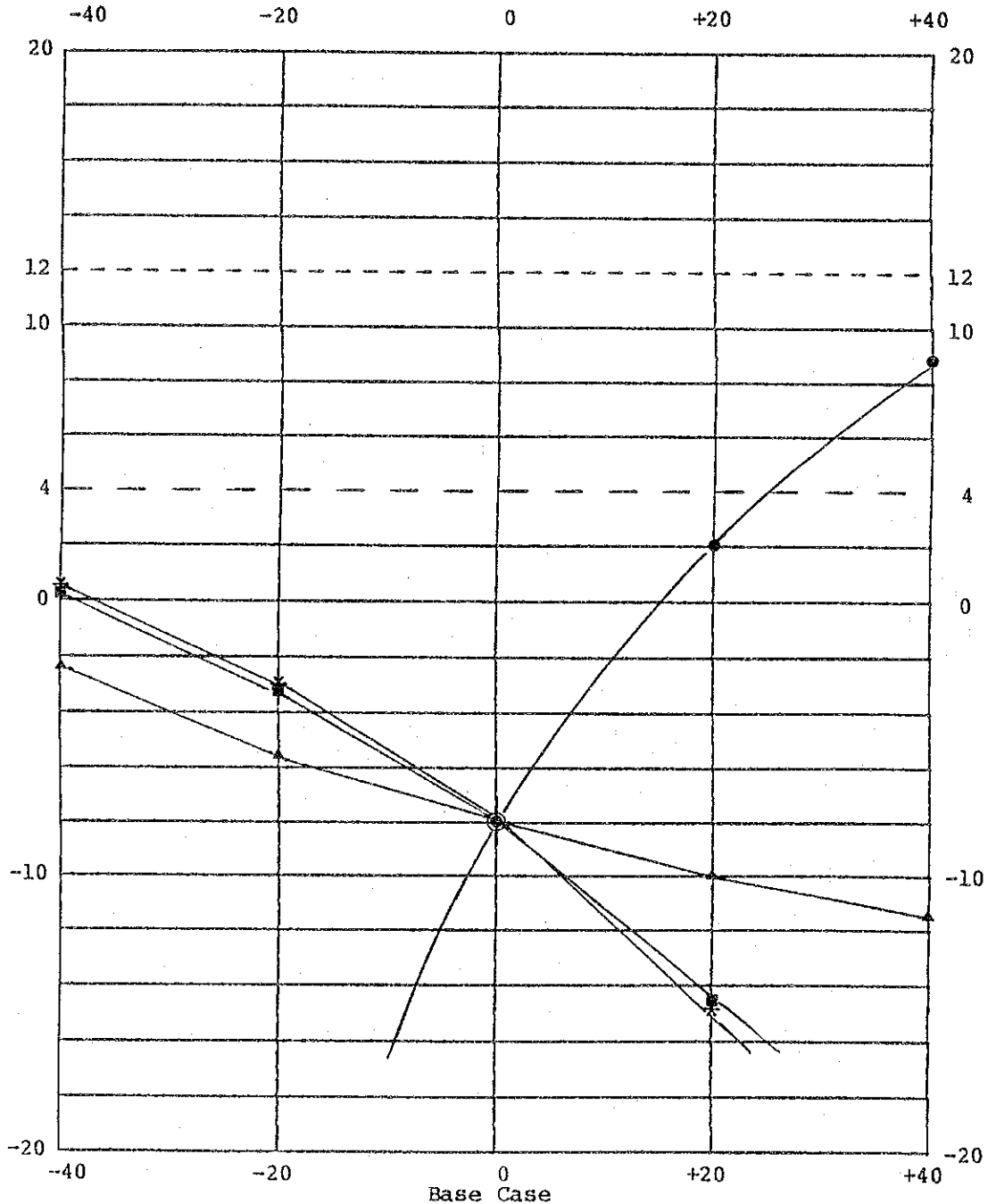
- Long Term Loan/Equity, % = 75/25
- Interest Rate; Long/Short Term Loan, % = 12.0/20.0
- Annual Escalation/Deflator Rate, % = 0.0/0.0
- Corporate Income Tax Rate, % = 35.0

Table 2-4-7-4 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (5/5)

9. Sensitivity Analysis Figure

Return on Investment

- FIRROI/After Tax/Constant Price/DCF, %/Year



Legend:

- - Product Price
- - Raw Material Cost
- ▲ - Investment Cost
- * - Utility and Transport Cost
- - ROI, Before Tax for Base Case
- - - - Long Term Loan Interest Rate (Base Case: 12%/Year)
- - - - Long Term Loan Interest Rate (Low Interest Rate Case: 4%/Year)

Table 2-4-7-5 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (1/5)

1. Project

Title : Phosphate Mining and Concentrate Project and Single Super Phosphate Project

Location : Chilembwe and Kafue, Zambia

Executing Agency : State Owned Corporation

Project Case : Base

Product : Single Super Phosphate, Bulk

Maximum Operable Days : 300 DPY

Rated Capacity (100%) : 190.68 TPD x 300 DPY = 57,205 TPY

Production Start Year : July 01, 1991

Monetary Unit : US\$ in terms of current price at the commercial production start date

2. Schedule

Pricing Estimate : January 01, 1987

Project Approval : July 01, 1988

Contract Award : July 01, 1989

Mechanical Completion : March 31, 1991

Commercial Production : July 01, 1991

Project Phase Out : June 30, 2006

Project Life : 15 Years (Effective Production for 14.6 Years)

Construction and Commissioning : 2 Years

3. Financing Required and Financing Plan on Commercial Production Date

<u>Financing Required</u>	<u>\$, MM</u>	<u>Financing Plan</u>	<u>\$, MM</u>
Land/Site Preparation	0.287	Equity : 25%	8.590
Erected Plant Cost	26.971	Long Term Loan: 75%	25.768
Pre-Operational Expense	0.942	- Interest 12.0%	
Interest during Construction	2.788	Short Term Loan/Local	Balanced
		- Interest 20.0%	
Fixed Capital Cost	30.988		
Initial Working Capital	3.370	Financing Plan	34.358
Financing Required	34.358		

Table 2-4-7-5 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (2/5)

4. Inputs and Pricing (CIF at the Plant on Commercial Production Date)

Inputs	Unit		Per Product Mix		Annual	
	Unit	Cost \$/Unit	Consumption Unit	Cost \$	Consumption Unit	Cost \$, MM
Raw Material						
- Raw Ore	Ton	0.00	1.818	0.000	104,000	0.000
- Sulfuric Acid	Ton	128.64	0.347	44.646	19,850	2.554
- Calcium Hydroxide	Ton	31.83	0.010	0.315	572	0.018
- Chemicals/Catalysts/ Consumables	\$	-	-	13.233	-	0.757
	-	-	-	(58.194)	-	(3.329)
Utility and Transport						
- Transport	\$	73.50	0.615	45.206	35,181	2.586
- Raw Water	Ton	0.00	10.955	0.000	626,703	0.000
- Fuel/Diesel Oil	kl/Ton	210.78	0.0143	3.007	816	0.172
- Electricity	kWh	0.0160	103.015	1.645	5.893MM	0.0941
	-	-	-	(49.856)	-	(2.852)
Personnel	Man·Year	1,597	-	5.332	191	0.305
Overhead	Man·Year x 30%		-	1.608	-	0.092
Maintenance	Plant Cost x 2.00%		-	9.457	-	0.541
Insurance/ Local Tax	Plant Cost x 0.50%		-	2.360	-	0.135
Sales Expense/ Administration	Annual Sales x 2.21%		-	3.758	-	0.215
	-	-	-	(22.516)	-	(1.288)
Total/Average	-	-	-	147.942	-	8.463

5. Outputs and Pricing (FOB at the Plant on Commercial Production Date)

Outputs	Unit		Per Product Mix		Annual	
	Unit	Price \$/Unit	Production Unit	Price \$	Production Unit	Sales \$, MM
Product Mix						
- Single Super Phosphate, Bulk	Ton	150.00	1.000	150.00	57,205	8.581
- Calcium Fluoride, Bulk	Ton	0.00	(0.012)	(0.00)	(687)	(0.000)
Total/Average	-	150.00	1.000	150.00	57,205	8.581

Table 2-4-7-5 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (3/5)

