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Integrated Development of Inorganic Chemicals and Metals in Democratic People's Republic of Korea

Report on Project Formulation and Technical Assistance Mission*

8 - 18 June 1987

Pyongyang DPRK

by

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United Nations Industrial Development Organization
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* This document was issued without formal editing

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1. INTRODUCTION

1.1. Background of the Mission

Permanent Mission of Democratic People's Republic of Korea on behalf of the Government of DPRK requested the project identification and formulation mission in the field of basic chemicals and low tonnage metals. UNDP office in Pyongyang confirmed the request. From the Department of Programme and Project Development Mr. A. M. Mansur was participating in the mission and was responsible for discussions with the Department of Ministry of Foreign Trade and UNDP on sources of financing definition and preliminary acceptance of the concepts. Therefore this report should be read jointly with Mr. Mansur's report.

1.2 Programme of the Mission

The time schedule of the mission activities is given in Annex I. The mission held the meetings with governmental counterparts and visited mine sites and pilot plants.

2. SUMMARY CONCLUSIONS AND RECOMMENDATIONS

2.1. Conclusions

1) The representatives of the institutions met were misinformed about UNIDO's role and its activities. At the beginning they requested free-of-charge delivery of industrial scale equipment and machinery. They were also not aware of the rules and procedures for requesting and receiving technical assistance through the UNDP/UNIDO channels.

2) The discussed potential programme of technical assistance was related to:

   a) High technology development in well-defined and concentrated problems;

   b) Future potential high-scale processing of natural resources into valuable, and in many cases, unique products in the region.

3) A list of projects identified and formulated in draft form is given in Chapter 5. The source of project financing is only indicative and should be decided by UNDP and the UNIDO Department for Programme and Project Development. The Permanent Mission of the Democratic People's Republic of Korea in Vienna, in consultation with the Fifth Department of the Ministry of Foreign Trade, may establish the priorities of selected projects.

2.2. Recommendations

1) All projects should be drafted not later than the end of July 1987 and submitted to the counterpart organizations and UNDP.

2) In the case of the titanium oxide project, the respective donor countries should be informed.

The detailed presentation of a project was prepared by the end of June and submitted to the donor countries through UNIDO's specialized services. As the first step in the joint venture project evaluation feasibility study

should be prepared with financial support of interested countries.

3) In several cases, UNIDO's professional staff may assist in contributing to solutions of problems raised. It seems possible to prepare in-house:

- evaluation of a float glass contract (CHEM, TECH);
- lithium production opportunity study (MET, FEAS);
- evaluation of a feldspar complex (CHEM, FEAS).

UNDP should finance these UNIDO activities from the Preparatory Technical Assistance Project.

3. REPORT ON DISCUSSIONS WITH GOVERNMENT REPRESENTATIVES

Meetings were held with the participation of representatives of each branch of industry selected for UNDP/UNIDO technical assistance. A list of persons met during these meetings is attached as Annex II.

At the beginning of the sessions, counterpart organizations were presenting the background and justification of the projects and were formulating the requests for UNIDO assistance.

The UNIDO role in the industrial development was not well known to the counterpart representatives and the main attention was concentrated on the potential delivery under the UNIDO projects of the large-scale equipment. Only after explanation and clarification of UNIDO/UNDP mandate the final shapes of projects were discussed.

With each group of specialists also second meetings were held on which SIRA presented the conclusions and recommendations on each project. These were discussed, modified and agreed. The background information collected during the discussions is attached as Annex III.

Special attention should be given to the following matters:

1) The four projects already formulated should be as soon as possible submitted to the counterpart agencies and the Department of Ministry of Foreign Trade.

2) The remaining projects of metallic ores beneficiation should be formulated by IOD/T/MET. In some cases the Preparatory Assistance Project may be necessary.

3) The titanium dioxide project was proposed as joint venture. The letter of appointment was given by Daesong Korea Trading Co., for UNIDO to make a search for potential partners. The provisional activities should start with the preparation of the feasibility study. Financial support for the studies should be searched in countries interested to secure the long-term delivery of titanium ores or pigments (FRG, Finland, Poland, USSR, etc.).

