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

(Unit: ton)

	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	290	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														
N	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
P2O5	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
K2O	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

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	Consumption
	(A)	End Products (B)	Raw Materials	(A+B)	(C)
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 NAMBOARD

(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	139.1	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-NAMBOARD 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 P2O5 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 PMP IN ZAMBIA

(Unit: '000 P2O5 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 SALES 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, TPY (TPD)								Raw Materials and Utilities Plant					Completion Date	Contractors
	NH_3	NA	SA	AN	AS	CF	MeOH	CO_2	Coal TPY	Pyrite TPY	Water TPD	Electricity MW	Steam TPH		
1. Plant I	30,000	50,000	-	60,000	-	-	-	-	65,000	-	6,000	13.0	27.0	May 27,1970	Kobe Steel Ltd., Japan
- Original	(95.3)	(172.4)	-	(205.5)	-	-	-	-	-		-	-	-		
			(ANBA: 20,000 Fert: 40,000)						(Stand-by)						
2. CO_2 Plant	-	-	-	-	-	-	-	1,000	-	-	-	-	-	August,1979	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	October 20,1982	Klockner Industrie -Analagen GmbH, (Krupp-Koppers, Spie-Batignolles, Zublin, Indumont and CdF *Chimie*), Federal Republic of Germany
- Expansion	(220)	(212)	-	(242)	(151)	(432)	(5)	-	-	-	-	-	-		
					CF "A"	1,220									
					"C"	11,200									
					"D"	48,000									
					"R"	22,600									
					"V"	4,900									
					"X"	54,400									
4. SA Plant	-	-	60,000	-	-	-	-	-	-	40,000	3,600	3.0	-	September 28, 1983	Kobe Steel Ltd., Japan
	-	-	(182)	-	-	-	-	-	-	-	-	-	-		
5. Rehabilitation of Plant I	-	-	-	-	-	-	-	-	-	-	-	-	-	July 8, 1986	Kobe Steel Ltd., Japan
	-	-	-	-	-	-	-	-	-	-	-	-	-		
6. Renovation of Plant II	-	-	-	-	-	-	-	-	-	-	-	-	-	(December 31, 1988)	Klockner Industrie -Analagen 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_2O_5	S-K_2O	T-S	S-B	Moisture		NH_3	AN	SA	AS	DAP	TSP	SSP	MOP	SOP	Borax	Coating	Total	
"A"	G*	2.0	18.0	15.0	9.0	0.1	3	Wt	8	29	-	21	-	213	455	-	296	9	10	1,041	Tabacco
	C*	2.1	18.0	15.2	12.0	0.1	-	NPK	6.6	10.0	-	4.4	-	99.0	80.5	-	152.4	-	-	352.9	
								SB	-	-	-	5.1	-	4.3	59.2	-	51.8	1	-	121.4	
"C"	G*	6.0	18.0	12.0	9.0	0.1	3	Wt	6	87	-	126	-	275	288	50	178	9	10	1,029	Tabacco
	C*	6.3	18.0	12.2	10.5	0.1	-	NPK	4.9	30.0	-	28.5	-	127.9	51.0	30.5	91.7	-	-	364.5	(Virginia,
								SB	-	-	-	30.9	-	5.5	37.4	-	31.2	1	-	106.0	Burley), Cotton (B Deficient Soil)
"D"	G*	10.0	20.0	10.0	11.0	0.0	1	Wt	-	145	32	237	15	408	-	-	197	-	10	1,044	Maize, Cotton
	C*	10.3	19.7	10.2	11.2	0.0	-	NPK	-	50.0	-	49.8	2.7/7.0	189.7	-	-	101.5	-	-	400.7	Potatoes,
								SB	-	-	10.4	58.1	0.5	8.2	-	-	34.5	-	-	111.7	Vegetables, Tabaco Seed Bed
"R"	G*	20.0	20.0	0.0	11.0	0.0	1	Wt	-	116	-	463	423	-	-	-	-	-	10	1,012	Maize
	C*	21.4	19.7	0.0	12.6	0.0	-	NPK	-	40.0	-	97.2	77.4/197.0	-	-	-	-	-	-	411.6	(Kafue Basin,
								SB	-	-	-	113.4	12.7	-	-	-	-	-	-	126.1	K_2O Sufficient Soil), Cotton, Irrigated Lucerne
"V"	G*	4.0	18.0	15.0	9.0	0.1	3	Wt	6	58	-	76	-	259	331	63	222	9	10	1,034	Tabacco
	C*	4.1	17.9	15.3	10.6	0.1	-	NPK	4.9	20.0	-	16.0	-	120.4	58.6	38.4	114.3	-	-	372.6	(Virginia,
								SB	-	-	-	18.6	-	5.2	43.0	-	38.9	1	-	106.7	Turkish), Fruit (Orchards)
"X"	G*	20.0	10.0	5.0	11.0	0.0	1	Wt	-	261	-	427	153	59	-	-	99	-	10	1,009	Maize, Cotton
	C*	20.8	9.9	5.1	12.8	0.0	-	NPK	-	90.0	-	89.7	28.0/71.1	27.4	-	-	51.0	-	-	357.2	
								SB	-	-	-	104.6	4.6	1.2	-	-	17.3	-	-	127.7	

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

2) Assumed analysis of raw materials (N - P_2O_5 - K_2O - S - B) in percentage.

NH_3 = (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 - 0 - 0 - 11.3)

3) Compound fertilizer plant capacity is 142,320 TPY (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.

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

5) The standard method of NPK analysis at NCZ is CdF Chimie Central Lab Methods (T-N, A-N, N-N, T-P_2O_5, S-P_2O_5, C-P_2O_5, W-P_2O_5, S-K_2O, Free Moisture) and AOAC Method-12th Edition, 1975 (T-N, A-N, N-N, T-P_2O_5, W-P_2O_5, Av-P_2O_5 (pH = 7, Sp Gr = 1.05), S-K_2O, T-S (SO_3), Free Acidity, Free Moisture). The rapid methods at NCZ are for A-N, N-N, T-P_2O and K_2O.

6) The particle size is 95% (2/4 mmD) and 5% (1/2 mmD) 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	Major Coverage	
	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 : Detaintion
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_2O_5 as P (Sample 100g/400ml H_2O, shaking for 0.5 hour) - T-K_2O 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_2O_5 as P: 1/20P, % (0.2/0.9%) - T-K_2O as K : 1/20K, % (0.6/1.7%) - Cl : 1/20 Cl, % - B : 1/5 B, % - S : No variation is allowed below minimum
3. Customes 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	Major Coverage	
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)	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/PSB/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:

Fertilizer	Analysis, (%) N	W-P_2O_5	K_2O	S	B	Mo	Zn	Other
								Biuret:
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	-	-	-	-
"V"	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
** $K_2O(SO_3)/K_2O$ = 0.75, K_2O (Cl)/K_2O = 0.25
*** $K_2O(SO_3)/K_2O$ = 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, (%) N	P_2O_5	K_2O	Moisture	Size %, mm
DAP	16-18	46-48	-	1.0	95(1.4-3.3)
MOP	-	-	61	1.0	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 PERTILIZER 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_2O_5, K_2O, S, B, Moisture, Size (mm) AN: 34.5, -, -, -, -, 0.3, 1-3 AS: 20.5, -, -, -, -, 0.2, 0.75(+) 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
8. Standard Analytical Method ... Nitrogen Chemicals of Zambia Ltd., (NCZ), Kafue Zambia	The fertilizer analytical method are adopted from (1) CdF Chemie's Method, France (NFU) and (2) Official Methods of Analysis of the Association of Official Analytical Chemists, 12th Edition, 1970, Association of Official Analytical Chemists, Washington DC, The USA	Analytical Method: - N : T-N, A-N, N-N - P_2O_5: T-P_2O_5, W-P_2O_5, Av-P_2O_5 (pH 7, Sp Gr 1.05, Agitation at 65°C for 1.0 hour) S-P_2O_5 (Joulje Citrate), C-P_2O_5 (NF U 42 212) - K_2O : W-K_2O (Water soluble at boiling temperature for 0.25 hour) - S : Acid soluble sulfate - Free Acidity : Acetone soluble as P_2O_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_2O_5: (H_2SO_4 soluble and $AgNO_3$ titration) - K_2O : T-K_2O
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_2O_5 in Chilembwe Phosphate Concentrate	Analytical Results : - Av-P_2O_5: 1.3% - F-P_2O_5 : 3.5% Not useful for direct application

Table 2-2-4 ZAMBIAN RAW MATERIAL ANALYSIS SUMMARY

Items	Phosphate Ore, Chilembwa, Zambia	Phosphate Concentrate, Chilembwa, 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_2O_5	18.60	33.69	-	-	-
- SO_3	-	0.23	-	-	-
- CO_2	-	0.04	-	-	-
- P	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_2O_3	1.66	0.57	5.36	0.45	0.21
- Al_2O_3	2.36	2.23	1.76	-	0.13
- SiO_2	38.63	12.49	41.44	0.26	98.38
- Na_2O	-	0.21	-	1.16	-
- K_2O	-	0.14	-	0.12	-
- Cd, ppm	-	1.0 (-)	-	-	-
- As	-	3.1	-	-	-
- F/Cl Adjustment, %	-	(-) 0.803	-	-	-
- NiO	-	-	0.19	-	-
- Cr_2O_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 P_2O_5 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_2O_5	33.69	34.18	-	-	20.28	20.30
P	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_2O_3	0.89	0.79	5.36	8.19	-	-
Al_2O_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_2O_5	33.69	34.18	-	-	20.28	20.30
C-P_2O_5 (pH: 2, Sp Gr: 1.09)	6.05	13.16	-	-	20.11	20.20
F-P_2O_5 (pH: 1.75, Sp Gr: 1.01)	7.14	15.03	-	-	20.03	19.83
C-P_2O_5 (pH: 4, Sp Gr: 1.02)	2.00	7.61	-	-	20.09	20.15
Av-P_2O_5 (pH: 7, Sp Gr: 1.09)	2.25	7.05	-	-	14.38	17.02
S-P_2O_5 (pH: 9.6, Sp Gr: 1.08)	0.86	3.56	-	-	14.25	13.92
W-P_2O_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 Akaline	-	-	-	-	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:

1) 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.

2) 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).

3) 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_2O_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_2O_3	0.89	1.79	-	-	0.47	1.19
Al_2O_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_2SO_4	100	100	65.34	61.90	-	-
- Experimental, H_2SO_4	100	100	60.06	55.72	-	-
Consumption, TPT	0.580	0.600	0.367 (72% H_2SO_4)	0.356 (70% H_2SO_4)	(-)1.000	(-)1.000
2. Fertilizer Nutrients, %						
T-P_2O_5	33.69	30.39	-	-	19.12	19.16
C-P_2O_5 (pH: 2, Sp Gr: 1.09)	6.05	7.81	-	-	18.05	18.20
F-P_2O_5 (pH: 1.75, Sp Gr: 1.01)	7.14	7.62	-	-	17.88	17.96
C-P_2O_5 (pH: 4, Sp Gr: 1.02)	2.00	2.60	-	-	.	.
Av-P_2O_5 (pH: 7, Sp Gr: 1.09)	2.25	2.79	-	-	17.79	17.83
S-P_2O_5 (pH: 9.6, Sp Gr: 1.08)	0.86	1.07	-	-	17.50	17.26
W-P_2O_5 (pH: 7, Sp Gr: 1.00)	0.08	0.07	-	-	16.38	15.72
Free Acid as P_2O_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	1.26	-	-	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:

1) 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.

2) 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.

3) Stoichiometric sulfuric acid consumption (H_2SO_4 gr/100 g Phos Rock) = 1.75 CaO% + 1.84 Fe_2O_3% + 2.88 Al_2O_3% - 0.69 P_2O_5% - 1.23 SO_3%.

