2-3 Rationalization and Modernization Plan (Production Line)

2-3-1 Recommendations to Combines

For each combine, the problems in geology, mining, ore dressing and smelting are shown on Table 2-3-1(1). The recommendations are shown on the Table 2-3-1(2).

If the note section is blank, data was only obtained by hearing in Almaty. There was no site survey done.

Table 2-3-1(1) Summary of current situation and problem of Combines (1)

Name of JSC:	Zhezkazgantsvetmet		Problems	Note
Mine Names:	North, South, East, West, Annensky, Akchi-Spassky			
Geology	Type:	Stratified copper(lead) deposits	Low average grade of Cu.	Development of a new
	Ore Reserve:	685 million tons	No economic parameters taken into	mine (Zilandinskaya)
	Ore grade:	Cu 1.04%	account for cutoff grades.	being studied.
		Relatively high lead (10.25-0.30%) at East and Amnesky dep.	Reserve estimation method-polygon over estimates average grade.	
Mining	1995 Production:	12.7 million tons		
	Grade:	Cu 1.19%	No systematic operation control.	
	Method:	R&P and some C&F, North mine-OP	Uneven distribution of underground	
	Depth:	550 m (deepest)	workings.	
	Equipment:	Underground	Ineffective high cost ventilation.	
		Jumbo 40	Surface subsidence due to	
		Loader 65+	underground caving.	
		Dumptruck 62	Low productivity due to	Study in progress.
		Open Pit	superannuated or obsolete heavy	
		Drill 8	equipment.	
		Shovel 25	Hydraulic long hole drill machine.	
		Loader 3		
		Dumptruck 78		
	Cost per ton:	$ 5.50 (average)		
	Employees:	6,525		
Concentrator	Total capacity:	25 million tons/year	No systematic operation control.	
	Method:	Flotation	Insufficient capacity of tailings	
	Feed:	15.3 million tons	pumps causing pollution by	
	Recovery:	77%	overflows.	
	Concentrates:	374,000 tons		A new pump station is
	Conc. grade:	36.29%		being constructed.
	Cost per ton:	$2.40		
	Employees:	2,038		
Smelter & Refinery	Capacity	700,000 tons of conc./year	Extremely poor working conditions.	To save energy costs,
		210,000 tons of cathode/year	Low recovery of sulfur from	other smelting
	Equipment	Electric furnaces 2	fugitive gases.	furnaces may be
		Converter furnaces 4	High energy cost.	adopted.
		Anode furnaces 4		Flush furnaces may
		Sulphuric acid plant 1	Extremely uneven sizing of anode.	not be applicable due
		Tankhouse 70 sections	Poor quality of cathode in	to the nature of the
			impurity contents and frequent	ore (mainly
	Cost	$0.10/ pound of copper	disruptions of electricity supply.	chalcocite).
				A power station has

Table 2-3-1(1) Summary of current situation and problem of Combines (2)

Name of JSC:	Balkhashmed		Problems	Note
Mine Name:	Kounrad			
Geology	Type:	Porphyry copper deposits	Extremely low grade.	Oxide stockpile
	Ore Reserve:	217 million tons	Increasing waste to ore ratio,	250 million tons
	Ore grade:	Cu 0.33%, Au 0.015g/t, Ag 0.62g/t	therefore mining cost.	0.25% Cu.
Mining	1995 Production:	5.2 million tons		Smelting slag
	Grade:	Cu 0.38%		15 million tons
	Method:	OP		0.69% Cu.
	Depth:	400 m		
	Equipment:	Drills 5		
		Excavators 13		
		Dumptrucks 18		
		Locomotives 17		
	Cost per ton:	$7.53 (1994 average)		
	Employees:	1,255		
Mine Name:	Sayak			
Geology	Type:	Skarn type copper deposits		
	Ore Reserve:	8.4 million tons	Extremely long hauling distance to	
	Ore grade:	Cu 1.16%, Au 0.4 g/t, Ag 6.0 g/t	concentrator (200km).	
Mining	1995 Production:	2.1 million tons	Too low grade for hauling ore to	
	Grade:	Cu 0.65%	Balkhash concentrator.	
	Method:	OP		
	Depth:	200 m		
	Equipment:	No data		
	Cost per ton:	No data		
	Employees:	No data		
Concentrator	Capacity:	12 million tons/year	Low recovery	
	Method:	Flotation	Low grade concentrate,	Slag flotation is
	Feed:	7.642 million tons		planned to commence
	Feed grade:	0.493% Cu		in 1997.
	Recovery:	75.4%		
	Concentrates:	200,100 tons		
	Conc. grade:	13.75%		
	Cost per ton:	$1.85 (average 1994)		
	Employees:	764		
Smelter &	Capacity	1.2 million tons of conc./year	Shortage of raw materials.	Development is
Refinery		270,000 tons of cathode/year		suspended.
	Equipment	Reverberatory furnaces 2	Poor working conditions.	Construction of new
		Vanukov furnaces 2	Low recovery of sulfur from	sulfuric acid plant
		Converter furnace 5	fugitive gases.	is suspended.
		Anode furnace 3	Low productivity of smelting	
		Tankhouse 6 units	furnaces.	
	Cost	$ 0.10/pound of copper		
			Low quality cathode in impurity	
			contents and appearances.	

Table 2-3-1(1) Summary of current situation and problem of Combines (3)

Name of JSC:	UK Pb-Zn Combine		Problems	Note
Smelter (lead)	Capacity	145,000 tons per year	SO2 gas from sintering.	
	Equipment	2 sets-sintering machine, 3 sets	Dust problems.	
		blast furnaces, 1 set Kivcet	Treatment of waste materials for	
	Employees	1,386	KIVCET.	
Smelter (zinc)	Capacity	186,400 tons per year	Old, small scale equipment.	
	Equipment	8 sets-furnaces	of zinc roasting and sulfuric acid	
		7 Waelz furnaces	production.	
	Employees	1,929	Low quality product.	Product quality
			Mist in cell house.	should be >99.99%.

Table 2-3-1(1) Summary of current situation and problem of Combines (4)

Name of JSC:	Shimkent Lead Plant		Problems	Note
Smelter (lead)	Capacity	160,000 tons	Difficulty settling accounts.	Toll smelter.
	Equipment	2 sets-sintering machine	Must import raw materials and	
		3 sets-blast furnace	export its products.	
	Employees	1,438	High repair & maintenance costs.	
			Low capacity utilization.	
				Demand=50,000 tons.
				Find cooperating
				company.

Table 2-3-1(1) Summary of current situation and problem of Combines (5)

Name of JSC:	Leningorsk PC		Problems	Note
Mine Name:	Tishinskoye			
Geology	Deposit:	Polymetal		
	Ore Reserve:	31.6 million tons		
	Ore grade:	Cu: 0.61%, Pb: 1.0%, Zn 6.08%		Ag: 12.67 g/t
Mining	1995 Production:	864,000 tons	Long ore haulage distance.	Au 0.63 g/t
	Grade:	Cu: 0.52%, Pb 1.19%, Zn 6.40%	1,000 cubic meters/hr of water	in its reserves
	Method:	SLS	inflow.	
	Depth:	600 m	High overhead and number of	
	Equipment:	Tmorock minihorer	employees.	Administration cost:
		Toro LHD	Lack of LHDs.	$11.00/t
		32 ton Tatra truck		
	Cost per ton:	$18.74		
	Employees:	800		
Mine Name:	Ridder-Sokolnoye			Ridder-Sokolnoye
Geology	Deposit:	Polymetal		and 40 Years
	Ore Reserve:	41.7 million tons		Lenin are considered
	Ore grade:	Cu: 0.40%, Pb 0.47%, Zn 1.17%		as one mine
Mining	1995 Production:	766,000 tons	Lack of explosives.	Ag 10.41 g/t
	Grade:	Cu: 0.40%, Pb: 0.30%, Zn 0.73%	High number of employees	Au 1.46 g/t
	Method:	SLC	Low grade(possible gold	in its reserves
	Depth:	680 m	production plan).	
	Equipment:	Hand-held drills		
		Scraper		
	Cost per ton:	$9.20		
	Employees:	1,250		
Mine Name:	Shubinskoye			
Geology	Deposit:	Polymetal		
	Ore Reserve:	3 million tons		
	Ore grade:	Cu: 2.18%, Pb 0.55%, Zn 3.97%		
Mining	1995 Production:	68,000 tons	Lack reserves.	Administration cost-
	Grade:	Cu: 0.92%, Pb: 0.23% Zn 0.92%	Spontaneous combustion problem.	$11.00/t
	Method:	SLS	High mining costs.	
	Depth:	200 m		
	Equipment:	Hand-held drills		
		Scraper		
	Cost per ton:	$19.17		
	Employees:	30		
Concentrator	Name & Location:	2 ore dressing plants	Small capacity machines.	Change from 6 to 30
	Capacity:	5 million tons	High maintenance costs.	cu-m flotation unit.
	Method:	Gravitation and Flotation		2 at Ridder-Sokolnoye
	Cost per ton:	$4.46		other 10 km away.
	Employees:	870		
Smelter (zinc)	Capacity	110,000 tons per year	Relatively low recovery of	70-80% precious metal
	Equipment	5 sets-furnaces	precious metals.	recovery rate.
		2 Waelz furnaces	Small scale equipment in	Capacity utilization
	Employees	1,929	calcination process.	rate=50%.
			Old and small facilities of zinc	
Smelter (lead)	Capacity	20,000 tons per year	roasting, sulfuric acid production	
	Equipment	1 set-Sintering machine	Sintering emission gas.	
		5 sets-electric furnaces	Poor collection of batteries.	Open Chekmar mine.
	Employees	538	Low capacity utilization.	Find a partner.

Table 2-3-1(1) Summary of current situation and problem of Combines (6)

Name of JSC:	Zyryanovsk Lead Combine		Problems	Note
Mine Name:	Zyryanovskoye			
Geology	Deposit:	Pyrite-polymetal		
	Ore Reserve:	37.0 million tons		
	Ore grade:	Cu: 0.13%, Pb: 0.70%, Zn 1.35%		
Mining	1995 Production:	1,078,300 tons	Low grade, 1,000 cubic meters/hr	
	Grade:	Cu: 0.15%, Pb 0.64%, Zn 1.10%	of surface water drains into the	Total labor cost=
	Method:	SLS and SLC	mine, 250 million tenge loss,	$4.27/t
	Depth:	800 m	high labor and electricity costs	Electricity=$2.13/t
	Equipment:	Toro 200 LHD		
		Hand-held drills		
		Scraper		
	Cost per ton:	$11.52		
	Employees:	700		
Mine Name:	Grehovskoye			
Geology	Deposit:	Polymetal		
	Ore Reserve:	18.9 million tons		
	Ore grade:	Cu: 0.56%, Pb 0.46%, Zn 1.52%		
Mining	1995 Production:	461,000 tons	Lack of parts for LHD, low grade	
	Grade:	Cu: 0.29%, Pb: 0.84%, Zn 1.96%		
	Method:	SLC		
	Depth:	700 m		1,108 people in non-
	Equipment:	Toro 200 LHD		production staff.
		Hand-held drills		
		Pneumatic drill		
	Cost per ton:	$8.85		
	Employees:	250		
Mine Name:	Maleevskoye			
Geology	Deposit:	Polymetal		
	Ore Reserve:	39.2 million tons		
	Ore grade:	Cu: 2.60%, Pb 1.19%, Zn 7.84%		
Mining	1995 Production:	313,000 tons	Lack surface facilities,	Present production
	Grade:	Cu: 1.34%, Zn 8.23%	spontaneous combustion problem	capacity is 500,000
	Method:	SLC and Cut & Fill		tons/year.
	Depth:	650 m		
	Equipment:	Toro 200 LHD		
		Hand-held drills		
		Pneumatic drill		
	Cost per ton:	$12.37		
	Employees:	300		
Concentrator	Name & Location:	Zyryanovsk, Zyryanovsk	70% of employees for repair and	
	Capacity:	6 million tons	auxiliary work, old equipment,	
	Method:	Gravitation and Flotation	low recovery rate, poor	
	Cost per ton:	$6.03	zinc concentrate grade	
	Employees:	742		

Table 2-3-1(1) Summary of current situation and problem of Combines (7)

Name of JSC:	Irtysh PC		Problems	Note
Mine Name:	Irtyshkoye			
Geology	Deposit:	Vein	Lack mechanization.	400,000 cu m not
	Ore Reserve:	12.6 million tons	Backfilling behind schedule.	backfilled.
	Ore grade:	Cu: 2.06%, Pb: 0.85%, Zn: 5.75%	High production costs.	$18.41/t mining cost
Mining	1995 Production:	60,600 tons		at western mine with
	Grade:	Cu: 0.86%, Pb: 0.5%, Zn: 2.70%		same capacity.
	Method:	SLS and Cut and Fill		Electricity=$3.20/t
	Depth:	450 m		Total combine
	Equipment:	Hand-held drills		employees=3,200
		Scraper		
	Cost per ton:	$39.10		
	Employees:	170		
Mine Name:	Belousovkoye			
Geology	Deposit:	Vein	Poor mining conditions,	
	Ore Reserve:	6.5 million tons	Lack of reserves.	
	Ore grade:	Cu: 1.33%, Pb:1.25%, Zn: 5.11%		Au:1.08 g/t
Mining	1995 Production:	64,400 tons		Ag: 70 g/t
	Grade:	Cu: 0.84%, Pb: 1.02%, Zn: 2.70%		
	Method:	SLS and Cut & Fill		
	Depth:	760 m		
	Equipment:	Hand-held drills		
		Scraper		
	Cost per ton:	$31.37		
	Employees:	100		
Mine Name:	Yubileyno-Snegirihinskoye			
Geology	Deposit:	Polymetal	No surface facilities.	180km to Belousovkoye
	Ore Reserve:	4 million tons		
	Ore grade:	Cu: 4.5% Pb: 0.9% Zn: 5.9%		
Mining	1995 Production:	0		
	Method:	SLS		
Concentrator	Name & Location:	Berezovsk Belousov	High reagent and electricity	40.6% and 21.5% of
	Capacity:	530,000 tons 800,000 tons	costs.	concentration cost,
	Method:	Flotation (both)	Obsolete equipment.	respectively.
	Cost per ton:	$17.05 $15.75	Low Zn conc grade.	Zn conc grade 43%.
	Employees:	N/A 250	Short tailings pond life.	
Smelter (copper)	Capacity	36,000 tons	Increase production to 40,000	
	Equipment	Blast furnace, sintering machine,	tons after 1999.	
		Kivcet		
	Employees	N/A		

Table 2-3-1(1) Summary of current situation and problem of Combines (8)

Name of JSC:	EKCChC		Problems	Note
Mine Name:	Nicolaevskoye			
Geology	Deposit:	Massive lead/zinc sulfide	Stripping is behind.	
	Ore Reserve:	23.4 million	Lack parts, diesel and electricity	
	Ore grade:	Cu: 2.01%, Ph: 0.49%	High blasting costs.	Explosive cost=
Mining	1995 Production:	650,000 tons		$3.95/t
	Grade:	Cu 0.9%, Ph 0.4%, Zn:4.35%		Au: 0.33 g/t
	Method:	Open pit		Ag: 33.06 g/t
	Depth:	250 m		
	Equipment:	Rotary drills		
		5 & 10 cubic m shovels		
		42 & 110 ton trucks		
	Cost per ton:	$13.97		
	Employees:	270		
Mine Name:	Shemonaihinskoye			
Geology	Deposit:	Polymetal	Low amount of reserves.	
	Ore Reserve:	1.2 million		
	Ore grade:	Cu: 3.86%, Ph: 1.34%, Ag:116.6		
Mining	1995 Production:	250,000 tons		
	Grade:	Cu: 2.58%, Ph: 1.25%, Zn 1.25%		Au: 0.67 g/t
	Method:	Open pit		Ag: 66.67 g/t
	Depth:	185 m		
	Equipment:	Rotary drills		
		5 & 10 cubic m shovels		
		42 & 110 ton trucks		
	Cost per ton:	$19.14		
	Employees:	130		
Mine Name:	Artemyevskoye		Lack surface facilities.	
Geology	Deposit:	Massive, vein, network		
	Ore Reserve:	16.9 million		
	Ore grade:	Cu: 2.47%, Ph: 2.03%, Zn: 8.07%		
Mining	1995 Production:	0		
	Method:	Cut & fill		
Concentrator	Name & Location:	Nicolaevsk, mine site	Large number of employees.	Cu conc grade 21%
	Capacity:	1.2 million tons	Worker performs only one task.	Zn conc grade 43%
	Method:	Flotation	Low concentrate grade.	10X the number of
	Cost per ton:	$7.00		workers as same scale
	Employees:	440		conc. in Japan.

Table 2-3-1(1) Summary of current situation and problem of Combines (9)

Name of JSC:	Zhezkent MCC		Problems	Note
Mine Name:	Orlovskoye			
Geology	Deposit:	Polymetal		
	Ore Reserve:	41.5 million		
	Ore grade:	Cu: 4.54% Pb: 1.02%, Zn: 3.58%		
Mining	1995 Production:	917,000 tons	Dilution from fill material.	
	Grade:	Cu:4.27%, Pb: 0.37%, Zn: 1.51%		
	Method:	Cut & Fill		
	Depth:	375 m		
	Equipment:	Hand-held drill		
		LHD		
	Cost per ton:	N/A		
	Employees:	1,000		
Concentrator	Name & Location:	Orlovsk, Orlovsk	Low recovery.	Zn conc grade: <43%
	Capacity:	1.2 million tons	Low concentrate grade.	Cu conc grade: 20-22%
	Method:	Flotation		Zn recovery 45%.
	Cost per ton:	$29.9 (includes mining)		
	Employees:	380		

Table 2-3-1(1) Summary of current situation and problem of Combines (10)

Name of JSC:	Achpolymetal		Problems	Note
Mine Name:	Ansaiy			
Geology	Type:	Tabular		
	Ore Reserve:	74.5 million tons		
	Ore grade:	Ba: 43.4%		
Mining	1995 Production:	200,000 tons	Lack spare parts for truck.	Only 6 of 17 trucks
	Grade:	Ba: 46%	Low productivity.	are in operation.
	Method:	OP	Settlement of customer accounts	Only profitable mine.
	Depth:	100 m	in Uzbekistan.	Final depth 300 m
	Equipment:	Rotary drills (110 and 250 m)		Oil & gas drilling
		Bulldozer (5 cu m)		market.
		Truck (27 ton)		55 million tons will
	Cost per ton:	$14.52		be mined by SLC
	Employees:	300		
Mine Name:	Gulborskiy/Mirgalimsay			
Geology	Type:	Tabular		
	Ore Reserve:	40.6 / 1.8 million tons	Tailings at bottom 3 mine levels.	
	Ore grade:	Pb 0.895%, Zn 0.55%, Ag 29.9 g/t	Water drainage of	
Mining	1995 Production:	122,000 tons (both)	105 million tons of water /y.	
	Grade:	Pb 0.95%, Zn 0.27%, Ag 29.9 g/t	Despite $6.25 million subsidy	8 million tons of
	Method:	SLC	from city, mine closed since	tailings.
	Depth:	600 m 300 m	beginning of 1996.	
	Equipment:	Scraper	High % loss (25.2%).	
		Hand-held drills	Low grade.	
		Pneumatic drill	High debt ($16 million).	
	Cost per ton:	$9.78 $12.02	Costs for mining & concentration.	
	Employees:	1,203 (total both mines)		
Mine Name:	Achisai			
Geology	Deposit:	Tabular		
	Ore Reserve:	0.8 million tons		
	Ore grade:	Pb 0.25%, Zn 12.46%		
Mining	1995 Production:	14,000 tons	High costs.	
	Grade:	Pb 0.25%, Zn 9%	Lack of timber.	
	Method:	Top slicing	Low reserves.	
	Depth:	100-400 m		
	Equipment:	Toro LHD		
		Hand-held drills		
		Pneumatic drill		
	Cost per ton:	$45.63	Costs for mining & concentration.	
	Employees:	150		
Concentrator	Name & Location:	Kentau & Mirgalimsay	Too much capacity.	
	Capacity:	4 million 2.2 million	Sell products to Almalic Combine	
	Method:		in Uzbekistan but 30% export tax.	
	Cost per ton:			
	Employees:	4,763 (1994 whole combine)		

Table 2-3-1(1) Summary of current situation and problem of Combines (11)

Name of JSC:	Shalkiya Mine Management		Problems	Note
Mine Name:	Shalkiya			
Geology	Type:	Strata-bound	Low grade.	Plan to change mining
	Ore Reserve:	173.8 million tons	Lack skilled workers.	method.
	Ore grade:	Pb 0.9%, Zn 3.31%, Ag 2.0 g/t	No concentrator.	150 km to Kentau
Mining	1995 Production:	0	High transportation cost.	concentrator.
	Grade:		High dilution.	($0.018/ton-km)
	Method:	SLC	Difficulty concentrating ore-	Completely trackless.
	Depth:	141 m	contains carbon.	Pb recovery=58%
	Equipment:	Toro LHD	No interested investors in	Zn recovery=68%
		Conveyor loader	concentrator.	Possible to increase
		Twin-boom drill	Product sales price is $13.53/t.	ore reserves 2X by
		20 ton truck		exploration.
	Cost per ton:	$15.98	Costs for mining & concentration.	
	Employees:			

Table 2-3-1(1) Summary of current situation and problem of Combines (12)