6. Operation Schedule

	Year								(Unit: %)	
	(-)2 89	(-)1 90	1 91	2 92	3 93	4 94	5 95	...16 2006	Average	
- Financing Disbursement	15	70	15							
- Production										
- Capacity Utilization			35	80	90	100	100	50	1,460	
- Inventory Increase			5	5	0	0	0	(-)10	0	
- Inventory			5	10	10	10	10	0	0	
- Sales			30	75	90	100	100	60	1,460	
- Depreciation/Salvage Value	15 years straight line/zero salvage value									
- Debt Service										
	<u>Loan Type</u>	<u>Maximum Grace plus Maturity</u>					<u>Annual Interest Rate</u>			
		Year					%			
- Development/Foreign										
- Base Case (Relending)		2.5 + 15.0					12.0			
- Low Interest Rate Case		7.5 + 20.0					4.0			
- Development/Local		0 + 1					20.0			
- Corporate Income Tax, %/Tax Holiday, Year		35.0/5.0								
- Minimum Cash Reserve		\$0.10 MM								
- Escalation/Deflator Rate, %/Year		0.0/0.0								

7. Financial Analysis by Discounted Cash Flow Method

	Constant Price		
	<u>Before Tax</u>	<u>After Tax</u>	
	%	%	
- Return on Investment, FIRROI-DCF			
- Base Case	(-)3.84	(-)3.84	
- Sensitivity Analysis			
- Product Price (+20%)	4.76	4.76	
- Raw Material Cost (-20%)	0.01	0.01	
- Investment Cost (-20%)	(-)1.14	(-)1.14	
- Utility and Transport Cost (-20%)	(-)0.50	(-)0.50	
- Cash Flow			
	<u>Year</u>	<u>Debt Service Ratio</u>	<u>Short Term Loan, \$, MM</u>
	1991	0.17	0.00
	1993	0.06	3.41
	1995	(-)0.29	12.16
	1997	(-)0.94	23.54
	1999	(-)1.99	38.99
	Project Life Avarate	(-)2.27	131.80-2005

Table 2-4-7-5 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (4/5)

8. Sensitivity Analysis

<u>Sensitivity Analysis</u>		<u>FIRROI-DCF, Constant Price</u>	
		<u>Before Tax</u>	<u>After Tax</u>
- Base Case		(-) 3.84%	(-) 3.84%
- Product Price	(+)40%	11.10	10.27
	(+)20	4.76	4.76
	(±)0	(-) 3.84	(-) 3.84
	(-)20	(-)22.00	(-)22.00
	(-)40	-	-
- Raw Material Cost	(+)40%	(-)15.72	(-)15.72
	(+)20	(-) 8.70	(-) 8.70
	(±)0	(-) 3.84	(-) 3.84
	(-)20	0.01	0.01
	(-)40	3.26	3.26
- Investment Cost	(+)40%	(-) 7.64	(-) 7.64
	(+)20	(-) 5.93	(-) 5.93
	(±)0	(-) 3.84	(-) 3.84
	(-)20	(-) 1.14	(-) 1.14
	(-)40	2.58	2.58
- Utility and Transport Cost	(+)40%	(-)13.36	(-)13.36
	(+)20	(-) 7.91	(-) 7.91
	(±)0	(-) 3.84	(-) 3.84
	(-)20	(-) 0.50	(-) 0.50
	(-)40	2.38	2.38

Notes:

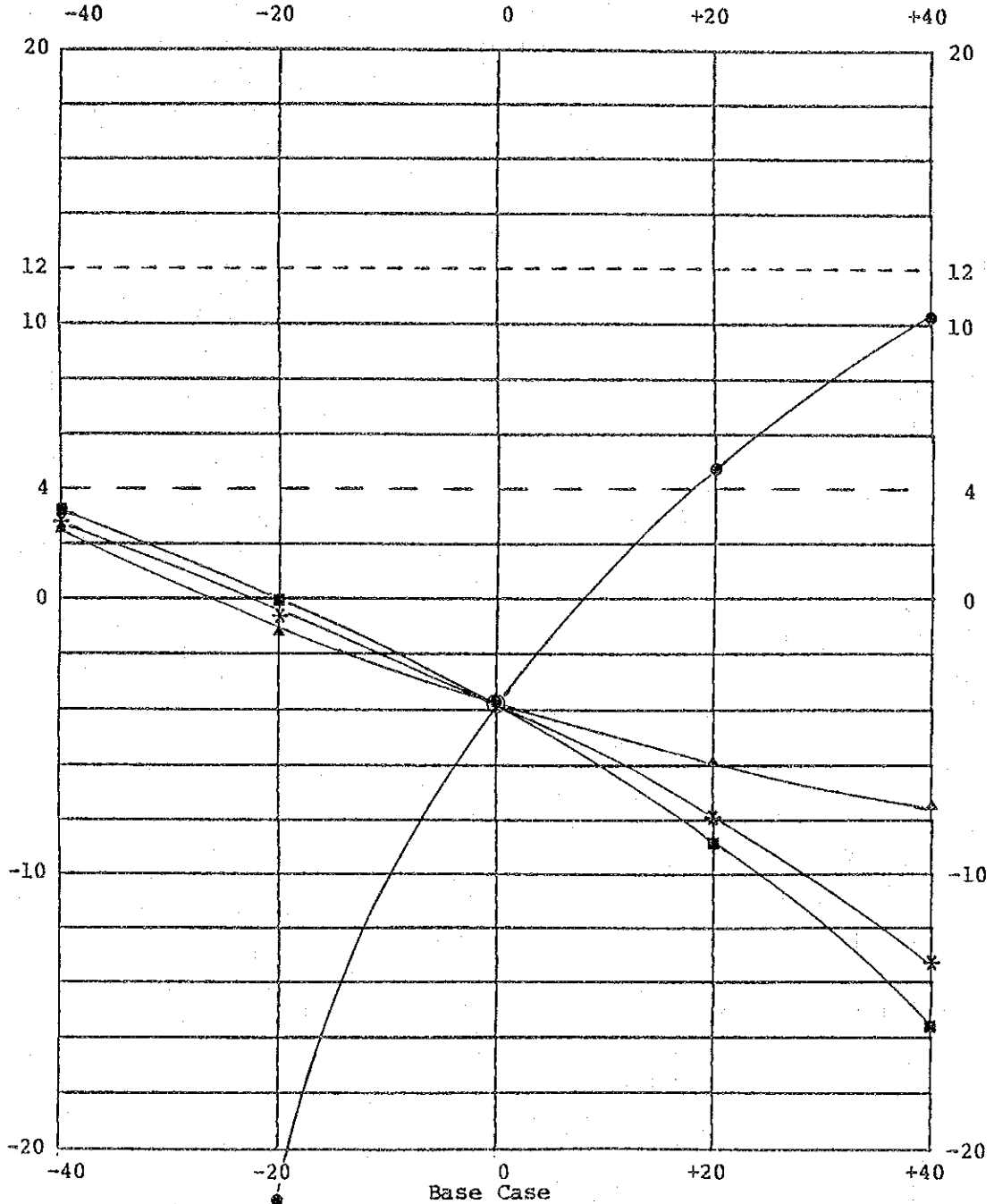
- Long Term Loan/Equity, %	=	75/25
- Interest Rate; Long/Short Term Loan, %	=	12.0/20.0
- Annual Escalation/Deflator Rate, %	=	0.0/0.0
- Corporate Income Tax Rate, %	=	35.0

Table 2-4-7-5 PROJECT PROFILE AND FINANCIAL ANALYSIS SUMMARY (5/5)

9. Sensitivity Analysis Figure

Return on Investment

- FIRROI/After Tax/Constant Price/DCF, %/Year



Legend:

- - Product Price
- - Raw Material Cost
- ▲ - Investment Cost
- * - Utility and Transport Cost
- - ROI, Before Tax for Base Case
- - - - Long Term Loan Interest Rate (Base Case: 12%/Year)
- - - - Long Term Loan Interest Rate (Low Interest Rate Case: 4%/Year)