4) 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	
	Kafue	Kabwe	Ndola	Kitwe	Chilembwe	Muloba, 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 Date						
- 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	(-)2.2	(-)2.2	2.8	(-)2.2
- 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	
	Kafue	Kabwe	Ndola	Kitwe	Chilembwe	Muloba, Mkushi
	Industrial Estate (Plot No.6)	Chimanimani Village	General Area	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 Raod	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	0.05 to ZR	0.1 to ZR	0.1 to ZR	None	21 to Lunsemfwa Station, TAZARA
- Air Transport, (km)	Lusaka, (44)	Lusaka, (140)	Ndola, (4)	Kitwe, (10)	Chipata, (220)	Ndola, (200)
- River and Ocean Transport	None	None	None	None	None	None
7. Utilities						
- Water Supply						
- Source, (km)	Kafue River, (3)	Mulungushi Dam,(10)	Kafue River, (40)	Kafue River, (10)	Mankwala Dam, (8)	None
- Availability	Available	Depend on Project	Available	Available	Limited	-
- Quality	High	High	High	High	High	-
- Pricing, Month*	Free of Charge	ZK60 + ZK0.44/m^3	NA	NA	Free of Charge	-
- Electric Power						
- Sub-Station, (km)	ZESCO, (0.6)	ZESCO, (5.0)	ZESCO (CPC), (5.0)	ZESCO (CPC), (5.0)	ZESCO, (40-Ketete)	ZESCO, (10)
- Voltage, kV	33, 11	33, 11	66, 33, 11	66, 33, 11	33, 11	11
- Frequency, Hz	50	50	50	50	50	50
- Pricing by ZESCO-Tariff**	D3	D3	D3	D3	D2	D1
- Fixed Charge, ZK/Month	13,250	13,250	13,250	13,250	1,325	70
- Demand Charge, ZK/kVA/Month	9.08	9.8	9.08	9.08	10.62	11.87
- Unit Charge, ZK/kWh	0.027	0.027	0.027	0.027	0.041	0.053
- Fuel Oil/Coal	Available	Available	Available	Available	Available	Available
8. Labour						
- Availability	Avaibale	Avablable	Available	Available	Available	Available
- Skill Level	High	Middle	High	High	Low	Middle
9. Physical Distribution						
- Raw Materials Transport, ZK/Ton, (km)						
- Phos Concentrate, Chilembwe, Road	541 (453)	635 (528)	818 (674)	856 (705)	-	-
- Serpentine, Mkushi, Road/Railways	299 (173)	131 (155)	191 (160)	257 (166)	-	-
- Product Distribution, km on Road/Railway						
- Ndola	356	187	0	66	-	-
- Kasama	864	696	756	822	-	-
- Lusaka	48	120	308	374	-	-
- Monze	108	277	464	530	-	-
- Mongu	627	624	807	845	-	-

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											
	Independent from NCZ		Integration with NCZ		Kabwe		Ndola		Kitwe		Chilembwe	Muloba, Mkushi
	FMP -EF	Others	FMP -EF	Others	FMP -EF	Others	FMP -EF	Others	FMP -EF	Others	Phoa Rock	Serpentine
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$, MM	0.058				0.184		0.184		0.184		0.000	0.000
- Tariff, ZK/Ton												
- Initial 45 Ton/Month	Free				1.33		NA		NA		Free	-
- Over 45 Ton/Month	Free				0.44		NA		NA		Free	-
3) Road Expansion/Construction												
											Mine / Dam	
- Distance, km	0.5				0.5		0.5		0.5		35 / 4.5	15
- Width, m	6				6		6		6		5 / 3	3
- Bridge	1				0		0		0		14 / 0	0
- Investment, ZK, MM	1.08				0.46		0.46		0.46		0.91**	0.30
4) Railway Siding Construction												
- Direct Distance, km	0.05				0.1		0.1		0.1		-	-
- Track	2				2		2		2		-	-
- Total Length, km	1.50				1.50		1.50		1.50		0.00	0.00
- Investment, ZK, MM	1.13				1.13		1.13		1.13		0.00	0.00
5) Investment Total,												
ZK, MM	11.75	5.44	11.75	3.61	16.44	7.54	14.01	7.54	14.01	7.54	5.50	3.28
+US$, 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	0.812	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	Industrial			Commercial	Household			Zimbabwe	
	CPC/ZCCM	D3	D2	D1	E4	E3	E2	E1		
0. Assume Load, MW	-	8.0	1.0	0.1	0.01	0.01	0.004	0.001	-	
1. Financial Price										- Load Factor = 0.75 - Power Factor = 1.00
- Tariff of ZESCO (August, 1986)	0.0377	0.0461	0.0624	0.0760	0.0776	0.0721	0.0717	0.0735	0.0168	- 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	
Total	0.0434	0.0530	0.0718	0.0874	0.0892	0.0829	0.0825	0.0845	0.0168	
2. Economic Price										- Study Report by Electricite de France (EDF), 1984/5
- Short Run Marginal Cost	-	-	-	-	-	-	-	-	-	- Self Financing = 50% (Domestic)
- Long Run Marginal Cost	0.1166	0.2407	0.2608	0.2579	-	0.2254	0.3142	0.3756	0.0633	- ROI = 8% - DSCR = 1.5
- 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	- Exchange Rate = ZK6.00/US$ - Period = 1986/7~1993/4
Total	0.1166	0.2407	0.2608	0.2579	-	0.2254	0.3142	0.3756	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	
- After Tax	2.6	4.5	3.6	2.9	-	2.7	3.8	4.4	3.8	
4. Annual Sales, MM kWh/Year - 1984	4,274				1,840				3,168	
- (Ratio)	(46%)				(20%)				(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 Alternatives	Material Movement TPY	Potential Phosphate Fertilizer Plant Sites																					
		Kafue						Kabwe						Ndola						Kitwe					
		Modes					Annual Costs ZK, MM	Modes					Annual Costs ZK, MM	Modes					Annual Costs ZK, MM	Modes					Annual Costs ZK, MM
		RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T		RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T		RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T		RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T	
Fused Magnesium Phosphate																									
- Raw Materials, Bulk																									
- Phosphate Rock from Chilembwe																									
		541	-	-	2	541		635	-	-	2	635		818	-	-	2	818		856	-	-	2	856	
	39,978	433	-	-	20	453	18.110	508	-	-	20	528	21.108	654	-	-	20	674	26.945	685	-	-	20	705	28.184
- Serpentine from Mkushi																									
		21	232	46	4	299		21	64	46	4	131		21	124	46	4	191		21	190	46	4	257	
	20,023	17	56	60	40	173	3.464	17	38	60	40	155	3.104	17	43	60	40	160	3.204	17	49	60	40	166	3.324
Sub-Total	60,001						21.574						24.212						30.149						31.508
- Product, Bagged and Destination to:																									
- Monze		-	108	-	2	108		-	277	-	2	277		-	464	-	2	464		-	530	-	2	530	
	18,849	-	25	-	20	45	0.848	-	53	-	20	73	1.376	-	76	-	20	96	1.810	-	84	-	20	104	1.960
- Lusaka		-	48	-	2	48		-	120	-	2	120		-	308	-	2	308		-	374	-	2	374	
	5,846	-	20	-	20	40	0.234	-	28	-	20	48	0.281	-	57	-	20	77	0.450	-	66	-	20	86	0.503
- Ndola		-	356	-	2	356		-	187	-	2	187		-	-	-	-	0		-	66	-	2	66	
	2,117	-	64	-	20	84	0.178	-	39	-	20	59	0.125	-	-	-	-	0	0.000	-	20	-	20	40	0.085
- Kabwe		-	168	-	2	168		-	-	-	-	0		-	187	-	2	187		-	253	-	2	253	
	5,544	-	36	-	20	56	0.310	-	-	-	-	0	0.000	-	39	-	20	59	0.327	-	49	-	20	69	0.33
- Mkushi		-	232	46	2	278		-	64	46	2	110		-	124	46	2	170		-	190	46	2	236	
	3,931	-	45	60	20	125	0.491	-	20	60	20	100	0.398	-	28	60	20	108	0.425	-	39	60	20	119	0.468
- Solwezi		173	490	-	4	663		173	321	-	4	494		173	134	-	4	307		173	68	-	4	241	
	302	138	81	-	40	259	0.078	138	59	-	40	237	0.072	138	30	-	40	208	0.063	138	20	-	40	198	0.060
- Chipata		612	-	-	2	612		705	-	-	2	705		888	-	-	2	888		926	-	-	2	926	
	8,972	490	-	-	20	510	4.576	564	-	-	20	584	5.240	710	-	-	20	730	6.550	741	-	-	20	761	6.828
- Mongu		627	-	-	2	627		624	-	-	2	624		807	-	-	2	807		845	-	-	2	845	
	504	502	-	-	20	522	0.263	499	-	-	20	519	0.262	646	-	-	20	666	0.336	676	-	-	20	696	0.351
- Mansa		175	488	-	4	663		175	319	-	4	494		175	132	-	4	307		175	66	-	4	241	
	1,008	140	80	-	40	260	0.262	140	59	-	40	239	0.241	140	29	-	40	209	0.211	140	20	-	40	200	0.202
- Kasama		-	232	632	2	864		-	64	632	2	696		-	124	632	2	756		-	190	632	2	822	
	3,327	-	45	110	20	175	0.582	-	20	110	20	150	0.499	-	28	110	20	158	0.526	-	39	110	20	169	0.562
Sub-Total	50,400						7.822						8.489						10.698						11.402
- Total	110,401						29.396						32.701						40.847						42.910
(Ratio)					Minimum ...		(1.000)						(1.112)						(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	Material Movement TPY	Potential Phosphate Fertilizer Plant Sites																					
		Kafue						Kabwe						Ndola						Kitwe					
		Modes					Annual Costs	Modes					Annual Costs	Modes					Annual Costs	Modes					Annual Costs
		RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T	ZK, MM	RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T	ZK, MM	RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T	ZK, MM	RD km ZK/T	ZR km ZK/T	TZR km ZK/T	HDL Times ZK/T	TTL km ZK/T	ZK, MM
Single Super Phosphate																									
- Raw Materials, Bulk																									
- Phosphate Rock from Chilembwe		541	-	-	2	541		635	-	-	2	635		818	-	-	2	818		856	-	-	2	856	
	39,978	433	-	-	20	453	18.110	508	-	-	20	528	21.108	654	-	-	20	674	26.945	685	-	-	20	706	28.184
- Sulfuric Acid																									
- from NCZ Kafue		-	-	-	1	0		-	168	-	2	168		-	356	-	2	356		-	422	-	2	422	
	20,255	-	-	-	10	10	0.203	-	36	-	20	56	1.135	-	63	-	20	83	1.682	-	70	-	20	90	1.823
Sub-Total	60,233						18.313						22.243						28.627						30.007
- Product, Bulk and Destination to:																									
- Kafue		-	-	-	1	1		-	168	-	2	168		-	356	-	2	356		-	422	-	2	422	
	57,205	-	-	-	10	10	0.057	-	35	-	20	55	3.147	-	63	-	20	83	4.749	-	70	-	20	90	5.150
- Monze		-	108	-	2	108		-	277	-	2	277		-	464	-	2	464		-	530	-	2	530	
	-	-	25	-	20	45	-	-	53	-	20	73	-	-	76	-	20	96	-	-	84	-	20	104	-
- Lusaka		-	48	-	2	48		-	120	-	2	120		-	308	-	2	308		-	374	-	2	374	
	-	-	20	-	20	40	-	-	28	-	20	48	-	-	57	-	20	77	-	-	66	-	20	86	-
- Ndola		-	356	-	2	356		-	187	-	2	187		-	-	-	-	-		-	66	-	2	66	
	-	-	64	-	20	84	-	-	39	-	20	59	-	-	-	-	-	-	-	-	20	-	20	40	-
- Kabwe		-	168	-	2	168		-	-	-	-	-		-	187	-	2	187		-	253	-	2	253	
	-	-	36	-	20	56	-	-	-	-	-	-	-	-	39	-	20	59	-	-	49	-	20	69	-
- Mkushi		-	232	46	2	278		-	64	46	2	110		-	124	46	2	170		-	190	46	2	236	
	-	-	45	60	20	125	-	-	20	60	20	100	-	-	28	60	20	108	-	-	39	60	20	119	-
- Solwezi		173	490	-	4	663		173	321	-	4	494		173	134	-	4	307		173	68	-	4	241	
	-	138	81	-	40	259	-	138	59	-	40	237	-	138	30	-	40	208	-	138	20	-	40	198	-
- Chipata		612	-	-	2	612		705	-	-	2	705		888	-	-	2	888		926	-	-	2	926	
	-	490	-	-	20	510	-	564	-	-	20	584	-	710	-	-	20	730	-	741	-	-	20	761	-
- Mongu		627	-	-	2	627		624	-	-	2	624		807	-	-	2	807		845	-	-	2	845	
	-	502	-	-	20	522	-	499	-	-	20	519	-	646	-	-	20	666	-	676	-	-	20	696	-
- Mansa		175	488	-	4	663		175	319	-	4	494		175	132	-	4	307		175	66	-	4	241	
	-	140	80	-	40	260	-	140	59	-	40	239	-	140	29	-	40	209	-	140	20	-	40	200	-
- Kasama		-	232	632	2	864		-	64	632	2	696		-	124	632	2	756		-	190	632	2	822	
	-	-	45	110	20	175	-	-	20	110	20	150	-	-	28	110	20	158	-	-	39	110	20	169	-
Sub-Total	57,205						0.057						3.147						4.749						5.150
- Total	117,438						18.370						25.390						33.376						35.157
(Ratio)					Minimum ...		(1.000)						(1.382)						(1.817)				Maximum ...		(1.914)

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

1. Raw Material Supply for Fused Magnesium Phosphate Production

Phosphate Concentrate, Chilembwe, Zambia		
Item	Experimental	Design Base
Specification, %		
- P_2O_5	33.69	30.00
- CaO	46.18	41.11
- F	1.89	1.68
- Other	17.70	26.67
Solid Sub-Total	99.46	99.46
- Free Moisture	0.54	13.56(12%)
Total Weight	100.00	113.02
Production, TPY		
- Wet Material	-	39,978
- Dry Material	-	35,181
- P_2O_5	-	10,554
Transportation from Chilembwe Concentration Plant to FMP Plant, Kafue, Zambia		
- Road, km	-	541
- Railway, km	-	0
- Total, km	-	541
- Transportation Charges, ZK/Ton-1987		433
- Loading and Unloading		20
		453