Name of JSC:	Tekeli Pb-Zn Combine		Problems	Note
Mine Name:	Tekeli			
Geology	Type:	Lense	Lack money.	
	Ore Reserve:	9.6 million tons	High electrical costs.	
	Ore grade:	Pb 2.89%, Zn 4.17%, Ag 28.8 g/t	High transportation costs to	
Mining	1995 Production:	Suspended in 1995	concentrator.	
	Grade:		Unprofitable.	
	Method:	SLS	Mining cost for combine is	
	Depth:	600-1000 m	$27.30/t.	
	Equipment:	Scraper	Total loss at combine-$3.9 m	
		Hand-held drill		
	Cost per ton:			
	Employees:	666		
Mine Name:	West Tekeli			
Geology	Type:	Lense		
	Ore Reserve:	2.0 million tons		
	Ore grade:	Pb 2.67%, Zn 4.71%, Ag 21 g/t		
Mining	1995 Production:	Suspended in 1995.	Low reserves.	
	Grade:			
	Method:	SLS		
	Depth:	750-800 m		
	Equipment:	Scraper		
		Hand-held drill		
	Cost per ton:			
	Employees:	79		
Mine Name:	Koksu			
Geology	Type:	Small lense		
	Ore Reserve:	2.3 million tons		
	Ore grade:	Pb 1.67%, Zn 8.32%, Ag 18.7 g/t		
Mining	1995 Production:	Closed in 1993	Low reserves.	
	Grade:		Concentrator located 75 km away.	
	Method:	Underground		
	Depth:			
	Equipment:			
	Cost per ton:			
	Employees:	42		
Mine Name:	Tuvuk			
Geology	Deposit:	Massive Lense	High grade ore-0.05 million tons	Stopped in 1995 due
	Ore Reserve:	12.6 million tons	No rail road from Tuvuk to	to lack of money.
	Ore grade:	Pb 1.36%, Ag 13.6 g/t, Ba 50.5%	Tekeri concentrator (510 km).	
Mining	1995 Production:	Suspended in 1995		
	Grade:			
	Method:	Underground		
	Depth:			
	Equipment:			
	Cost per ton:			
	Employees:	156		
Concentrator	Name & Location:	Tekeri Koksu		
	Capacity:	1.2 0.3 million tons		
	Method:			
	Cost per ton:			
	Employees:	239	Combine-2,668	

Table 2-3-1(1) Summary of current situation and problem of Combines (13)

Name of JSC:	Sary-Arkapolymetal		Problems	Note
Mine Name:	Far West			
Geology	Type:			
	Ore Reserve:	39.6 million tons	Crude ore transported to Kentau	
	Ore grade:	Pb 1.37%, Zn 4.37%, Ag 20.54g/t	(700 km) and Tekeri (800 km).	Ba 16.31%
Mining	1995 Production:	0	No non-ferrous metal production	
	Grade:		in 1995.	
	Method:	OP		
	Depth:			
	Equipment:			
	Cost per ton:			
	Employees:			
Mine Name:	Ushkatyn-III			
Geology	Type:			
	Ore Reserve:	38.4 million tons		
	Ore grade:	Pb 2.63% Ag 27.79 g/t, Ba 14.15%		
Mining	1995 Production:	0		
	Grade:			
	Method:	OP		
	Depth:			
	Equipment:			
	Cost per ton:			
	Employees:			
Mine Name:	Ushkatyn-III	Mn		
Geology	Type:			
	Ore Reserve:	27.6 million tons		
	Ore grade:			
Mining	1995 Production:			
	Grade:			
	Method:			
	Depth:			
	Equipment:			
	Cost per ton:			
	Employees:			

Table 2-3-1(2) Recommendations for Improvement of Combine (1)

JSC	Improvement Items	Improvements to be Effected
UK Pb-Zn Combine	Refining ①Establish the base for a smelting-refining complex of copper, lead and zinc ②Promote production of higher grade products (secure future demand)	①Fully utilize the KIVCET Process for lead smelting for cost reduction (energy saving) and environmental improvement. ②Convert the idle zinc electrolysis plant to copper electrolysis plant, for integrated operation involving Irtysh Refinery. ③Ensure sulfuric acid production ; acid plant to be reinforced, including installation of sulfur burning equipment. ①Higher grade copper, lead and zinc to be produced, receive the LME price. ②Higher grade by-products;secure future demand. ③Establish quality control system.
Leninogorsk PC	Mining ①Tishinsky Mine ・Improve haulage equipment for developing lower part ・Cost reduction (10$/t) ・Raise productivity ・Re-estimate low-grade ore reserves in deep portion ②Ridder-Skolnoye ・Define auriferous bonanza ③Shubinsky Mine Ore dressing ①Cost reduction ②Improve operation performance Refining ①Establish basis for zinc refinery to treat its own ore ②Plant exclusively for treating lead batteries (Owns new battery dismantling facilities)	①The skip equipment at No.16 level to be moved and improved; LHDs to be increased(study larger type) for cost reduction, (4.7$/t). ②LHD operation rate to be raised to 50→60% level by maintenance of parts. ①Reduce welfare cost by 1/2. ①Cost reduction (20%); review accounting apportionment of indirect expenses; renew equipment. ②Reinforce countermeasures for spontaneous combustion. ①Install a tailings thickner to raise tailings slurry density during transportation to tailings dam, thereby saving energy. ②Study applicability of heavy-media separation to Tishinsky ore, for reduction of personnel and maintenance. ③Reduce personnel of repair division (by preventive maintenance, nurture of multi-functional operators). ①Improve flotation operation and automatic reagent control system (distributed process control by FA computers). ②Separate treatment of slime (slime flotation). ③Install large flotators (cap. 20~30m³) ①Improve recovery of by-products (gold and silver) by utilization of the Jarosite process. ②Higher grade zinc will be produced, receive the LME prices. ③Ensure sulfuric acid production; acid plant to be reinforced, incl. installation of sulfur burning equipment. ①Actively collect battery scraps, which has to be made a national policy. ②Complete stoppage of sintering machine (advice for improvement).
Shymkent Lead Plant	Refining ①Establish raw materials procurement system (for maintaining operation) ②Promote diversification of products(secure demand)	①A base for imported ore treatment (strategic point of communication to the Central Asia and the Middle East). ②To be made a toll smelter, by the state policy guidance. ③Actively collect lead slag; treat copper smelter flue dust. ①Promote lead battery business; the ongoing plant construction to be continued. ②Promote lead chemicals business; study merger of Irtysh copper refinery. ③Ensure sulfuric acid production; acid plant to be reinforced, incl. installation of sulfur burning equipment.
Zhezkazganstvetmet	Mining ①More efficient operation control ②Raise productivity ③Safety measures, etc. ④Effective utilization of mineral resoures	①Systematization of data and information by computers. ②More efficiency and improved quality of ore reserve calculation by introduction of geostatics method and computers. ③Flexibility in setting cut-off grade. ①Concentrate and simplify stopes. ②Simplify ventilation system; reduce airflow; introduce computers (ventilation simulation). ③Remote-controlled LHDs and hydraulic long-hole drills. ④Use larger open-pit mining equipment (loaders, dump-trucks, drills). ①Study mining methods for mechanical stabilization of worked-out pits; AE (acoustic emission) measurement; introduction of a cave collapse forecast system. ①Implement leaching of copper oxide ore (1.0% Cu, 15 million t)and SX-EW process.

Table 2-3-1(2) Recommendations for Improvement of Combine (2)

JSC	Improvement Items	Improvements to be Effected
Zhezkazganstvetsvet	Ore dressing ①Improve and stabilize operation ②Prevent mine pollution Refining	①Improve flotation operation; introduce automatic control system for reagents. ②Install instrumentation equipment (sensors, flowmeters, pressure gauges, watt meters). ①Increase tailings slurry pumps. ②Improve water recycling circuit by installing tailings thickeners. ①Improve acid plant. ②Study conversion to another furnace other than electric furnace. ③Install new casting machine. ④Improve quality control system. ⑤Construct in-house power generation plant.
Balkhashmed	Mining ①Study cost reduction ②Close/reduce unprofitable mines ③Promote survival measures Ore dressing ①Improve operation performance ②Effective utilization of mineral resources Refining	①Convert from rail transportation to truck transportation. ①Study reduction/closure of Kounrad and Sayak Mines. ①Promote projects of leaching of copper oxide ore (0.25% Cu, 250million t) and SX-EW process. ①Modification of processes. ②Improve water recycling circuit by installing tailings thickener. ①Install equipment for recovering smelter slag (flotation). ①Improve acid plant. ②Fully utilize the Vanukov process instead of reverberatory furnaces. ③Improve quality control system.
Zyryanovsk Lead Combine	Mining Zyryanovsk Mine ①Reduce ground water (24,000t/day), an increasing cost factor. ②Prevent dilution. ③Raise operation rate of machinery Grehovsk Mine ①Review mining method for raising ore grade. ②Study mine closure. Maleevskoye Mine Ore dressing ①Cost reduction. ②Improve operation performance.	①Plan preventive measures of water inflow from old pits; abandon part of galleries. ①Reduce ore mined by sublevel caving method. ①Improve procurement of parts. ①Mining of high-grade ore. ②Improve parts supply system. ③Separate non-production divisions. ④Use larger LHDs; study Western manufacturer's machines (4~6 m^3/bucket). ①Convert mining method mainly to mechanized cut and fill method, to improve pillar recovery. ②Construct filler plant, ventilation shaft, waste water treatment plant and concentrator. ③Solve shortage of parts for mining equipment; improve payment and inventory adjustment. ④Reduce mining recovery to improve dilution. ①Reduce personnel of repair division by preventive maintenance and nurture of multi-functional operation. ②Reduce personnel for site sampling and of assay divisions by promoting automation. ①Improve flotation operation and automatic control system of reagents (distribution process control by FA computers). ②Study influence of water recycling; repeated ore dressing test using recycled water. ③Study ore dressing methods for Maleevskoye ore: Prevent oxidization of crude ore; study particle sizes, reagents, etc; review of flow chart (separate thorough treatment of slime). ④Construction of concentrator at Maleevskoye Mine site.

Table 2-3-1(2) Recommendations for Improvement of Combine (3)

JSC	Improvement Items	Improvements to be Effected
EKCChC	Mining Nicolaevsk Mine • Improve working pit slope Shemonaiha Mine Artemyevskoye Mine • Early development Ore dressing ①Cost reduction ②Improve operation performance ③Others	①Plan open-pit stripping(approx 5 million m³ for 3 years ; 9 million $), improve explosives consumption(2.95$→0.32$). ②Reduce working pit slope(27°). ③Improve maintenance of heavy machinery to raise operation rate from 40%→60%. ④Use larger dump trucks(increase 110 ton trucks). ①Gradually shut down the mine due to exhaustion of ore reserves ; effective utilization of abandoned pits. ①Convert to trackless mining method. ②Complete businees plan ; accelerate fund raising. ①Reduce flotation process operators by introducing automation system into flotation operation(distribution process control by FA computers). ②Reduce personnel by nurture of multi-functional operators. ①Separate treatment of slime(slime flotation). ②Depression of pyrite in flotation process ; improve separation of marmatite and pyrite(study of lime and cleaning) ; improve NaCN addition control. ③Improve Copper-lead separation performance ; review flow chart(Cu-Pb semi-bulk, differential flow) ; applicability of hot water flotation. ①Continue testing for the hard-to-treat Artemyevskoye ore to improve performance. ②Feasibility study on Artemyevskoye ore.
Irtysh PC	Mining ①Irtysh Mine • Improve productivity(increase operating days) • Recover delay in backfilling • Improve underground work conditions • Separation of non-production divisions ②Yubileyno-Snegirihinskoye Mine • Early development(disclosure of business plan) ③Belousovk Mine Ore dressing ①Cost reduction ②Improve operation performance	①Promote mechanization(renewal of old equipment and system). ②Increase capacity of filler plant. ③Complete NW ventilation shaft for access to a bonanza in lower part. ④Rationalize personnel arrangement ; reduce electric power cost and welfare costs. ⑤Spin-off of beer and brick factories. ①Construct surface facilities including concentrator. ②Construct only production-related facilitics at mine site. ③Utilize idle machinery in the country, to minimize investment expenditure. ④Utilize infrastructure facilities at JSC "Irtysh PC"(long-distance commuting). ①Gradually shut down the mine. ①Reduce reagent requirement per ton of concentrate ; reduce types of reagents. ①Raise Zn concentrate grade ; depress Fe(pyrite). ②Stabilize receiving of crude ore.
Zhezkent MCC	Mining ①Prevent dilution, ensure safety Ore dressing ①Improve operation performance, Prevent fluctuation	①Improve filling surface by cut and fill mining method. ②Devise preventive measures for accidents. ①Reduce personnel by preventive maintenance and nurture of multi-functional operators. ②Study influence of water recycling ; improve water recycling circuit; study where to use recycled water; prevent fluctuation in recycled water volume and pressure; differential use of recycled water by quality ; separate treatment of unprocessed water ; use of activated carbon. ③Promote automatization of ore dressing operations(distributed process control by FA computers). ④Separate treatment of slime(slime flotation). ⑤Raise Cu concentrate grade(study Pb removal from Cu concentrate, review concentrate pricing system). ⑥Improve performance of Cu/Zn separation ; study use of zinc sulfate and sulfurous acid.

Table 2-3-1(2) Recommendations for Improvement of Combine (4)

JSC	Improvement Items	Improvements to be effected
Tekeli Pb-Zn Combine	Mining ①Review crude ore transportation and mining system (Government assistance unavailable) ②Exploration of surrounding area.	①In current circumstances, continuance of the entire combine is not possible. ②Separate non-production divisions. ③Discontinue crude ore transportation (the concentrator to be moved). ④Government exploration to be continued.
Achpolymetal	Mining Ansaiy • Continue the enterprise by barite production • Renew equipment; improve operation rate. • Cost reduction by changing mining method. Gulbokiy, Mirgalimsaiy • Operation is difficult to continue. • Improve environmental conservation. • Effective utilization of infrastructure. Achisai • Oxidic zinc ore ($ZnO_2(CO_3)SiO_2$) cost 45$/t	①Renew dump trucks. ②Improve parts supply system. ③All the combine's resources to be concentrated in the mine. ④Increase production to comply with the barite market. ⑤Discontinue mining in deep part of open-pit; change to underground mining. ①Solidify existing waste fill built up underground. ②Separate water supply division and make it an independent business(the provincial Government participation). ③Nurture industries utilizing infrastructure. ④Market research for barite concentrate. • Study production increase of barite concentrate by expanding Achisai Mine. • Study expansion of barite concentrates' market. ⑤Discontinue underground operation of Gulborskiy and Mirgalimsaiy Mines. ⑥Utilize ODA for solidification treatment of filling materials built up underground at Gulborskiy and Mirgalimsaiy Mines. ⑦Discontinue operation of Kentau concentrator ; study utilization of idle machinery (Shalkiya Mine or JSC"Sary-Arakapolymetal"). ⑧Reduce export duty on zinc oxide (petition Government ; sale to the Almalic combine of Uzbekistan seems advantageous). ①Quickly mine out. ②Promote mining of Talap ore deposits.
Sary-Arkapolymetal	Mining ①Discontinue long-distance transportation of crude ore.	①Study construction of concentrator at the mine site (e.g., removal of idle equipment). ②Overall review of feasibility study.
Shalkiya Mine Management	Mining ①Confirm relative high grade zone in ore bodies. ②Electrification; improve transportation and drainage costs.	①Selective mining in the upper, lower and boundary zones. ②Feasibility study for construction of concentrator. ③Ore dressing tests. ④Request Government for assistance (exemption/reduction of infrastructure utilization fees, Ex, electricity, road maintenance, tree planting). ⑤Exploration of surrounding areas. ⑥Receive surplus personnel of the JSC"Achpolymetal". ⑦Seek financial sources for development.

2-3-2 Facility and Equipment

(1) Proposals for maintenance and repair of facility

Current problems

① Facilities and equipment usually have spares. For a two furnace operation, there is a spare, one for repair for a total of four furnaces.

② Facilities and equipment are operated and stopped without special reasons. There is little concern with facility maintenance and safety of the operation.

The maintenance and repair cost of the gas system is high.

At the Shymkent lead refinery, the repair goods cost accounts for 10.3 percent of the processing cost and maintenance cost is 18.5 percent for a total of 28.8 percent. This is an extraordinary large percentage.

③ Although we could not conduct a complete investigation, we found that the maintenance is carried out only when failures or malfunctions occur. They do not give much think about preventive maintenance and no training is given.

④ Spare parts are poorly managed and parts are always in short supply.

Proposals

1. Reform policy on spare facilities and equipment.
2. Countermeasures for sulfuric acid plant depend on operation and stoppage at the smelter. Installation of sulfur conversion equipment.
3. Introduce preventive maintenance for each combine. For example, establish committee for improvement in the maintenance and repair work..

2-3-3 Process and Quality Control

(1) General

Each combine has standards about the quality control for example, process diagram, process management chart, product standard but actually they have not considered the quality control because they concentrate on only production.

Kazakhstan was introduced to the market economy system in a short period. They have sense to produce high quality goods but do not have the sense of efficiency, distribution and delivery. There is a need for a countermeasure for the number of defective goods.

It is questionable that the process control standard is kept and measures against abnormal condition are implemented. They are not conscious of the Deming cycle (Plan (P), Implementation (D), Check (C), Review (A)), that is the basis of quality control and quality assurance. It seems they lack the check and action functions.

They have strong awareness for product-out, that is, to sell the products what they manufactured but they have little intention for quality the market demands (market-in). They have not investigated what the market requires.

While the quality is fair from the statistical point of view, but the quality of management, work and service are poor.

Current problems and measures

① Measures to fill the difference between the government plan and the site plan are delayed. (quality of control)

* Make a system for planning and reviewing, coordinating and decision making.

② The measures are delayed for the difference between plan and implementation. (quality of control)

* Make a system for planning and reviewing, coordinating and decision making.
* Establish the organization of responsibility for division of work and each level.

③ Quality of control and assurance are at low level. (Quality of product, control, work and service)

* Training and practice of statistical point of view and the concept for statistics.
* Be more cost conscious (metal-balance, recovery rate and main unit consumption)
* Improve the quality of control, work and service.
* Establishing a system for handling claims.
* Enhancing the concept for organization as measure for operation management.
* Introduce and promote the concept for TQC (by the government, combine and each division)

Shymkent lead and Leninogorsk zinc meet LME standards but other combine products need a higher level of purity.

Demands for zinc are used mostly in the field of corrosion prevention. The Leninogorsk plant is making and selling many kinds of alloys on a trial basis. In the corrosion prevention field, foreign countries already demand high purity so it is necessary to improve its purity. Recently, the demands for zinc used as the material for batteries are rapidly increasing. Here the even higher purity is required.

Recently, cadmium demand is also mostly for the material of batteries. Although we do not yet know the trends of demand for cadmium in Kazakhstan, a higher purity may be required if they set a target for manufacturing cadmium for the material of batteries.

The Kazakhstan plant has fostered superb technology of Kivcet for lead refinery and Vanykov for copper refinery. But unfortunately, these new technologies are not contributing to the lead and copper refineries due to many reasons. The government support and cooperation is urgently required to completely establish these new technologies and contribute to the refinery operations in the world.

An examination and improvement are needed for the following process control as below:

① Examine oxygen enrichment to roasting furnace (to reduce power consumption)

② Continuous operation of the roasting furnace and sulfuric acid plant by annexing a sulfur combustion system.

③ Improving technique for treating coarse particles produced from the leaching process.

④ Re-exam the leached slag treatment process (increasing recovery rate of zinc and recovering the whole amount of gold and silver contained)

⑤ Improving the control technique for the cleaning process (target for higher purification)

(2) Quality of Product

Quality of copper, lead, zinc ingots produced at the smelters is less than Japanese products. When the survey team visited the smelting plant, they refused to give a sample so we could not analyze the sample in Japan. A comparison of the ingot quality for Japan and Kazakhstan is below.

	(%)										(ppm)
Copper Ingot	Cu	Se	Te	Bi	Sb	As	Pb	S	Ni	Fe	Ag
Kazakhstan	99.99	≦0.5	≦0.5	≦0.2	≦1.5	1.0	1.0	12	0.3	3.7	13
Japan	99.99	≦0.4	≦0.1	≦0.1	≦0.1	0.2	0.4	7	0.3	0.3	10

	(%)								(ppm)
Lead Ingot	Pb	Ag	Cu	As	Sb	Sn	Zn	Bi	Fe
Kazakhstan	99.985	10	10	5	10	5	10	60	10
Japan	99.995	1	1	1	1	1	1	5	1

	(%)	(ppm)			
Zinc Ingot	Zn	Pb	Fe	Cd	Cu
Kazakhstan	99.985	80	28	27	7
Japan	99.998	13	2	2	1

○ The use of copper ingot is for wire. In the case of processing to wire, bismuth and sulphur have negative influences in the processing and selenium, tellurium, bismuth, antimony and arsenic have negative influences on the electro-conductivity. The Kazakhstan products have high impurities so it is needs more refining.

○ The lead refining method is different between Japan and Kazakhstan. Kazakhstan adopts a pyrometallurgical refining method while Japan uses an electro-refining method so there is a difference in the limit of impurities. The lead ingot is mainly used in batteries. The performance of the battery has increased compared to the past along with the required quality of the lead ingot as the raw material becomes purer. The trend of high purity has spread all over the world. There is a fear that Kazakhstan's lead ingot is unsuitable for the raw material for the battery from a quality viewpoint.

○ The main usage of the zinc ingot is for rust protection. There are many kinds of zinc ingots for rust protection material. There are some areas which can be satisfied with the Kazakhstan metal ingot but the high level area of rust protection is advancing and the quality of Kazakhstan's ingot is insufficient.

(3) Process control

○ Quality distribution

For example quality of product is different between analysis done by Kazakhstan and Japan. At the site, we found the distribution in the analysis record at the factory. Below examination of quality control method is necessary to narrow the quality distribution.

	(%)							(ppm)
Lead Ingot	Pb	Ag	Cu	As	Sb	Zn	Bi	Fe
Kazakhstan	99.99	12	≦1.0	≦1.0	≦1.0	17	57	3
Japan Analysis	99.96	11	8	5	4	32	115	200*

	(%)				(ppm)
Zinc Ingot	Zn	Pb	Fe	Cd	Cu
Kazakhstan	99.985	80	28	27	7
Japan Analysis	98.8	106	11900*	10	96

* Note: It is thought that when making the sample there was contamination of iron

○ Operation manual

The operation manual was made but it is not clear whether the manual was reviewed.

○ Quality assurance

There is a trend to require an assurance on the quality of the metal ingot because of product quality standards and cost reduction. For this purpose, the international organization ISO was established. The purpose of Kazakhstan non-ferrous industry is the export of ingots so it is necessary to quickly establish a system for the assurance of quality. It is necessary to adopt the quality control philosophy.

2-3-4 Environmental Control and Operation Safety

(1) Problems that were pointed out

① Environment of Work Site and Inside the Building

The environment of work site has been improved considerably since the last survey and especially in the past several years. This improvement is due to the efforts of the company. On the other hand, the reduction and slowdown of the production operation are related to this improvement.

The problems the following are as follows.

(1) Generation of dust resulting from the handling of ore and powder.

(2) Leakage of dust and exhaust gas from the combustion unit, heating furnace and reactor.

(3) Generation of volatile gas and mist.

(4) Poor control and treatment for preventing diffusion of exhaust gas.

(5) Poor control and treatment of waste water.

(6) Poor control of powder, solid and liquid waste.