Table 2-4-8 CONVERSION FACTORS FOR ECONOMIC ANALYSIS OF PROJECT IN ZAMBIA

1. Tradeable Items		: International prices to prevail during the economic life of the project (15 years) with no salvage value at the end.		
2. Non-Tradeable Items		: Conversion Factor		
		Fertilizer Industry		
		Restructuring Project, Economic Evaluation Unit, This Study		
		The World Bank Feb 4, 1986 INDECO, 1986 JICA, 1987		
Standard Conversion Factor		0.96	-	-
Exchange Rate		-	0.80	1.00
Land		-	1.00	1.00
Site Preparation		-	0.81	1.00
				<u>Foreign</u> <u>Local</u>
Equipment and Materials		-	0.91	0.95 0.80
Field Expenses		-	0.80	0.95 0.80
Engineering Services		-	0.80	0.95 0.80
Imported Material/Services		-	0.80	0.95 -
Transport		0.76	-	- 0.76
Raw Materials		0.86	-	1.00 0.80
Intermediate Goods		0.95	-	1.00 0.80
Electricity		0.97*	0.85	- 0.87**
Fuel		-	0.85	- 1.00
Raw Water		-	0.90	- 0.80
Labor				
- Skilled		0.85	0.96	- 0.85
- Semiskilled		0.67	0.67	- -
- Unskilled		0.54	0.52	- 0.54
3. Cut-Off Rate, %				
- Financial Analysis		12.00	12.00	12.00
- Economic Analysis		12.00	18.00	12.00
4. Exchange Rate, ZK/US\$				
		2.1-1984	-	8.00-1987
		3.1-1985	-	-
		6.0-1986+	-	8.00-1991
5. Inflation Rate, %/Year***				
		7.2-1986	-	-
		6.8-1987	-	3.00-1987
		6.8-1988	-	-
		7.0-1989	-	-
		7.1-1990	-	-
		4.0-1991+	-	3.00-1991

* Up to year 1996, the economic cost of electricity is opportunity cost of exporting to Zimbabwe as surplus, and after 1996 it is taken 30% higher than the financial cost.

** Tariff without sales tax is applied in due consideration of long run marginal cost and export price of electricity.

*** Assuming the difference between domestic and international inflation rates will be reflected in the foreign exchange rate.