Serpentine, Mkushi, Zambia		
Item	Experimental	Design Base
Specification, %		
- MgO	38.45	38.45
- SiO_2	41.44	41.44
- Others	7.36	7.36
- Ignition Loss	11.96	11.96
Solid Sub-Total	99.21	99.21
- Free Moisture	0.79	4.78(4.5%)
Total Weight	100.00	103.99
Production, TPY		
- Wet Material	-	20,023
- Dry Material	-	19,103
- MgO	-	7,345
Transportation from Mkushi Mine to FMP Plant, Kafue, Zambia		
- Road, km	-	21
- Railway, km	-	278
- Total, km	-	299
- Transportation Charges, ZK/Ton-1987		133
- Loading and Unloading		40
		173

2. Product Specification of Fused Magnesium Phosphate

Chemical Analysis, %	
- T-P_2O_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_2O_5	20.11 (99.0%)
- P-P_2O_5	20.03 (98.6%)
- Av-P_2O_5	14.38 (70.8%)
- S-P_2O_5	14.25 (70.2%)
- W-P_2O_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	Conceptual Design for FMP Plant Production		
	TPT	Unit TPT	Daily TPD	Annual TPY
Raw Material, Ton				
- Phosphate Concentrate, Dry (P_2O_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_2O_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% CaF_2, others are 2.1% of SiO_2 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

Item	Chilembwe Phosphate Concentrate, Zambia Experimental	Design Base
Specification, %		
- P_2O_5	33.69	30.00
- CaO	46.18	41.11
- F	1.89	1.68
- Other	17.70	26.67
Solid Sub-Total	99.46	99.46
- Free Moisture	0.54	13.56(12%)
Total Weight	100.00	113.02
Production, TPY		
- Wet Material	-	39,978
- Dry Material	-	35,181
- P_2O_5	-	10,553
Transportation from Chilembwe Concentration Plant to SSP Plant, Kafue, Zambia		
- Road, km	-	541
- Railway, km	-	0
- Total, km	-	541
- Transportation Charges, ZK/Ton-1987		433
- Loading and Unloading Charges		20
		453

Item	Sulfuric Acid NCZ, Kafue, Zambia Experimental	Design Base
Specification, %		
- H_2SO_4	98.0	98.0
Sub-Total	98.0	98.0
- Free Moisture	2.0	2.0
Total Weight	100.0	100.0
Supply from NCZ, Kafue, TPY		
- Wet Material (98%)		20,255
- Dry Material (100%)		19,850
- Sulfur		6,483
Transportation from NCZ, Kafue to SSP Plant, Kafue, Zambia		
- Pipeline, km		1
- Transportation Charge, ZK/Ton-1987		0
- Loading and Unloading		10
		10

2. Product Specification of Single Super Phosphate

Chemical Analysis, %	
- T-P_2O_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_2O_5	17.46 (97.5%)
- F-P_2O_5	17.40 (97.2%)
- Av-P_2O_5	17.20 (96.0%)
- S-P_2O_5	17.10 (95.5%)
- W-P_2O_5	15.15 (84.6%)
- Free Acid (P_2O_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	Conceptual Design for SSP Plant Production		
	TPT	Unit TPT	Daily TPD	Annual TPY
Raw Material, Ton				
- Phosphate Concentrate, Dry (P_2O_5 : 30.00%, CaO : 41.11%)	0.597	0.615*	117.27	35,181
- Sulfuric Acid (H_2SO_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_2O_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% CaF_2, others are 2.1% of SiO_2 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 Fund US$,MM	Foreign Currency Demand US$,MM	Bids Range Low ZK/US$	Bids Range High ZK/US$	Bids Number Successful	Bids Number Total	Note
End, 1980	-	0.80	-	-	-	-	-	-	Monthly Bulletion of
End, 1981	-	0.88	-	-	-	-	-	-	Statistics, United
End, 1982	-	0.93	-	-	-	-	-	-	Nations
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	9.207	-	-	-	-	-	-	
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
31	69	9.00/12.50	-	-	-	-	-	-	- Re-peg within Range
	(Av.	13.25)							
March 27, 1987	-	15.17 (9.00/12.50)	-	-	-	-	-	-	Ranged Official and Auction Private Rates
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	20.0	20.0
- 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	C		
- Farming		-	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

Itmes	Basic Data for Estimate January 01, 1987		Base Estimate January 01, 1987		Projection July 01, 1991	
	Unit Cost ZK/Ton	Annual Throughput TPY	Unit Cost $/Ton	Annual Cost $, MM/Year	Unit Cost $/Ton	Annual Cost $, MM/Year
0. Basis of Projection						
- Foreign Currency Exchange Rate, ZK/$	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	56.63	2.264	64.68	2.586
- Chilembwe/Kafue: 541 km	-	35,181-Dry	64.35		73.50	
2. Serpentine Mining Cost, Mkushi	136.1	20,023-Wet	17.01	0.340	19.41	0.389
- Project Capital Cost: $0.960 MM	-	19,103-Dry	17.83		20.34	
- Personel : ZK10,489 x 20/MY						
- Consumable : $0.088 MM/Year						
3. Transport Cost of Serpentine on Road and Railway	173.0	20,023-Wet	21.63	0.433	24.70	0.495
- Mkushi/Kafue: 297 km	-	19,103-Dry	22.67		25.89	
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,	ZK/kWh	kWh, MM/Year	$/kWh		$/kWh	
- ZESCO Tariff plus 15% Sales Tax	0.0657x1.15	3.318	0.00944	0.0313	0.0189	0.063
- Phosphate Mining and Concentrate Project, Chilembwe						
- 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 Trend[1], 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 Price[2], $/Ton-1982			
- FAO/UNIDO/World Bank: New Developing Site (Capacity)	40.4 - High Grade Ore 48.5 - Low Grade Ore (3,000,000 TPY)	236.7 (356,400 TPY)	340.2 (356,400 TPY)
3. Present Price for Export to Zambia[1]			
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_2O_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, %	Importing Raw Material and Product Prices: Phosphate Rock (0-33.4-0) January 01, 1987	Phosphate Rock (0-33.4-0) July 01, 1991	Triple Super Phosphate (0-46.4-0) January 01, 1987	Triple Super Phosphate (0-46.4-0) July 01, 1991	Diammonium Phosphate (18.2-46.4-0) January 01, 1987	Diammonium Phosphate (18.2-46.4-0) July 01, 1991
FOB, Bulk, North Africa	14.23	35.0	40.0	150.0	171.3	185.0	211.3
Packaging and Loading	14.23	20.0	22.8	20.0	22.8	20.0	22.8
Ocean Freight to Dar-es -Salaam, 5,000 Tonner	14.23	35.0	40.0	35.0	40.0	35.0	40.0
Unloading/Transshipment	14.23	20.0	22.8	20.0	22.8	20.0	22.8
Railway to Kafue	14.23	55.0	62.8	55.0	62.8	55.0	62.8
Interest/Insurance/Shrinkage	14.23	12.4	14.2	21.0	24.0	23.6	27.0
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	386.7
- Unit Nutrient (N + P_2O_5)		531.1	606.6	648.7	740.7	524.2	598.6
- Nutrient Price Ratio		1.000	1.000	1.221	1.221	0.987	0.987

5. Import Substitute Pricing for Zambian Product, $/Ton	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)
Price Standard Specification			
Annual Production, TPY	35,188-Dry	50,400-Bulk/Bags	57,205-Bulk/Bags
Ex-Factory Price, Kafue			
- P_2O_5 Equivalent[3]	159.3 / 182.0	129.9 / 148.4	111.6 / 127.4
- Sulfur Credit, (Gypsum-15% S, $40/Ton-1987)	- / -	- / -	29.6 / 33.8
- Magnesia Credit, (Dolomite-20% MgO, $30/Ton-1987)	- / -	21.2 / 24.2	- / -
- Alkaline and Others Credit (Lime -53%, $20/Ton-1987)	- / -	18.9 / 21.6	- / -
	159.3 / 182.0	170.0 / 194.2	141.2 / 161.2
- Unit Nutrient Price, $/Ton-$P_2O_5$	531.1 / 606.6	848.7 / 969.5	820.9 / 937.2
- Nutrient Price Ratio	1.000 / 1.000	1.598 / 1.598	1.546 / 1.546
Farmer's Gate Price, Zambia as Average			
- Transport Cost Adjustment[4]	- / -	(-)22.5 / (-)25.7	(-)32.9 / (-)37.6
- Inventory Time Cost Adjustment[5]	- / -	(-)12.1 / (-)13.8	(-)10.0 / (-)11.4
	- / -	135.4 / 154.7	98.3 / 112.2
- Unit Nutrient Price, $/Ton-$P_2O_5$	- / -	676.0 / 772.3	571.5 / 652.3
- Nutrient Price Ratio	- / -	1.182 / 1.107	1.000 / 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-P_2O_5 in SSP = Av-P_2O_5 in TSP and C-P_2O_5 in FMP = Av-P_2O_5 in TSP
4) Domestic average transport cost of ZK155.2-1987 ($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 [I]		Fused Magnesium Phosphate Project, Kafue, Zambia [II]		Single Super Phosphate Project, Kafue, Zambia [III]		Phosphate Mining and Concentrate Project and Fused Magnesium Phosphate Project, Chilembwe/Kafue, Zambia [I] + [II]		Phosphate Mining and Concentrate Project and Single Super Phosphate Project, Chilembwe/Kafue, Zambia [I] + [III]	
1. Long Term Loan Interest Rate. %/Year	Low Case 4.0	Base Case 12.0	Low Case 4.0	Base Case 12.0	Low Case 4.0	Base Case 12.0	Low Case 4.0	Base Case 12.0	Low Case 4.0	Base Case 12.0
2. Project Cost, $, MM - 1991	13.71	14.56	20.31	21.52	18.73	19.79	34.02	36.08	32.44	34.36
3. Transfer Price of Phosphate Concentrate, $/Ton, Bulk, Dry, Kafue	130	130	130	130	130	130	120.3	120.3	131.3	131.3
4. Product Price, $/Ton, Kafue, (Nutrient Price, $/Ton-$P_2O_5$)-Packaging	[130] (433) - Bulk	[130] (433) - Bulk	180 (899) - Bags	180 (899) - Bags	150 (872) - Bulk	150 (872) - Bulk	180 (899) - Bags	180 (899) - Bags	150 (872) - Bulk	150 (872) - Bulk
5. ROI, DCF, Constant Price, After Tax, %	(-)4.29	(-)4.27	(-)10.11	(-)10.06	(-)3.53	(-)3.52	(-)8.04	(-)8.00	(-)3.85	(-)3.84
6. Debt Service Ratio										
- 1991	0.85	0.16	0.32	0.06	0.93	0.18	0.50	0.10	0.90	0.17
- 3	0.94	(-)0.05	0.21	0.19	1.00	0.09	0.48	(-)0.12	1.00	0.06
- 5	1.26	(-)0.46	0.13	(-)0.73	1.26	(-)0.26	0.68	(-)0.59	1.29	(-)0.29
- 7	0.58	(-)1.21	(-)0.16	(-)1.63	0.58	(-)0.89	0.20	(-)1.42	0.59	(-)0.94
- 9	0.44	(-)2.44	(-)0.68	(-)3.13	0.61	(-)1.91	(-)0.15	(-)2.78	0.62	(-)1.99
Project Life Average	0.35	(-)2.76	(-)1.27	(-)3.50	0.64	(-)2.18	(-)0.51	(-)3.12	0.63	(-)2.27
7. Short Term Loan, $, MM (Interest Rate; 20%/Year)										
- 1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- 3	0.01	2.42	0.00	3.33	0.00	1.65	0.00	5.16	0.00	3.41
- 5	0.00	6.59	0.78	10.47	0.00	6.57	0.16	16.28	0.00	12.16
- 7	0.00	12.08	2.32	20.05	0.00	12.97	1.50	31.08	0.00	23.54
- 9	0.76	19.58	5.73	33.26	0.00	21.63	5.46	51.39	0.00	38.99
- 2005, Project Life	5.14	65.07	26.64	114.37	2.49	73.56	29.02	175.45	4.97	131.80

Notes: 1) Equity/Long Term Loan = 25/75

2) Project Life/Depreciation = 15 years/15 years (1991 to 2005)

3) Loans :

	Interest Rate	Grace Period	Repayment
- Long Term - Base Case	12.0%	2.5 years	15 years
- Low Case	4.0	7.5	20
- Short Term	20.0	0.0	1

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

Financing Required	$, MM
Land/Site Preparation	0.189
Erected Plant Cost	12.100
Pre-Operational Expense	0.292
Interest during Construction	1.244
Fixed Capital Cost	13.825
Initial Working Capital	0.739
Financing Required	14.564

Financing Plan		$, MM
Equity	: 25%	3.641
Long Term Loan:	75%	10.923
- Interest 12.0%		
Short Term Loan/Local		Balanced
- Interest 20.0%		
Financing Plan		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	Consumption	Cost	Consumption	Cost
		$/Unit	Unit	$	Unit	$, 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	Production	Price	Production	Sales
		$/Unit	Unit	$	Unit	$, 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	(-)1	1	2	3	4	5	... 16	
	89	90	91	92	93	94	95	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	(-)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

Year	Debt Service Ratio	Short Term Loan, $, MM
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 Averate	(-)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