For the solution to the above problems, great effort for improvement was taken both spontaneously and responding to the suggestions of the supervising officials. For instance, the installation of dust collectors for the exhaust gas, mixing lime in the waste water, etc. have been executed using limited funds. However, some of the existing production facilities are outdated and thus lacking in design consideration for the environment, and the improvement of such old production facilities is difficult in many cases.

② Environmental Condition Inside the Premises of Production Facilities

Extremely frequent movement of the materials in and out of storage amount of the production facilities premise was necessary for reasons such as securing necessary amounts of ores, concentrates, recycling resources, stocks of raw materials and intermediate products, etc. Fluctuation of the quality and quantity is very large. In the area, large volume of metal and material is stocked sometimes for very long periods and the material is exposed to rain. At the mining site, there is no problem excluding the high grade of ore but the concentrator and smelter, the intermediate product, product waste, slag, waste water, etc., must be under control. Depending on the soil pollution, the contamination of the above mentioned materials is carried to the underground water which has generated serious contamination. This is a fact that contamination occurs and is very difficult to rehabilitate. If there is any rivers, lakes, swamps near this area, it is necessary to make a measure for the prevention of contaminates carried in the surface water. The waste and or slag, etc., is mixed with cement and transported underground for backfilling material. The method is very effective.

The waste water is finally introduced into a settling pond, but the quality of the water in the settling pond always should be analyzed, monitored and controlled regardless of whether it is to be recycled or discharged. For example, the zinc concentration is measured for the analysis of water quality. However, the sampling and

analyses are made manually in most of the cases. There is no equipment for environmental analysis for each environmental control element nor equipment for the continuous monitoring and recording for environmental control in a short period. There is either no or poor management system and equipment.

In some cases of the temporary settling pond on the work site premise, the management of the sedimentation treatment system is considered to be improper. Management of the operations are expected to be rather difficult especially in the winter because production must be disposed by rail.

③ Surrounding Environment of Work Site

When the flue gas is poorly treated or builds up easily due to the terrain or weather, the air pollution will become a problem to the neighboring areas. In many instances, the residential area is situated near the work site. In general, it is necessary for the implementation be based on the area characteristics by combining the management of discharge standards and environment control depending on the environmental quality standards.

Large-scale tailing dams, settling ponds, water circulation facilities, etc. are located a small distance apart from the work site so it is necessary to operate a pumping facilities and lay a pipeline. These facilities are controlled so that the discharge level during the summertime can be differentiated from that during the wintertime.

All tailing dams are approaching their allowable capacity limits so there is a need to increase their storage capacities by construction or establish a plan, but it is difficult to start due to financial difficulty.

The engineering and other matters were implemented by central agency planning, but it is important that every combine and region have this type of technological potential for the implementation of improvement and modification at the site and plan changes according to the site conditions, land and structure.

Power facilities, waste water treatment and waste disposal facilities, etc. are located in the vicinity of the work site. In many instances, the work site and residential area are managed interdependently. The environmental management of the residential area and work site is not clearly classified. The positives and negatives of this system were not be mentioned. The combine must have a cooperative relationship for its activity concerning the transportation distance of its work site related materials and mineral production. The main methods of transportation are rail and roads. It is expected the readjustment of the non-ferrous metal industry raw material distribution system will strengthen management and increase activity.

Rail and road maintenance are indispensable. The recent road conditions are expected to be inappropriate for heavy vehicles that are frequently operated.

④ Environmental Problems Relating Residential and Urban Areas

The environmental problems in this area are supposed to be covered under the general environmental control system. However, the nonferrous metal industry work site and residential areas are characterized by a close relationship both socially and geographically which must be considered. The environmental administration is supervised by the Ministry of Environment, the measures for the nonferrous metal industry in the environmental countermeasures are supervised by the Ministry of International Trade and Industry and the environmental control

is administered by the state government but it was not mentioned if there is an understanding of management cooperation for the situation.

The environment management depends on the general national environmental control standards and the state government managed non-ferrous metal industry is supported by a unique industrial town environmental permit. Furthermore, the combine management of the environment within the work site does not have a unified management system. This situation is considered to be an unstable factor for a part of the combine that is privatized to become firmly established.

(2) Measures for Improvement

In the management of the nonferrous metal industry on the above mentioned environmental issues, four points will be given.

(1) Problems of work environment and worker's health and safety.

(2) Problems related to the understanding and monitoring the diffusion of pollution from the work site.

(3) Problems related to the treatment of pollution accumulated from the past, reclamation of soil and conservation of the water resource.

(4) Problems related to the establishment of environmental management system and implementation organization.

A great national effort must be given to struggle to find solutions to these problems. The non-ferrous metal industry's main companies, combines together with each local public body, state government, Ministry of Industry and Trade, Ministry of Environment, central government local agencies need to become unified for the solutions to the problems. Naturally, it should be guided by central government's financial aid and important administration steps.

① Problems of Work Environment and Worker Health and Safety

There are regulations for the management for health and safety of worker and conservation of the work site environment . Administration control system exists but there is only nominal base control and guidance with no consideration given to original or superannuated equipment.

There is a need for the reduction and re-arrangement of facilities, improvement in enforcement in this phase, internal enterprise supervision and administration control system.

② Understanding and Monitoring Diffusion of Pollution from Production Facilities

Environmental standards were transferred from the former USSR and became the national standard values for environmental management. The foundation of operation management for standards corresponding for exhaust gas, waste water, subsurface water or toxic substances has spread to each state but there are doubts that the management is being practiced

One factor that there is no comprehensive management is a total system has not been established for

measurement, analysis equipment, staff, measuring method, etc. At the work site, there is usually measuring equipment or analysis devices having highly accurate measurement or quick analysis but management of production and product quality are the main goals so there is a feeling that environmental management and control facilities are not directly related to profit.

Furthermore, the measurements and analyses of the administration side is fixed for normal work and implemented periodically and it is rare to implement it periodically. Depending on the annual investigation, the administration report is based on this survey. For example, the contamination concentration is many times the allowable concentration so it seems the administration is not implemented with suitable guidance.

The environmental management within this limited area, the administration and enterprises take the present situation for operation and continuous monitoring and periodical survey are needed. Depending on the results, it is possible to clear the cause of the pollution by understanding of the administration and enterprises. It is possible to propose countermeasures for the improvement cooperatively.

③ Treatment of Pollution Accumulated from the Past, Reclamation of Soil and Conservation of Water Resource

The contamination of resource in the non-ferrous metal industry area is the result of the accumulation of contaminates from the past several decades. From now, the volume is very large for quick treatment and reclamation. Also, it is very difficult to decide the treatment method because the quality of the contaminates is not clear. The treatment cost is certain to be large. This financing is burdened by not only the enterprises and state government but also the Kazakhstan government. In the case of the radioactive contamination burden, this fact has been pointed out in the past. In the non-ferrous metal industry area, accumulated contamination pollution is also large.

For this issue, the contamination will be solved by a governmental long-term plan. Potable water resource and the water drainage system to ponds and lakes are very urgent problems. In the case of heavy metals, contaminate is diffused to the underground water. After several decades, this influence has been confirmed. It is thought there is a fear that the influence has appeared.

One of the pollution resource is the tailings dam. It is caused by the long-term usage of the tailings dam at capacity. The filling material in the dam has some useful substances like gold and other non-ferrous metals. In this case, a recovery plan is made. The recovery and treatment of filling material has the following three merits.

1. Removes pollution resource
2. Recovery of valuable metals
3. Regenerates tailings dam capacity

Therefore, the recovery and treatment work are a positive advancement. The recovery of valuable metals is judged by economics so the beginning of the work has been suspended. An additional two reasons are to evaluate it economically and it must be evaluated.

④ Establishment of Environmental Management System and Implementation Organization

The international trend for the environment now is progressing to evaluate the standardization of the enterprise environmental management system by the ISO. The ISO 4001 standard system is already established. Another philosophy of environmental management is not under the enterprise but is independent so this system is independent and is necessary to make an independent management concept. It seems very advantageous for Kazakhstan non-ferrous metal industry to be recognized in international trading and receive registration of international standards. It is necessary to establish the implementation organization of environmental management by state and private enterprises. This organization is located near the industry area and organization have measuring equipment and analysis for environmental management, staff, analyze the results of monitoring and site survey and change and disclose this information. The above mentioned organization is most suitable but management of this organization and location of the structure are decided by government policy.

2-3-5 Production of Sulfuric Acid and Gypsum

(1) Exhaust gas treatment and sulfuric acid at each smelting plant.

Sulfur dioxide gas (SO_2) treatment method at each smelting plant is below but we do not have detailed information on some equipment in our survey.

Copper Smelter				
Zhezkazgan	Drying furnace → → →	Stack		
	Electric furnace → → ↓			
	→	Sulfuric acid plant →	Stack	SO_2 0.1%
	Converting furnace → ↑			
	Refining furnace → → →	Stack		
Balkhash	Drying furnace →			
	Reverberatory furnace → → →	Stack		
	VANYKOV → → ↓			
	→	Sulfuric acid plant x 3 →	Stack	SO_2 0.1-0.7%
	Converting furnace → → ↑			
	Refining furnace			
Irtysh	Drying furnace → → →	Stack		
	Sintering furnace → → →	Stack		SO_2 15-19%
	Blast furnace → → →	Stack		SO_2 10-11%
	KIVCET → → ↓			
	→	Sulfuric acid plant x 1 →	Stack	SO_2 0.X%
	Converting furnace → → ↑			
Lead Smelter				
Shymkent	Sintering furnace → → →	Sulfuric acid plant x 3 →	Stack	SO_2 0.3%
	↓ → →	Stack		SO_2 0.8%
	Blast furnace → → →	Stack		SO_2 0.03%
	Fuming furnace → → →	Stack		SO_2 tr.
Lead/Zinc Smelter				
Leninogorsk	Lead sintering → → →	Stack		SO_2 0.9-1.0%
	Lead smelting → → →	Stack		SO_2
	Zinc roasting → → →	Sulfuric acid plant x 3 →	Stack	SO_2 0.3%
	→ → →	Stack (start time)		SO_2 6.0%
	Waelz → → →	Stack		SO_2 tr.

Ust-Kamenogorsk	Lead sintering	→ → →	Sulfuric acid plant x 2	→	Stack	SO_2
		↓ → →			Stack	
	Blast furnace	→ → →	Stack			SO_2
	KIVCET	→ → →	Sulfuric acid plant	→	Stack	SO_2
	Zinc roasting	→ → →	Sulfuric acid plant x 2	→	Stack	SO_2 0.3%
	Converting furnace					

; → flow of SO_2, x 2 ; Numbers of Sulfuric acid plants

The production of sulfuric acid and the production ratio from January to September 1996 are below.

	Main Product	Amount (t)	Sulfuric Acid Amount (t)	Sulfuric Acid Production Ratio*
Zhezkazgan	Copper	138,658	96,929	0.699
Balkhash	Copper	66,062	32,698	0.495
Shymkent	Lead	3,684	281	0.076
Leninogorsk	Zinc	61,611	90,668	1.471
Ust-Kamenogorsk	Lead	41,211		
	Zinc	61,849	127,591	

*Sulfuric acid production ratio= the sulfuric acid production/main products.

In Japan, sulfuric acid ratio is copper:2.7, lead:0.7, zinc:2.0 if the standard sulfide concentrate is used. Compared to these figures from Kazakstan smelting plants, it is assumed that a large quantity of SO_2 is exhausted into the atmosphere.

(2) Sulfuric acid plant

The sulfuric acid plant treats corrosive high temperature SO_2 gas. Therefore, the maintenance of the equipment is very difficult. The continuous operation is basic. When the case is the plant stops, the temperature of the SO_2 gas drops and becomes sulfuric acid. Therefore, the plant is corroded and there a need to make the below mentioned countermeasure during the stoppages.

① Countermeasure for the corrosion prevention of the plant.

② To maintain the operation by the aid of the combustion of sulfur.

On the 3rd survey, the sulfuric acid plant had a great amount of damage compared to other plants. The Kazakhstan side made a renewal plan for the sulfuric acid plant, started construction but the construction schedule has been delayed. This problem is serious.

In the case of the rearrangement of the smelting plant, we strongly recommend both the strengthening of the sulfuric acid plant and the construction of the sulfur combustion plant be given the highest priority.

Depending on the construction of the sulfur combustion device, it will be able to maintain the sulfuric acid production for reducing the operation of the smelting plant and making it possible to fulfill its responsibility of supplying the consumer.

(3) Treatment of the low concentration of the SO_2 gas.

Generally the SO_2 concentration for the sulfuric acid production must be over 4%. In this case of low concentration , some countermeasures are necessary. As the above mentioned (1), the dry exhaust gas from the dry furnace and refining furnace and poor gas from sintering furnace have a low SO_2 concentration so the under mentioned countermeasures are necessary.

① Mixing of high concentration gas

For example, poor gas from the sintering furnace is introduced to the zinc fluid bed roaster.

② Recirculation of gas

For example, poor the gas from the sintering furnace is recycled in the furnace and increases the concentration of the gas. If there is less concentration, for example, exhaust gas from the smelting plant from a single gas contact plant (in Kazakhstan all the plants are single contact) and other low concentration gases are treated by de-sulfurization method as below. The gypsum method has the advantage depending of the product being utilizing.

① Gypsum Method

1) Lime gypsum method

$Ca(OH)_2 + SO_2 = CaSO_3\ 1/2H_2O + 1/2H_2O$

$CaSO_3\ 1/2H_2O + 1/2O_2 + 3/2H_2O = CaSO_4 2H_2O$

2) Basic aluminum sulfate method

$Al_2(SO_4)_3Al_2O_3 + 3SO_2 = Al_2(SO_4)_3Al_2(SO_3)_3$

$Al_2(SO_4)_3Al_2(SO_3)_3 + 3/2O_2 = 2Al_2(SO_4)_3$

$2Al_2(SO_4)_3 + 3CaSO_3 + 6H_2O = 2Al_2(SO_4)_3Al_2O_3 + 3CaSO_4 2H_2O + CO_2$

② Zinc sulfate method

$ZnO + SO_2 + 5/2H_2O = ZnSO_3 5/2H_2O$

$ZnSO_3 5/2H_2O + 1/2O_2 + 9/2H_2O = ZnSO_4 7H_2O$

There were no actual results in Japanese smelting plants but the Topsoe Company of Denmark developed the WSA process for sulfuric acid production from low concentrations of SO_2 gas. It has been adopted in many places in the world. On the 3rd survey at the JSC "UK Pb-Zn Combine", we could not confirm that a sulfuric acid plant was using a heat exchanger with a converting device developed by the former USSR. This plant is profitable from the viewpoint of construction and operation costs. By using these methods, it is expected to treat the exhaust gas completely.

(4) Storage of sulfuric acid and gypsum

Sulfuric acid is not stored at another facility excluding tanks because of its characteristics so during the operation the transfer of sulfuric acid is necessary. Based on our survey, it is very rare case that the operation at the smelting plant is limited by the transfer of sulfuric acid. It can not be assumed that the quantity of sulfuric acid

produced and the demand will always meet. In Japan, it often happens there is an unbalance of both the demand of metal and sulfuric acid. The sulfuric acid is overproduced. For this case in order to continue the smelting operation and maintain the sulfuric acid production , it is desirable for the sulfuric acid to be continuously produced. It is hopeful to make the production system of gypsum from SO_2 gas.

① Produced from SO_2 gas directly

This method is adopted for the treatment for low concentrated SO_2 gas. There is a case where high concentration of SO_2 gas is used.

② Produced from H_2SO_4

This method is used from the oversupply of sulfuric acid or low grade quality sulfuric acid. In Japan, the gypsum is used for raw material gypsum board and additional material for cement. It is expected to use gypsum effectively in Kazakhstan.

(5) The problem in the sulfuric acid consumption area

The survey team received the below comment during the survey of Dzhanbyl SuperPhosphate Plant, JSC Gypsum Combine.

① Sulfuric acid from the smelting plant (Dzhanbyl Superphosphate Plant)

The sulfuric acid supply is unstable.

In this plant, the sulfuric acid was produced by pyrite roasting by themselves but they changed based on the guidance from the government so they buy sulfuric acid from the smelting plant. However, the supply volume and delivery are unstable so they can not make a production plan. In viewpoint of development of the industry, it is necessary for government policy guidance for coordination of the smelter and chemical combines.

② Chemical Gypsum (JSC Gypsum Combine)

The quality is poor and the price is high compared with natural gypsum. The problem of quality is solved technically while the price consists mainly of transportation fare so this should be resolved by the government.

The above mentioned customers' opinion is necessary to be examined for the stable operation of the smelting and chemical fertilizer industry.

(6) Treatment of exhaust gas in the working environment

We found the place should be improved in the future from the viewpoint of the working environment. This factor mainly depends on the low concentration of SO_2 gas. These gases are collected by the partial exhaust system and needs de-sulfurization treatment. Lime is used as a neutralizing agent because it is cheap. If the lime is overcharged, the excess lime will be used as the neutralizing agent for the waste water.

2-3-6 Energy Conservation

Kazakhstan has many energy resources that are unevenly distributed so power, refined petroleum products and energy are imported.

Since the non-ferrous metal industry is a high energy type of industry, the energy conservation for cost reduction is a most important point. For example, despite the fact that its GDP is not so large, the power consumption per capita is the same as Germany. From a productivity standpoint, it shows the efficiency of energy power use is poor.

The adopted energy conservation has the following two important points.

- Establish a policy for the promotion of the energy conservation.
- Promote energy conservation in each field.

(1) Energy Conservation of Smelting Plant

The smelting plant of copper, lead and zinc consumes much energy. The necessary energy of each smelter for each metal are below; Zinc smelters consume the most energy.

copper	5.39×10^6 kcal/t
lead	3.95×10^6 kcal/t
zinc	12.47×10^6 kcal/t

Therefore the ratio of the energy cost to the total cost is high. The energy conservation is contributing to the cost reduction. In Japan, there is the experience of the energy crisis and the rapid increase of its cost. Each factory implemented process change and several types of improvement. For example, energy conservation by reducing the excess lighting and new investment for energy conservation. These implementations contributed to the reduction of energy consumption. However, these countermeasures were done for the purpose of succeeding in the energy supply crisis and the sharp in increase of energy costs therefore it is not clear these countermeasures will be effective under the present situation of Kazakhstan.

In this project, it is an important objective to understand the economic situation of the smelting plants. However, at the site survey, there is a difference at corresponding plants and/ or personnel especially concerning the matter of cost and production which is basically confidential. The survey work was very difficult as the team received some information on energy cost but no information on unit consumption. Based on the examination of the production site and information from conversations with the staff people, the survey team estimated the energy costs. The unit consumption of the coke for the lead blast furnace and unit consumption electricity for zinc electrolysis are the main factors in the operation costs in the lead/zinc smelting plant. The coke unit consumption is 400 kg/ton and the electricity consumption of 3,200 kWh/ton. These values are at normal levels. No information was received about copper smelting. Energy costs in Kazakhstan are below. These costs are very cheap but now it is increasing rapidly.

		1993	1995	Japan
Electricity (tenge/kWh)	Shymkent	128.8	2.004	8-15 yen/kWh
	Leninogorsk	-	0.900	
Coke (tenge/t)	Shymkent	220	7,000	15,000
	Leninogorsk	--	4,584	~20,000 yen/t
Coal (tenge/t)	Shymkent		924	7-8,000 yen/t

The under mentioned describe the countermeasures for the energy conservation that was implemented in Japan.

1) Process Change

Copper, lead, and zinc ore exist in the form of sulfide ore so the basic philosophy is to use the sulfur in the ore for the energy resource in the smelting process. Considering this basic policy, the direct smelting method was developed in the world. Vanykov and Kivcet are the same as this philosophy. The Western countries flash, MCS, QSL process are the same. The copper smelting method in Japan were changed to flash and MCS process except one smelting plant adopted the reverberatory furnace. In Kazakhstan, it is also hoped the use of Vanykov and/or Kivcet process developed in Kazakhstan will be in full operation for the Vanykov furnace at JSC "Balkhashmed" and Kivcet at the JSC "UK Pb-Zn Combine" and JSC "Irtysh PC".

2) Reduce the Amount of Energy	Several kinds of improvement. Reduce the humidity of the combustion air.	Reduce coke consumption,
3) Reduce the energy unit cost	Change the fuel for copper reverberatory furnace.	From heavy oil to carbonaceous materials, used tires, etc.
	Change fuel of flashing furnace	Heavy oil to carbonaceous materials
	Change the reduction material for copper refining furnace.	Wood to Ammonium.
		Propane gas to heavy oil.
	Utilize the bacteria oxidation	Air power (electric power) to bacteria utilization
	Utilize electric power at night	Night cost is cheap
4) Exhaust sensible heat utilization	Enrichment of oxygen to combustion air	Reduce exhaust gas volume

5)	Utilize exhaust sensible heat	Power generation by sensible heat from smelting furnace
		Power generation by molten metal cooling.
		Power generation by sensible heat generated by calcine ore.
		Power generation by sensible heat of cooling of furnace body
		Power generation for sensible heat generation from slag cooling.
6)	Utilize exhaust latent heat	Power generation by CO gas including blast furnace exhaust gas.
7)	Electricity process	① Increase the acidity of electrolysis solution.
		② Countermeasure for the reduction of electrolyte resistance
		③ Raise solution temperature
		④ Shorten the distance of the poles
		⑤ Reduce anode scale
		⑥ Reduce Mg in electrolysis solution
		Reduce the electrolysis power by the above mentioned measures
8)	Facility for energy conservation	Variable Voltage Variable Frequency
		Heat pump
9)	Improvement	Heat insulation
		Cut the waste energy

To implement the energy conservation, it is necessary for a large investment excluding the lighting reduction, the stoppage of the exhaust fan and the reduction of the pressure adjustment for the compressor. Therefore, it is not useful if there is no return on the investment. In the case of Kazakhstan, the cost of goods is cheaper than Japan so it is questionable that the example of Japan is effective.

(2) Energy conservation in the non-ferrous metal industry and related private organizations.

① Minimize the energy unit consumption through higher energy efficient equipment and product process and system improvement. Examples are as follows;

- Suitable ventilation amount for underground mining (depending on calculation by means of computers etc.). Clean burning engines on underground transportation equipment to improve the emission source of harmful gases. Modification of the standards depending on the law.

② Improvement of the energy recycling systems

- Smelting process at the smelter has an atmosphere of high temperature and thermal energy, but the heating of the plant and other private use heating also has a low temperature system. Make an energy system that is a power efficient combination of heat transfer from high temperature to low temperature without any waste.