4) Some problems can be solved by in-house study of UNIDO. These are:

- Float glass contract evaluation (CHEM, TECH);
- The nepheline production complex (FEAS, CHEM);

- Promotional study for talcum powder and crystalline graphite (CHEM, FEAS).

These studies should be financed from the Preparatory Assistance Project. Background information on these projects is kept in IO/CHEM files.

All counterpart representatives from whichever organization were well-prepared professionals. The general request is for high professional level foreign expertise to finalize development of sophisticated processes. The main industrialization goals are well formulated and strongly linked to the national raw materials and integrated to existing local or international demand.

4. ADVISORY NOTES

During the mission the technical and economical matters of technical assistance projects were discussed. In this chapter are given the preliminary assessment of shown titanium ore deposits areas and pilot plants as well as some concepts of technical improvements of the process are presented.

The advisory notes are collected in Annex IV and should not be disseminated but only to the counterpart organization.

5. LIST OF TECHNICAL ASSISTANCE PROJECTS

Preliminary List of Projects Identified During the Meetings with:

- The Daesong Jeryuk Trading Co.
- The Light and Chemical Industries Committee
- The Ministry of Mines
- The Ministry of Metallurgy and Machinery

1) "Assistance to the Development of Non-Metallic Mineral Beneficiation Technology"

- Counterpart: Department of Metallurgy of the MMM
- Main minerals:
  - Bentonite
  - Kyanite
  - Hard Kaolin
  - Soft Kaolin
  - Diatomite
- Project components:
  - study tour and training
  - experts
  - laboratory equipment (process units)
    (control (analytical)
- Source of financing: IPF
- Project cost: US$ 677,000 (2 years)

2) "Assistance in the Light Metals Technology Development"

- Counterpart: Institute of Non-Ferrous Metals (Ministry of Mines)
- Main products: Li, Mg
- Project components:
  - study tour and training
  - experts
  - critical pilot plant equipment
- Source of Financing: IPF
- Project cost: US$ 200,000 (18 months)

3) "Assistance in the Pure Metals Production Technology Development"

- Counterpart: Institute of Pure Metals (Academy of Science)
- Main products: NB, Ta
- Project components:
  - study tour
  - experts
  - laboratory equipment
- Source of Financing: IPF
- Project cost: US$ 180,000 (18 months)

4) "Assistance in the Salt Production Technology Development"

- Counterpart: Salt Institute (Salt Bureau of the Light and Chemical Industry Committee)
- Main products: Potable and industrial salt
- Project components:
  - study tour
  - experts
  - laboratory equipment
- Source of financing: IPF
- Project cost: US$ 112,000 (12 months)

5) "Assistance in the Soda Ash Installation Technology Improvements"

- Counterpart: Institute of Chemical Industry (under the Scientific-Technical Bureau of CIC)
- Main product: Soda ash
- Project components:
  - study tour, fellowships
  - experts (3 m/m)
- Source of financing: SIS
- Project cost: US$ 28,000

6) "Energy Conservation and Production Diversification in Chemical and Related Industries"

- Counterpart: DJTC

- Project components: - study tour
  - experts
- Source of financing: IPF
- Project cost: US$ 187,000

7) "Titanium Dioxide from Rutile Technology Development"

- Counterpart: DJTC
- Project components: - experts
  - subcontracts (feasibility study)
  - fellowships
  - pilot plant (beneficiation)
- Source of financing: Donor
- Project cost: US$ 2.0 million

6. ACKNOWLEDGEMENTS

The mission wishes to record its appreciation of the efficient co-operation and kind hospitality received during the work in the field, and especially the Ministry of Foreign Affairs which took over the coordination of the mission activities. Special thanks are due to His Excellency Ambassador Choi Gi Chol for his efforts to identify allinterested parties and fruitful participation in the meetings.

Also co-operation of the UNDP office in Pyongyang is highly appreciated especially the briefings of Mr. Melcher were meaningful support to the mission activities and conclusions.