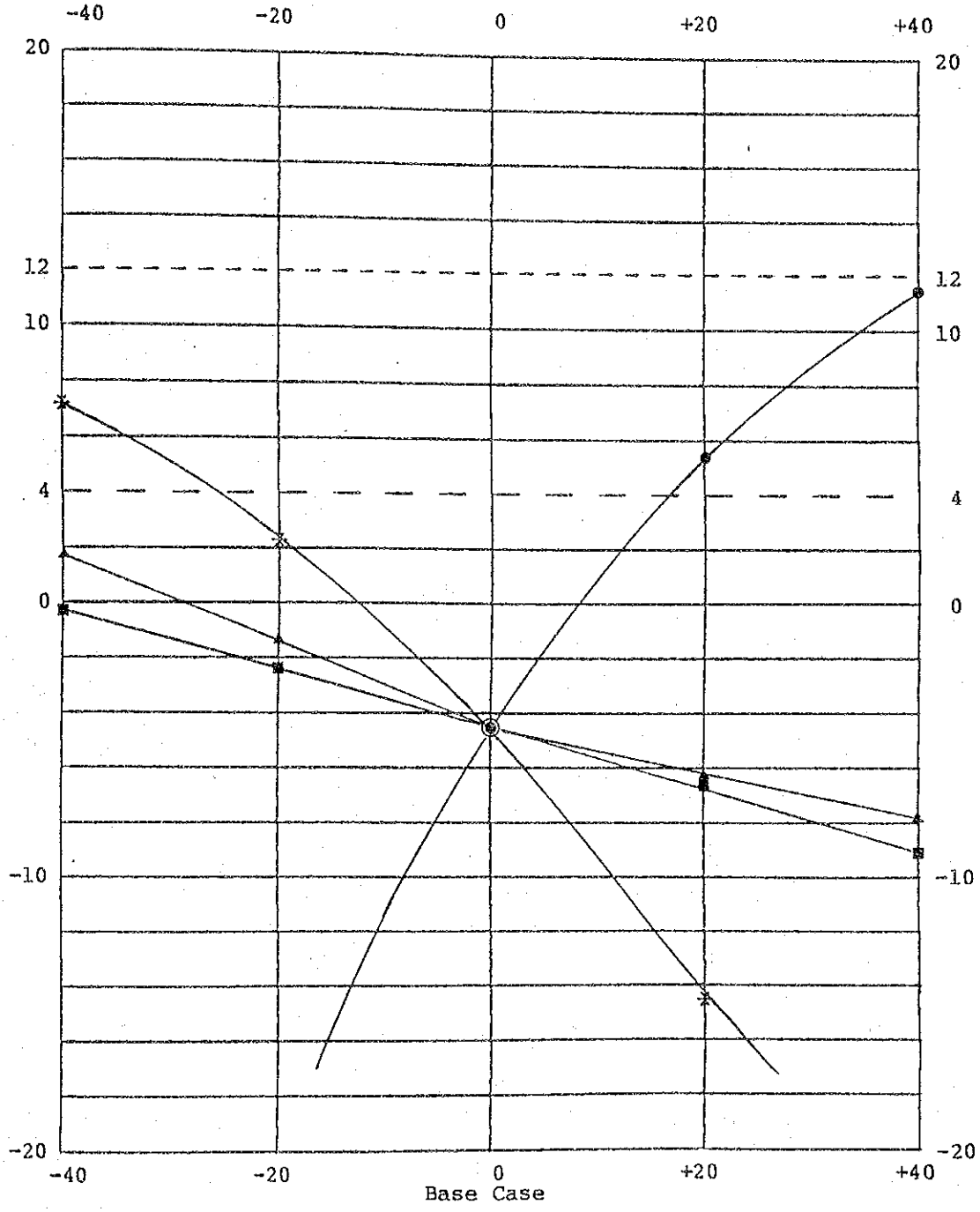
Notes:

- 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)

Variant from Base Case, %

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
Land/Site Preparation	0.136
Erected Plant Cost	17.338
Pre-Operational Expense	0.367
Interest during Construction	1.764
Fixed Capital Cost	19.605
Initial Working Capital	1.915
Financing Required	21.520

Financing Plan		$, MM
Equity	: 25%	5.380
Long Term Loan:	75%	16.140
- Interest 12.0%		
Short Term Loan/Local		Balanced
- Interest 20.0%		
Financing Plan		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	Consumption	Cost	Consumption	Cost
		$/Unit	Unit	$	Unit	$, 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	Production	Price	Production	Sales
		$/Unit	Unit	$	Unit	$, 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

(Unit: %)

	Year (-)2	(-)1	1	2	3	4	5	... 16	
	89	90	91	92	93	94	95	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	(-)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

Year	Debt Service Ratio	Short Term Loan, $, MM
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 Averate	(-)3.50	114.37-2005

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

8. Sensitivity Analysis

Sensitivity Analysis		FIRROI-DCF, Constant Price Before Tax	After Tax
- 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

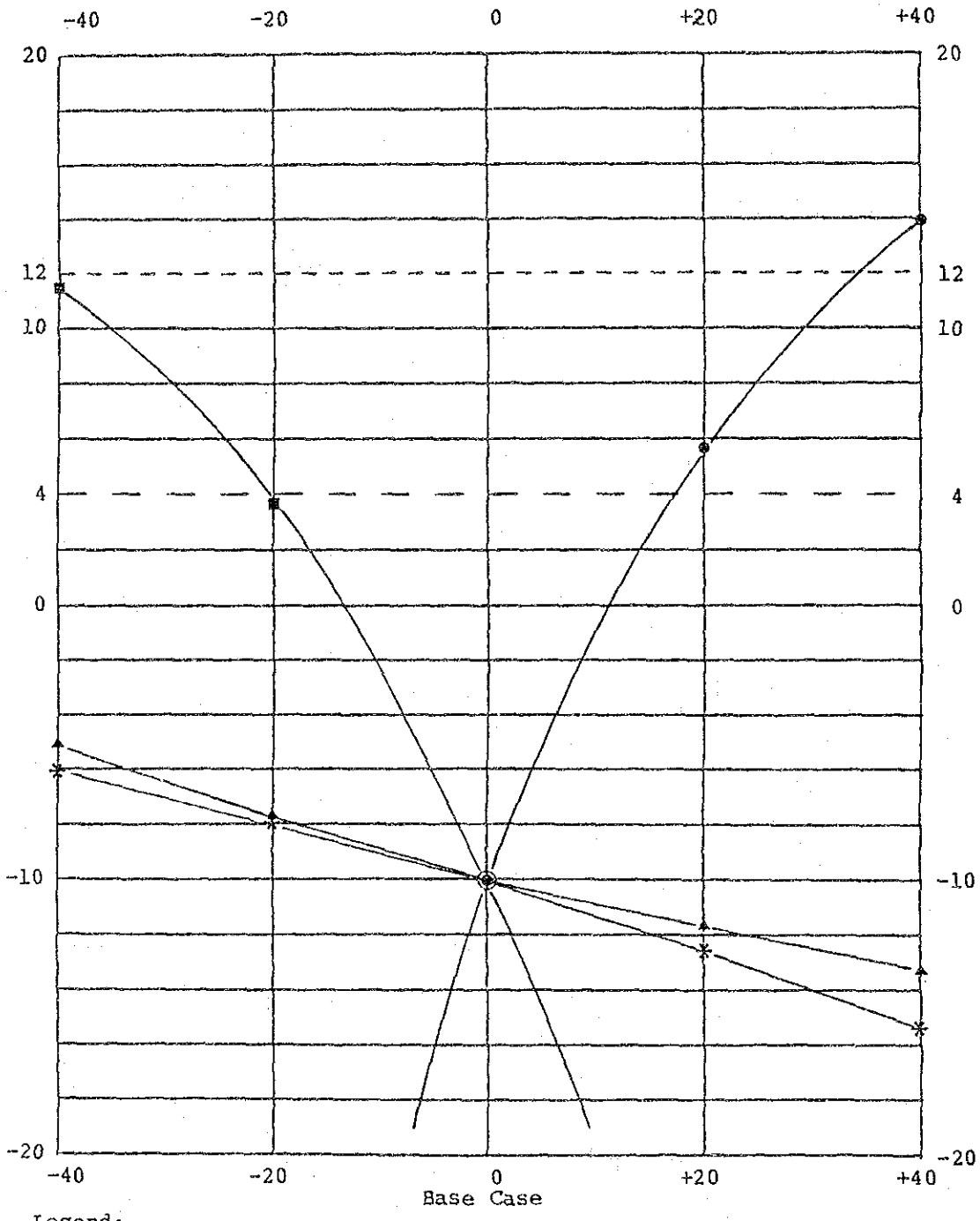
Notes:

- 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)

Variant from Base Case, %

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
Land/Site Preparation	0.098
Erected Plant Cost	14.871
Pre-Operational Expense	0.650
Interest during Construction	1.544
Fixed Capital Cost	17.163
Initial Working Capital	2.631
Financing Required	19.794

Financing Plan		$, MM
Equity	: 25%	4.949
Long Term Loan:	75%	14.845
- Interest	12.0%	
Short Term Loan/Local		Balanced
- Interest	20.0%	
Financing Plan		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	Consumption	Cost	Consumption	Cost
		$/Unit	Unit	$	Unit	$, MM
Raw Material						
- Phosphate Concentrate, Dry	Ton	130.00	0.615	79.958	35,181	4.574
- Sulfuric Acid, 100% H_2SO_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	Production	Price	Production	Sales
		$/Unit	Unit	$	Unit	$, 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

(Unit: %)

	Year								
	(-)2	(-)1	1	2	3	4	5	.. 16	Average
	89	90	91	92	93	94	95	2006	
- 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	(-)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

Year	Debt Service Ratio	Short Term Loan, $, MM
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 Averate	(-)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

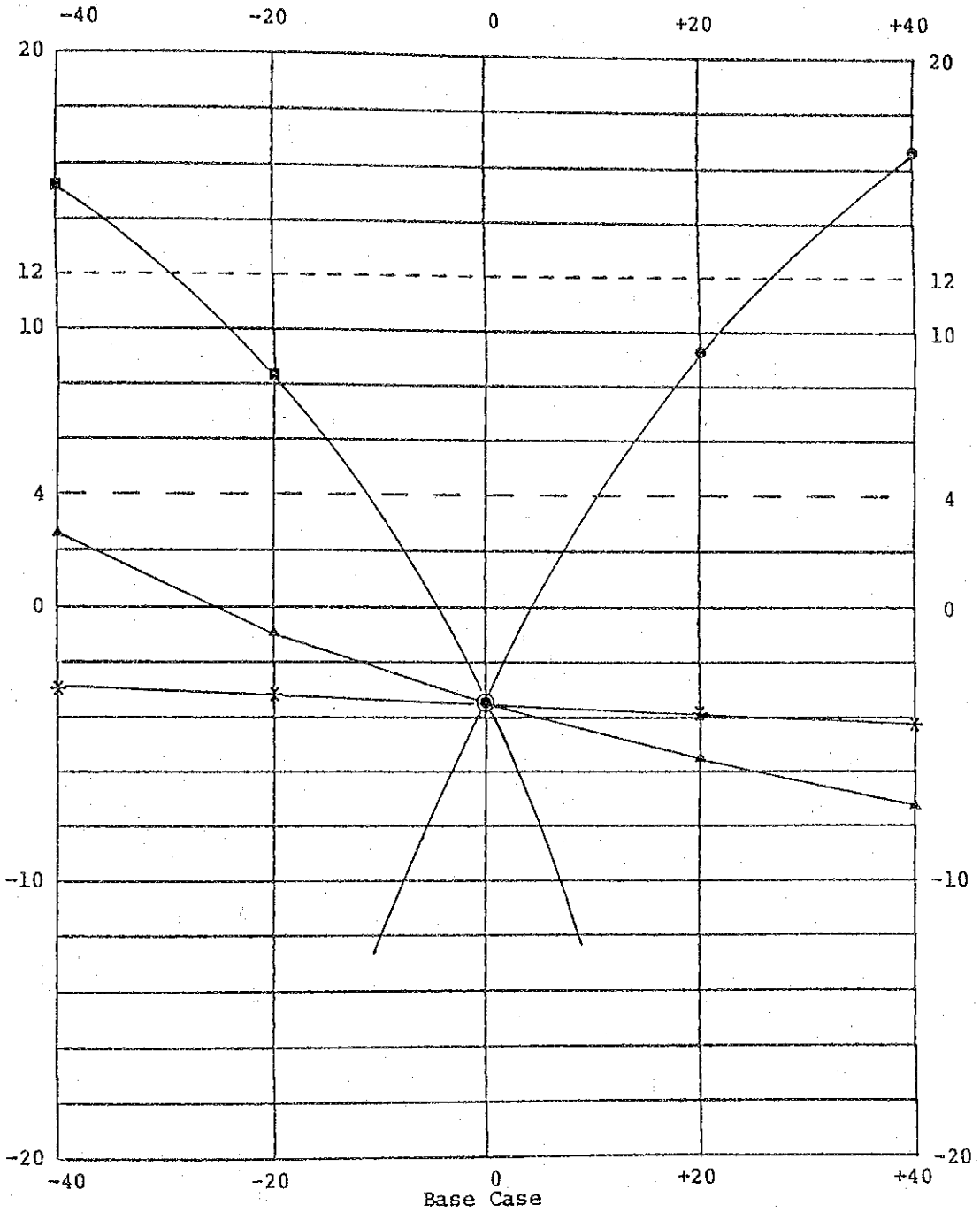
Notes:

- 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)

Variant from Base Case, %

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
Land/Site Preparation	0.325
Erected Plant Cost	29.438
Pre-Operational Expense	0.659
Interest during Construction	3.008
Fixed Capital Cost	33.430
Initial Working Capital	2.654
Financing Required	36.084

Financing Plan		$, MM
Equity	: 25%	9.021
Long Term Loan:	75%	27.063
- Interest	12.0%	
Short Term Loan/Local		Balanced
- Interest	20.0%	
Financing Plan		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	Consumption	Cost	Consumption	Cost
		$/Unit	Unit	$	Unit	$, 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	Production	Price	Production	Sales
Product Mix		$/Unit	Unit	$	Unit	$, MM
- 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	(-)1	1	2	3	4	5	... 16	
	89	90	91	92	93	94	95	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 Averate	(-)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

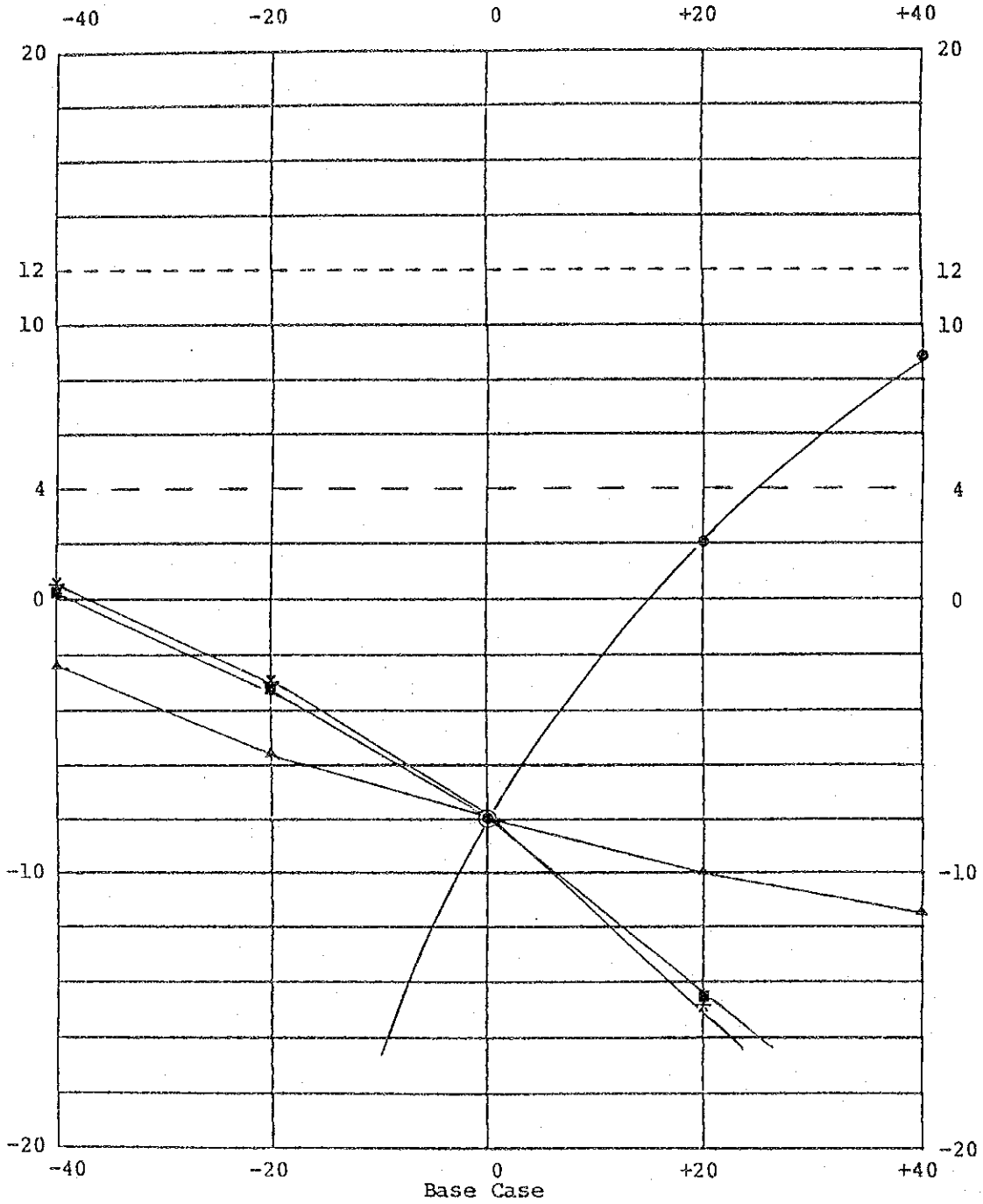
Notes:

- 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)

Variant from Base Case, %

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

Financing Required	$, MM	Financing Plan	$, MM
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	Consumption	Cost	Consumption	Cost
		$/Unit	Unit	$	Unit	$, 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	Production	Price	Production	Sales
Product Mix		$/Unit	Unit	$	Unit	$, MM
- 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	(-)1	1	2	3	4	5	... 16	
	89	90	91	92	93	94	95	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	(-)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

Year	Debt Service Ratio	Short Term Loan, $, MM
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 Averate	(-)2.27	131.80-2005

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

8. Sensitivity Analysis

Sensitivity Analysis		FIRROI-DCF, Constant Price Before Tax	After Tax
- 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

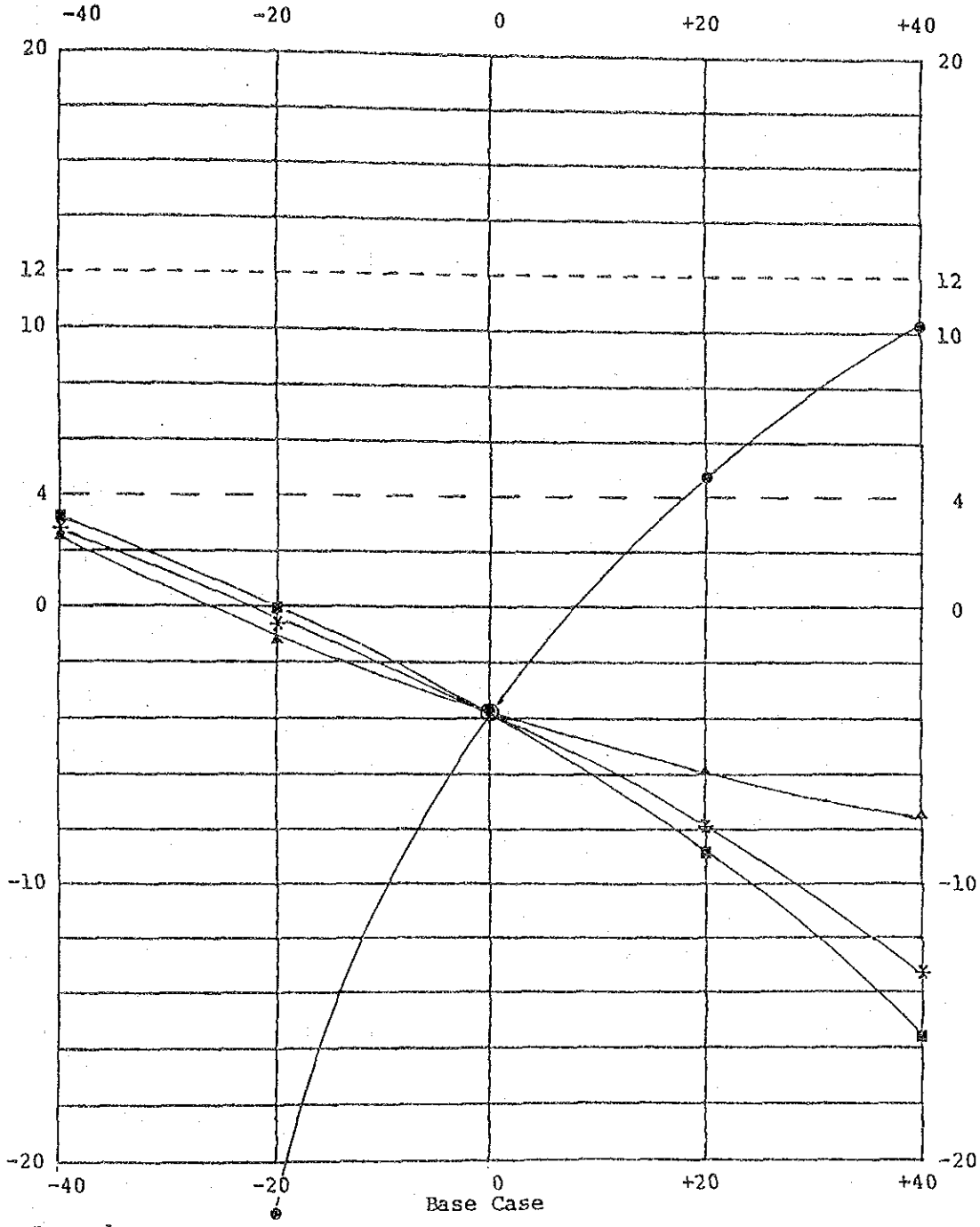
Notes:

- 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)

Variant from Base Case, %

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, The World Bank Feb 4, 1986	Economic Evaluation Unit, INDECO, 1986	This Study JICA, 1987	
			Foreign	Local
Standard Conversion Factor	0.96	-	-	
Exchange Rate	-	0.80	1.00	
Land	-	1.00	1.00	
Site Preparation	-	0.81	1.00	
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