Figure 2-1-1 FLOW OF FERTILIZER DISTRIBUTION

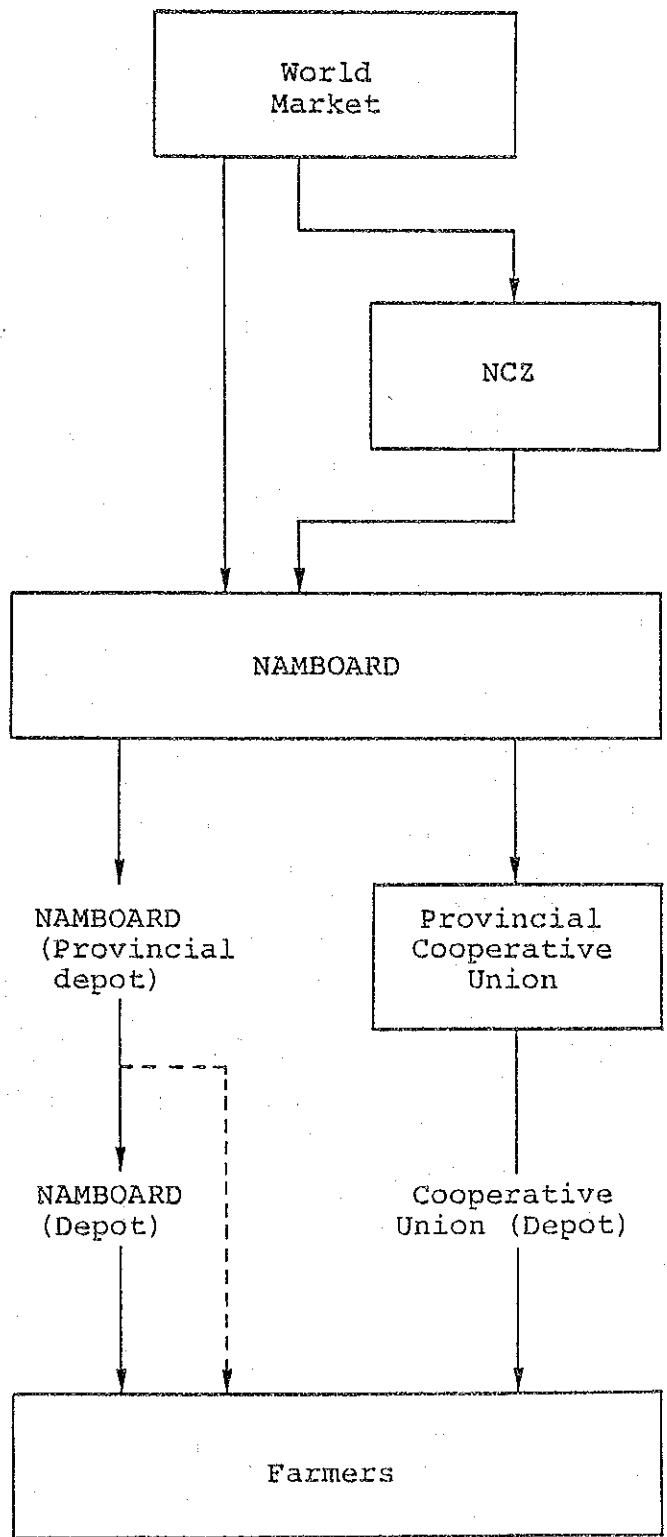


Figure 2-1-2

CLASSIFICATION OF AREA IN VIEW
OF USE OF FMP AND LIME

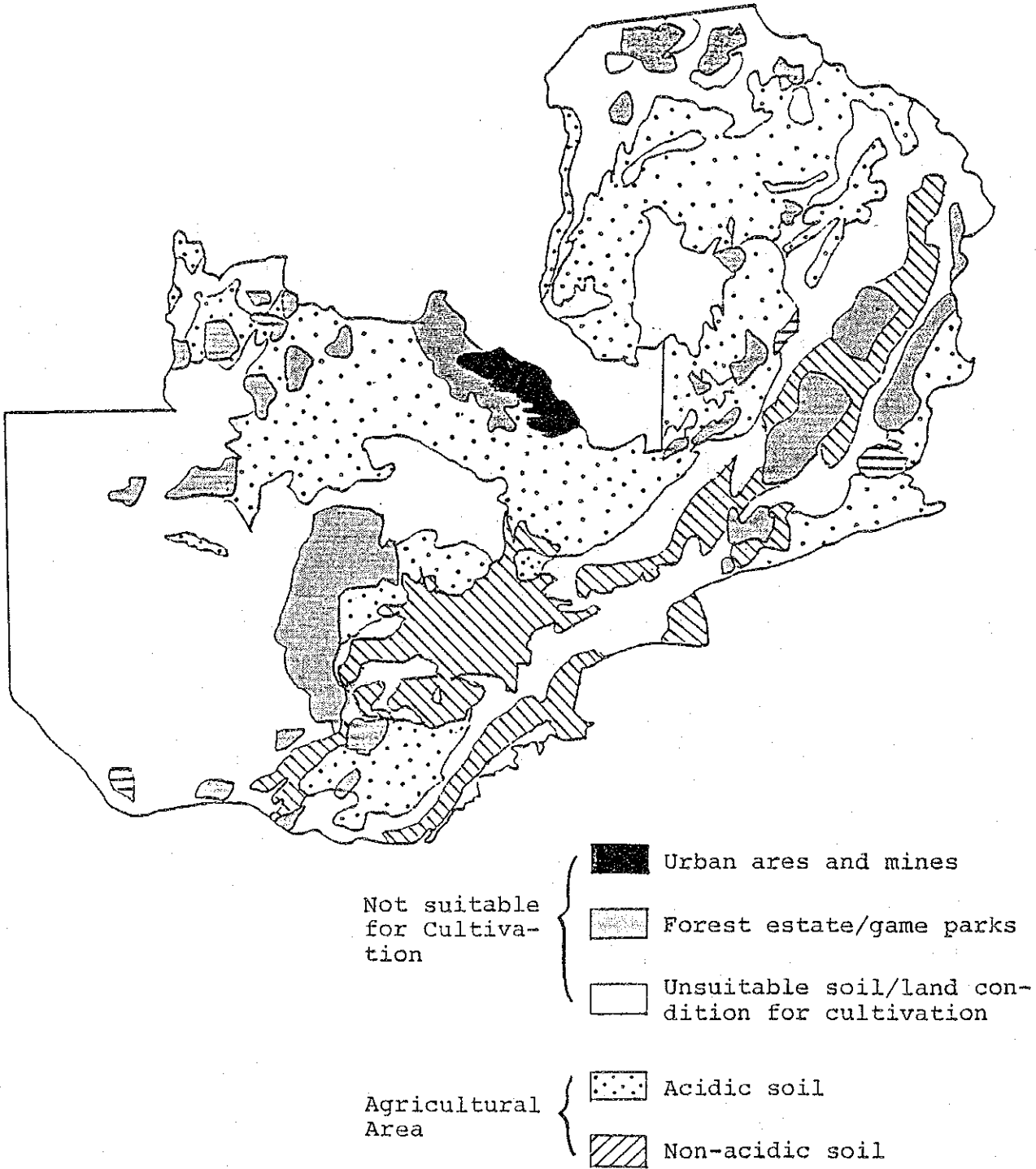
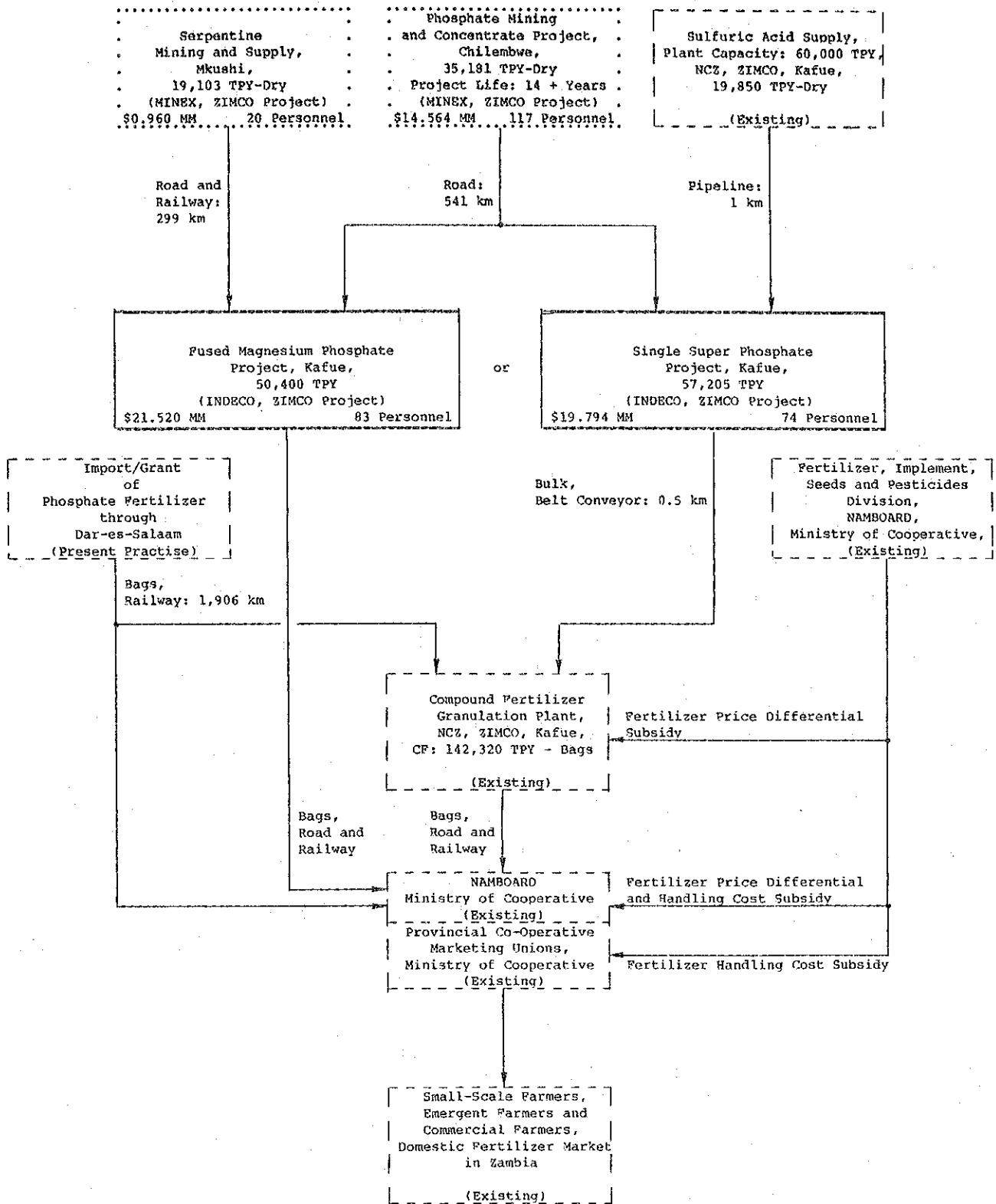


Figure 2-3-1 INTEGRATION OF PHOSPHATE MINING AND CONCENTRATE PROJECT AND PHOSPHATE FERTILIZER PROJECTS IN ZAMBIA



Legends:

Proposed Project

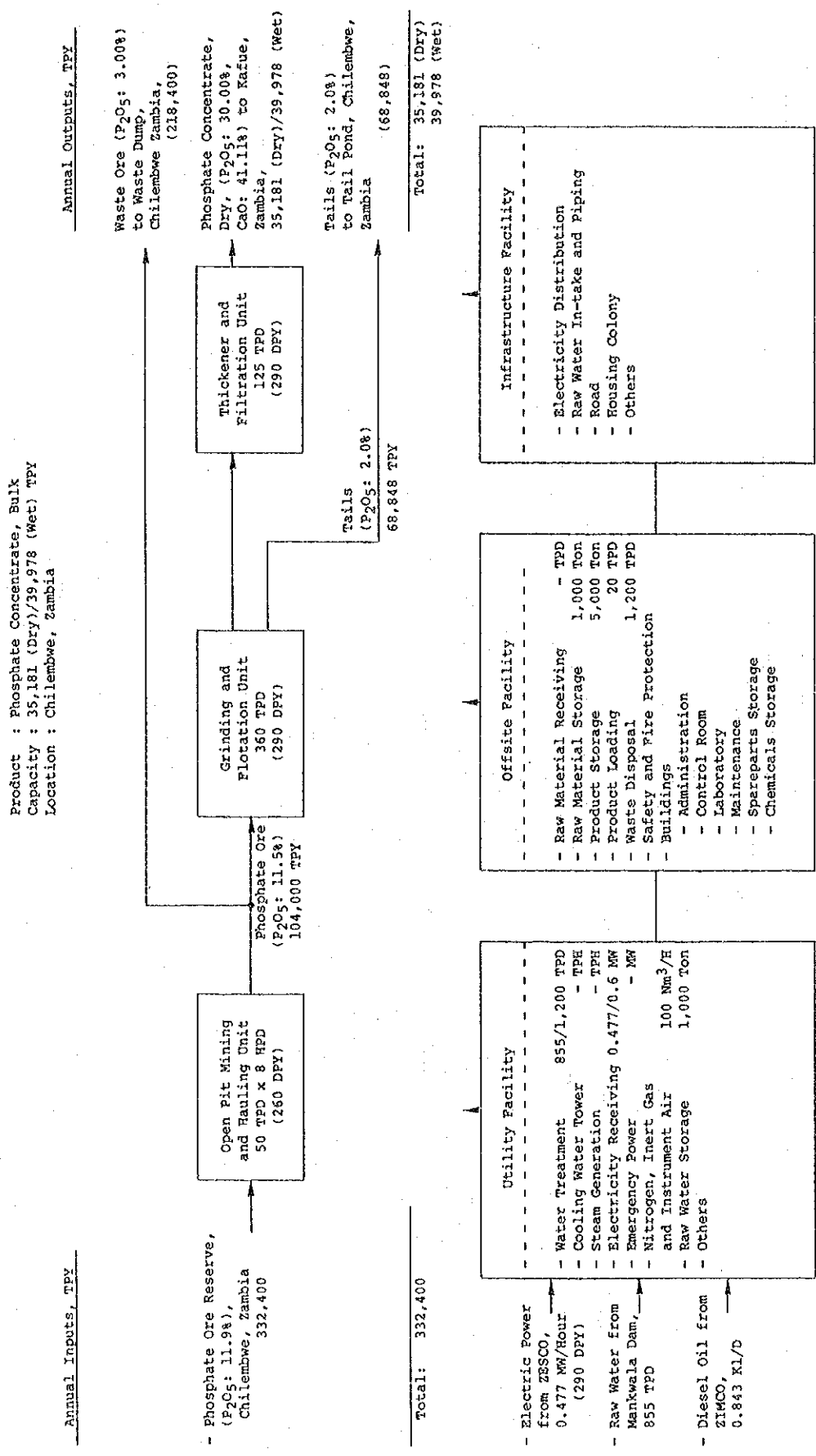
Existing Activity

Premise Project

Notes:

- Commercial Production; July 01, 1991
- Exchange Rate ; 2K8.00/US\$
- Interest Rate ; 12%/year
- Escalation during 1991/1987
 - Foreign ; 14.23%
 - Zambian ; 14.23%

Figure 2-3-2 PROCESS CONFIGURATION FOR THE PHOSPHATE MINING AND CONCENTRATE PROJECT



Notes: 1) Material flow under normal operating conditions at design capacity for 290 Dpy of annual operable days is illustrated.
 2) Normal flow and facility design capacity with allowance for utility and offsite are shown in normal flow/design capacity, respectively.