ANNEX I

TIME SCHEDULE OF THE MISSION

Wednesday, 10 June 1987:	Arrival in Pyongyang
	Discussion of meetings agenda
Thursday, 11 June 1987:	Meeting with Dawsong Jeryuk Trading Corporation
	Meeting with Chemical and Light Industries Committee
	- Salt bureau
	- Scientific-technical bureau
	Meeting with Ministry of Mines
Friday, 12 June 1987:	Meeting with Ministry of Metallurgy and Machinery
	Meeting with Ministry of Mines
Saturday, 13 June 1987:	Mission to South Kwanghoe province
	Inspection of titanium rutile deposits
Sunday, 14 June 1987:	Meeting with Daesond Jin Korea Corporation
	Departure to Pyongyang
Monday, 15 June 1987:	Meeting with Ministry of Mines
	Inspection of Susqm ilmenite ore mine and pilot plant
	Meeting with Daesong Jeryuk Trading Corporation
Tuesday, 16 June 1987:	Preparation of final conclusions and recommendations
Wednesday, 17 June 1987:	Departure to Vienna

ANNEX III

Background Information on:

- Bentonite
- "Hard" and "soft" Kaolins
- Kyanite
- Diatomite
- Titanium oxide/Rutile Ilmenite
- Lithium
- Magnesium
- Talk Powder
- Crystalline Graphite
- Tantalum and Niobium

ANNEX II

LIST OF PERSONS MET BY THE MISSION

Korea Dalsong Jeryuk Trading Corporation

President: Mun Gun Jin

Deputy Managing Director: Kim Ung Sam

Korea Daesong Jeil Trading Corporation:

Deputy Managing Director: Kim Bong Gil

Korea Daesong Trading Corporation:

Vice General Managing Director: Li Chi Sam

Manager: Kim Dok Gi

Assistant Manager: Pak Chun Su

Staff Member: Kim Chol

Ministry of Mines

Deputy Director of Training Dept.: Sim Heong Roang

Institute of Non-Ferrous Metals: Chu Hong-Yob

Chemical and Light Industries Committee:

Salt Bureau Director: Kim Mun San

Foreign Economic Co-op. Bureau Director: Ju Jong Rual

Scientific Technical Bureau Specialist: Kong Hi

Ministry of Metallurgy and Machinery:

Foreign Economic Co-operation Dept., Area officer: Hon Son Dok

Department of Metallurgy, Director: Li Ghi Zon

Department of Metallurgy, Deputy Director: Zoi Ghi Hi

Department of Metallurgy, Refractions desk: Mun Gon Chan

BENTONITE.

Location of reserves: Yuson region-Haeryong District

Reserves proved I class: 5,000,000 t

The Yuson field is 5200 meters long with thickness of maximum 3.2 m and minimum 0.7 m.The deepness of field is average 70 meters.Open pit excavation is envisaged.

Location of reserves: Baekam region

Reserves proved II class: 4,000,000t

Mineralogical composition: (Yuson field)

Montmorllonite	80%-85%
limonite	
quartz	
orthoclase/ologoclase	
arsenpiryte sericite	

Chemical composition:

SiO_2	Al_2O_3	FeO	Fe_2O_3	CaO	MgO	K_2O	N_a2O
				% by weight			
67-70	15-20	0.1-0.5	1.5-2.2	1.5-3.2	0.8-3	0.3-0.7	0.4-1.0

Preliminary physical properties:

Moisture content 7.7%-8.3%

Swelling degree: 2

Colloidal degree: 26-83.6

Absorbtivness(after 52 hours) 14.79%

Viscosity degree: 55.5-83.6

PH - 7-8

Development programme: Open pit mine of capacity of 20,000 MTPY of processed bentonite is envisaged. This capacity is considered as pilot.After the estbalishment of the proecess th capacity will be increased to the required by market.

Assistance required:

Development of the technological process of bentonite beneficiation to be used in the following applications:

metal casting, paper industry, textile, china and porcelain, soap, cosmetics as well for the land structure improvement

Location patterns:

Brown coal avaliable as fuel, no limitations on water.

Logistic infractructure is requiring improvements.