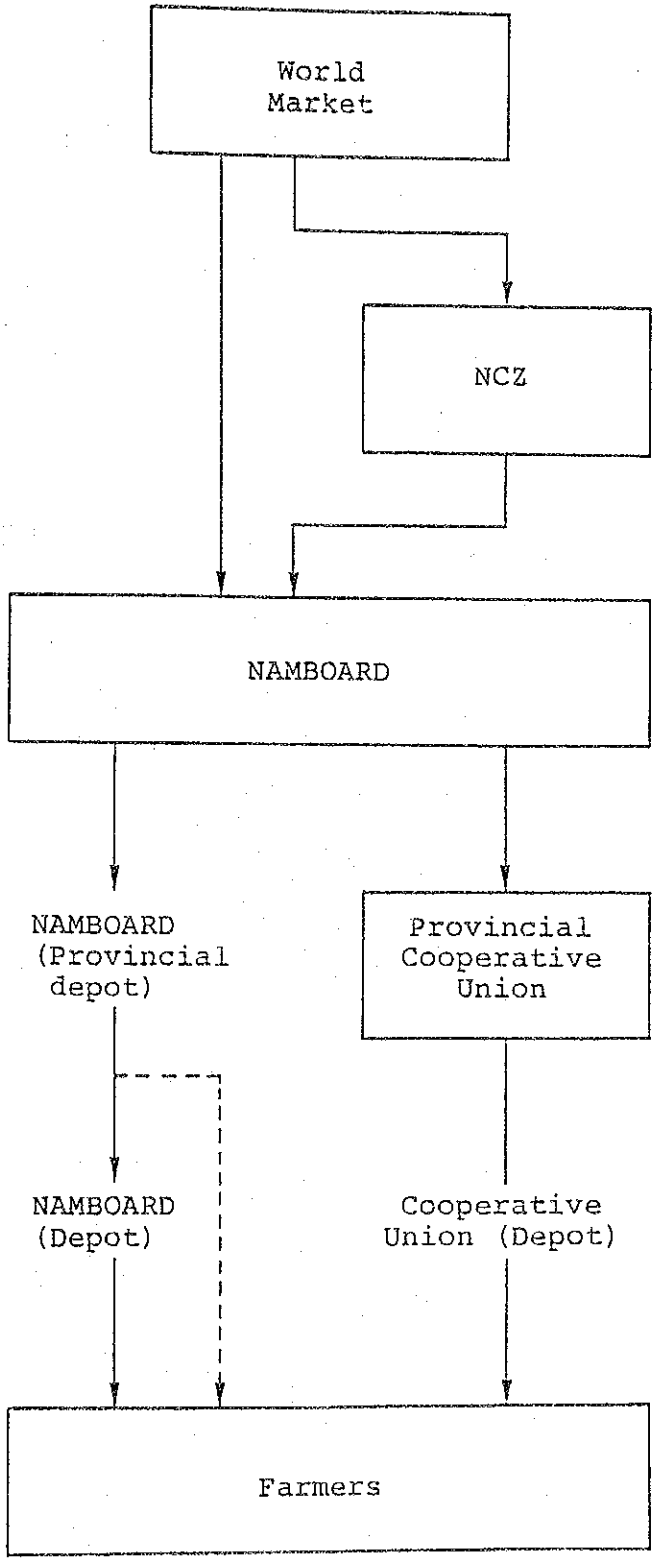


Figure 2-1-2 CLASSIFICATION OF AREA IN VIEW OF USE OF FMP AND LIME

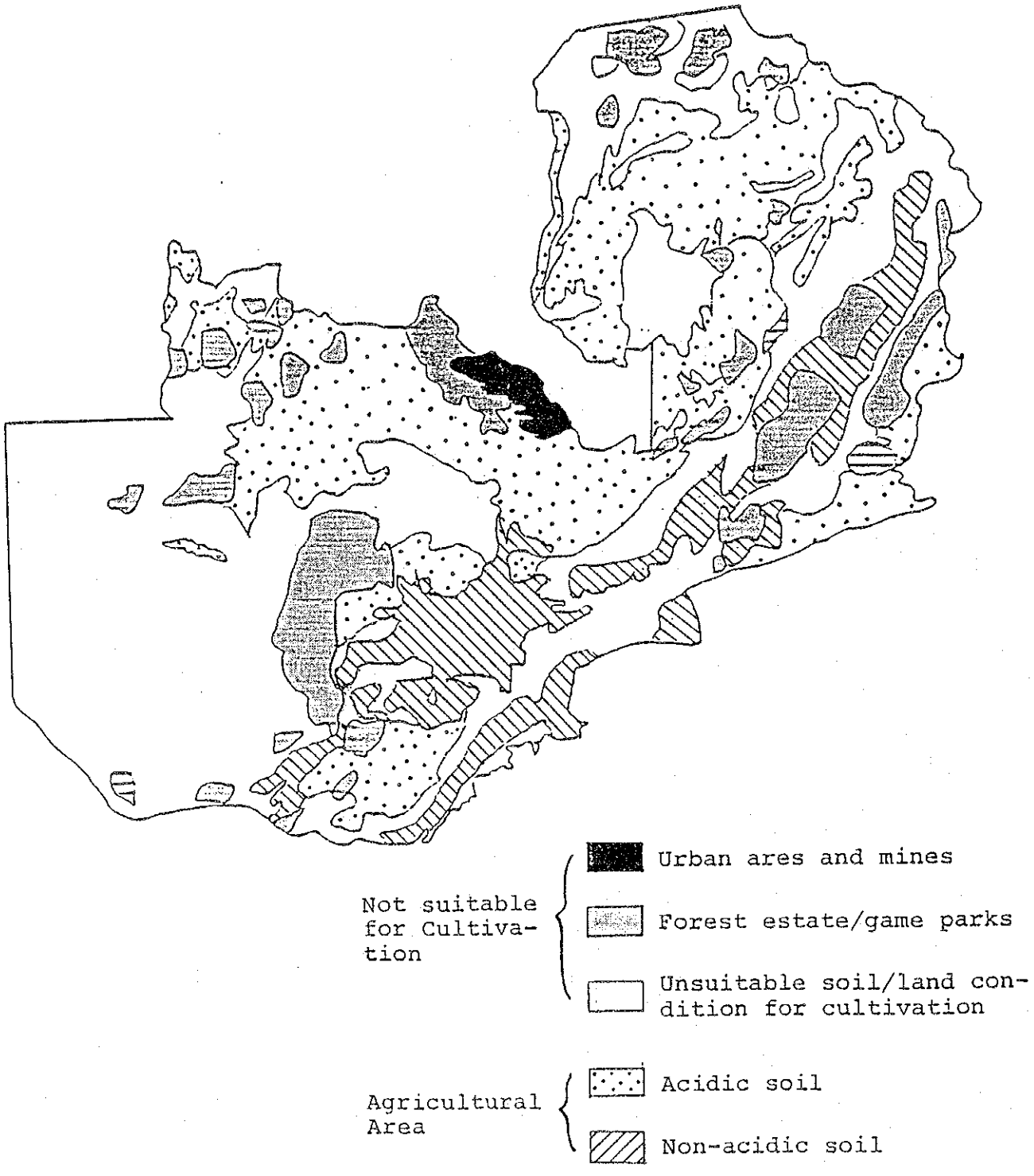
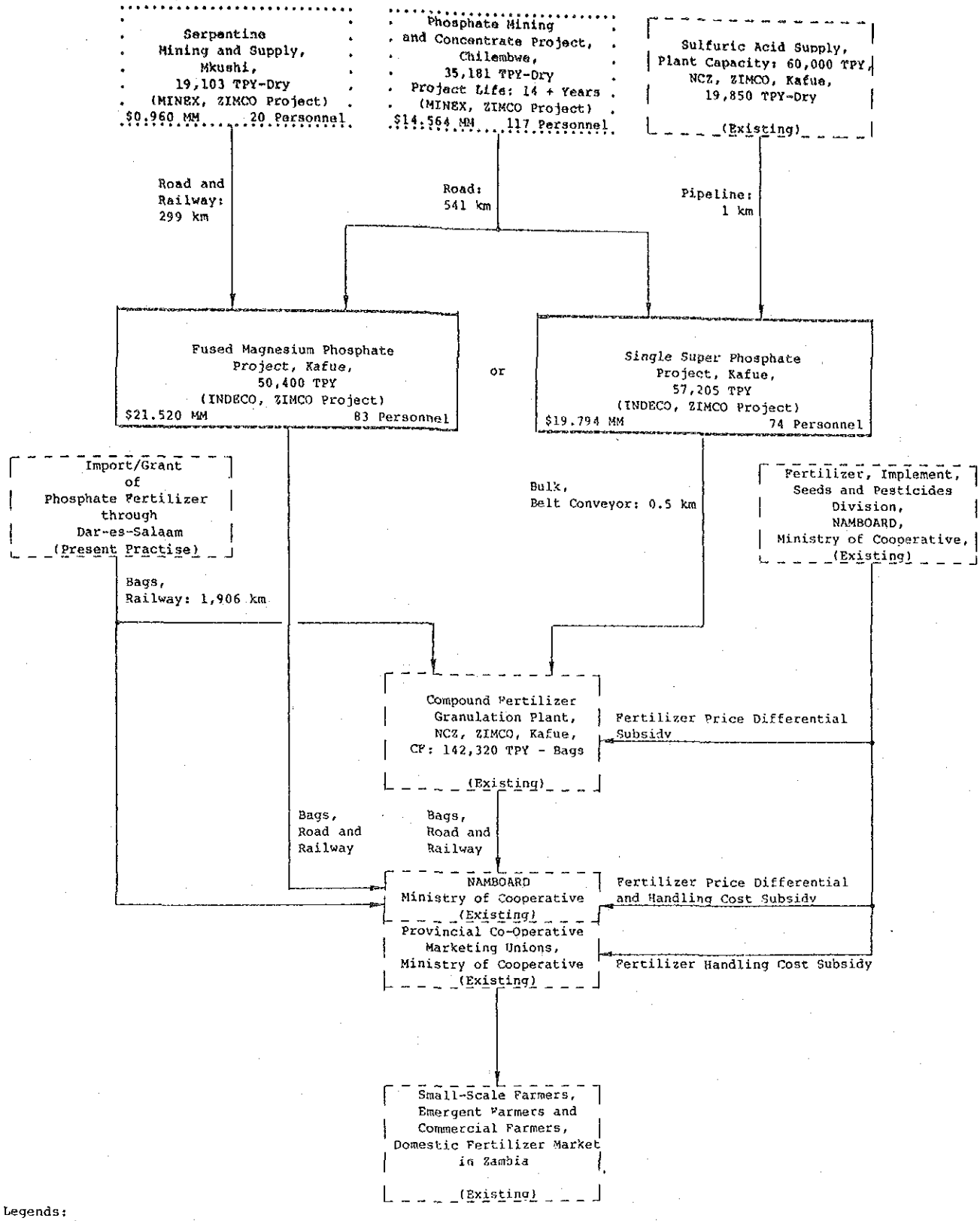


Figure 2-3-1 INTEGRATION OF PHOSPHATE MINING AND CONCENTRATE PROJECT AND PHOSPHATE FERTILIZER PROJECTS IN ZAMBIA



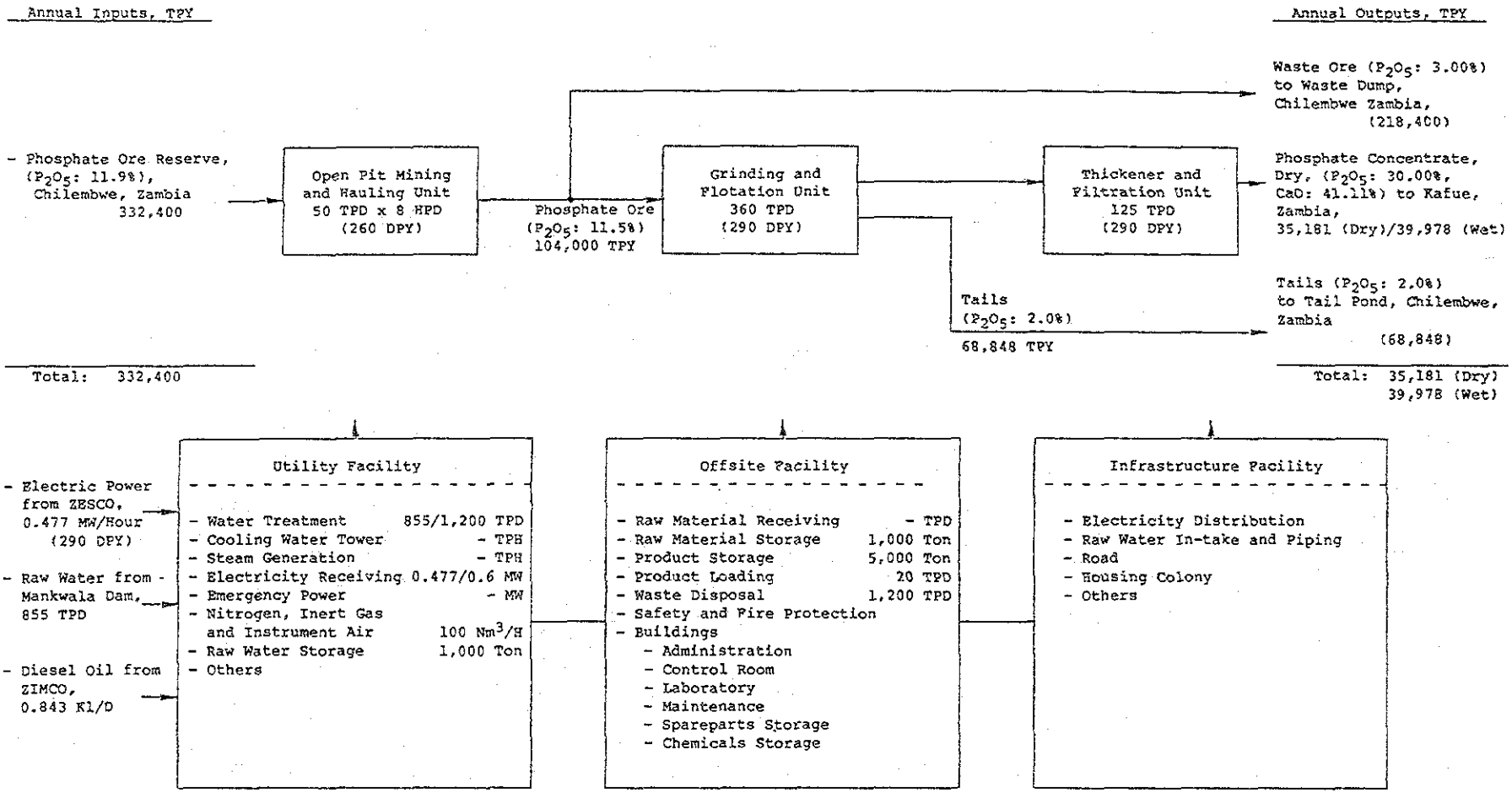
Legends:

- Proposed Project
- Existing Activity
- Premise Project

Notes:
- Commercial Production: July 01, 1991
- Exchange Rate : ZK8.00/US$
- Interest Rate : 12%/year
- Escalation during 1991/1997
  - Foreign : 14.23%
  - Zambian : 14.23%

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

Product : Phosphate Concentrate, Bulk
Capacity : 35,181 (Dry)/39,978 (Wet) TPY
Location : Chilembwe, Zambia



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.