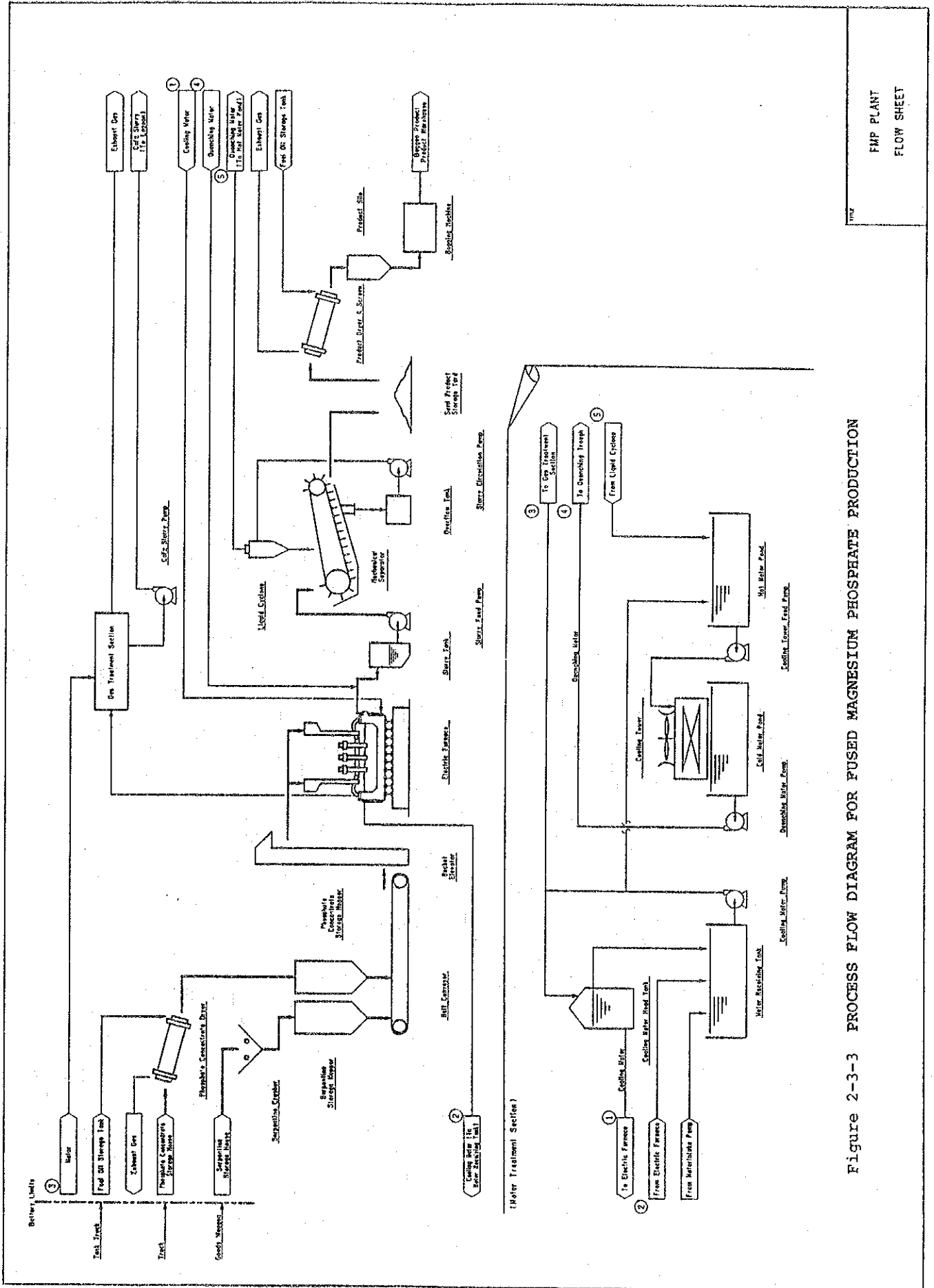
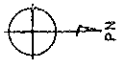


Figure 2-3-3 PROCESS FLOW DIAGRAM FOR FUSED MAGNESIUM PHOSPHATE PRODUCTION



NOTE

- ① Phosphate Concentrate Storage Yard
- ② Scrapline Storage Yard
- ③ Phosphate Concentrate Dryer
- ④ Phosphate Concentrate Storage Hopper
- ⑤ Scrapline Storage Hopper
- ⑥ Electric Furnace
- ⑦ Mechanical Separator
- ⑧ Seal Product Storage Yard
- ⑨ Product Dryer
- ⑩ Product Silo
- ⑪ Product Bagging and Warehouse
- ⑫ Water Treatment
- ⑬ Gas Treatment & Waste Water Treatment
- ⑭ Office Building
- ⑮ Spare Parts Storage House
- ⑯ Maintenance House
- ⑰ Electrical Room
- ⑱ Control Room
- ⑳ Laboratory