"SOFT" KAOLINE

Location of reserves:

Onsong brown coal mine.

Reserves: clay with the content _25% of Al_2O_3 more than 30,000,000 t

clay with the content _20% of Al_2O_3 more than 470,000,000 t

The thickness of the mineral body is from 1 to 31 meters-average 9 meters, under the brown coal layer.

Mineralogical composition:

Decomposition of the granite rock.

Chemical composition:

Al_2O_3	Fe_2O_3	SiO_2
	% by weight	
min.20	3	min.70

Development programme:

The benefciation plant is to be constructed of 5,000 MTPY (?) of capacity , using all infrastructure of the existing brown coal mine. The laboratory tests of beneficiation were carried out without the trialas on elimination of the iron and biotite. The wet method is considered for industrial implementation.

Reqested assistance:

Development of the wet technology of kaolin beneficiation with strong emphasis on iron separation.

Location pattern:

Brown coal (calorific value 3,500 kcal/kg) is availbale as fuel, and water from open pit.The logistic infrastructure is better than average. The water treatment plant should be also included into technology development programme.

"SOFT" KAOLINE

Location of the reserve: Saenggilyeng mine

Resources of the reserve: 2,900,00 t (open pit)

Mineralogical composition:

Kaoline clay ($Al_2O_3.2SiO_2.2H_2O$) and montmorillonite($Al_2O_3.4SiO_2.12H_2O$)

impurities:orthoclase/oligoclase,pyrite,limonite,siderite,ilmenite,mica

organic impurities including carbon.

Chemical composition:

Al_2O_3	SiO_2	Fe_2O_3	H_2O
	% by weight		
21.5-32	52.8-64.6	1.7-3	9-13

Development programme:

Extraction and beneficiation production facilities with capacity of 20,000MTPY.Yearly production of kaoline 15,000 MTPY (about 80% effciency).Processes of crushing,smelting in water,sedimentation,filtering and drying are operational. Existing beneficiation process has low efficient filtration system and no iron separation.Therefore the quality of kaoline does not correspond the reqired by processors.

Assistance required:

Development of the process of filtration,selection of adequate equipment.Development of the process of iron separation(under 1 %) and selection of adequate equipment.

Location pattern: Mine and beneficiation plant are operational.Fuel is brown coal (calorific value 4000 kcal/kg).

"HARD" KAOLINE

Location of reserves:

Zangsan region

Reserves proved: 100,000,000 t

Stratum is composed from two layers.

Mineralogical composition:

Main component: kaoline clay

Impurities:dispore and organic compunds,sand

Chemical composition:

Al_2O_3	Fe_2O_3	SiO_2
	% by weight	
Upper layer		
37-42	0.8-?	38-45
Lower layer		
30-37	11-5	42-49

Development programme:

At the moment the Zangsan mine is exploited with the capacity of 150,000 MTPY.(?)The beneficiation plant capacity is 200,000 MTPY(?). Main user is the refractories factory. One process unit: magnetic separation is not working properly.Therefore the quality of product is low and brick fire resistance is not sufficient. The experience gained on the beneficiation plant will be disseminated to other beneficiation installations.

Required assistance:

Development of the iron separation process and selection of the suitable equipment for the existing beneficiation plant.

Location pattern:

Industrially developed area.

DIATOMITE

Location of reserves:	Reserves:
1).Namyang Ri if Kilju District	30,000
2).Kumchen Ri of Kilju District	1,000,000 t
3).Suan District	1,200,000 t

Mineralogical composition: Mainly diatomite

Impurities: sand,clay,alkali metals oxides and sulphates, the organic residues.

Chemical composition:(related to respective location)

	SiO_2	Fe_2O_3	P_2O_5	CaO	MgO	TiO_2	H_2O	Na_2O
1).	70-81	2-4	7-8.1	1-1.4	0.9-1.5	trace	trace	trace
2).	65	6.5	2.5	1.8	1.2	trace	trace	trace
3).	69-81	3-5	6.12	0.2-0.9	0.8-1.4	0.3-2	0.8-1.2	0.3-0.5

Physical properties:

Density 2-2.15

Porosity 60%-70%

Hardness 1

Thermal conductuvity coefficient: 0.059 - 0.13 kcal/m.^{o}C.h

The prospective applications: Filtration agent, light brick land improving agent,paper industry, china etc,.