③ General waste incinerator for private use.

(3) Energy conservation in the transportation field

Transportation by trucks requires five times as much as energy than railroad. The enforcement of rational distribution for the transportation of raw materials and products.

① The improvement of transportation efficiency

Excluding the high value crude ore, the transportation of crude ore is stopped from an economic viewpoint because it is better to construct the concentrator near the mine. The transfer of secondary products are distributed in a suitable area and the transportation energy should be minimized.

② Arrangement of distribution centers

Installation and management of distribution facilities are implemented by the collaboration of each combine. The train containers, loading/unloading equipment facilities and stockyards, etc. are used mutually by each combine to minimize the transportation of empty containers.

(4) Welfare and public energy conservation countermeasure

① Implementation of countermeasure for welfare and public energy conservation.

- To make the countermeasure for energy conservation using the rule of the people who receive the benefit will make the payment. The cost of electricity, gas and heat will be paid by each person and depends on the quantity of consumption. If this rule is not enforced, there is no incentive for energy conservation. Energy conservation is done by improving the lifestyle of each person through government policy and public relations announcements.

(5) Support for energy conservation

It is necessary to support energy conservation through policy and regulation.

① Financial support and tax system used to support investment for the introduction of energy conservation facilities.

- Reduction and/or exemption of the import tax for energy conservation facilities in the nonferrous metal industry.
- company receives incentive if it implements energy conservation so the company can obtain a low interest loan for the improvement of the process.
- Low interest rate financing or guaranty for the introduction of system for energy conservation for energy recycling.

② Support for special electric rates to large electric consumers including aluminum industry. Adoption of special electric rate system for big electric consumers for night time use to increase the night time use to the average consumption rate.

If high efficiency user, introduce a discount system for incentive to conserve energy.

(6) Promotion of new technology for energy conservation

To develop energy conservation technology

The institutes, universities and industry should cooperate and promote this development. Tax from petroleum and other energy will be used as the financial resources for this special budget.

(7) Request for international support

The advanced countries of energy conservation developed energy conservation technology during the oil crisis. Technical cooperation from these countries would surely accelerate energy conservation in Kazakhstan.

- To receive energy conservation survey team ··· for the investigation, analysis and proposal for improvement or implementation.
- Receive experts ··· for technical discussions and technology transfer
- Dispatching trainees ··· to foreign countries acquire techniques for energy conservation in advanced countries.
- Development of model business for technology transfer.

The above mentioned items are for the active treatment on global environmental issues so these items are easy for mutually cooperation all over the world.

The survey team was asked by the Kazakhstan MIT regarding its own power plant so this is the reason for the questionnaire as below.

(8) Power generation plant of the smelting plant

① In Kazakhstan, the supply of power is not stable for it causes problems at the production plant. When the power stops, it causes many problems.

On the first survey in 1995, the smelting plant could not receive any power because of the non-payment of power charges.

In 1996, the third survey due to the sudden stoppage of power at the smelting plant had troubles. In the case of the non-payment of cost even if smelting plant has its own power generation plant, these problems would be still unsolved. The construction of its own power generation plant is a reasonable solution for the operation troubles caused by the sudden stoppage. A large amount of capital is needed for the construction of the power generation plant. An investigation is necessary on the situation for the reason for the sudden stoppage because of the imbalance of the capacity and the demand of the power supply company.

② JSC "Dhezkazgantsvetmet" has a power plant construction plan for a 250 MBtu capacity (construction cost estimate is $500 million).

③ It seems that all the smelting plants and steel plants in Japan that the Kazakhstan counterparts visited had their own power generation plants. It must be profitable for them to have their own power plants.

1) The present situation of the ownership of power generation plants in Japan.

① Hydroelectric and geothermal. There are three smelters located in the mountains that have their own power plants. These power plants were built many years ago so these smelters have made much profit.

② Power plants using exhaust energy.

In the copper smelting plants, the exhaust gas from the smelting furnace and converting furnace are used for the boiler and generates the steam. Power plant uses this steam.

	Capacity (blister copper tpm)	Capacity Generator
A	7,365	3,400 kW x 1
B	19,481	7,500 kW x 2
C	18,319	6,000 kW x 1
		7,700 kW x 2
D	17,932	8,500 kW x 1
E	18,290	8,700 kW x 2
F	23,939	12,000 kW x 1
		5,400 kW x 1

Operation cost is 3-4 yen per kWh, depreciation not included.

x 1 ; Numbers of generators

Zinc Smelting Plant (hydrometallurgical process)

The exhaust from the roasting furnace is introduced to the boiler and generates steam but there is a difference in the case of the copper smelting. There is a little power plant using these steam with examples shown below.

	Roasting Capacity (amount of concentrate t/m)	Capacity Generator	
A	13,500	8,600 kW x 1	Shutdown 4/1996
B	20,100	2,300 kW x 1	
C	18,800	4,200 kW x 1	Shutdown4/1996

Zinc Smelting Plant (pyrometallurgical process)

Utilize the combustion energy of CO gas in the exhaust gas and sensible heat of the molten metal.

	Smelting Capacity (zinc production amount t/m)	Capacity Generator	
A	9,000	7,150 kW X 1	
B	9,600	19,900 kW X 1	Shutdown 6/1986

In the case of lead melting plant, there is no power plant that utilizes exhaust energy.

2) The construction of new power plant

A large amount of capital is needed to construct its own power plant. In this case, the following matters should be examined for the construction of a new power plant.

① There is much steam generated by the cooling of the exhaust energy	copper smelting, zinc smelter (hydrometallurgical process)
② There are many energy components like CO on the exhaust gas	zinc smelting

pyrometallurgical
process plant
steel plant

③ In case of electric power cost is very expensive — daytime power in Japan

④ In the case of effective utilization of steam generated

⑤ No stability of power supply — *Kazakhstan

* It is believed that this case applies in Kazakhstan

⑥ Long distance between smelter and power plant

In case of ③ in Japan, the large power consumption industries (aluminum, ferroalloy and zinc) is examined for the construction of power plants. In these industries the ferroalloy industries have operating power plants. In the case of the aluminum industry, all plants have their own power generation plants but they are not internationally competitive so all these plants are closed except a hydroelectric plant. In the case of zinc plants, there are construction plans at some smelters but they were not implemented.

The construction costs are estimated based on past results in Japan.

In the case of ①, (utilize the exhaust heat) 300,000-400,000 yen per kWh

In the case of ②, (coal combustion) 400,000-500,000 yen per kWh

The cost includes the investment and operation costs so for the case of ① is 5-6 yen per kWh. In the case of③, the cost of generating power is 14-15 yen/kWh assuming the price of coal is 7,000 yen per ton, the selling price of generator steam is 2,300 yen/ton. In Kazakhstan assuming the same conditions as Japan such as the price of coal (1,000 tenge/ton) and steam (6,000 tenge/ton) are the same (it is very difficult to estimate the price as steam due to the infrastructure conditions), the cost of generating power is the same as Japan. This power cost difference greatly depends on the construction cost and the utilization method of the vapor.

3) Economics of ownership of power generation plant

In the case of the above mentioned matters, it is not economical in Kazakhstan. However, this is only one case so the implementation of the power generation plant is examined considering the under mentioned items.

① Capacity

② Kind of fuel

③ Utilization method and evaluation of steam

Especially in the case of Kazakhstan, there is a high demand for steam in the cold areas. Depending on the evaluation of the steam that is utilized, the economics will have variable grades.

2-3-7 Kivcet and Vanykov Technology

Kazakhstan MIT requested the survey team to evaluate the Kivcet and Vanykov technology. The survey team expected to operate these processes effectively in Kazakhstan and evaluate these processes comparing with existing processes from the competitive viewpoint. However, at the smelting plant in Kazakhstan, the survey team did not obtain the data for the economic evaluation of these processes and had a limited examination. The examination request of the Vanykov process was refused at the first survey and the Kivcet process was not operating during the last two surveys at Ust-Kamenogorsk and Irtysh (long term repair). Therefore, there was no data for evaluation and the processes were not observed. Under this situation, we can not make an economic evaluation nor respond to their (MIT) request. Kivcet was exported to Saminu Company in Italy by the CIS. The engineering work was completed by Snamprogetti Company of Italy. Now the plant is operating at a capacity of 50-60,000 tons per year. However, there was no information on the plant that was constructed in Bolivia. The engineering work was done by KHD Humboldt, Germany. Conversely, Kivcet technology was recently exported to Cominco of Canada. This plant will be operating at the end of 1996 (capacity of 120,000 tons per year.). Therefore, the Kivcet technology was evaluated and the technology is capable of being exported. The Vanykov technology has not been exported to foreign countries on a commercial production basis so we did not evaluate the technology. We received information that a plant using the technology is now operating in Norisk, Russia but there was no detailed information. From the viewpoint of energy conservation, both processes are recommendable and expected to operate effectively in the future. A smelting engineer in Kazakhstan mentioned the following about Kivcet.

① It is too complicated for the pre-treatment of the raw material (mixing, filtering, drying, etc.,)

② There are disadvantages for the corresponding raw material. It is not able to treat secondary raw materials.

③ It can not produce good slag because of the quick reaction in the furnace

④ It has very effective way to improve the environment.

The survey team completely agreed on this point.

It is hopeful that they will develop the operation technology and improve the facility for the continuous operation of the smelting plant. The many stoppages at the plant caused the reduction of efficiency and trouble with the equipment. These plants are connected directly with the sulfuric acid plant so the stoppage of the smelting plant's effluent to the sulfuric acid plant causes damage by the sulfuric acid.

2-3-8 Recycling of Water of Concentrator

As shown in Table 2-3-8(1), there were many cases at the concentrators that were surveyed at the mines where tailings were sent directly to the tailings dam and the tailings dam overflow water was recycled. However, following the investigation, cases were reported that differed from the supervisor's explanations, where overflow water was discharged from the concentrator into the river without being treated or recycled.
Below are the results of the investigations regarding the recycling of industrial water in the processing operation at each mine that was surveyed.

・ JSC "Zhezkazgantsvetmet"

About 95% of the concentrator water is reused as tailings dam overflow. The copper flotation flow sheet of the Zhezkazgan concentrator is simple. Therefore, the main reagents used are a pH adjustment (lime), frother (oil), and collector (xanthate). Then, residual reagents in the reused water provided a beneficial effect on the flotation process.

The recycled water is also used for the power station. If this method is continued in the future, it is feared that calcium scale from the lime (calcium hydroxide) used as a pH adjustment will adhere to the pipes and generating machinery. Research and investigation into the relation between calcium ion concentration and scale formation must be conducted over a relatively long period (5 to 10 years).

・ JSC "Balkhashmed"

The Kounrad and Sayak concentrator plants are at the JSC "Balkhashmed". At both concentrators, approximately 60% of the water is provided from the tailings dam overflow. The copper flotation flow sheets at these concentrators are relatively simple. Accordingly, since the recycling rate is lower, the effects of residual reagents are smaller than at Zhezkazgan.

・ JSC "Leninogorsk PC"

The JSC "Leninogorsk PC" has the No.2 and No.3 concentrators. The No. 2 concentrator is equipped with a tailings thickener. At the No. 3 concentrator, however, tailings are sent directly to the tailing dam, and although recycling of the tailing dam overflow water takes place, the proportion is not available. The plant is deteriorating and the availability of the No. 2 concentrator is reported as 74% while No. 3 concentrator is 44.5%. To maintain stable operations by improving the availability is more important than the process fluctuations due to the effects of recycling water.

・ JSC "EKCChC"

The Nicolaevska concentrator is at the JSC "EKCChC", but no data is available on its tailings treatment at the concentrator.

・ JSC "Irtysh PC"

The Belousovka and Berezovska concentrators are at the JSC "Irtysh PC". Tailings from both concentrators is sent directly to the tailings dam. The processing flow sheet at these concentrators have the complex characteristics of polymetal ore processing and there are numerous reagents that are used: a distributor, pH adjustment (lime), frother (multiple oils), collector (xanthate - multiple), activator (copper sulfate), and depressor (multiple including cyanide). Following the investigation, tailing dam overflow water is 100% recycled, but the concentrator performance is adversely affected by the complex effect of the residual reagents in the recycled water. In particular, there is a need to eliminate the effects of the activator (copper sulfate) and depressors (multiple, including cyanide). One method would be to investigate the use of activated carbon. Both concentrator have flotation test equipment , but the types of reagents stored for test use are limited (former Soviet products only). In the West, reagents have a strong effect, and a wide variety of concentrator reagents (from manufacturers such as Cyanamid, Dow, and Monsanto) that do not adversely affect the later processes that are used in recycled water. It is recommended that such reagents be obtained and tested.

・ JSC "Zyryanovsk Lead Combine"

At the Zyryanovsk concentrator, tailings are sent directly to the tailings dam, and the tailings dam. The overflow water is discharged after spending 24 hours in a lagoon situated in front of the dam embankment. The construction of facilities (pumps, pipes) aiming at complete recycling is under way. However, the effect of the residual reagents which can be lowered through the 24-hour retention time is limited only to free CN^- ions and xanthate. Non-decomposed residual reagents will accumulate in the recycled water, so estimated confirmation (flotation tests) is essential. Fortunately, test facilities have also been set up at Zyryanovsk, so these confirmation tests should be simple to perform. As with Irtysh, reagents used worldwide should be obtained and tested.

・ JSC "Zhezkent MCC"

This combine is in an arid region where the annual rainfall is less than 40 mm, so recycling is employed because water is precious. At the same time, the separation of copper and zinc is poor. The separation of zinc especially poor as the zinc grade in zinc concentrate reaches only around 40%. From hearing, it can be guessed that the flotation operation is not working properly. In this site investigation, a detailed investigation of water recycling was not possible, but effects from residual reagents in the recycled water are likely.

Points of note on the use of water recycling in the concentrator are listed below.

① Pay attention to the quality of recycled water, analyze the constituents if necessary, and test the processes using the recycled water. Use these results to ensure that there are no adverse affects on the recycled process.

- Examination of locations using recycled water

For example, recycled water is used in crushing, grinding processes, or bulk flotation rougher etc. If possible, use fresh water (new water or not recycled water) in the cleaner and differential flotation, which have a greater likelihood of affecting the concentrate separation.

- Examination of mixtures of recycled water and fresh water

Mix and dilute the recycled water with fresh water when there is a high concentration of residual reagents in the recycled water.

② Reduce flow and pressure fluctuation in the recycled water.

For example, install a surge tank to lessen the fluctuations in recycled flow due to stoppages or breakdowns of the machinery.

③ Classification of circulation water according to water quality.

Instead of sending water used in the concentrator all together with the tailings to the tailings dam and recycling the overflow from the tailing dam, a detailed classification is performed according to the constituents and residual reagents and recycled in appropriate processes.

For example, use slurry containing slime from the crushing process as discharge water on the crusher conveyor belt, ore-receiving chute, or use the zinc-concentrate thickener overflow water in the zinc flotation rougher, etc.

④ Separate miscellaneous water.

For example, treat good quality water such as cooling water or snow melt during winter months separately and recycle in the appropriate processes.

⑤ Reducing losses

Prevention of losses due to vaporization or percolation, etc., permits an increase in the recycled water volume and brings a reduction in the usage of fresh water.

Overall, there are many cases in which tailings are discharged from the concentrator to the tailings dam (situated in some plants anywhere from a few kilometers away to well over 10 km away), and then the tailing dam over flow water is recycled back to the concentrator by means of pumps.

A reasonable pumping cost reduction can be made by installing a thickener in the concentrator and recycling the thickener overflow water while the thickener spigot is pumped up to the tailing dam. For example, if the solid concentration of tailing with a true specific gravity of 3.0 is increased from 25% to 45% by installing a thickener in the concentrator, the specific gravity of the slurry increases from 1.2 to 1.43, but the flow rate decreases to 84%. Theoretically, the energy to transport the slurry is the same, but with the drop in flow speed, friction at the pump impeller, pumping equipment, and pipes, etc., is greatly reduced, and this contributes to a major reduction in maintenance costs. Similarly, the energy required to pump the tailings dam overflow water to the concentrator can be cut by the amount of flow rate reduction (100% - 84% = 16%). Water loss can be prevented as described in item ⑤ to enable a major reduction in the retention time.

Table 2-3-8(1) Current Situation of Treatment of Mine Water and Concentrator Wastewater in Kazakhstan

Name of Combine	Concentrator	Metal	Method of Treatment	Recycle Rate (%)	Problem	Note
1. JSC "Zhezkazgantsvetmet"	Zhezkazgan	Cu	Tailing → Tailing Dam directly	95	Necessity of Construction of Thickner	Recycled Water is used for power genaration
2. JSC "Balkhashmed"	Kounrad	Cu	(Tailing → Tailing Dam directly)	60		
	Sayak	Cu	(Tailing → Tailing Dam directly)	60		
3. JSC "Leninogorsk PC"	No.2	Cu,Pb,Zn	Tailing → Thickner → Tailing Dam		Old facility Availability 74 %	
	No.3	Cu,Pb,Zn	Tailing → Tailing Dam directly		Old facility Availability 44.5 %	
4. JSC "EKCChC"	Nikolaevska	Cu,Pb,Zn	Tailing → Tailing Dam directly			
5. JSC "Irtysh PC"	Belousovka	Cu,Pb,Zn	Tailing → Tailing Dam directly		Remaining capacity of tailing pond is around 400,000t.	
	Berezovska	Cu,Pb,Zn	Tailing → Tailing Dam directly		Remaining capacity of tailing pond is around 400,000t.	
6. JSC "Zyryanovsk Lead Combine"	Zyryanovsk	Cu,Pb,Zn	Tailing → Tailing Dam directly	100		
7. JSC "Achpolymetal"	Kentau	Cu,Pb,Zn Barite	Tailing → Filling → Contamination of Mine water Necessity of pumping up the mine water after ceasation of the mine			

2-4 Corporate Management

2-4-1 Corporate Structure

Since Tusti Metaldari was dissolved in January 1996, each combine is being individually managed under its own corporate. Management of some combines has been transferred or entrusted to manager combines according to 'Management Transfer Contract Agreement'. However, the managing companies are mostly dealing with the financial side of the combines' operation and have virtually made no alteration or reformation of the combines' management structures for operations.

As aforementioned, the corporate management in Kazakhstan principally follows the system inherited from the USSR era, and appears to be inflexible in adjusting itself to any changes of business circumstances. A corporate structure in Kazakhstan is usually complicated comprising a number of sectors defined strictly and in detail for their roles and duties. There is no system to laterally exchange data and information between the sectors. This type of corporate structure is suitable for producing a large amount of goods with simple specifications under stable market conditions. However, market needs and conditions have changed very swiftly in recent years. It is required for the corporate management to change without delay in order to survive under the free trade economic circumstances.

Fig 2-4-1(1) is an example of a corporate organization for a complex including mines, concentrators, smelter and refineries. Although the figure is similar to a traditional organization, at a first glance, each sector is inter-connected according to its function in relation with neighboring sectors as schematically illustrated in Fig.2-4-1(1). It is desirable that the organization be as simple as practicable. Roles and duties of each sector should be clearly defined, taking account of inter-relations between sectors. The sectors should exchange information and cooperate with each other as necessary. Raw data, collected in day-to-day operations, are filed in a data storage in each sector and integrated to a central data base together with those obtained from outside of the corporation. All data in the central data base should be accessible from every sector at all times.

The corporate strategy should be prepared by the board of directors and approved by the share holders (investors). The approved strategy is instructed to the general manger who calls for a meeting comprising managers of each sector. According to the conclusion of the meeting, the production plan and control department should prepare a basic production plan that is reviewed from time to time. The department should play the most important role to achieve satisfactory operation performance, giving appropriate instructions to each sectors and monitoring results of day-to-day operations.

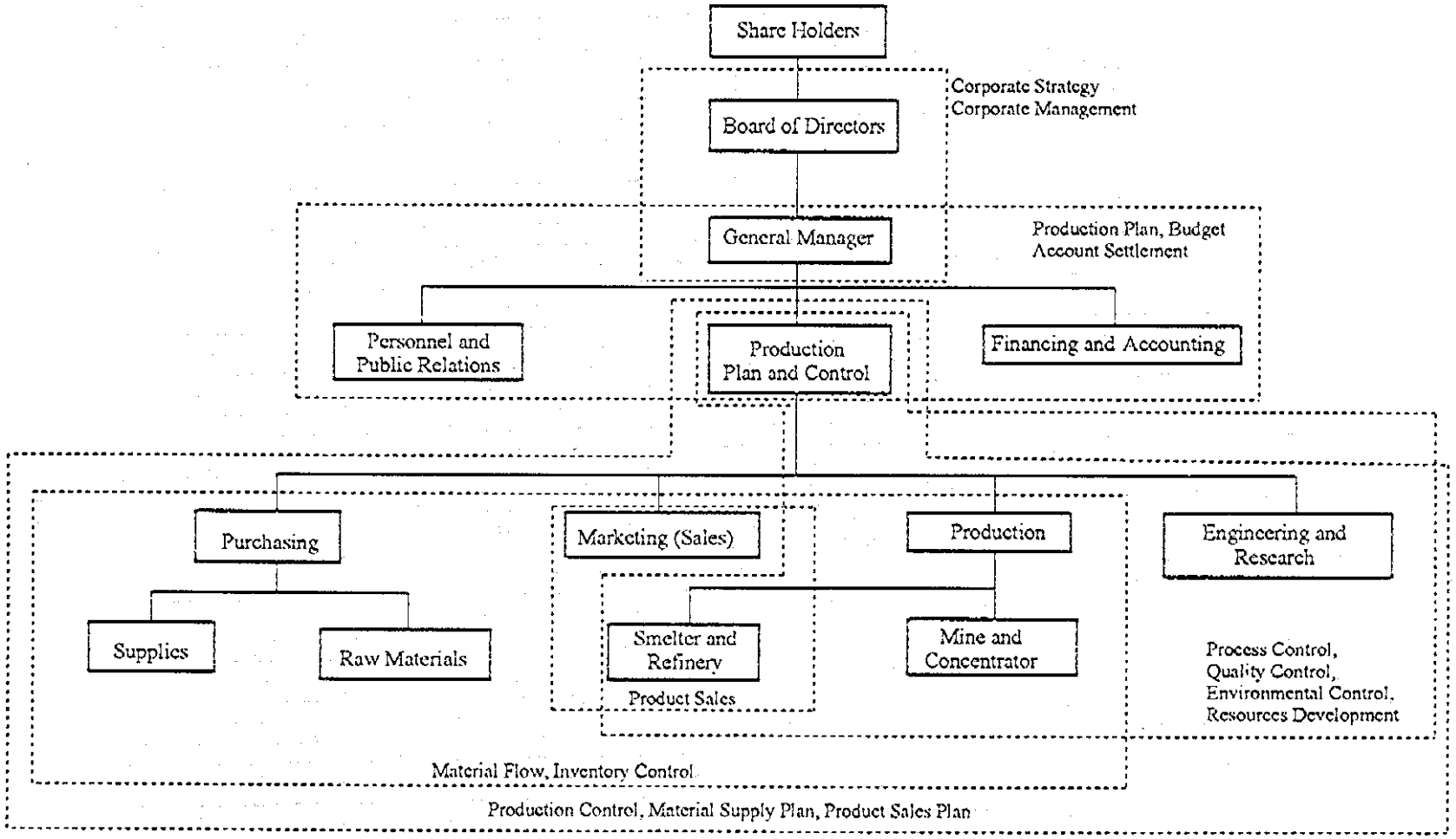


Fig. 2-4-1(1) Simplified Organization Chart of A Corporation

2-4-2 Management Practice

The corporate management in Kazakhstan, inherited from the former USSR system, is oriented to maintaining production and employment rather than to maximizing corporate profits or adequately responding to market needs. However, under the free trade economy, It is necessary for the corporate management to achieve best performance in marketing products and hence in increasing revenues. In this regard, there are some critical problems or difficulties in the corporate management practice in Kazakhstan as follows;

(1) One of the common problems of the enterprises in Kazakhstan is that the workforce is generally too large for their production rates in comparison with those of similar enterprises in western countries as shown in Table 2-4-2(1). At the present time, salaries and wages in Kazakhstan are much lower than western standards, which is an advantage for Kazakhstan products in their cost competitiveness. However, the non-ferrous metals industry is principally labour-intensive and the production cost will rapidly rise in proportion to increasing labour costs as inflation advances at the present pace. From the view point of profitable operations, the number of employees should be reduced in order to raise productivity per employee. Reduction of employees automatically increases unemployment and will lead to labour and social unrest. In order to minimize such an adverse effect, an appropriate programme for rationalization should be prepared including a manning schedule according to restructuring of the enterprise. It is, as a matter of course, desirable that the unemployed be absorbed by other local firms which may be newly created as the rationalization progresses. In this regard, administrative and financial support by the state and local governments are indispensable for satisfactory achievement of the rationalization.