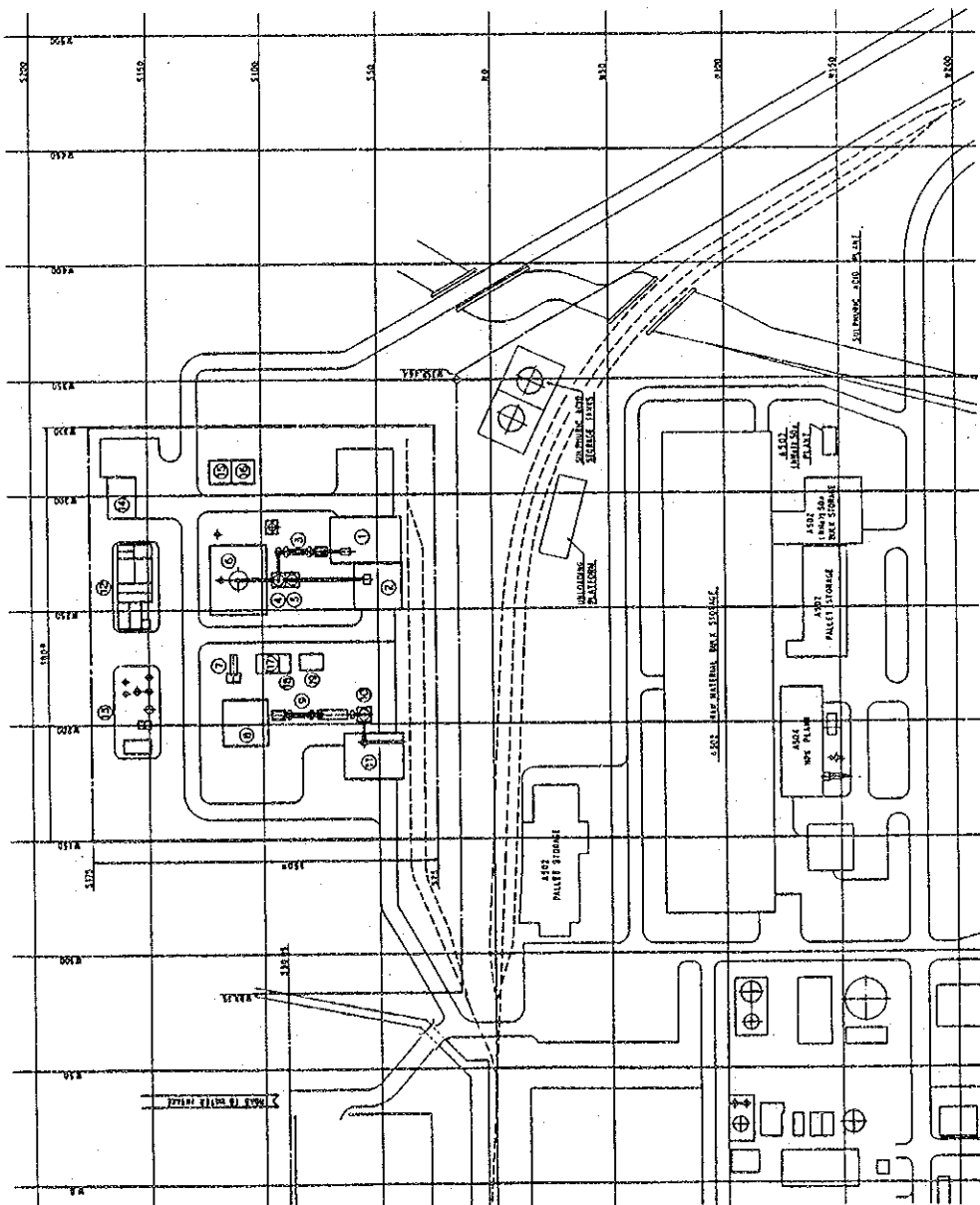
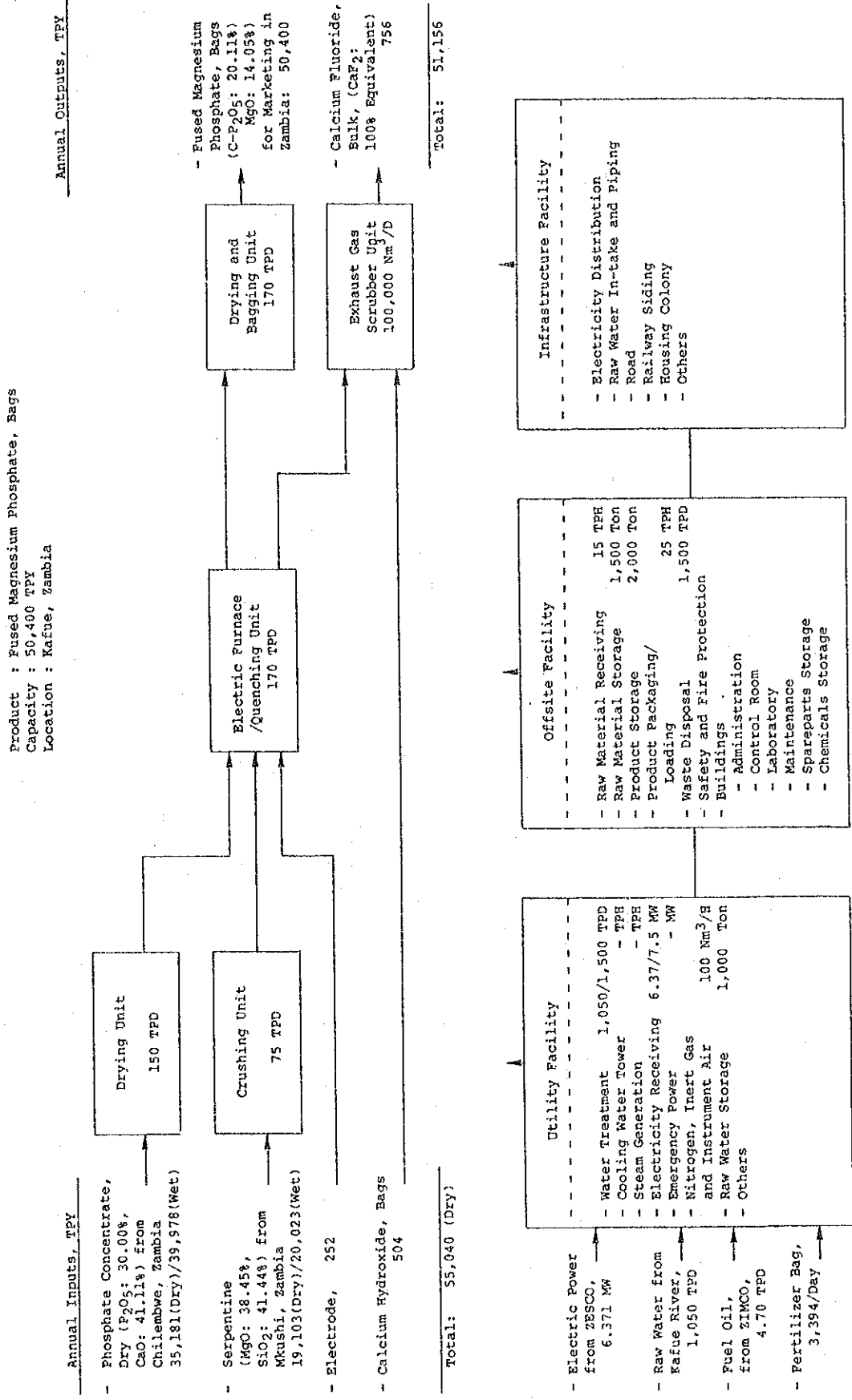


Figure 2-3-4 GENERAL PLOT PLAN OF FUSED MAGNESIUM PHOSPHATE PROJECT

ZAMBIA
FMP PLANT
GENERAL LAYOUT

Figure 2-3-5 PROCESS CONFIGURATION FOR THE FUSED MAGNESIUM PHOSPHATE PROJECT



Notes: 1) Material flow under normal operating conditions at design capacity for 300 DPY of annual operable days is illustrated.
2) Normal flow and facility design capacity with allowance for utility and offsite are shown in normal flow/design capacity, respectively.

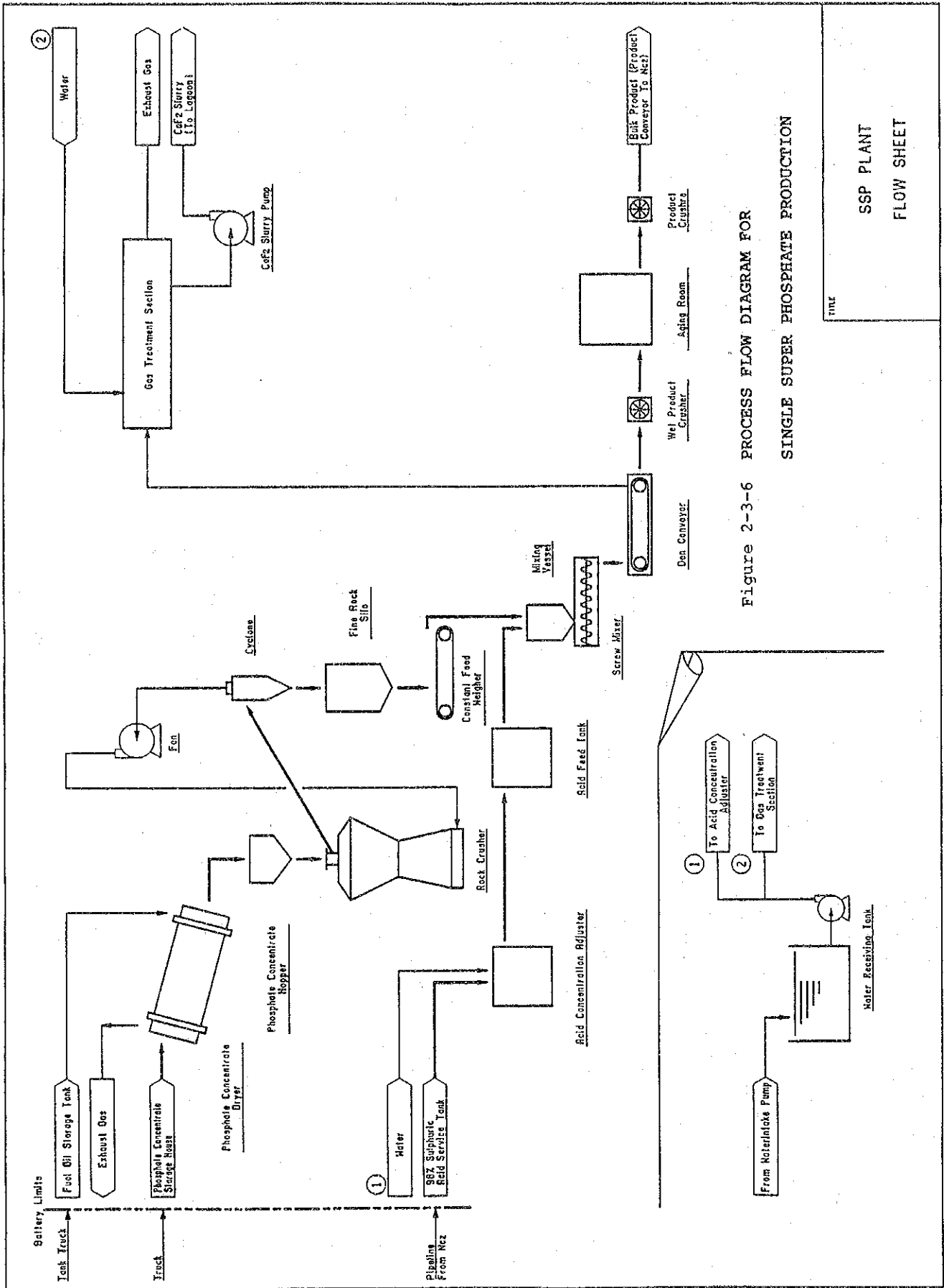
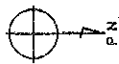