Development programme:

At the moment small exploatatiou in Kilju county is carried out.The product is used mainly as fitration agent and for the land improvement. The beneficialtion factory is to be built of capacity 10,000 MTPY from which 5,000 MTPY will be used for refining purposes and rest for the light brick production.

Required assistance:

Development of the technology of the diatomite beneficiation and assistance in the pilot plant of 10,000 MTPY capacity.After the technology will be proved in the pilot plant scale the larger scale plant will be built.

Loaction patterns: The brown coal (calorific value 3,500 kcal/kg)is available. The infrastructural conditions are not known but district is populated, therfore one can expect that there exists limited logistic support.

CYANITE

Location of reserves: Rumjong mine
Reserves of mineral: 1,500,000 t for open pit mine
20,000,000 t for underground mine
The upper body of mineral:
-deepness 1-10 meters (average 2,5 m)with degree of body inclination 30°-50°.
The underground body of mineral:
-deepness 1000 meters and the width of field is from 100 -430 meters with thickness of 2.5 m average.
Location of reserves: Jongine mine
Reserves of mineral: not defined
The body of mineral is 1000 meters long with average thickness of 2.5 m (maximum 6 m) and width from 50 m to 350 m.
Open pit mine is envisged.
Mineralogical composition:
Main coaponent - wollartonite
Impurities:corrundum, diaspore, pyrophyllite,elementar carbon.
Chemical composition:

Al_2O_3	SiO_2	Fe_2O_3	CaO	MgO	TiO_2	Reduction
				% by weight		
45-62	32-39	0.5-9	0.5-1	0.2-0.7	0.7-1	4-5

Physical properties:
White or grey rock with hardness 6.5-7° .
Development programme:
Pilot installation is running of capacity of 2,500 t of cyanite. Ore after primery treatment is calcinated in verical calcinator. As fuel the anthracite is used with the calorific value of 5900 kcal/kg but ash content is 15%,which is highly influencing the quality of final product. Also iron is not separated what in certain production batches is giving low quality material for refractory use. The foreseen application is for the high quality refractories for the metallurgical industry. The fire-brick factory of capacity of 50,000 MTPY is considered for construction including ore benficiation including calcination. Also the potential for export of 100,000 MTPY of beneficiated cyanite was identified.
Required assistance:
Development of the technology of cyanite beneficiation and advisory services to the establishment of the fire-brick factory.
Location patterns:
Cyanite mine is located in the region where the fuel, water are available.The logistic conditions are better than average.

TALC POWDER

Location of deposit:

Naepyong-ri, Sepo County, Gwang Won province.

The ore body is convinienly deposited. Lenght: 7 km, width: 10- 40 m .

Established reserve: 4,500,000 t. Prospective reserve:7,000,000 t.

Talc ore composition:

Components	% by weight
SiO_2	55-61
MgO	25-29
Fe_2O_3	3-5
Withness	80-90
Abrasion	60-70

Talc powder composition: (96% passing sieve 325 mesh)

SiO_2	min. 58%
MgO	min.28%
Fe_2O_3	max.1%
Withness	min.85%

Technical assistance programme:

Identification of the new powder grinding mill (to receive 400 mesh 95% of product)

Decrease the iron content to improve the colour.

Location of deposits:

$MgCl_2$ concentrate is a by-product of the edible salt porduction from the sea water. The capacity of the concentrate production is 20,00-30,000 MTPY.

Chemical composition of the magnesium brine:

Components	% by wieght
$MgCl_2$	15
KCl +NaCl	10
$CaCl_2$	2
SO_4''	0.5

Production programme:

Establishment of the pilot plant of capacity of 2,000-3,000 MTPY.