(2) Many enterprises in Kazakhstan, at the present time, hold a wide range of non-producing sections, which is one of the major reasons for excessive workforce. It will be most effective to separate some of the non-producing sectors from the enterprises as self-supporting firms in order to reduce the number of employees. Such off-shoot firms will become cores for creating new businesses as above mentioned. Possible businesses which may be handle by the off-shoot firms are listed as follows;

1) Explosive manufacturing and sales
2) Machine and equipment repairs
3) Building material manufacturing and sales
4) Material handling and trading
5) Construction contractors
6) Others

Entrepreneurs who are familiar with business practices will be required to appropriately manage these businesses. At the present time, however, there appears to be only a few entrepreneurs who have business experience under the conditions of free market economy. Therefore, on education institute and system should be established to foster entrepreneurs with such knowledge. Administrative and financial support by the state and

local governments will be necessary in this regard as well.

(3) The most urgent matter is to settle the accumulated debt. Under the former USSR administration, it was possible for an enterprise to continue its production by purchasing a necessary amount of materials under the guarantee by the Central Government (Moscow) and by receiving a supplemental supply of working capital from the government. Upon the collapse of the USSR, however, the guarantor automatically disappeared and the debt was left with the enterprise. In addition, the supply of working capital was cut. Under such conditions, the enterprise was suddenly privatized without an appropriate plan for reforming and adjusting itself to the new system of the free market economy. This is the process that placed the enterprises in the present situation of financial difficulty. Therefore, this problem is not a normal subject of the corporate management. Never-the-less, repayment of the accumulated debt is the responsibility of either the Kazakhstan Government or the enterprise under the present situation without the guarantor. Provided that the enterprise takes full responsibility for repayment of the debt, the repayment is the first priority subject of the corporate management. The enterprise should prepare a realistic repayment programme based on its corporate profit-loss forecast and should make its best effort for implementing the programme. Meanwhile, a number of enterprises in industries other than non-ferrous metals are facing similar financial difficulties. Lest the accumulated debt should not be settled within a limited period, there is a fear that a nationwide industrial crisis may emerge. It may be one conceivable repayment scheme that the State Government extends a medium-long term loan with a low interest rate to the enterprise and that the enterprise repays the loan on a deferred payment basis from its corporate profit. The scheme is shown in the section 2-6-3 as an example for the Balkhash combine. For the loan to be granted, the enterprise is required to present a corporate plan for production, sales of products and financial forecast that meet the repayment schedule. The State Government should apply for long term loans from various international funding agencies in order to raise necessary funds for this scheme. The funds are lent to the enterprise through the Central Bank upon its corporate plan passing the screening standards set by the government (2-Step Loan Scheme). It may be also possible to raise the funds by issuing a national bond in the international bond market. It must be noted, as a matter of course, that the above scheme is applicable only to enterprises which will be able to operate with profits in medium and long terms.

(4) Under the state controlled economic system, emphasis was placed on achievement of planned production and maximum utilization of mineral resources rather than maximizing profits (total product values-total cost) in corporate activity. Even at the present stage of transition to the free market economy, non-ferrous metals enterprises, including mines, concentrators, smelters and refineries, tend to be satisfied with profits as a whole, even if some sectors are operating at a loss. Under the free market economic conditions, however, enterprises should maintain their cost competitiveness in the international market. Therefore, each production sector should make an effort to maximize its productivity (product values/production cost). for this purpose, the account of each production sector must be clearly settled in order to continuously observe changes of its productivity. It is also necessary to set a clear definition for partitioning costs of non-producing sectors (overhead) to each production sector.

(5) Management and control of personnel, process, maintenance, quality, inventory, cost and others are unsatisfactory in production sectors of most non-ferrous metals combines in Kazakhstan, as repeatedly commented in the sections 2-3-2, 2-3-3 and 2-3-4. Accordingly, the corporate management has no sound ground to achieve satisfactory perfonmance of the combines as a whole. Although the system of free market economy as a notion has been well known among industrialists and economists in Kazakhstan, there are only a few who have sufficient experience in practicing corporate management under the free market economy condition. It is necessary to establish clear standards and codes for managing and controlling the number of employees, working hours, unit consumption of materials, availability and utilization of facilities and equipment, optimum amounts of supply and product inventories, product quarity and so forth.

(6) It is an ordinary practice in western country to construct a data base in order to efficiently manage and control various factors of production sectors. Although raw data are routinely collected items necessary for production and cost control in the present practice in Kazakhstan, there is no system for efficient utilization of the collected data. Therefore, it is necessary to construct an appropriate data storage and retrieval system for achieving maximum efficiency in production lines. The roles of data bases in a corporate structure are schematically illustrated in Fig.2-4-2(1). Necessary information should be exchanged between departments in order to improve corporate performance as a whole. Automation and computerization of the production lines will enable automatic data collection. Personal computers which store raw data in each section should form a network in order to make the data accessible from every section. The data are integrated to the central data base together with externally acquired data. Thus all the data become available for further processing and analysis as required, and facilitate appropriate operation and management control as mentioned in the previous section.

Table 2-4-2(1) Comparison of Number of Employees

Open Pit Mines

	Kazakhstan		North American Standard		
	Dzhezkazgan (North)	EKCChC	A	B	Note
Crude Ore Production	15,000 t/D	3,000 t/D	10,000 t/D	20,000 t/D	
Stripping Ratio	7		8	8	
Number of Employees					* East Kazakhstan
Salary	123		60	97	Mine-400
Hourly	491		164	272	Concentrator-440
Total	614	840	224	369	

Underground Mines Table Consists of Production and Employees for JSCs Zhezkent MCC, Zyryanovsk Lead Combine and Leninogorsk PC.

	Kazakhstan						Western Countries			
	Dzhezkazgan						Room & Pillar	Cut & Fill	Polaris Canada	Red Dog USA
	East	West	South	Zhezkent	Zyryanovsk	Leninogorsk				
Production t/D	22,000	15,000	20,000	3,000	6,000	8,000	14,000	2,000	3,000	3,000
Number of Employees				Mine	Mine	Mine			Mine	
Salary	290	176	281	1,000	1,250	2,080			127	
				Concentrator	Concentrator	Concentrator			Concentrator	
Hourly	1,470	994	1,594	440	742	870			44	
Total	1,760	1,170	1,875	1,440	1,992	2,950	420	188	171	350

	Japan		Kazakhstan	
	Name of Plant	Manpower	Name of Plant	Manpower
Copper Smelter & Refinery	Tamano Production Capacity Blister 263,000 t/yr Electrolytic Copper 191,000 t/yr	200	Dzhezkazgan Production Capacity Blister t/yr Electrolytic Copper 211,000 t/yr	21,246 (1994) (Combine Total)
	Onahama Production Capacity Blister 294,000 t/yr Electrolytic Copper 247,000 t/yr	450	Balkhash Production Capacity Blister t/yr Electrolytic Copper 308,000 t/yr	11,182 (1994) (Combine Total)
Lead Smelter	Chigirishima Production Capacity Electrolytic Lead 94,800 t/yr	170	Shymkent Production Capacity Refined Lead 160,200 t/yr	2,587 (Combine Total)
Zinc Refinery	Iijima Production Capacity Electrolytic Zinc 156,000 t/yr	190	Leninogorsk Production Capacity Electrolytic Zinc 156,000 t/yr Refined Lead 20,000 t/yr	13,460 (Combine Total)
	Hachinohe Production Capacity Distilled Zinc 108,000 t/yr Crude Lead 40,000 t/yr	180	Ust-Kamenogorsk Production Capacity Electrolytic Zinc 186,400 t/yr Refined Lead 145,900 t/yr Electrolytic Copper 40,000 t/yr	9,544 (Combine Total)

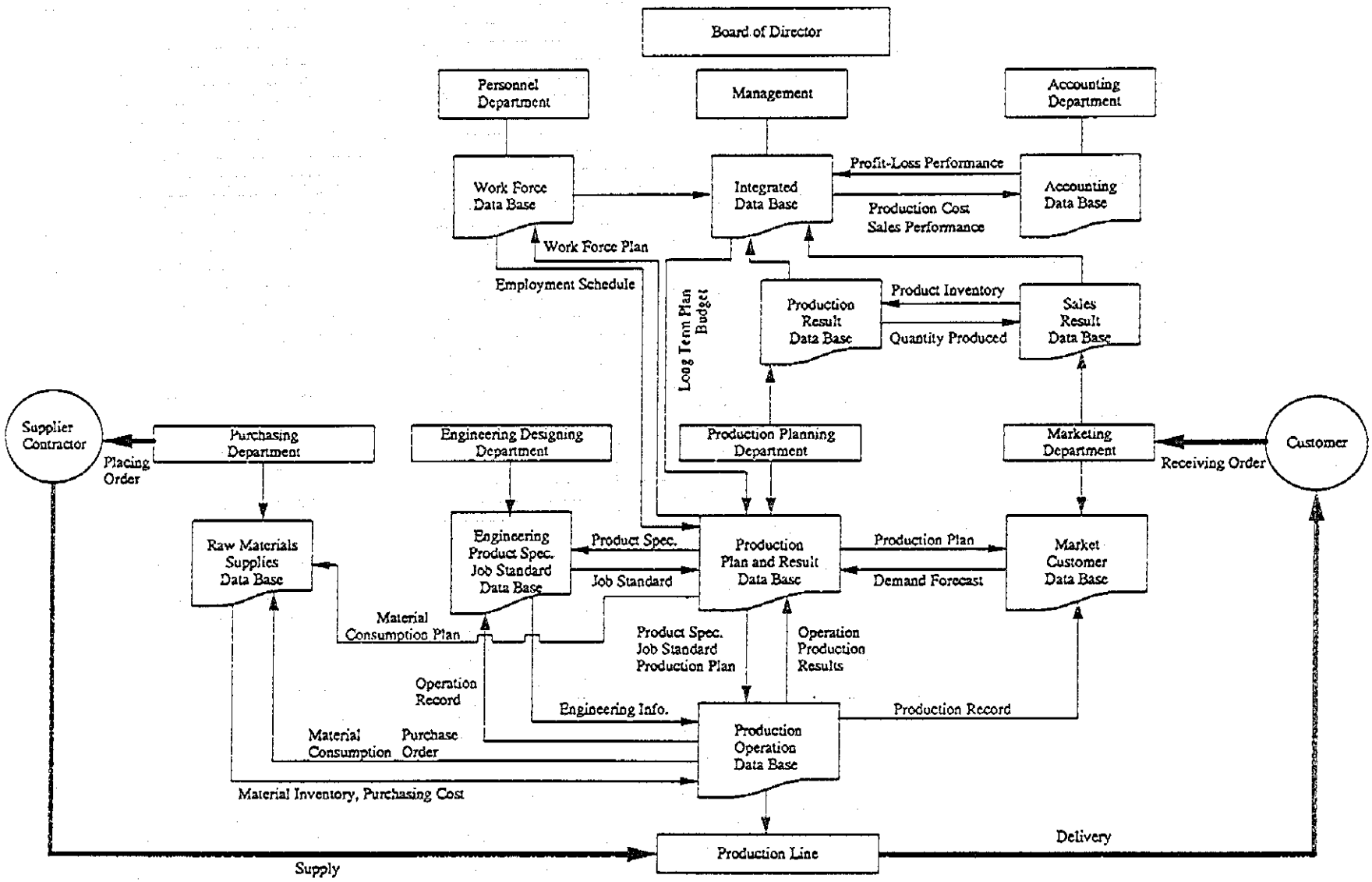


Fig.2-4-2(1) Corporate Structure and Use of Data Base

2-5 Marketing

2-5-1 View of Supply and Demand and Market of Non-ferrous Metals

(Introduction)

The demand for non-ferrous metal has a conspicuous rising trend in Asia (except Japan) which continues its remarkable economic growth. However, in Japan, North America, and Western Europe where their economy seems to be in a mature stage, the demand is leveling off or shows a slight increase. In the CIS countries, there is a strong possibility that the short-term demand will continue to remain sluggish from the disruption following the transition in the economic system. In order to foster the sound development of the Kazakhstan economy by promoting the non-ferrous industry, it is required to correctly understand the CIS and world non-ferrous metal demand trend, make an industry promotion plan that corresponds to the trend, and reconstruct the domestic production and supply system.

1. Trends and prospects for demand for non-ferrous metal in the world (Table 2-5-1(1) and (2))

World demand for non-ferrous metals will tend to increase toward 2000. In the period from 1995 to 2000, annual demand for copper will probably increase from 11,800,000 to 14,000,000 tons, lead from 5,400,000 to 6,300,000 tons, and zinc from 7,300,000 to 8,800,000 - 9,000,000 tons.

Advanced countries like Western Europe, North America, and Japan make up more than half of the world demand for non-ferrous metals (for example, in case of copper, 29.3% in Western Europe, 19.6% in North America, 12.7% in Japan, their share for lead is 61.8% and their share for zinc is 56.0%). A large demand in these countries is not expected in the future, but in East Asia and Southeast Asia where there has been remarkable economic growth recently a sharp increase in the demand is expected. Special attention should be given to the trends in China. In 2000, it is expected that China will consume about 1,500,000 tons of copper and 1,200,000 tons of zinc. In the disruption accompanying the shift of the economic system in the Eastern bloc, its demand for non-ferrous metal will continue to remain sluggish, and a sharp decline in the demand and an increase in metal exports to Western countries constitute factors for a slump in the international market.

2. Prospects for supply of non-ferrous metal ore in the world (Table 2-5-1(3) to (6))

It is necessary to boost the annual smelting capacity of copper to 2,000,000 tons or more, lead to 900,000 tons and zinc to 1,500,000 - 1,700,000 tons to meet the forecasted demand for non-ferrous metals in 2000. Presently, various countries are considering plans for facilities to expand their annual smelting capacity of copper and zinc totaling 1,600,000 tons and 1,4000,000 tons, respectively until 2000. In 2000, additional facilities are required to secure a supply capacity which satisfies the demand for non-ferrous metals.

3. Prospects for demand by ore type of non-ferrous metal

Prospects for demand in copper, lead, and zinc are as follows;

(1) Copper (Table 2-5-1(7))

Demand for copper metal has shown a steady increase since 1993 mainly due to increased consumption in Asia. It is expected that in 2000 its annual demand will reach about 14,000,000 tons. In response to this situation, the production capacity of copper concentrate and SX-EW copper is being boosted mainly in South America and Asia. For this reason, the smelting capacity in 2000 will fall short of prospect and it is thought that a discharge of metal in the Eastern bloc will make the supply exceed the demand for the time being in the medium term.

The market hit bottom in 1993, rebounded to its peak in 1995 and will become soft so it will be difficult for the market to improve by 2000.

(2) Supply and demand for lead (Table 2-5-1(8))

Lead metal consumption is increasing about 3%/year because of the demand for new car batteries bought in 1994 and 1995, economic development in Southeast Asian countries and signs of a business recovery in Europe and America. Since ore production hardly showed an increase in the first half of 1990's, metal was increasingly produced from secondary material. For this reason, the recent supply and demand has been tight. In addition to an increase in secondary material, an increase in ore production is forecasted starting in 1996. Therefore, it is expected that both supply and demand will expand.

Although the market is considered to be firm in the short term, it is expected that it will become soft after 1997 toward 2000.

(3) Supply and demand for zinc (Table 2-5-1(9))

The supply and demand for zinc metal from 1991 through 1993 was extremely slack due to a sharp increase in export from the Eastern bloc. A low-level metal production from 1993 through 1995 corrected inventory excesses and it seems that supply and demand will be brought almost into balance in 1996. Judging from economic growth in Asian countries and signs of business recovery in Europe and America, it is forecasted that supply and demand for zinc metal will increase by 2 to 4%/year. In response to this situation, a plan to increase ore production and metal production is progressing.

In a presumption until the year 2000, it is thought that a growth in zinc metal production of 5% to 6% is possible in Western countries by developing new mines, expanding major zinc mines and increasing the production capacity of zinc smelters. The major part of the expansion plan will be made in 1998 and 1999 and its realization is noteworthy from the viewpoint of supply and demand.

In case of the Eastern bloc, although it is expected that China will increase metal production by 170,000 to 190,000 tons/year by 2000, it is thought that there is no increase in other countries.

By 2000 zinc smelters in Western countries will work close to capacity. An increase in concentrate exports from Western countries to zinc smelters in the Eastern bloc and an increase in metal exports to Western countries in return for export of concentrate will keep the world supply and demand for zinc metal in balance.

Table 2-5-1(1) Prospects for demand for non-ferrous metal (1)

(Unit: 1,000 tons)

Region	Copper					Lead					Zinc				
	1992	2000				1992	2000				1992	2000			
	Actual performance value	Low		High		Actual performance value	Low		High		Actual performance value	Low		High	
		Estimated value	Growth rate	Estimated value	Growth rate		Estimated value	Growth rate	Estimated value	Growth rate		Estimated value	Growth rate	Estimated value	Growth rate
North America	2,352	2,393	0.2%	2,393	0.2%	1,379	1,379	0.0%	1,379	0.0%	1,162	1,121	▲0.4%	1,121	▲0.4%
Central and South America	465	465	0.0	465	0.0	313	313	0.0	313	0.0	336	336	0.0	336	0.0
Western Europe	3,254	3,451	0.7	3,451	0.7	1,604	1,334	▲2.3	1,334	▲2.3	1,920	2,216	1.8	2,216	1.8
Africa	101	101	0.0	101	0.0	108	108	0.0	108	0.0	140	140	0.0	140	0.0
Japan	1,411	1,270	▲1.3	1,691	2.3	402	400	▲0.1	448	▲1.4	784	764	▲0.3	904	1.8
Asia															
Korea	353	561	6.0	561	6.0	193	262	3.9	262	3.9	257	458	7.5	458	7.5
Taiwan	416	714	7.0	894	10.0	109	144	3.5	144	3.5	128	220	7.0	277	10.1
Others	606	1,026	6.8	1,258	9.6	304	397	3.4	397	3.4	508	629	2.7	629	2.7
Oceania	126	126	0.0	126	0.0	65	65	0.0	65	0.0	134	134	0.0	134	0.0
Communist bloc															
China	882	1,836	9.6	2,167	11.9	240	349	4.8	349	4.8	551	1,147	9.6	1,281	11.1
Others	1,139	1,042	▲1.1	1,139	0.0	764	699	▲1.1	764	▲0.0	982	899	▲1.1	982	0.0
World total	11,105	12,985	2.0	14,246	3.2	5,481	5,450	▲0.1	5,563	0.2	6,902	8,064	2.0	8,478	2.6

Data: Report of Mining Industry Council of Agency of Natural Resources and Energy of the Ministry of International Trade and Industry in Japan (1993)

(Note) The estimated value is based on an economic growth rate in various countries of the world and a GDP value of elasticity of the consumption.

Table 2-5-1(2) Prospects for demand for non-ferrous metal (2)

(Unit: 1,000 tons)

	Copper			Lead			Zinc		
Region	1995	2000		1995	2000		1995	2000	
	Actual perform-ance value	Estimated value	Growth rate (%)	Projection	Estimated value	Growth rate (%)	Projection	Estimated value	Growth rate (%)
Western bloc	10,541	11,590	2.7	4,840	5,230	1.9	6,182	6,760	2.5
Eastern bloc (except China)	1,273	1,040 ~ 1,140	△1.1 ~ 0.0	594	700 ~ 760	△1.1 ~ 0.0	1,122	900 ~ 980	△1.1 ~ 0.0
China		1,400 ~ 1,500			350	4.8		1,150 ~ 1,280	9.6 ~ 11.1
World total	11,814	14,030 ~ 14,230	3.5	5,434	6,280 ~ 6,340	3.0	7,304	8,810 ~ 9,020	4.3

Note 1. The estimated value of each metal in the Western bloc in the year 2000 was an average of the estimated value in the year 2000 calculated from an expected growth rate of each metal based on an actual performance value in each year from 1992 to 1994.

Note 2. A growth trend from 1991 to 2007 based on Fig. 1 was used to obtain the expected growth rate of each metal.

Note 3. The values in Table 1-1 were used for the estimated value in the year 2000 in the Eastern bloc, and a forecast value of 1,500,000 tons offered by Colored Metal Industry Co., Ltd. or an estimated value of 1,400,000 tons from the actual performance trend was listed for copper in China.