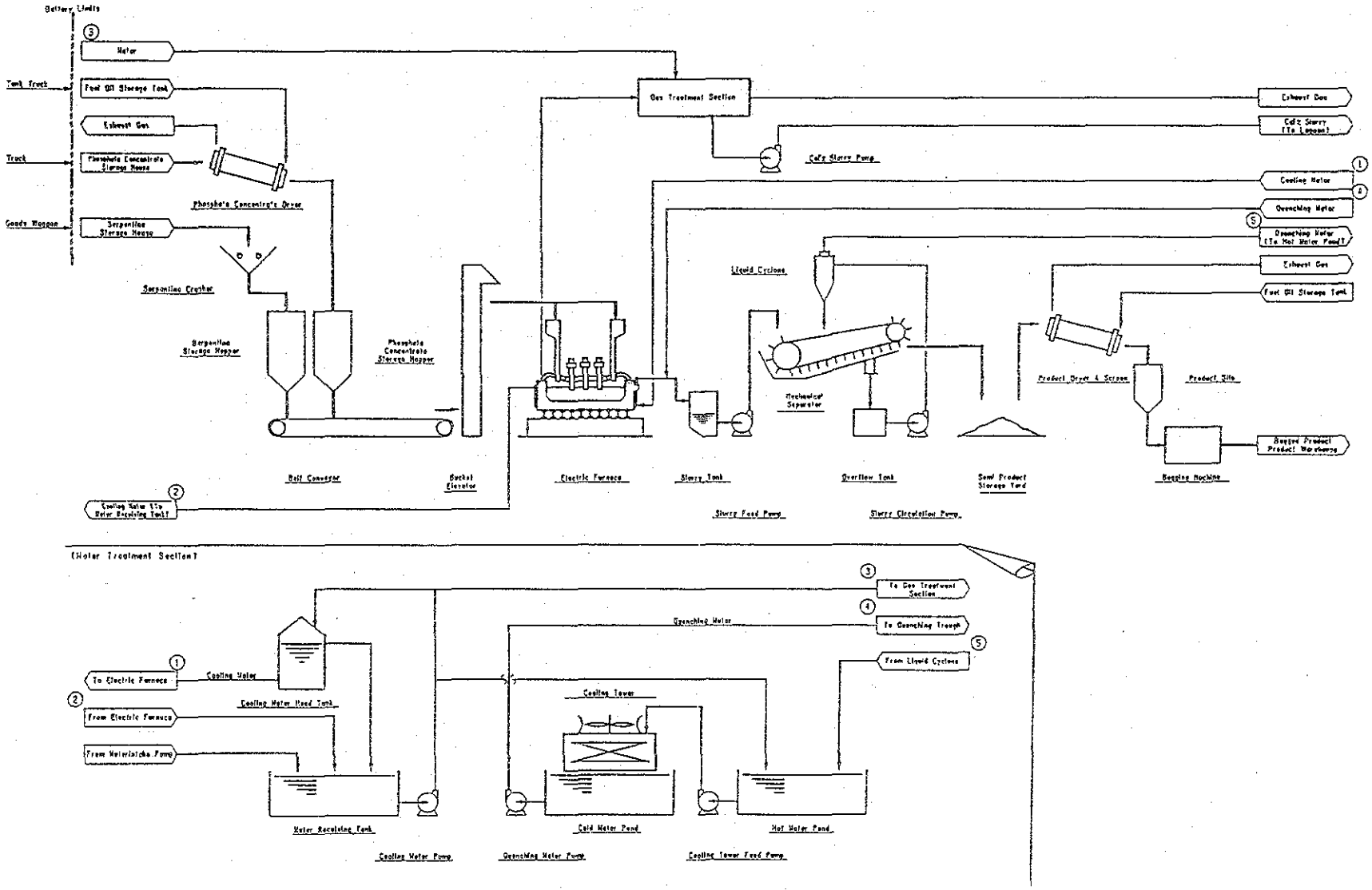


Figure 2-3-3 PROCESS FLOW DIAGRAM FOR FUSED MAGNESIUM PHOSPHATE PRODUCTION

FMP PLANT
FLOW SHEET

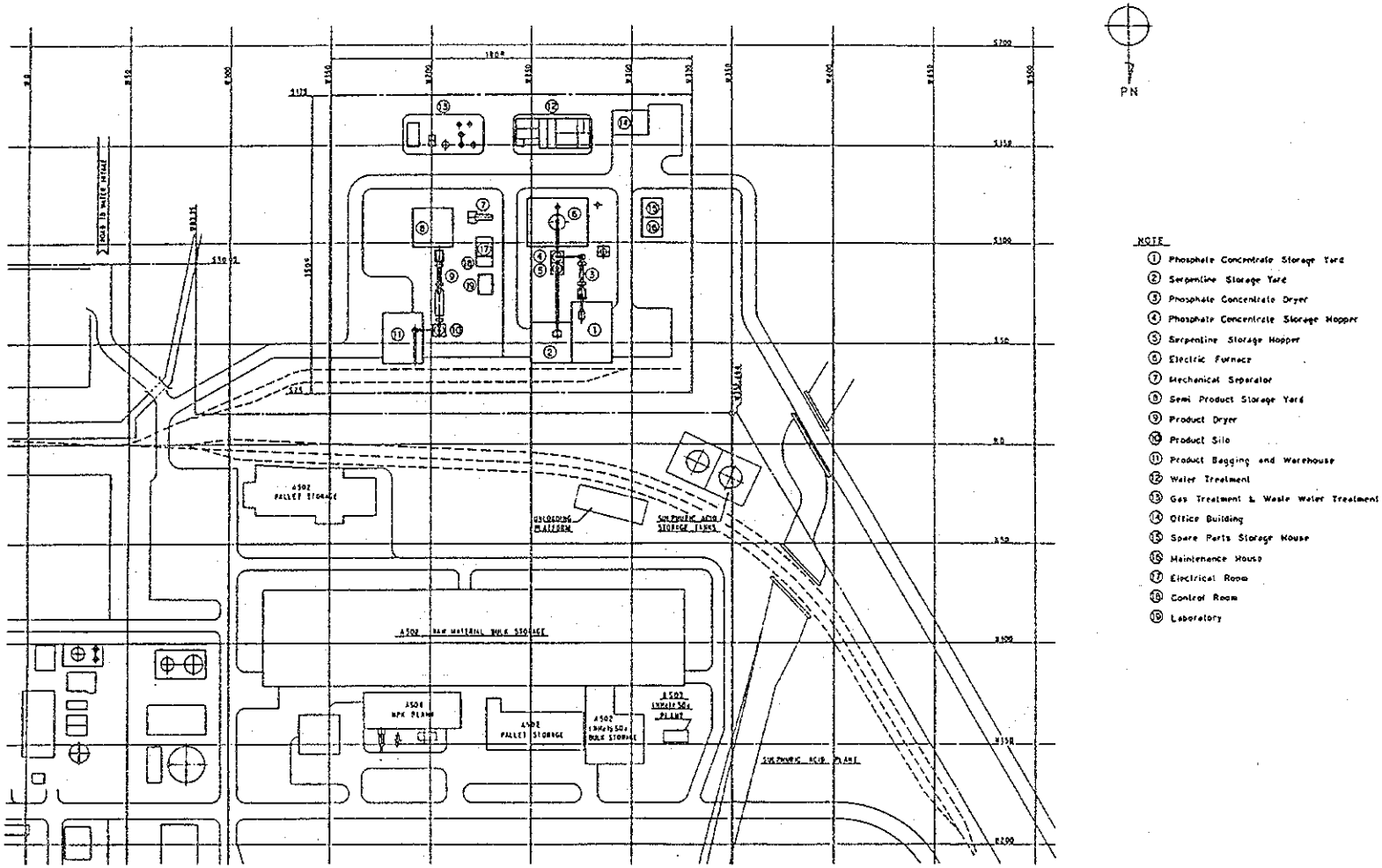
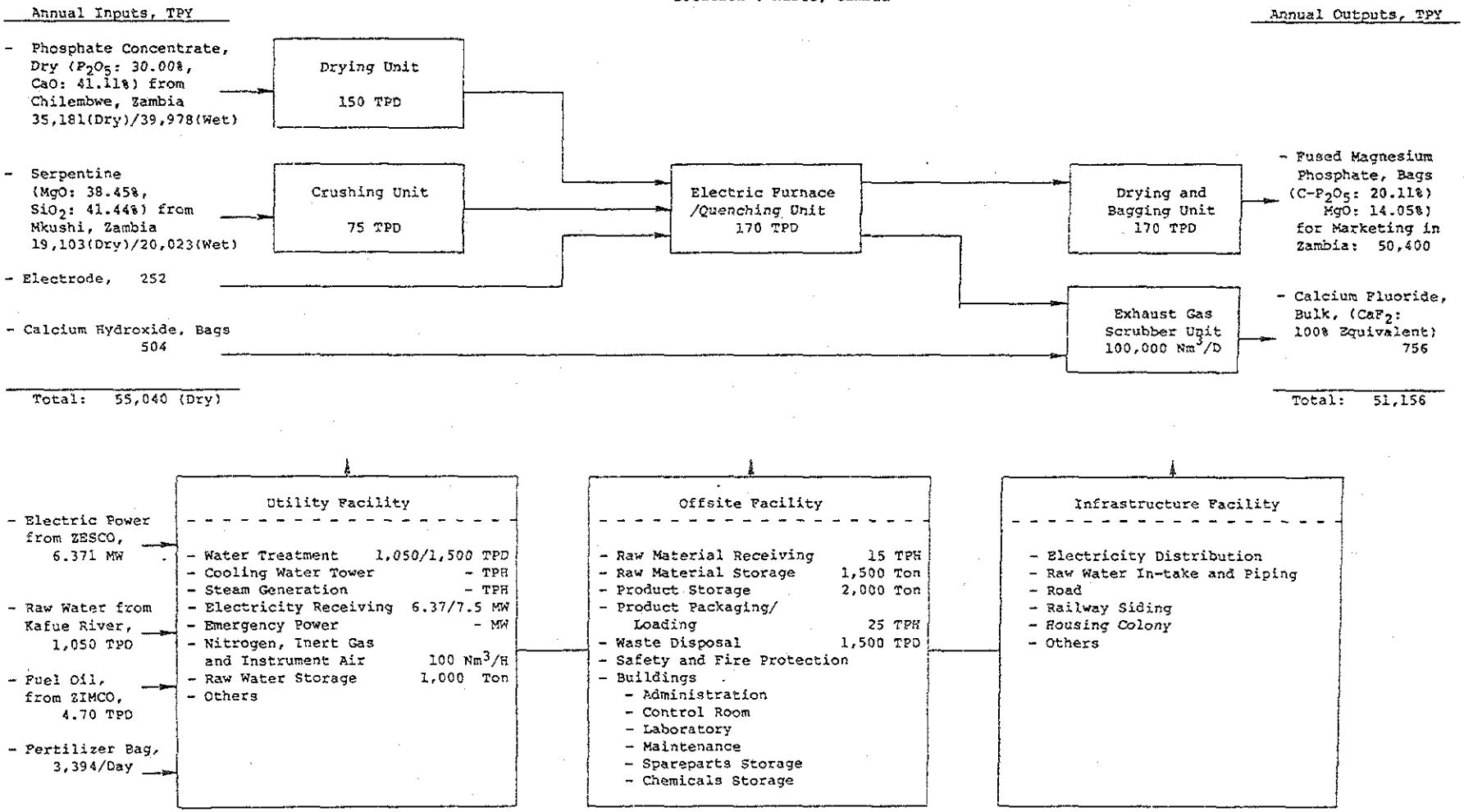


Figure 2-3-4 GENERAL PLOT PLAN OF FUSED MAGNESIUM PHOSPHATE PROJECT

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

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



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.