Technical assistance required:

1) Training in the magnesium technology field: 2m/m

2)Equipment:

Pumps (HCl) $10m^3/h$

Pumps(smelted salts $5\ m^3/h$

Transformers

Fan (HCl gas) $200m^3.h$

Heatexchanger $500m^3/h(400^o-600^o\ C)$

Measurment and analytical equipment.

LITHIUM

Location of the deposit:

Chong Gye deposit, county Bov Dong in the Gang Won province.

Geological survey did show 178,000 tons in mine N1 (three vains). Established reserves are about 1,2 millions tons and potential of several millions tons. The deposition is requiring underground mining. The drop of the ore body is resonable.

Mineralogical composition:

Lepidolite with spodumenn and petalite.

Chemical composition:

Components	% by wieght
Li_2O	1.14
Rb_2O	0.21
Cs_2O	0.08

Location features:

Unknown.

Production programme:

Mining of ore	52,000 MTPY
Li concentrate	7,5000 MTPY
Li metal	50 MTPY
Rubidium sulphate	3 MTPY
Cesium carbonate	0.5 MTPY

The complex will be composed from the ore mechanical beneficiation , chemical concentration and separation and metallic Litium will be produced by melt-electrolysis.

NIOBIUM AND TANTALUM

Location of the deposit:

Pyong Gang deposit. The prospective reserves were evaluated and laboratory testing of the ore beneficiation is completed. The deposit of 53 million tons of ore was identified .

Mineralogical composition:

The main niobium mineral is a pyrochlore. It is accompanied by wide range of rare earths elements, like Ytrium, Neodium, Lantan, and Zirconium.

Chemical composition:

Components	% by weight
Nb_2O_5	0.129
Ta_2O_5	0,012
ZrO_2	0.509
Rare earths	ppm to 0.01

Location features:

The ore is deposited only 1-2 m under the surface, therefore the open pit mining is considered. The beneficiation plant will be located about 1km from the mine. Infrastructural conditions are satisfactory.

Production programme:

The mining of the ore:1000,000 MTPY (0.14% of Nb and Ta)

Concntrate production:2,200 MTPY (32%-34% of Nb and Ta)

Zirconium concentarte:4,400 MTPY (58% of ZrO_2).

Technology of beneficiation was established:coarse and fine crushing, gravuty separation, magnetic and flotational separations. Later concentrates will be processed to the NB-Ta metals in metallurgical section of the factory. The technology of the metallurgical section is under development.

CRYSTALINE GRAPHITE

Location of the deposit:

I. Daepyong-ri, Yonsan County, North Hwanghae Province.

Reserves: C1 6,823,450 t of average carbon content 7.2 %

C2 4,811,180 t of average carbon content 5%

Total graphite prospected quantity:731,847 t

Deposition of ore is allowing to mine 30% in the open pit and rest in underground mine.

Mineralogical composition:

Main rock is gneiss, and crystaline gneiss, quartz, feldspar, mica, clay etc. The graphite is deposited irregulary in the gneiss layers.

Chemical composition:

Components	% by weight
C	7.33
SiO_2	60.95
Fe_2O_3	7.13
Al_2O_3	0.72
CaO	2.82
MgO	0.52
TiO_2	0.40
P_2O_5	2.86
K_2O	0.90
Na_2O	1.00

Production programme:

Mine started operation in February 1984. The mine capacity is allowing to produce 2,000 MTPY of crystaline graphite. The beneficiation plant was constructed at the distance of 1.5 km from mine. The cable car transportation facililties are under construction. The beneficiation plant is composed from following units:

- crushing
- milling
- floatation
- dewatering
- drying
- mechanical packing

Treatment capacity: 5-7 tons/h. Rate of recovery:70%.

Technical assistance and promotion programme:
Development of the production capacity to 7,000-10,000 MTPY including recovery of by-products.