Table 2-5-1(3) Prospects for production capacity of non-ferrous metal - From 1995 to 2000

(Smelting of copper) (Unit: 1,000 tons/year)

Region	1995	2000	Capacity of production increase
Europe	2,348	2,373	25
Africa	981	989	8
Asia	2,040	2,565	525
North America	3,038	3,129	91
Central America	295	327	32
South America	2,090	2,738	648
Oceania	367	352	-15
Total Western countries	11,159	12,473	1,314
CIS	1,597	1,637	40
China	880	1,094	214
Others	301	301	-
Total Eastern bloc	2,778	3,032	254
Total	13,937	15,505	1,568

Data: IWCC

Table 2-5-1(4) Prospects for production capacity of non-ferrous metal - From 1992 to 1997

(Smelting of lead and zinc) (Unit: 1,000 tons/year)

Region	Lead (Primary and secondary smelting)		Zinc (Smelting)	
	1992	1997	1992	1997
Europe	1,967	1,967	2,340	2,360
Africa	227	227	257	257
Asia	986	998	1,653	1,951
North America	1,982	2,044	1,125	1,135
Central America	429	429	243	243
South America	307	307	396	471
Oceania	261	261	345	345
Total	6,159	6,233 (0.1%/year)	6,359	6,762 (1.2%/year)

Data: IWCC

Table 2-5-1(5) Major new and expanding zinc mines - From 1996 to 2000

Year	Country	Mine	Output
1996	Australia	McArthur River	160
	Canada	Faro/Grum	150
	Canada	Grevet	70
	Ireland	Galmoy	60
	Peru	Iscayeruz	55
1997	Canada	Canbou	70
	U.S.	Greens Creek	45
1998	Australia	Century	450
	Ireland	Lisheen	180
	U.S.	Red Dog	170
	Australia	Cannington	50
1999	Canada	Kudz Ze Kayah	65
	U.S.	Pend Oreille	40
2000	U.S.	Crandon	200
	China	Lanping	60

Table 2-5-1(6) Build-up of production capacity in major zinc smelting works - From 1996 to 2000

(Unit: 1,000 tons)

	Zinc smelting works	Production capacity
1996	Korea Zinc, Korea (Expanded)	80
	Penoles, Mexico (Expanded)	40
	Padaeng, Thailand (Expanded)	30
1997	National enterprise, Shaoguan, China (Expanded)	60
1999	Korea Zinc, Australia (Newly established)	170
	Cominco, Peru (Expanded)	130
	Outokumpu, Finland (Expanded)	50
	Binani Zinc, India (Expanded)	30
2000	Gencor, South Africa (Newly established)	200
	Arabian Shield, Saudi Arabia (Newly established)	200
	Platinova, Greenland (Newly established)	170
	Savage Resources, U.S. (Expanded)	160
	National enterprise, Lanping, China (Newly established)	60

Table 2-5-1(7) Supply and demand for Copper

Supply and demand for copper in the world from 1993 through 1997

(Actual performance and prospects)

(Unit: 1,000 tons)

	1993	1994	1995	1996	1997
	Actual performance	Actual performance	Actual performance	Prospects	Prospects
Ore production	9,430	9,322	10,003	10,804	11,263
Metal production	11,270	11,102	11,608	12,519	13,130
Metal consumption	10,924	11,429	11,814	12,008	12,332
Metal balance	346	△327	△206	511	798

(Data: IWCC)

Supply and demand for copper in Western countries from 1993 through 1997

(Actual performance and prospects) (Unit: 1,000 tons)

	1993	1994	1995	1996	1997
	Actual performance	Actual performance	Actual performance	Prospects	Prospects
Ore production	8,053	8,004	8,541	9,366	9,785
Metal production (a)	9,540	9,399	9,747	10,645	11,205
Import from the former communist bloc (b)	379	447	650	485	455
Export to the former communist bloc (c)	185	90	135	170	170
Metal consumption (d)	9,513	10,287	10,541	10,674	10,923
Increase or decrease in inventory (e)	22	0	0	0	0
Balance f = a + b - c - d ± e	243	△531	△279	286	567

(Data: IWCC)

Table 2-5-1(8) Supply and demand for Lead

Lead: Production and consumption in Western countries from 1994 through 1996: Summary

(Unit: 1,000 tons)

	1994 Actual performance (A)	Prospects for 1995			Prospects for 1996		
		Actual performance in the first half of the year	Latter half	Annual total (B)	First half	Later half	Annual total (C)
Ore production	1,991	957	1,020	1,977	1,083	1,088	2,171
East-West trade	15	6	▲3	3	▲9	▲12	▲21
Suppliable amount for smelting	2,006	963	1,017	1,980	1,074	1,076	2,150
Metal production	4,483	2,335	2,268	4,603	2,341	2,313	4,654
Primary	2,158	1,129					
Secondary	2,325	1,206					
Metal consumption	4,771	2,421	2,419	4,840	2,480	2,458	4,938
East-West trade	233	89	67	156	79	87	166
Discharge of American stockpile	63	9	11	20	20	20	40
Balance between supply and demand for metal	8	12	▲73	▲61	▲40	▲38	▲78
Stock (End of the term)	624	593					

Lead: Production and consumption in the Eastern bloc from 1994 through 1996: Summary

(Unit: 1,000 tons)

	1994 Actual performance (A)	Prospects for 1995			Prospects for 1996		
		Actual performance in the first half of the year	Latter half	Annual total (B)	First half	Later half	Annual total (C)
Ore production	716	296	371	667	300	368	668
East-West trade	▲15	▲6	3	▲3	9	12	21
Metal production	866	377	444	821	397	441	838
East-West trade	▲233	▲89	▲67	▲156	▲79	▲87	▲166
Metal consumption	581	290	304	594	295	310	605
Balance between supply and demand for metal	52	▲2	73	71	23	44	67

Lead: Production and consumption in the world from 1994 through 1996: Summary

(Unit: 1,000 tons)

	1994 Actual performance (A)	Prospects for 1995			Prospects for 1996		
		Actual performance in the first half of the year	Latter half	Annual total (B)	First half	Later half	Annual total (C)
Ore production	2,707	1,253	1,391	2,644	1,383	1,456	2,839
Metal production	5,349	2,712	2,712	5,242	2,738	2,754	5,492
Discharge of American stockpile	63	9	11	20	20	20	40
Metal consumption	5,352	2,711	2,723	5,434	2,775	2,768	5,543
Balance between supply and demand for metal	60	10	0	10	▲17	6	▲11

(Source) ILZSG

Table 2-5-1(9) Supply and demand for Zinc

Zinc: Production and consumption in Western countries from 1994 through 1996: Summary

(Unit: 1,000 tons)

	1994 Actual performance (A)	Prospects for 1995			Prospects for 1996		
		Actual performance in the first half of the year	Latter half	Annual total (B)	First half	Later half	Annual total (C)
Ore production	5,136	2,594	2,794	5,383	2,394	2,897	5,791
East-West trade	▲20	▲64	▲85	▲149	▲95	▲106	▲201
Suppliable amount for smelting	5,116	2,530	2,709	5,239	2,799	2,791	5,590
Metal production	5,337	2,695	2,735	5,430	2,769	2,769	5,538
Primary	4,907	2,475					
Secondary	470	220					
Metal consumption	5,849	3,181	3,001	6,182	3,168	3,118	6,286
East-West trade	551	240	176	416	231	245	476
Discharge of American stockpile	40	9	9	18	20	20	40
Balance between supply and demand for metal	119	▲237	▲81	▲318	▲148	▲84	▲232
Stock (End of the term)	1,642	1,276					

Zinc: Production and consumption in the Eastern bloc from 1994 through 1996: Summary

(Unit: 1,000 tons)

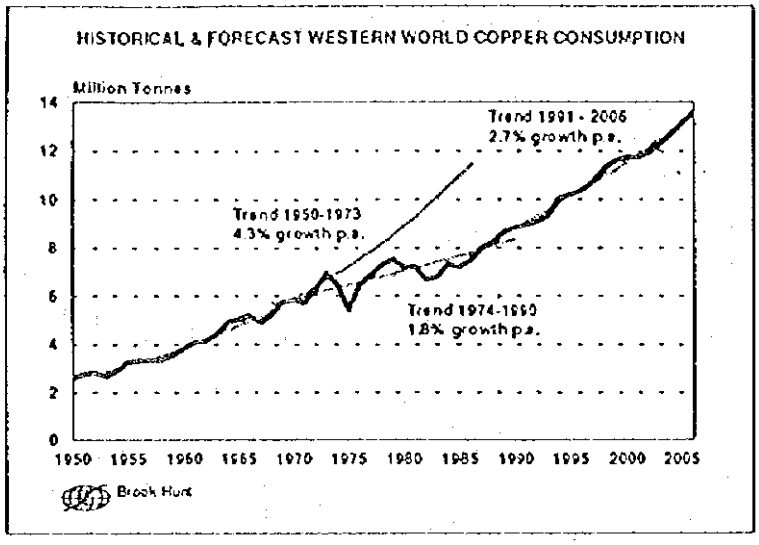
	1994 Actual performance (A)	Prospects for 1995			Prospects for 1996		
		Actual performance in the first half of the year	Latter half	Annual total (B)	First half	Later half	Annual total (C)
Ore production	1,656	775	821	1,596	790	841	1,631
East-West trade	20	64	85	149	95	106	201
Metal production	1,755	900	880	1,780	925	930	1,855
East-West trade	▲551	▲240	▲175	▲416	▲231	▲245	▲476
Metal consumption	1,110	563	559	1,122	572	575	1,147
Balance between supply and demand for metal	94	97	145	242	122	110	232

Zinc: Production and consumption in the world from 1994 through 1996: Summary

(Unit: 1,000 tons)

	1994 Actual performance (A)	Prospects for 1995			Prospects for 1996		
		Actual performance in the first half of the year	Latter half	Annual total (B)	First half	Later half	Annual total (C)
Ore production	6,792	3,369	3,615	6,984	3,684	3,738	7,422
Metal production	7,132	3,595	3,615	7,210	3,694	3,699	7,393
Discharge of American stockpile	40	9	9	18	20	20	40
Metal consumption	6,959	3,744	3,560	7,304	3,740	3,693	7,433
Balance between supply and demand for metal	213	▲140	64	▲76	▲26	26	0

(Source) ILZSG



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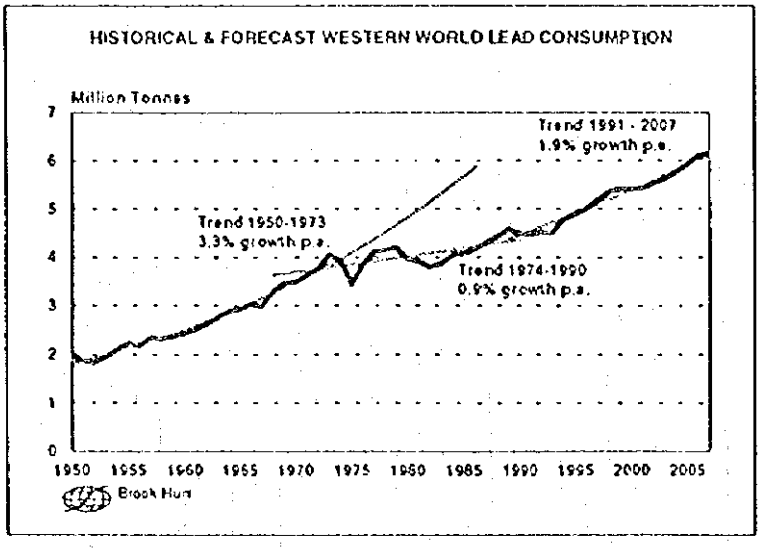

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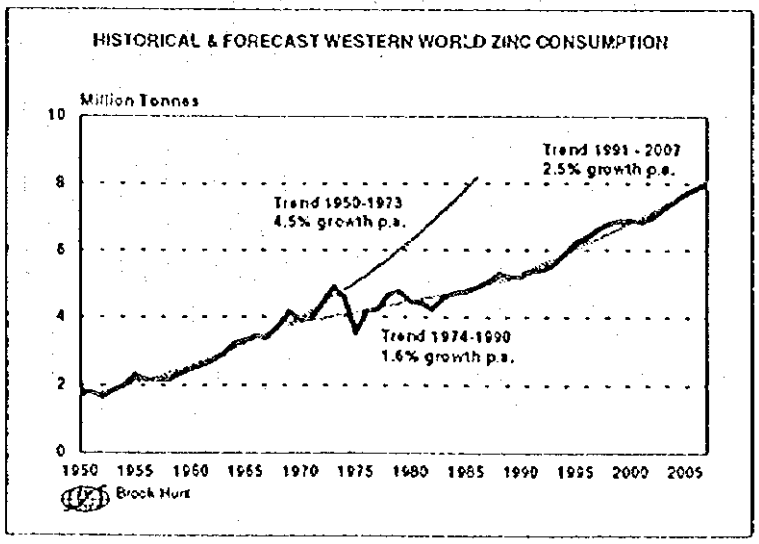

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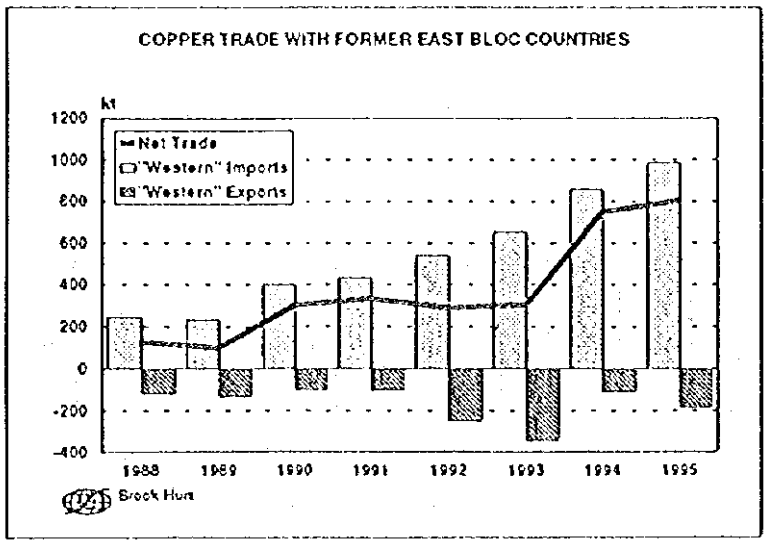
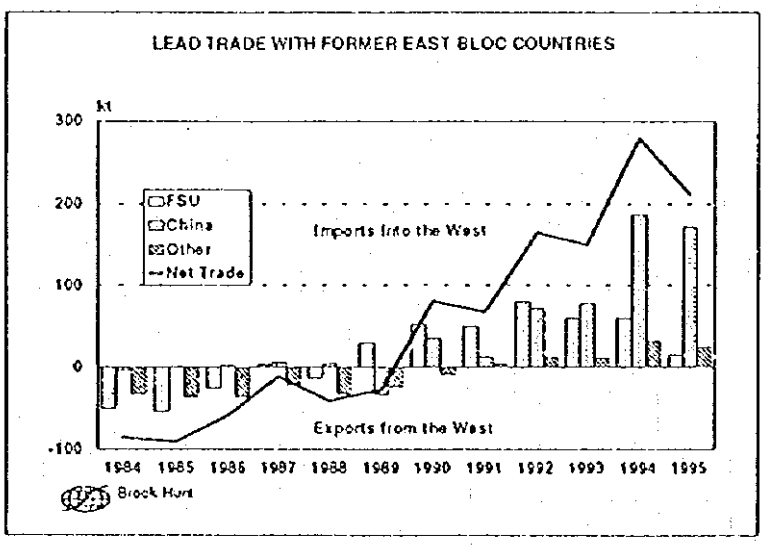
Fig.2-5-1(1) Historical & Forecast Westerrn World Consumption



非鉄金属東西間貿易推移



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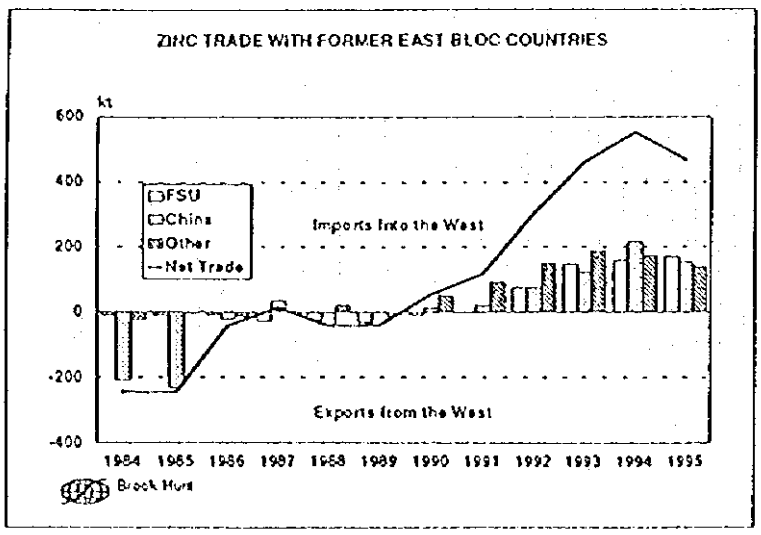
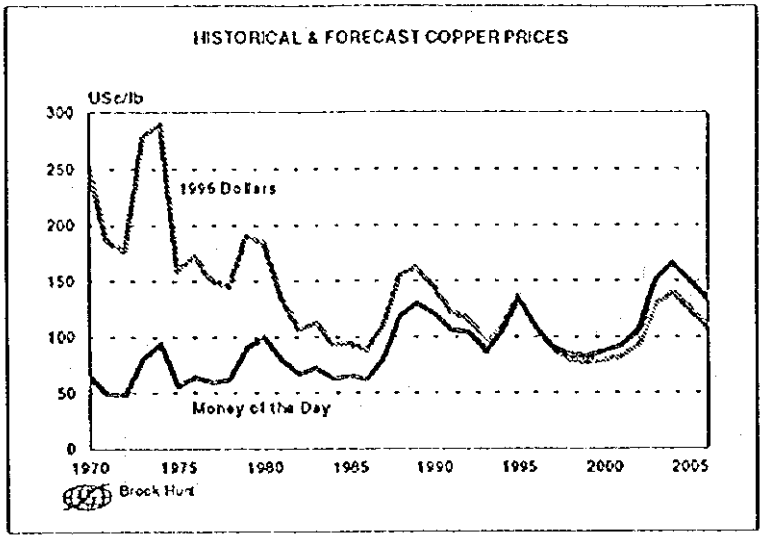


非鉄金属東西間貿易推移

Fig.2-5-1(2) Base metal Trade with Former East Bloc Countries



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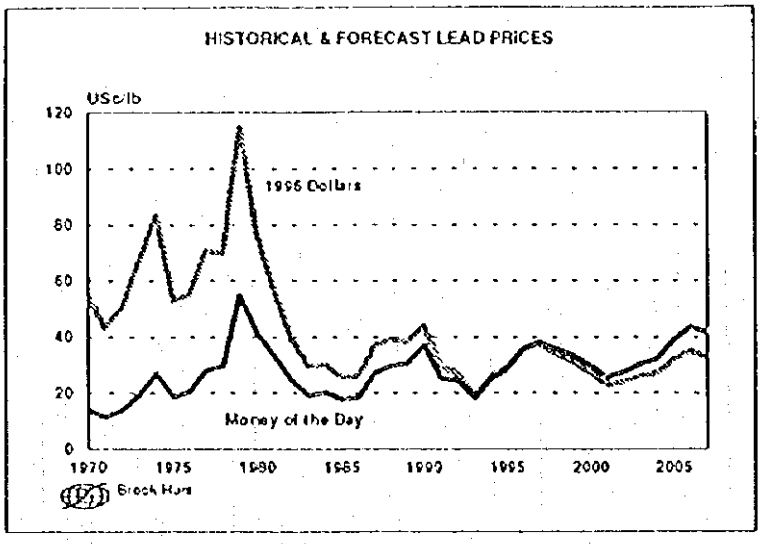

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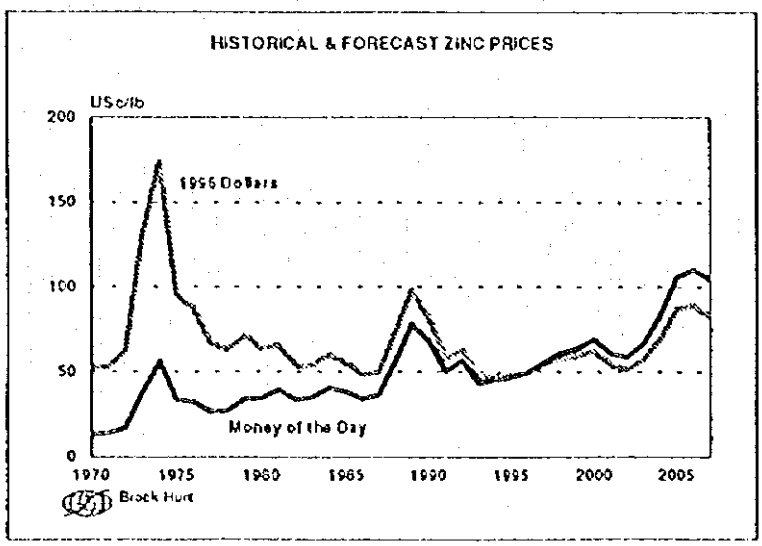

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Fig.2-5-1(3) Historical & Forecast Prices

2-5-2 Registration of LME

This market exchange system implements the principle of free competition. In this procedure, there exists historic rules. The LME is the center of the world's non-ferrous metal exchange and the registration of goods is given full confidence.

Among the non-ferrous metal exchange price indicators, many traders of the West rely on the LME market price. Of course, the buying and selling of concentrate at the market price has many standards.

Therefore, these indicators can separate the cheaply priced exports and criticize the price of some goods as an unfair dumping price even though they are not registered on the LME.

In Kazakhstan, only Shymkent lead is registered on the LME. In the West, this trademark is known. However, Shymkent copper and zinc are not recognized by the LME so there is a fear that it is under a disadvantage on the international exchange markets.

Both base metals must urgently win the LME approval to enter the international market distribution system.

(1) Copper

The many conditions necessary for the registration of copper metal are shown as follows.

- Application for registration of goods is made to a LME ring member.
- Present description of the goods (brand name, shape and measurements and photograph).
- Over 50,000 tons per year production.
- Ensure conformance to quality requirements (see attached list).