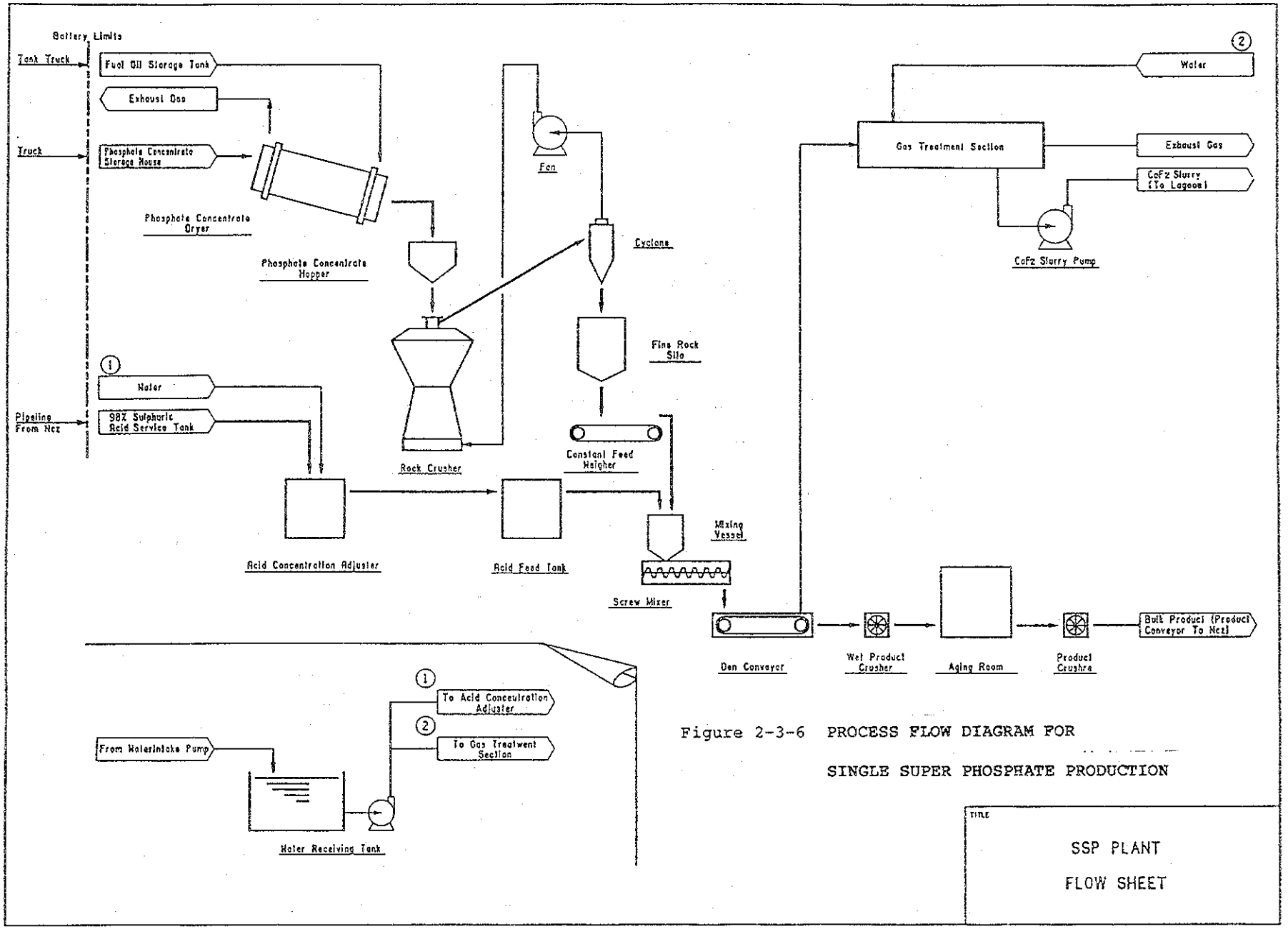


Figure 2-3-6 PROCESS FLOW DIAGRAM FOR SINGLE SUPER PHOSPHATE PRODUCTION

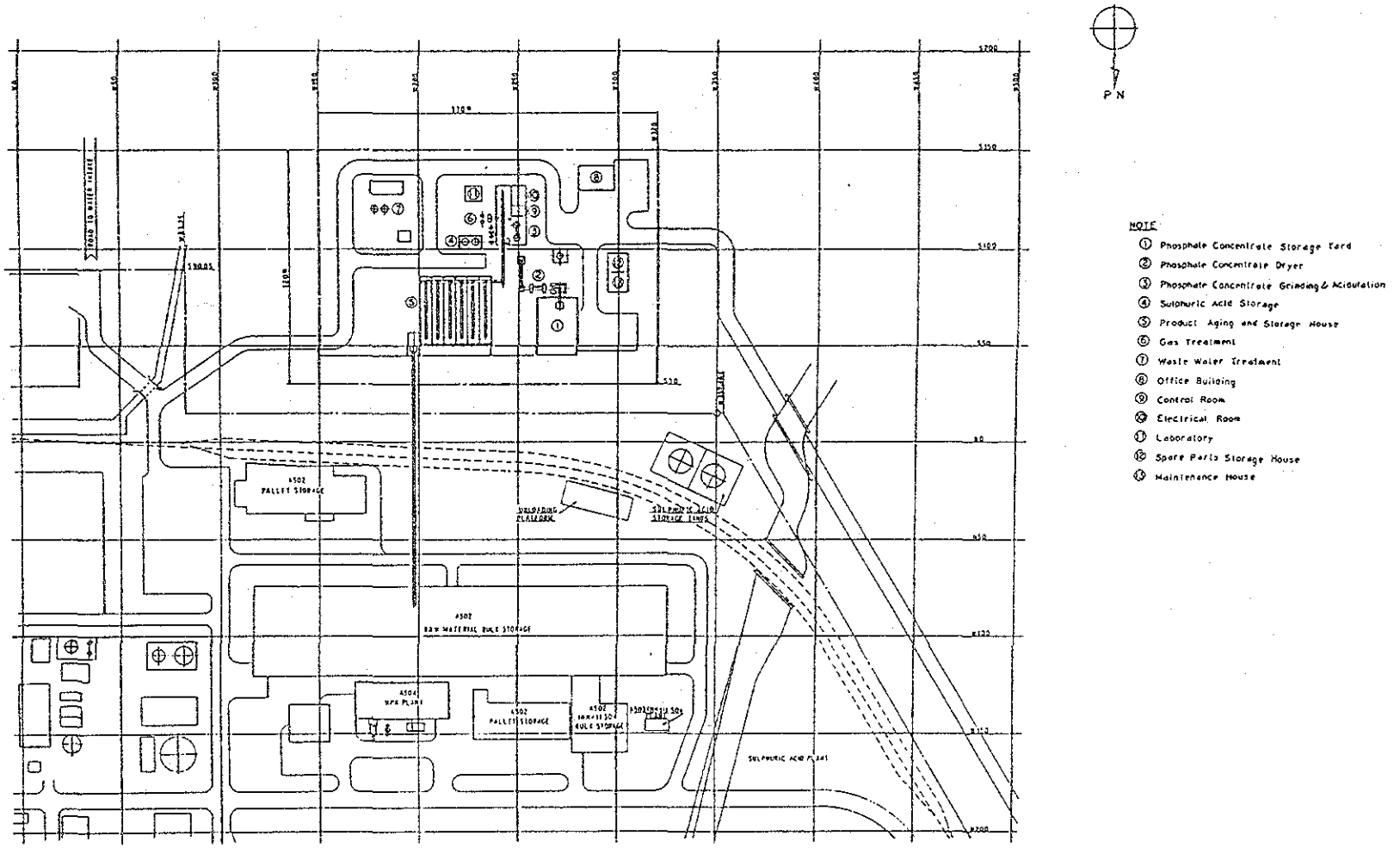
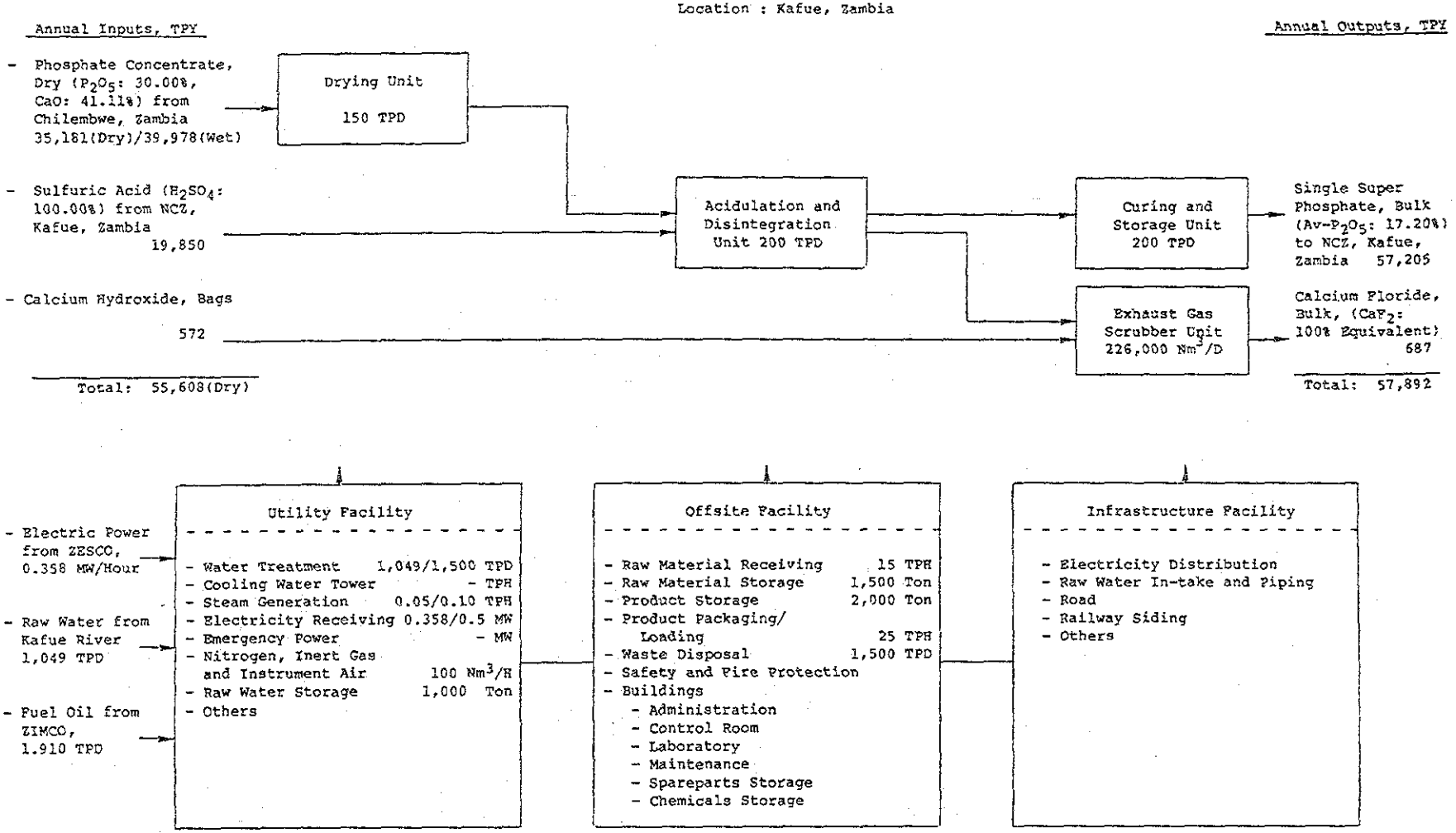


Figure 2-3-7 GENERAL PLOT PLAN OF SINGLE SUPER PHOSPHATE PROJECT

ZAMBIA SSP PLANT
GENERAL LAYOUT

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

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



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
Managing Director
INDECO LTD.

INDECO LIMITED
P.O. BOX 31933
LUSAKA

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

(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

(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:

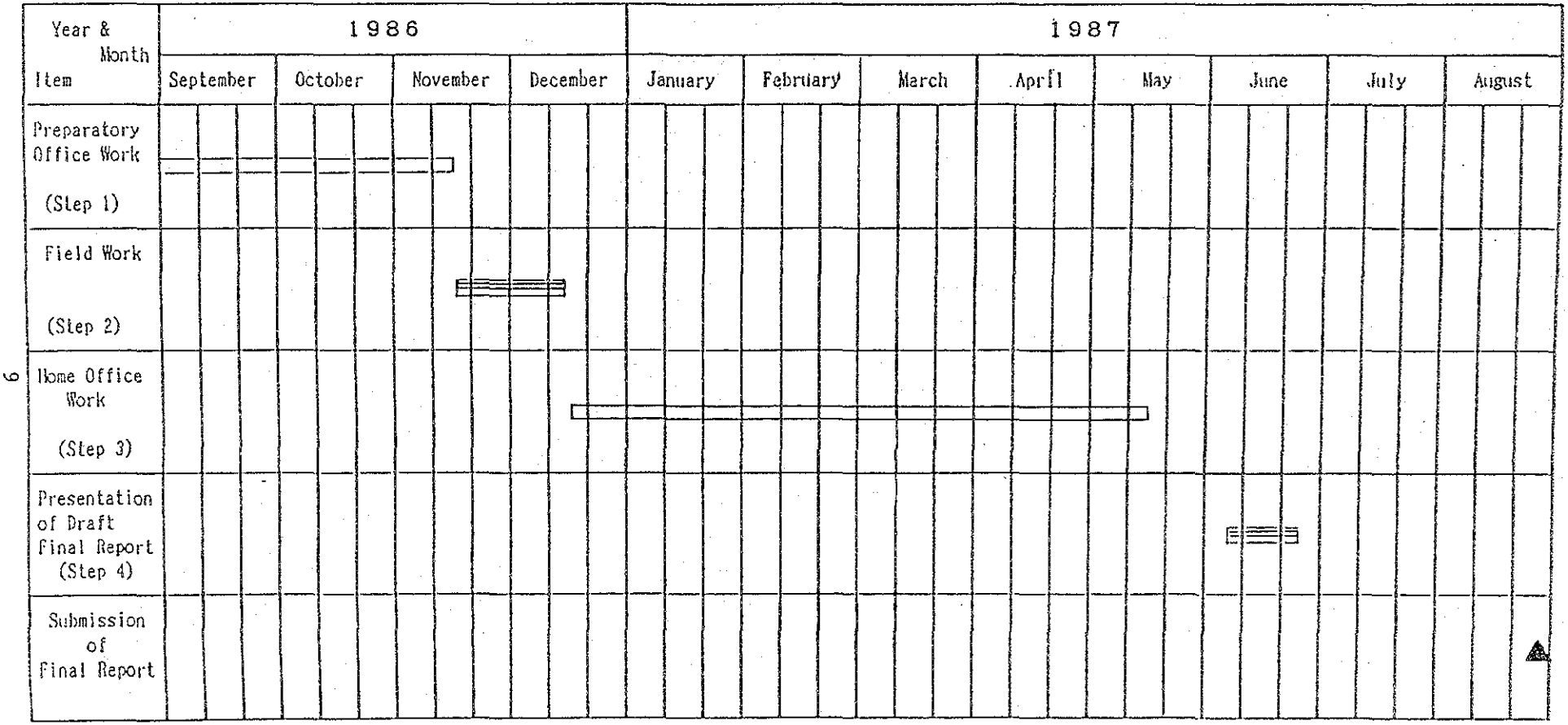
1. To dispatch, at its own expense, the Team to Zambia
2. To pursue technology transfer to Zambian counterpart personnel in the course of the Study

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.

<Annex>

Tentative Schedule of the Study



JICA