II. Hung Sang, Chungdan county, South Hwanghae Province.
The prospected quantity of ore is 10,000,000 t (estimated more than 30,000,000).
Several deposits of size 6 km length and 3 km width are found. Thickness of the deposits is average 15 m (max.60 m, min. 10 m).
Mineralogical composition:
Ore is composed from calcite,iron pyrrites, ilmenite, arsenpyrrite, zodiacal light etc.
Chemical composition:

C	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	K_2O	Na_2O	P_2O_5	H_2O
						% by weight			
8.83	44.58	12.59	13.12	4.45	5.74	1.42	0.61	0.1	0.28
9.67	50.69	7.41	13.83	3.80	4.51	2.09	0.91	0.26	0.44

Production programme:
The 14,000 MTPY treatment capacity was constructed at Hungsang mine. It is planned to develop the production and treatment of the ore to the capacity of 500,000 MTPY (?).Expected graphite quality: 90% purity.
Technical assistance programme:
Development of the up-to date technology of the graphite of electrode quality.

KOREA DAESONG TRADING CORPORATION

The Democratic People's Republic of Korea.
Botonggang District, Pyongyang

CABLE ADD: "DAESONG" PYONGYANG
TELEX: PRK PY 473 DS PYONGYANG

Your Ref. No.

Our Ref. No.

Pyongyang 15th Jun, 1987

Re: Authorising on the development of Titanium ore

It is the intention of Korea Daesong Trading Corporation to develop the deposits of Titanium ore of rutile and ilmenite in the way of joint venture according to Law of the Democratic People's Republic of Korea on joint ventures which is inspiring the joint ventures on the principle of mutual equalty and benefit with companies and private partners in other countries.

The concerned scientific and technical points and economical value have already been proved through the laboratory tests.

We are sure that U N I D O shall provide the best assistance and cooperation in introducing the suitable partner with high technology and concerned funds to be necessary for establishing new processing industry of Titanium ore in our country.

We are pleased to authorize U N I D O to act as our agent and contact with concerned party who are interested in this joint venture so as to develop Titanium ore with success.
In the meantime we remain
Yours faithfully,

KOREA DAESONG TRADING CORP.
PYONGYANG

DETAILED RULES AND REGULATIONS FOR THE IMPLEMENTATION OF THE LAW OF THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA ON JOINT VENTURES.

(Adopted by the Decision No. 14 of the Administrative Council on March 20, 1985)

CHAPTER 1

GENERAL RULES

ARTICLE 1. The Detailed Rules and Regulations aim at expanding and developing economic and technological exchange and cooperation with many countries of the world by correctly executing the "the Law of the Democratic People's Republic of Korea on Joint Ventures."

ARTICLE 2. The Democratic People's Republic of Korea (hereinafter called the DPRK) encourages joint ventures between the companies and enterprises of the DPRK and foreign companies, enterprises and individuals within the territory of the DPRK on the principle of equality and mutual benefit.

ARTICLE 3. Joint Ventures in the DPRK may be set up in many fields of the national economy including electronic and automation industry, metal industry, mining industry, machine-building, chemical industry, food processing industry, clothing industry, daily necessaries industry, construction, transportation and tourism.

ARTICLE 4. Joint Venture companies to be established within the territory of the DPRK shall be capable of introducing the latest science and technology, improving the quality of the products and increasing exports.

ARTICLE 5. A joint company to be established within the territory of the DPRK shall take the form of a limited liability company.

ARTICLE 6. The state protects by law the properties invested by foreign parties to joint ventures and income accruing from the operation of enterprises.

ARTICLE 7. A joint company conducts its management activities independently pursuant to the laws of the DPRK, the contracts between parties to the joint ventures and its statute.

ARTICLE 8. A joint venture company shall abide by correctly the legal norms and regulations of the DPRK in all its activities.

ARTICLE 9. Koreans overseas including Korean traders and manufacturers in Japan may open joint ventures with the companies and enterprises of the DPRK under the Detailed Rules and Regulations.

CHAPTER 2

ORGANIZATIONS OF JOINT COMPANIES

ARTICLE 10. The companies and enterprises of the DPRK which are going to organize joint venture companies with foreign companies, enterprises and individuals shall open negotiations with foreign parties after reaching an agreement with the Ministry of External Economic Affairs.

ARTICLE 11. After concluding contracts for the organizatio of joint venture companies, the parties to the joint ventures shall obtain an approval of the Ministry of External Affairs. Economic Affairs.