It is necessary to present detailed data for the special grade A. The quality conditions list for Cu-Cath-1 is attached.

- Two letters from well-known consumers, one from the European community, stating that they used the product and it is suitable.
- Certificates of quantitative chemical analysis from two official assayers approved by the LME.
- The LME director shall give the LME designation. If the quality can not meet the standards, the director can cancel the registration to the LME. The director and officers are not liable in a legal dispute.

Table 2-5-2(1) Chemical Composition of Cu-CATH-1

Element Gruop	Element	Maximum concentration of element % (min)	Group total maximum concentrations % (min)
1	Selenium Tellurium Bismuth	0.00020 0.00020 0.00020	] 0.00030] 0.0003
2	Chromium Manganese Antimony Cadmium Arsenic Phosphorus	– – 0.0004 – 0.0005 –	] 0.0015
3	Lead	0.0005	0.0005
4	Sulphur	0.0015+	0.0015+
5	Tin Nickel Iron Silicon Zinc Cobalt	– – 0.0010 – – –	] 0.0020
6	Silver Total concentration of all impurities Listed above	0.0025 0.0065	0.0025

(2) Zinc

- Quality is above 99.995%.
- Brand is on the LME list for special high grade zinc.
- Weighs less than 55 kg per piece.
- Each lot is 25 tons.
- Settlement of accounts is in US$.

(3) Lead

- Quality is above 99.97%.
- Weighs less than 55 kg per piece.
- Each lot is 25 tons.
- Settlement of accounts is in Sterling (UK pound).

2-5-3 Transportation

Since Kazakhstan is located in the center of the vast Eurasia continent, transportation is one of the important factors for marketing products. The freight cost from Zkezkazgan to St.Petersburg is approximately US$90 per ton of cathode, according to the verbal information obtained at the JSC "Zhezkazgantsvetmet" on the occasion of the first site investigation in December 1995. If the cathode has to be sold on the basis of C.I.F. (Cost, Insurance and Freight) St.Petersburg, the freight cost is estimated at US$0.04 per pound of copper which is significant compared to the total smelting-refining cost of US$0.185 per pound of copper. The inland fright of US$90 per ton between Zhezkazgan and St.Petersburg appears to be comparable to the international standard, taking account of the distance of some 3,500 km. An example in North America indicates a freight of US$0.03 per ton for 1 km, based on which the freight for the distance of 3,500 km is estimated at approximately US$105 per ton.

The inland freight cost as above mentioned is too expensive for concentrates to be sold to distant market because their values are much lower than those of metals. Similarly purchasing concentrates from remote sources such as in Mongolia or Chile is not economically justified unless the sellers bear transportation costs. In contract, the present domestic freight appears to be much lower than that in other countries. Fig.2-5-3(1) indicates the relation between railway tariff and distances. The tariff appears to be classified into two categories with some reasons. The tariff to carry a ton of goods is estimated at 0.37 tenge or US$0.006 per km, using the steeper line in the figure. At the present time, marketing of concentrates to domestic smelters has a few problems according to the railway tariff as above. Adequacy of present tariff should be reassessed for economic operation of railways.

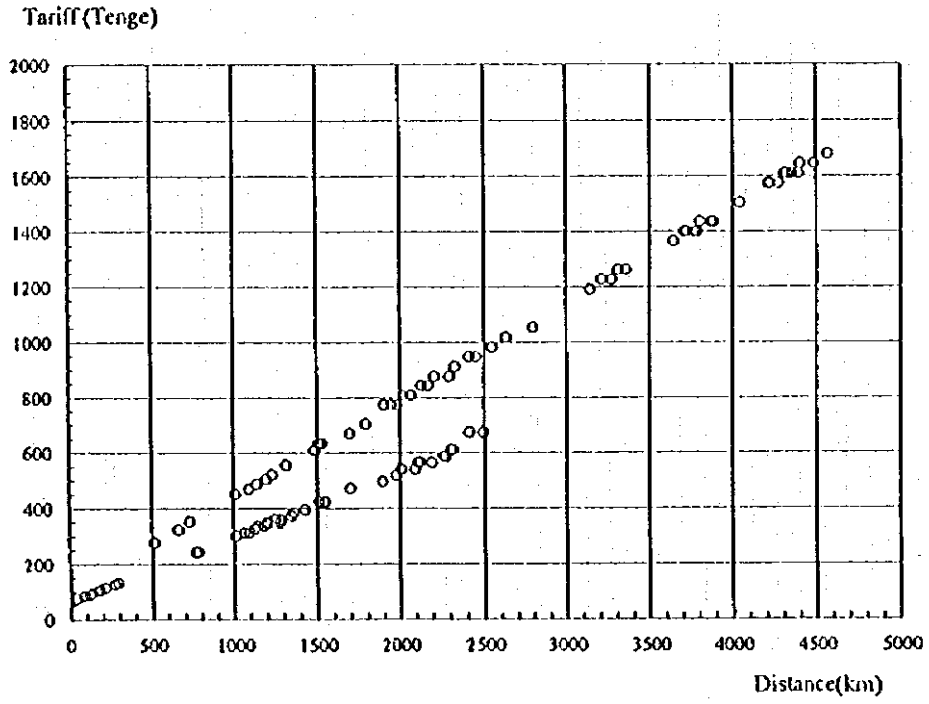


Fig.2-5-3(1) Domestic Railway Tariff per ton of Goods

Table 2-5-3(1) Railroad Tariff per Ton of Metal

tenge

	Name	Dist. km	Tariff 1	Dist. km	Tariff 2	Dist. km	Tariff 3	Dist. km	Tariff 4	Dist. km	Tariff 5	Dist. km	Tariff 6	Dist. km	Tariff 7	Dist. km	Tariff 8	Dist. km	Tariff 9	Dist. km	Tariff 10	Dist. km	Tariff 11	Dist. km	Tariff 12	Dist. km	Tariff 13	Dist. km	Tariff 14	Dist. km	Tariff 15	Dist. km	Tariff 16
1	Ust-Kamenogorsk	—	—	96	86	179	104	1251	361	2318	611	1186	338	2016	338	1251	361	37	75	120	89	2130	565	3710	1400	4392	1609	4225	1574	2451	948	1139	487
2	Leninogorsk	96	86	—	—	275	126	1347	373	2414	675	1282	349	2112	565	1347	373	133	94	216	113	2226	588	3806	1436	4488	1645	4321	1609	2547	982	1235	521
3	Zryanovsk	179	104	275	126	—	—	1430	396	2497	675	1385	384	2195	565	1430	396	216	113	299	131	2309	611	3889	1436	4572	1678	4404	1645	2630	1018	1318	556
4	Akchatau(Balkhash)	1251	361	1347	373	1430	396	—	—	1201	349	783	245	765		—		1214	349	1131	326	1013	303	2632	1018	3273	1227	3147	1191	1200	504	728	353
5	Turkestan(ACHISAI)	2318	611	2414	675	2497	675	1201	349	—	—	1284	361	1702	471	1201	349	2281	588	2198	565	188	108	1511	635	2072	808	2026	808	2137	844	1795	704
6	Tekeri	1186	338	1282	349	1365	384	783	245	1284	361	—	—	1548	425	783	245	1149	338	1066	314	1096	314	2795	1053	3356	1262	3310	1262	1983	773	663	325
7	Zhezkazgan	2016	541	2112	565	2195	565	765	245	1702	471	1548	425	—	—	765	245	1979	518	1896	495	1514	425	3213	1227	3774	1400	3718	1400	1486	609	1493	609
8	Balkhash	1251	361	347	373	1430	396	—	—	1201	349	783	245	765	245	—	—	1214	349	1131	326	1013	303	2632	1017	3273	1227	3147	1191	1200	504	728	353
9	Irtysh Combine	37	75	133	94	216	113	1214	349	2281	588	1149	338	1979	518	1214	349	—	—	82	84	2093	541	3792	1400	4353	1609	4307	1609	2414	948	1094	469
10	[illegible](E.K.C.C)	120	89	216	113	299	131	1131	326	2198	565	1066	314	1896	495	1131	326	83	84	—	—	2010	541	3709	1400	4273	1574	4224	1574	1331	913	1011	452
11	Chimkent	2130	565	266	588	2309	611	1013	303	188	108	1096	314	1514	425	1013	303	2093	541	2010	541	—	—	1699	670	2200	877	2214	877	1949	773	2172	844
12	Iletsk	3710	1400	3806	1436	3889	1436	2632	1018	1511	635	2795	1053	3213	1227	2632	1017	3792	1400	3709	1400	1699	670	—	—	1139	487	515	278	3648	1365	3316	1262
13	Aksaraiskaya	4392	1609	488	1645	4571	1678	3273	1227	2072	808	3356	1262	3774	1400	3273	1227	4353	1609	4273	1574	2300	877	1139	487	—	—	1533	635	4211	1574	3875	1436
14	Ozinkiy	4225	1574	321	1609	4404	1645	3147	1191	2026	808	3310	1262	3728	1400	3147	1191	4307	1609	4224	1574	2214	877	515	278	1533	635	—	—	4044	1505	3710	1400
15	Petropovlovsk	2451	948	547	982	2630	1018	1200	504	2137	844	1983	773	1486	609	1200	504	2414	948	2331	913	1949	773	3648	1365	4211	1574	4044	1505	—	—	1904	773
16	Druzhba	1139	1400	235	521	1318	556	728	353	1795	704	663	325	1493	609	728	353	1094	469	1011	452	2172	844	3316	1262	3875	1436	3710	1400	1904	773	—	—

17 Lokot-Nahodka (Transportation to Russia) Distance 6553km Tariff per Ton of Metal : 167.4 Swiss Fr 140USD

18 Alazhankou—Tianjin (Transportation to China) Distance 3979km Tariff per Ton of Metal : 184.4 Swiss Fr 153.4USD

2-5-4 Marketing Strategy

The most important strategy is to maintain the quality of products to international standards and sell them at adequate prices. At the present time, metal traders are purchasing the products of Kazakhstan at substantially lower prices than those in international markets, claiming that, the products are low quality compared to international standards or are not registered in LME. Then they are selling them at higher prices, upgrading or processing them at minimal costs if necessary. The producers of Kazakhstan appear to be weak in their bargaining power because of their geographical locations and unfamiliarity with international trading. In particular, depressed Russian industries have placed the non-ferrous metals industry of Kazakhstan in a considerably difficult position for marketing its products. As mentioned in the previous section, it is costly to sell the products to the west European countries due to transportation costs for long distances. An alternative market can be sought in China, whose metal consumption is growing at a significant pace as its industrialization progresses. However, transportation costs will be a major problem because industrial centers are mostly concentrated in the far southeast of the vast country.

It is hoped to create domestic industries which use a large amount of non-ferrous metals, such, as automobile, electric appliances and other manufacturing industries. However, markets for the products of these industries are very limited in the CIS countries excluding Russia and have no prospect for rapid growth in foreseeable future.

Adding value to products is desirable but will raise costs as well. Therefore, it is a matter of balance between added values and increased costs. The market for processed metals is different from that for unprocessed metals. Thorough market research will be required.

The only effective strategy at the present time is to produce cost-competitive products with adequate quality is by reducing production costs, raising productivity and controlling quality.

As for marketing technique, it may be an option to establish a metal trading corporation, strongly supported the Ministry of Industry and Trade, which handles all metal products exclusively. Sales competition among metal producers will further weaken their bargaining power against foreign metal traders. Alternatively, a supervisory organization may be attached to the Ministry in order to monitor pricing in metal trading transactions. The latter option is now adopted by the Government of the Republic of South Africa.

(1) Basic Approach to Market

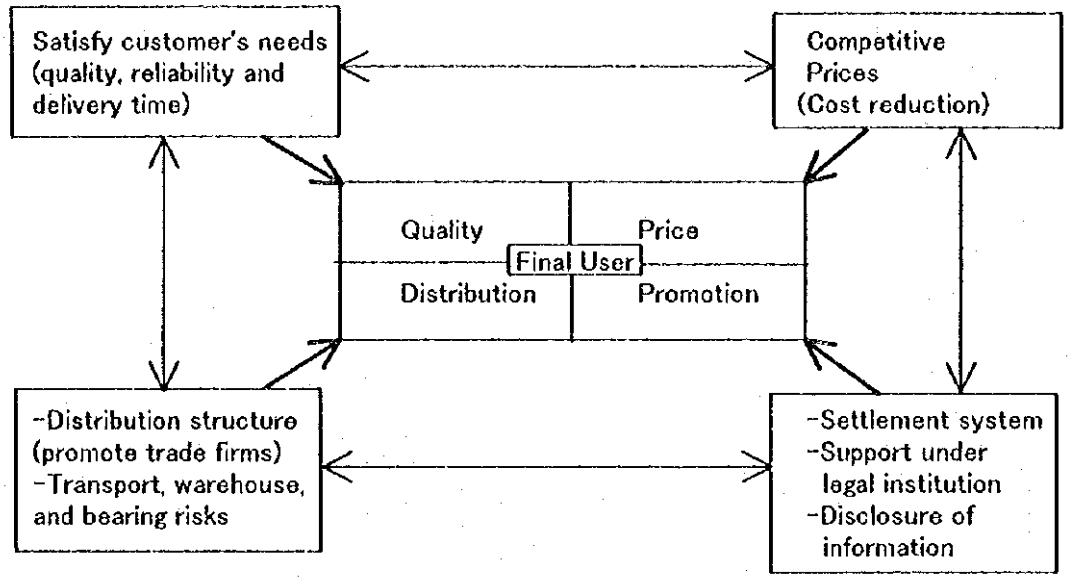
Base metal prices are subject to wide fluctuations, depending on international demand-supply situation, affected sensitively by an international conflict, labor dispute at a mine, and even by a scandal in commercial transactions. In Kazakhstan, as well, non-ferrous metal commodities, including secondary processing items, have to be subjected to transactions under the market economy, which naturally requires an approach totally different from that in the past.

Since transactions under the market economy are governed by demand and "customers' wish," a seller must have the so-called "market-in" concept; in other words, he must explore demand and approach market for himself.

The changes in market approach can be explained by the four aspects, as shown in the following table which compares those under the centrally planned economy and the market economy:

	Planned Economy	Market Economy	Suggested Approach
Customers	(1)The former planned economy sphere centering around Russia/CIS. (2)Product market was formed under the State's initiative.	(1)In industrialized countries in Europe, Americas and Asia, private manufacturers take the initiative. (2)Customers constantly upgrade their wish and demand.	(1)Discover stable customers among users in Europe, the nearest market. (2)Explore Chinese market especially for copper) (3)Explore demand in the domestic industries (esp. manufacturing of machinery and supplies for oil industry).
Technological Innovation (product quality)	(1)Importance attached to maintenance of demand quantity (military demand). (2)Product quality had only to be maintained at a stable level.	(1)Industrial mature western market has precise deman on product quality.	(1)Attach importance to users' demand on product quality. (2)Establish a grievance settlement system.
Distribution	(1)Allotment under national plan. (2)Offset settlement commonly practiced (unstable criteria).	(1)Global market (pricing mechanism of commodity exchange). (2)Distribution structure comprised of private manufacturers and trade firms	(1)Obtain LME certification for copper and zinc metal within 3 years. (2)Establish and promote a trade firm with the domestic capital which the State should provide support. (3)Bring up commercial experts capable of negotiating with multinational traders.
Market	(1)Removal within a regional economy. (2)Offset settlement (barter trade,etc) commonly applied.	(1)World trade liberalization centering on GATT-WTO. (2)All settlements are made in hard currencies.	(1)Adopt flexible export-import policy (customs, duty, etc.) (2)Build a reliable settlement system under cooperation between the government and private sectors. (3)Disclosure of information and deregulation.

(2) Marketing Strategy



Marketing strategy in the market economy must be based on the free competition principle. In case of Kazakhstan, however, mutually complimentary relationships at various levels between the provinces and the private companies will still be required. It will be insufficient if Kazakhstan relies only on its private trading firms to explore the overseas market. The State's policy guidance and support will be indispensable, which must be provided in the form of various authorizations/approvals, regulation, collection of information by diplomatic missions abroad, etc.

Producers/manufacturers must first study and analyze domestic and overseas users, and conduct their own exploration of demand and sale in the domestic and international markets. In principle, it is desirable for producers/manufacturers to market their products for themselves.

The distribution division, as represented by trading firms, acts as an intermediary between producers and users to help increase sales. Trading firms must possess functions to provide advance payment, credit, insurance and bear foreign exchange risks in favor of producers.

(3) Kazakh Non-ferrous Metal Industry as Viewed from the Sales Aspect

The non-ferrous metal industry sector in Kazakhstan constitutes an industrial complex comprising several production process divisions from mining to metal processing; these process divisions can hardly function independently and have the following characteristics:

- The primary products such as concentrates and metals have almost clear international quality standards and world market requirements.
- The processed metal products do not meet the world market requirement, quality-wise and cost-wise.
- The production processes involve risks of environmental pollution and resultant social tension, in view of the current levels of atmospheric and water emission of harmful substances, as well as control of solid waste containing valuable substances.
- The energy-intensive non-ferrous metal industry has to bear higher costs of power, fuels and transportation than the other industries, and the sector is losing power to absorb further increment of energy cost.
- As the result of the contraction of the Russian/CIS market, the industry is facing severe competition with its Western rivals in the world metal market.

The ex-COMECON countries including the CIS members used to be the principal customers of Kazakhstan, of which Russia has been a major base metal user of the world level. As these countries' consumption has substantially dwindled, the Kazakh non-ferrous metal producers have been forced to drastically change the sales target toward the Western market. Fortunately, the nation's foreign trade has increased thanks to a series of policy changes including trade liberalization, easing of the quota and approval systems, improvement in export duty, etc. Assisted by the trend and favorable world metal market, Kazakhstan managed to increase its base metal export to Europe, which has absorbed the nation's metal production.

It can hardly be said, however, that all the local people concerned fully recognize the fact that not many Kazakh products are internationally competitive. For example, Kazakhstan has no internationally recognized quality assurance system (such as certification for LME transactions) nor a quality examination system. The nation's future base metal export depends upon structural improvement such as government policy, quality improvement, shifting products to higher processing stages, and reinforcement of the competitive edge.

The stagnant domestic consumption (except lead for batteries) seems to be attributable to a decline in demand caused by the dwindling production of the machinery and military industries. In the COMECON economy, metal transactions were done mostly under the State instruction while today, the metal prices are exposed directly to the world market, and the resultant metal price increase might have caused the decline in domestic demand.

As for production costs, energy consumption per unit of a Kazakh product was higher than the overseas product while energy price was held extremely low; therefore, total energy cost for the product was comparable to that of the overseas product. However, the recent increase in energy and transportation costs in Kazakhstan, although still lower than the international level as compared in US Dollar terms, have substantially pushed up the production costs of Kazakh products.

(4) Trade Policy Aimed to Promote Non-ferrous Metal Industry

The export ratio of the domestic non-ferrous metal production has been rising in recent years.

In the case of export to Russia/CIS market, payment is frequently delayed while offset settlement by barter trade is commonly practiced, which generates no monetary receipt. These can rarely be seen in exports to the West. So far, the CIS has been the most important destination of Kazakh metals while in the future, it will necessary to shift to the USA and Western Europe where accurate settlement in hard currencies were institutionalized. In addition, efforts to export to China, Korea and Southeast Asia will possibly be rewarded with quantitative increase of sales.

A number of market forecasts undertaken by Western users and research institutes pay enthusiastic attention to the Southeast Asian market, and conclude that, until the year 2000, metal consumption in the developing economies in Asia and Latin America will increase on average of 30%.

The following are recommendations on measures to be taken for trade promotion aimed to encourage the non-ferrous metal industry in the Kazakh Republic.

① Maintain the prices of metals and secondary-processed metal products at the world market level:

Kazakh metal products are occasionally supplied to foreign countries at "incredibly low" prices. Basically, this is caused by insufficient coordination between suppliers' behavior and governmental trade-price policy.

	Copper	Lead	Zinc
	(US$/t)	(US$/t)	(US$/t)
LME quotation	2,446	549	998
Export price	2,042	481	788

It is rumored that in some cases, Kazakh metals are in fact sold at even lower prices. The following are conceivable causes for such dumping.

- artificial price manipulation by trade firms
- hasty selling due to producers' shortage of funds
- users' tough demand for price reduction to account for the failure to meet the LME quality specifications

However in the domestic market, suppliers tend to be reluctant to reduce selling prices as they wish to defend the LME prices.

This seems to have caused a vicious circle that the high domestic prices make domestic users hesitant to buy, which results in declines in the domestic demand.

② Reduce the export duty:

The current tariff of export duties should be reduced. For some base metals (zinc, lead, cadmium, etc.), the duties should be abolished.

③ Take measures for reduction/exemption of customs duty:

- reduction of the import tariff on production equipment

- exemption of import duties on equipment and materials which are not produced in Kazakhstan (such as explosives, mining machinery, etc.)
- toll processing should not be taxable

④ Other taxation measures

- exemption of the value-added tax on by-products in transactions of intermediate metal products
- deduction of foreign exchange losses from taxable amounts

(5) Promotion of Self-supported Marketing Activity

As mentioned, Kazakh non-ferrous metal products are sold to the CIS market and other foreign markets. While the delay in settlement and other problems have slowed the sales to the CIS market, it is shifting the exports to the US, Western European and Southeast Asian markets are considered important.

Western competitors, having long commercial traditions, are connected with each other through old relationship including tacit price agreements. Taking advantage of such market barriers, they may try to discriminate or prevent Kazakh metal products from launching out into the Western market. Marketing strategies to cope with such situations are suggested as follows:

① Build an international sales network and publicize Kazakh products in the world (using various mass media to make brand names of Kazakh products known to foreign countries).

② Nurture trading firms which are able to sustain the distribution structure under the market economy (for this theme, refer to relevant discussions in other sections).

③ Participate actively in international organizations for market research, for example, ILZSG (the International Lead and Zinc Study Group) under the close collaboration between the private and government sectors.

④ Obtain international quality certification for Kazakh products including secondary-processed products.

⑤ Train an English-speaking negotiation staff.

It seems necessary, as the first step, to elaborate a foreign users list which enables sales specialists carrying product catalogs to visit potential customers so that Kazakh non-ferrous metal products may be recognized by the users. For this purpose, the proposed International Trade Promotion Corporation and its overseas representatives stationed at diplomatic missions abroad must be fully utilized in addition to the private sector's efforts.

Situated deep in the interior, Kazakhstan is inevitably handicapped by higher freight costs of its products to any destination. To set off the disadvantage, efforts are critically needed to minimize other distribution costs such as warehousing cost.