Figure 2-3-6 PROCESS FLOW DIAGRAM FOR SINGLE SUPER PHOSPHATE PRODUCTION

TITLE
SSP PLANT
FLOW SHEET



NOTE

- ① Phosphate Concentrate Storage Yard
- ② Phosphate Concentrate Dryer
- ③ Phosphate Concentrate Grinding & Acidulation
- ④ Sulphuric Acid Storage
- ⑤ Product Aging and Storage House
- ⑥ Gas Treatment
- ⑦ Waste Water Treatment
- ⑧ Office Building
- ⑨ Control Room
- ⑩ Electrical Room
- ⑪ Laboratory
- ⑫ Spare Parts Storage House
- ⑬ Maintenance House

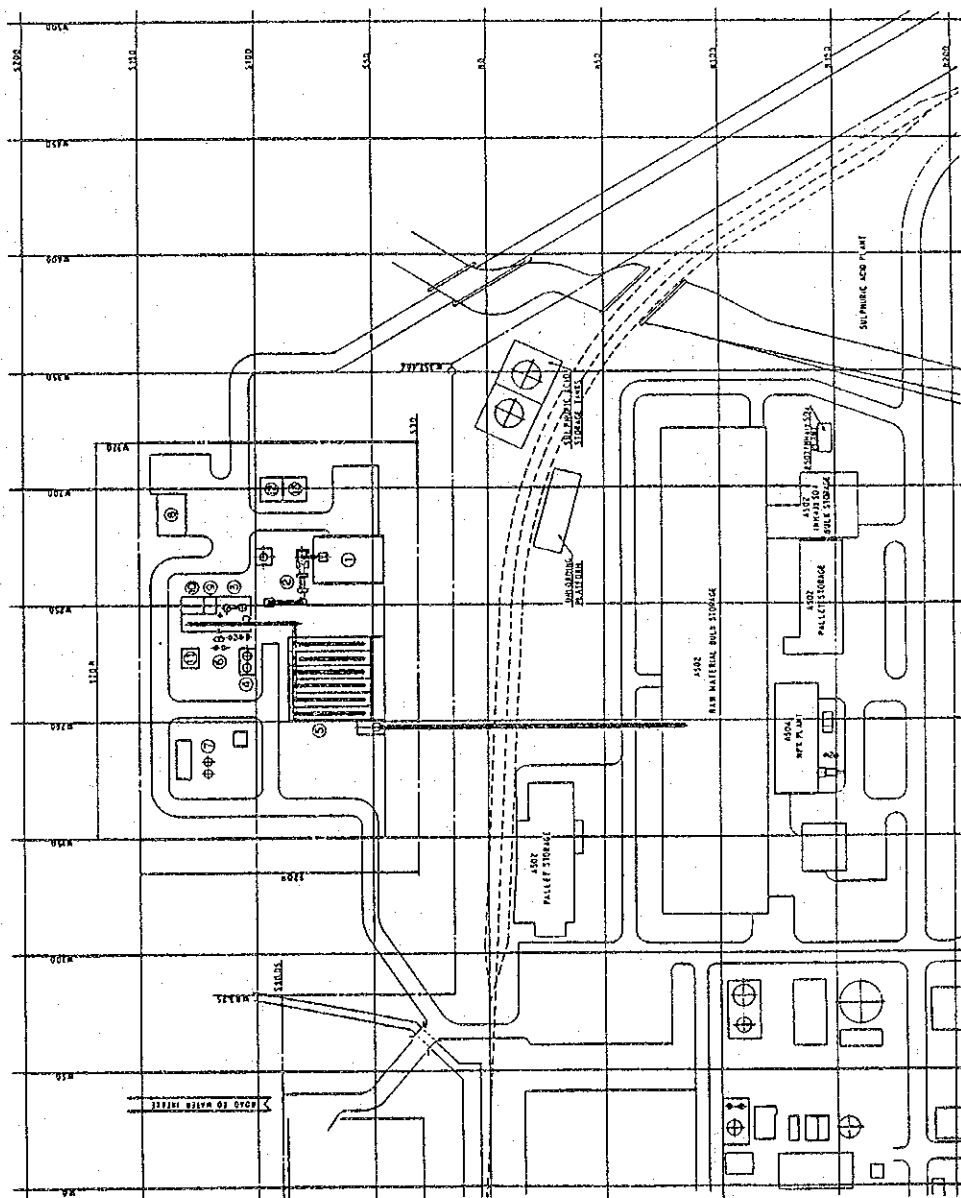
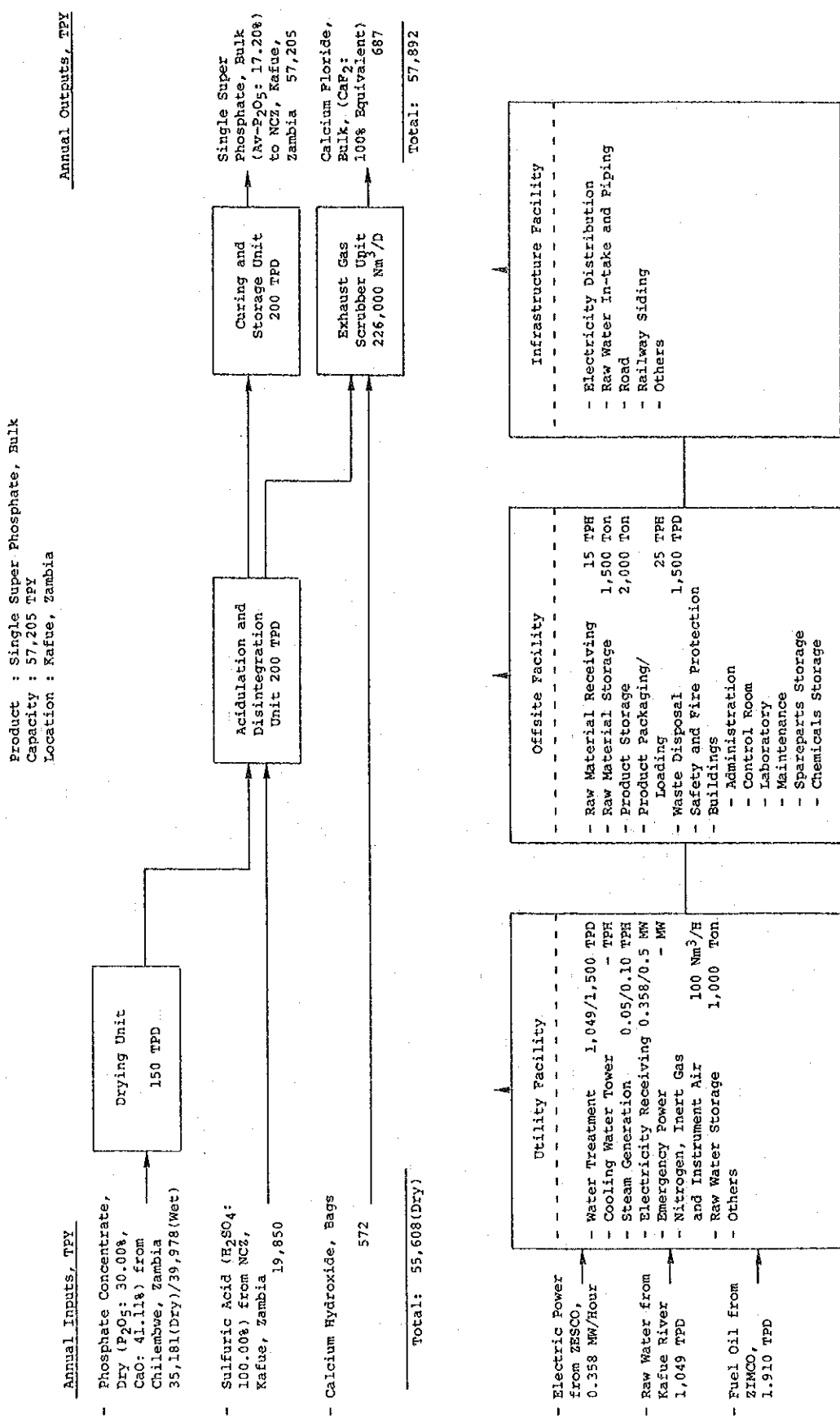


Figure 2-3-7 GENERAL PLOT PLAN OF SINGLE SUPER PHOSPHATE PROJECT

ZAMBIA
SSP PLANT

GENERAL LAYOUT

Figure 2-3-8 PROCESS CONFIGURATION FOR THE SINGLE SUPER PHOSPHATE PROJECT



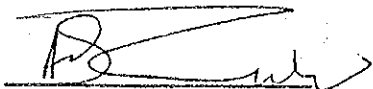
Notes: 1) Material flow under normal operating conditions at design capacity for 300 DPY of annual operable days is illustrated.
 2) Normal flow and facility design capacity with allowance for utility and offsite are shown in normal flow/design capacity, respectively.

ANNEX 1

SCOPE OF WORK FOR THE FEASIBILITY STUDY

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
THE ESTABLISHMENT OF A FUSED MAGNESIUM PHOSPHATE FERTILIZER PLANT
IN
THE REPUBLIC OF ZAMBIA
AGREED UPON BETWEEN
INDECO LTD
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

Lusaka, August 19th 1986



Mr. Dixie ZULU INDECO LIMITED
Managing Director P.O. BOX 31933
 LUSAKA

INDECO LTD.

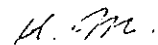


Mr. Keiji MIURA

Leader of the Preliminary
Survey Team

The Japan International
Cooperation Agency





I. Introduction

In response to the request of the Government of the Republic of Zambia, (hereinafter referred to as "Zambia") the Government of Japan has decided to conduct a feasibility study on the establishment of a fused magnesium phosphate fertilizer plant in the Republic of Zambia (hereinafter referred to as "the Study") in accordance with the laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study, in close cooperation with authorities concerned of the Government of Zambia.

The present document sets force the scope of work with regard to the Study.

II. The Objective of the Study

The objective of the Study is to investigate the technical and economic feasibility of the establishment of a fused magnesium phosphate fertilizer plant in Zambia with utilization of phosphate rock in Chilembwe and dolomite in Lusaka.

III. Scope of the Study

In order to achieve the above objectives, the Study will cover the following items:

1. Literature survey on the background of the Project

1-1 To review worldwide supply & demand and price movement of fertilizers

1-2 To review present situation of and policy on agriculture in Zambia

1-3 To review present situation of and policy on fertilizer in Zambia

(1) Fertilizer industry

(2) Supply and demand of fertilizers

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(3) Trend of consumption of fertilizers

1-4 To review the Pre-feasibility Study Report for the Phosphate Development Project provided by JICA in 1985

2. Study on the fertilizer market and its distribution system in Zambia

2-1 To review present and past supply and consumption of fertilizers

2-2 To investigate present and past prices of fertilizers

2-3 To review the cost and channel of transportation of fertilizers

2-4 To predict potential supply and demand of fertilizers in Zambia for coming ten years

2-5 To analyze present marketing and distribution system and to propose an appropriate marketing and distribution system for the Project

3. Study on the availability of utilities and raw materials for the Project

3-1 Electric power

3-2 Industrial water

3-3 Phosphate rock

3-4 Dolomite

3-5 Others

4. Study on the project site

4-1 To investigate the natural conditions of the site and its surrounding area

(1) Meteorology

(2) Geology and topography

4-2 To investigate the socio-economic conditions

(1) Regional population, labour force and wages, etc.

(2) Existing regional industries

(3) Regional development plan

4-3 To investigate utilities and infrastructure

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(1) Electric power

(2) Industrial Water

(3) Transportation (road and railway) and communication

4-4 To select the plant site based on the raw materials, utilities, infrastructure, and on the distribution of products

5. Preparation of the basic plan and the conceptional design of a fertilizer plant

5-1 To determine the optimum production scale

5-1 To determine condition for the design of the proposed fertilizer plant

5-2 To prepare conceptional design

5-3 To propose transportation plan of equipment and materials for plant construction

5-4 To prepare implementation program of plant construction

5-5 To propose organization and manpower plan for plant construction

5-6 To prepare operation program on the commercial basis

5-7 To propose operation and management organization

6. Estimation of construction cost of the proposed fertilizer plant

6-1 To estimate construction cost of the process plants

6-2 To estimate construction cost of the utility and off-site facilities

7. Financial analysis

7-1 Capital requirements

(1) Fixed capital

(2) Working capital

(3) Investment schedule

7-2 Procurement of capital

7-3 Production cost

7-4 Projected balance sheet

7-5 Projected income statement

7-6 To estimate financial internal rate of return

7-7 To estimate degree of sensitivity to the following variables:

- (1) Investment cost
- (2) Price of raw materials
- (3) Selling price
- (4) Interest rate

8. Economic and social evaluation

9. Conclusion and recommendations



IV. Steps and Schedule of the Study

1. Steps

Step 1: Preparatory work in Japan

Step 2: Field work in Zambia

Step 3: Home office work in Japan

Step 4: Presentation of and discussion on the Draft Final Report

2. Schedule

Schedule of the Study is shown in Annex .

V. Reports

JICA shall prepare and submit the following reports written in English to the Government of Zambia within the time periods indicated below:

1. Progress Report at the end of the Step 2: 10 copies
2. Draft Final Report and its summary within 6.5 (six and a half) months after the commencement of the Step 2: 15 copies
3. Final Report and its summary within 2.5 (two and a half) months after the receipt of comments on the Draft Final Report from the Government of Zambia: 30 copies

VI. Undertaking of the Government of Zambia

1. To facilitate the smooth implementation of the Study, the Government of Zambia shall take necessary measures:
 - 1-1 To secure the safety of the Japanese study team (hereinafter referred to as "the Team")
 - 1-2 To permit the members of the Team to enter, leave and sojourn in Zambia for the duration of their assignment therein, and exempt them from alien registration requirements
 - 1-3 To exempt the members of the Team from taxes, duties and other charges on equipment, machinery and other materials brought into Zambia for the implementation of the Study
 - 1-4 To exempt the members of the Team from income taxes and other charges of any kinds imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study
 - 1-5 To provide the necessary facilities to the Team for the remittance as well as utilizations of fund introduced in Zambia from Japan in connection with the implementation of the Study
 - 1-6 To provide medical services as needed and its expenses will be chargeable on the members of the Team
 - 1-7 To secure permission for entry into private properties or restricted areas for the conduct of the Study
 - 1-8 To secure permission to take all data and documents related to the Study (including photographs) out of Zambia to Japan by the Team
2. The Government of Zambia shall bear claims, if any arises against the members of the Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the Japanese members of the Team.
3. INDECO LTD. shall act as counterpart agency to the Team and also as coordinating body in

relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. INDECO LTD. shall, at its own expense, provide the Team with the following, in cooperation with other relevant organization:

4-1 Available data and information related to the Study

4-2 Counterpart personnel

4-3 Suitable office space with necessary equipment

4-4 Identification cards

VII. Undertaking of JICA

For the implementation of the Study, JICA shall take the following measures:

1. To dispatch, at its own expense, the Team to Zambia
2. To pursue technology transfer to Zambian counterpart personnel in the course of the Study

VIII. Consultation

JICA and INDECO LTD. shall consult with each other in respect of any matter that may arise in the interpretation of implementation of the present arrangement.

Tentative Schedule of the Study

<Annex>

Year & Month Item	1986						1987					
	September	October	November	December	January	February	March	April	May	June	July	August
Preparatory Office Work (Step 1)												
Field Work (Step 2)												
Home Office Work (Step 3)												
Presentation of Draft Final Report (Step 4)												
Submission of Final Report												

In Japan

In the Republic of Zambia

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JICA