(6) Roles and Functions of Trading Firms

Generally, the essential functions to be fulfilled by a trading firm are to combine demand and supply and to distribute merchandise. A trading firm intended to undertake international distribution must possess-- in addition to its elementary function of merchandise handling -- accessory functions especially such as raising funds and collection and analysis of world market information, as elaborated below:

① Function to combine demand and supply

For sales - research on demand; activities for demand creation and securing orders

For purchasing - research on sources of supply; inducing production and placing orders

For price formation - competitive bids; commodity transactions

② Function of distribution

Transportation function - removal of commodities; administration of transportation means

Storage function - warehousing and its administration

Shipping function - loading, unloading and packing

③ Accessory functions:

Financial function - providing credit and financing

Function to bear risks - inventories, consignment, insurance and foreign exchange

Management consulting function - training, managerial guidance and assessment

Information function - collecting and providing information; creation and utilization of information network

Trade firms' selling systems must comply with characteristics peculiar to the respective commodities to be handled:

Wholesale market system - spot transactions in the wholesale market, which do not fit the base metal transactions

Distributor system - commodities are sold, under producers' initiative, to users via distributors

Sales agent system - an initiative is usually taken by a trading firm which leads producers

Utilization of commodity exchange - futures market; transactions at LME, COMEX, etc.

Sales system involving an organized group of companies - a selling system organized exclusively for a particular producer/manufacturer (for selling secondary processed goods, for example, enameled wire, it is essential to establish the connection with customary users.)

It is a noticeable trend in recent years that the international commodity transactions by major trading houses have become even more multilateral, influential and information-oriented. In case of major Japanese trading firms, for example, their multilateral commercial activities rely on their expertise in collecting, analyzing and dealing with information in diverse areas. They have gained customers' confidence and built up business records from their many years of business. With these historically accumulated assets in the background, they are further upgrading their functions while enlarging their size.

Demand-supply forecast of base metals has increased its precision especially in recent years. News on a price change of an international commodity instantly runs around the world, affecting every corner of the globe. In

the current information-oriented world, trade firms' functions have expanded beyond the conventional framework of market research and sales promotion, having gone so far as to provide producers with consulting and advice on production rate, types and quality of products.

(7) Need for Trading Firms in Kazakhstan

During the Soviet era, Kazakhstan was appointed mainly to supply raw materials (mining and ore beneficiation) and intermediate products (smelting and refining), while production/manufacturing of final products were assigned to other constituent republics, from the overall political viewpoint of the Union. The constituent republics were connected by the Union's long-distance railways, whereby the gigantic industrial complex was sustained. Under the system, the Kazakh central government (in those days, KazMetallExport) was responsible for coordination of transportation and sale of raw materials and products. After the system collapsed, the inter-republic coordination lost its smoothness.

Now that the Kazakh privatization has passed the point of no return, it is recommended that a trading firm should be newly established and promoted with a view to improving the distribution division of the nation's non-ferrous metal industry. It appears advisable that the new trading firm would be established on the basis of the mentioned KazMetallExport which, in view of its historical background, is believed to still retain distribution experts.

Work and services to be undertaken by the proposed trade firm would include:

- Purchasing and assisting supply of materials required for non-ferrous metal production.
- Export-import of concentrates and metals either on producers' request or at its own risk and account. The government would have to license the trading firm to act as a trader specialized in export-import. The trading firm would have to support itself with handling commissions received.
- Market research on non-ferrous metal industry-related commodities; consulting service for producers (advice on production rate and product quality).
- Commercial credit, fund raising and insurance in favor of producers.
- Nurturing experts in commodity transactions and international business negotiation (for which it is recommendable to build relationships with Western trading firms to bring up experts through training).

In principle, the proposed trading firm would desirably be a private company; however, it is recommended that there should remain an allowance for the government to regulate, instruct and control export pricing mechanism, etc., thereby avoiding possible harmful influence to the national interest.

Another alternative is that the government would temporarily (say three years) hold some 30% of the company's share capital so that the former may extend policy guidance and corporate supervision to the latter through the managerial participation. Governmental assistance in some form would be necessary at least until the year 2000 when the privatization is expected to reach a stage of maturity. Planning should be made so that the proposed trading firm may be fully privatized after 2000 and conduct its own domestic and overseas trade.

The policy guidance and corporate supervision to be given by the government should, in principle, include the following:

- Prevention of export dumping to assure legitimacy of export pricing.
- Exclusion of monopolistic pricing mechanism.
- Audit for fair trade including an audit system based on the Corporation Law and prevention of monopolistic export terms, for instance, abnormally low rates of smelting/ refining recovery.

A case in Peru is referred to as an example of trade firms in Western countries. The South American republic richly endowed with mineral resources once established a state-owned non-ferrous metal trade organization called "MINPECO," which monopolized the nation's export-import of concentrates and metals. MINPECO opened its offices in major cities, such as London and New York where world traders flock together, to collect and analyze market information and execute sales contracts covering the entire exports of all the Peruvian private non-ferrous metal mines and refineries owned by the domestic capital. The arrangement ensured MINPECO to carry out its transactions at average prices of the world market and fair trade terms for which the organization gained a high reputation in the international non-ferrous metal society.

In 1995 when many of the Peruvian state corporations were privatized, MINPECO was also dissolved as its roles were considered to have been fulfilled. The organization was restructured into private trading firms which are currently operating on their own. The commercial experts trained within MINPECO moved to various companies where they are playing an active role.

The achievement of MINPECO, which was limited to a period of transition to the market economy, is especially noteworthy because it left invaluable human assets to the nation's non-ferrous metal sector.

(8) Support for Trading Firms

In Kazakhstan, the mentioned KazMetallExport played a somewhat similar role; accordingly, it appears advisable to effectively utilize this organization for creating a private trading firm(s). The state-run corporation's activity is said to have covered financial operations such as raising working capital, providing financing and credit, and bearing certain risks in favor of mines, smelters and refineries, for their export-import.

The State must extend a wide-range of assistance which includes granting of authorizations/approvals and financial support, in order to smooth out the privatization process and self-reliance of a trading firm. Simultaneously, it would be necessary for the government to provide guidance to ensure the trading firm to be linked with Non-ferrous Metal Industry Promotion Corporation (desirably to be placed under the control of the Ministry of Industry & Trade) and with the Non-ferrous Metal Industry Association, both of which will be discussed in the later paragraphs.

The government would also be required to control, under the legal framework, customs clearance and taxation, domestic treatment of a certain percentage of concentrates of Kazakh origin, and approve production-sales

cartel arrangement for designated commodities. Regarding the control over foreign-affiliated companies, policy decision should be taken from a higher standpoint.

(9) Creation of International Trade Promotion Agency

For efficient promotion of international trade, it is recommended that a new organization for this specific purpose should be established and its overseas representatives attached to the Kazakh diplomatic missions abroad should act in compliance with the government economic policy (the overseas representatives' posts may concurrently be held by the embassy staff in charge of economic affairs).

The principal functions of this organization would be:

① Research on export-import market; information service

② Introduction and publicity of Kazakh commodities (trade fairs, etc.)

③ Assistance for international trade

④ Settlement of international trade disputes

(10) Support by Non-ferrous Metal Industry Association

It is also proposed that non-ferrous metal producers and trade firms should jointly form a sector association which is not affiliated with the government nor its agencies. The association is intended to serve as a channel for bilateral communication between its member companies, the sector and government or foreign companies. The main activities of this proposed association are envisaged as follows:

① Coordinate prices between producers and trading firms.

② Provide statistical information on sales; coordinate export competition (organizing an export cartel).

③ Collect information on export organizations in cooperation with the proposed International Trade Promotion Corporation.

④ Propose and petition to the government authorities bills related to the sector interest.

⑤ Technological exchange with foreign companies; self-imposed environmental control.

⑥ Create an export data bank (this requires disclosure of information held by each member companies).

⑦ Introduce foreign users; compile data and information for improving competitiveness.

⑧ Join in international base metal study groups to collect global data and information.

Admission into the Association of a foreign company's local subsidiary should be encouraged, in order for the Association to serve as an effective channel for collection of overseas information and also for transmission of the local sector's request/demand to foreign companies, which would constitute the Association's objectives. For example, it appears necessary to demand through the Association a payment guarantee from foreign trade firms, thereby facilitating commercial transactions with foreign countries.

(11) Nurturing Distribution Experts

Nurturing of experts to be engaged in commercial transactions under the free market economy is a critically needed task in today's Kazakhstan. It is therefore suggested that , besides on-the-job training through the actual business contact with Western trade representatives stationed in Almaty, a Kazakh trading firm(s) should consider sending its personnel (trainees) to Western trading firms for training and exchange of information.

Kazakhstan needs to train commercial experts fluent in English, French, Spanish, Chinese, etc. in addition to the Russian language commonly used in the country.

As far as Japan is concerned, it appears that Kazakh trainees should effectively utilize the training systems and facilities offered by government organizations such as JETRO.

2-6 Industry Restructuring

Each combine is evaluated by the present situation and future plan. Depending on this evaluation, two important problems have appeared. One is the polymetal industry of East Kazakhstan area. The second is the lack of raw material of the JSC "Shymkent Lead Plant" and JSC "Balkhashmed" (refer to Table 2-6(1)).

A rank - This enterprise can pass through the crisis if they supply their funds timely and utilize the knowledge of the private management.

- We can expect good profit if these projects are implemented smoothly.
- Obtain long-term loan to pay part of its short-term debt then these combines can expect the proper circulation of working capital and good project management.

B rank - Freeze accumulated debt and supply new funds, rationalize management and innovate the production facilities. These combines can regenerate and be managed independently.

C rank - Under the market economy, a detailed investigation for the determination on whether these combines can be independent.

On this table, we classify and totally analyze the items below.

① Present situation of mine and economic value.

② Present situation of concentrator and smelter including the raw material supply and profitability.

③ Accumulated debt as of July 1, 1996.

2-6-1 East Kazakhstan Area

In the business plan of East Kazakhstan State, there are many polymetal deposits and these deposits should be developed in the future.

In this area, the project object of base metal are five combines that have 13 mines including concentrators and smelters. Depending on the production plan of the base metal in this area, there are characteristics of each five-year period.

- The production of copper concentrate will increase from 300,000 tons per year to 570,000 tons per year.
- The lead concentrate production will increase 25,000 tons per year to 67,000 tons per year, but compared to 1991, it has decreased greatly.
- Zinc concentrates production will increase from 280,000 tons per year to 570,000 tons per year.

It is better for concentrate produced in East Kazakhstan area to be treated at smelters in the East Kazakhstan area.

There are advantages by reducing the transportation costs. The high equipment operation ratio and can reduce costs by using the existing infrastructure and the capability of solution of the employment issue and other social issues makes East Kazakhstan area have many advantages. The above mentioned matters consist of the objectives of the industrial policy and administration of the state.

(1) Combine management structure

- JSC "Zhezkent MCC"

It is possible to earn a profit at Orlovskoye Mine.

Already Nova Resources has the management contract. managed and under good operation. Nova Resources has 60% share so JSC "Zhezkent MCC" is managed by a private company and more development is expected.

However, the concentrates are sold under a free market system although concentrates are sold to free market to smelters located nearby at Ust-Kamenogorsk and Irtysh. In general taking into account export tax imposed by the government policy and transport expenses, it is necessary to deliver as much concentrates as possible to help promote local economy.

- JSC "EKCChC"

It will depend on two mines, Nicolaevskoye and Artemyevskoye. The combine is managed by a private company. The concentrate is sent to Ust-Kamenogorsk and not exported to Russia and Ukraine.

- JSC "Zyryanovsk Lead Combine"

It is very important to develop Maleevskoye Mine. If Maleevskoye Mine is operated, the combine can earn a profit after several years under the same management structure.

However, Western countries are not interested in financing the development of Maleevskoye Mine if the unprofitable operation of Zyryanovskoye Mine is tied with such development plan.

It is necessary to improve and reduce the debt at the Zyryanovskoye Mine.

It is necessary to support and self reconstruct to become profitable in the 10 year period which depends on the production of the Maleevskoye Mine.

- JSC "Leninogorsk PC"

All the operating Mines have a low profitability. Even if it makes a new production plan of the Chekmar Mine, there is not much expectations.

It is necessary to change the structure including the smelter to make it profitable.

For this purpose, subsidiaries not related to mining should be separated and privatized. Profitable enterprises should expand and be activated in its area while unprofitable enterprises should change to another business and/or be closed.

In the combine, there are many staff people so they can be transferred to another business so there are much opportunity to extend their technology.

- JSC "UK Pb-Zn Combine"

The object of JSC "UK Pb-Zn Combine" is to treat all of the lead zinc ore in the East Kazakhstan area.

It will maintain the capacity of 50,000 tons/year of lead and 180,000 tons/year of zinc, add gold and silver treatment technology and recover other valuable metals. Add these technologies to strengthen the management structure.

- Irtysh copper smelter

It is necessary to expand the facility depending on increasing the copper resources in the East Kazakhstan area.

Make the smelting capacity to 70,000 tons/year of lead. The existing facilities must be renewed with the latest process and implement cost reduction and environmental improvement. Make the feasibility study quickly to make and disclose its plan for cooperation from international financial aid organizations.

Blister is sent and refined at Ust-Kamenogorsk. The excess blister is sent to Balkhash.

- JSC "Irtysh PC"

If development is implemented at the Yubileyno-Snegirihinskoye Mine, the profitability will not be good.

It is necessary to rationalize the operating mines. However, even if hard countermeasures are adapted, it seems that it is impossible to make a profit.

Subsidiaries like brick and beer factories are separated from the combine and quickly privatized. The combine is merged with by Ust-Kamenogorsk.

The above mentioned management organization is shown in Fig.2-6-1(1).

Table 2-6(1) Evaluation of Enterprises' Actual Results, Hearing, Estimate includes Qualitative Evaluation

◎: Good (A)
○: Average (B)
△: Need Countermeasure (C)

Summary / JSC Name	Enterprise Profitability				Continuance of Enterprise				International Competitiveness				Evaluation Rank ※	Note
	Production Cost	Technical Level	Profit	Debt	Intermediate & Long Term Plan (capital)	Function of Equipment & System	Potential for Raw Material	Site Infrastructure & Workforce	Product Quality Management	Environmental Protection	Public Information	Market & Customer		Important Points
Zhezkazgantsvetmet	◎	◎	○	△	○	○	○	△	○	○	△	◎	A	Stable operations, management trust
EKCCbc	◎	◎	○	○	○	△	○	○	○	○	○	◎	A	Plan to increase production
Zhezkent MCC	◎	◎	◎	◎	○	○	○	○	○	○	△	○	A	Improve rate of recovery
Karagaylinsky MCC														
Zyryanovsk Lead Combine	△	◎	△	△	○	○	◎	○	○	○	△	○	B	Develop Maleevka mine
Leninogorsk PC	○	◎	△	○	○	○	△	◎	○	○	○	◎	B	Secure own mines, review feasibility study, recycling plan
UK Pb-Zn Combine	○	○	△	△	○	△	—	○	○	○	○	◎	B	Modernize equipment, increase copper treatment
Irtysh PC	△	○	△	△	△	△	○	○	○	○	○	○	C	Mine development, reduce mining and dressing costs
Balkhashmed	△	◎	△	△	△	○	△	○	○	△	○	○	B	Secure raw materials from own mines and tolling
Shymkent Lead Plant	○	◎	△	△	△	○	△	○	◎	○	○	○	B	Secure the import of raw material, reduce facility capacity
Akshatau Ken-Baiytu Combinaty														
Sary-Arkapolymetal														
Achpolymetal	△	○	△	△	△	△	△	○	○	○	○	○	C	Mainly barite production
Tekeli Pb-Zn Combine	△	○	△	△	△	△	○	△	○	○	○	○	C	Gradually reduce production and/or close
Shalkiya Mine Management	○	○	○	○	△	○	△	△	○	○	○	○	C	Review feasibility study

※ Depending on 1995 Report

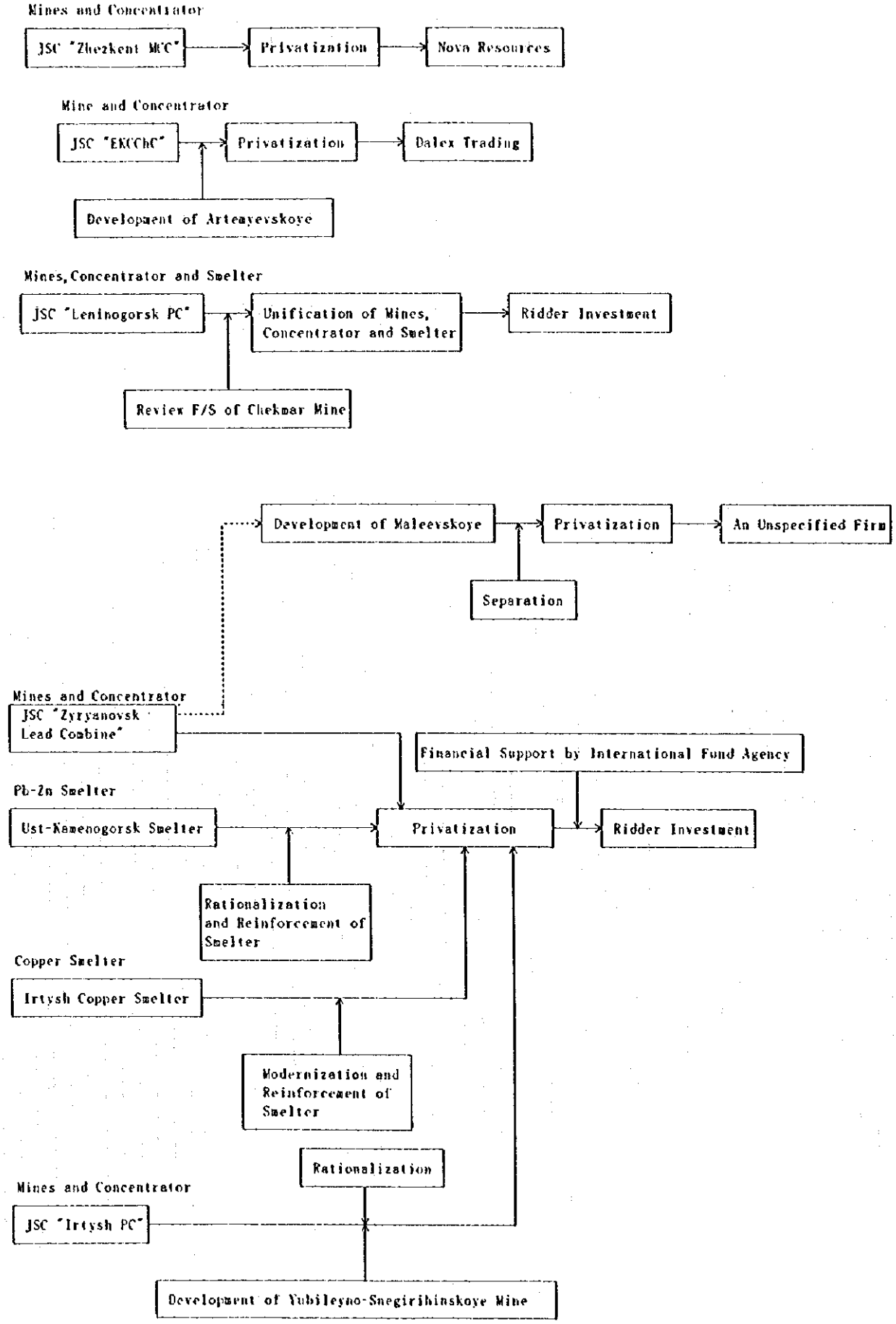


Fig.2-6-1(1) Schematic Procedure in Restructuring of East Kazakhstan

(2) The possibility of change in business

- Depending on the use of the existing infrastructure, it is hopeful to increase the supporting industries of the non-ferrous metal industry.
  - Produce explosives and civil construction industry
  - Increase the capacity of mining and agriculture machines
  - Distribution businesses (transportation business, utilization of existing facilities)
- Nurture of similar industries to utilize own technology

  Processing of base metals, gold, silver, etc. and recycling business (battery, etc.), expansion into related industry fields such as utilization of gypsum, etc.
- Nurture of businesses for utilization of staff

  Construction, service industry (insurance, sales) trading company, civil construction business in foreign countries.

(3) Policy of business change

Strengthen the training center, establish an organization to nurture small business management.

(4) Management transfer of welfare facilities to the state governments.

Management transfer for welfare facilities to the state governments. The transfer of water, sewage and heating system, etc., to the management of the state governments (to be managed with local tax collected from mining industry).

Sports/cultural facilities and the sales system of daily necessities should be independent and self-managed to meet operation costs. Under the market economy, welfare cost is paid partially by those who receive the benefit. Depending on the system, it appears the difference in value judgments of individuals creates a new demand.

2-6-2 JSC "Shymkent Lead Plant"

As a result of the difficulty of receiving raw materials, the enterprise's existence is now in a crisis situation. Based on the items mentioned below on the policy of the production structure, we recommend that the innovation of the production structure must be done.

(1) The metal production capacity depends on the stable raw material supply as listed below.

Lead metal:50,000 tons per year Sulphuric acid:25,000 tons per year

(Possible raw material supplies)

Domestic;

Zhezkazgan lead concentrate: 10,000-15,000 tons per year

South Kazakhstan lead concentrate: 10,000 tons per year

Zhezkazgan and Balkhash lead slag of copper smelting: 5,000 tons per year

Foreign;

Uzbekistan and Almalic lead concentrate: 10,000-15,000 tons per year

(2) Improvement of production facility

The above mentioned planned production is very small compared with the production capacity of 160,000 tons per year so it is necessary to re-arrange the facilities.

	Number of Facilities	Operation
Sintering	75 sq m x 2 units	70 sq m x 1 unit
Melting Furnace	10.2 sq m x 2 units	10.2 sq m x 1 unit
Sulphuric acid plant	240 tons/d x 3 units	240 tons/d x1 unit

(3) Market Forecast

The metal production of 50,000 tons per year is suitable for the below mentioned demand.

Plant consumption- lead chemicals, fabricated lead metal :	5,000 tons/year
- lead battery: (1.2 million batteries)	15,000 tons/year
Domestic Consumption :	10,000 tons/year
Foreign Consumption (including lead concentrate tolling) :	20,000 tons/year

Now the JSC "Shymkent Lead Plant" is planning construction of a lead battery plant so it is necessary to implement this plan in the future.