ARTICLE 12. The contract for the organization of a joint company shall include important matters on the organization and operation of the joint company such as the contracting parties and the name of the company, the duration of the company, the total funds of the company, the share of investment of each party, the organization of the board of directors, the number of workers and staff members of the company and its wage standard, guarantee of living

conditions, etc.

ARTICLE 13. A joint company shall register with the provincial people's committee concerned.

In applying for registration, the company should produce the documents of approving the contract for the joint venture its statute and the document of proving the investment of each party, together with the application for the registration of the company.

The joint company will become a corporate body from the time of registration.

ARTICLE 14. When a joint company intends to change items registered, it should reach an agreement with the Ministry of External Economic Affairs on the changes and inform the company registration organs of the changes.

ARTICLE 15. A joint company shall have its statute.

The statute of the company should include the name and location of the company, its business line, its total funds, the share of investment of each party, the duration of the company, the principles and order of the company's activities.

CHAPTER 3

INVESTMENT

ARTICLE 16. The total funds of a joint company and the share of investment of each party shall be decided by agreement between the parties to the joint ventures.

ARTICLE 17. Parties to a joint venture may make investment in the form of currency, builings, raw materials, machinery and equipment, invention right, technical documents, land, etc.

ARTICLE 18. Currency to be invested by the parties to a joint venture shall be decided by agreement between them.

ARTICLE 19. When buildings, raw materials, machinery and equipment, invention right and technical documents are invested, their prices are assessed by the parties to a joint venture according to international market prices.

ARTICLE 20. In case land is not included in the share of investment a joint company should pay land rent.

The land ren t is set by the State Price Assessment Commission.

ARTICLE 21. Ajoint company shall not reduce registered funds.

ARTICLE 22. Parties to a joint venture are liable for the debts incurred in the course of running the company only within the limit of shares of their investment.

ARTICLE 23. When a party to a joint venture wants to transfer a part or the whole of the share of its investment to a third party, it should get the consent from the other party.

CHAPTER 4

BOARD OF DIRECTORS AND STAFF MEMBERS.

ARTICLE 24. A joint company shall have the board of directors.

The board of directors shall be the highest deciding body of the joint company.

ARTICLE 25. The board of directors is composed of the required number of directors.

The board of directors shall have a chairman and a vice-chairman.

The number of directors nominated by each side to a joint venture and the chairman and the vice-chairman are decided in the contract.

ARTICLE 26. The meeting of the board of directors is

convened by the chairman more than once a year. The vice-chairman may call the meeting of the board of directors with the authorization of the chairman.

The chairman or vice-chairman shall notify in advance directors of the date, place and agenda of the meeting of the board of directors when he intends to call it.

ARTICLE 27. The board of directors discusses and decides on such important matters concerning the management of the company as the increase of the registered capital of the company, the extension of the duration of the company, the dissolution of the company, the measures for the company's development, the plan for its management activities, the account settlement and the distribution of profits, the appointment and dismissal of the president and the vice-president and the appointment of auditors.

ARTICLE 28. The problems to be discussed at the meeting of board of directors are decided by the unanimous vote of directors present at the meeting.

ARTICLE 29. A joint company has a president, a vice-president and required number of staff members.

ARTICLE 30. The president of a joint company organizes and conducts the management of the company according to the contract or the organization of the company, its statute

and the decisions taken by the board of directors, and answers to the board of directors for its work.

CHAPTER 5

PURCHASING OF MATERIALS AND SELLING OF PRODUCTS.

ARTICLE 31. A joint company may purchase in the DPRK raw and other materials, semi-finished goods and equipment (hereinafter referred to as materials) needed for production.

Pertinent organs and enterprises in the DPRK should preferentially provide joint companies with required materials. A joint company may buy from foreign countries materials which are not produced or cannot be bought in the DPRK.

ARTICLE 32. A joint company may purchase invention right technical documentation, technical know-how and other advanced technology from foreign countries.

ARTICLE 33. The export of products should be the main line of business of a joint company.

ARTICLE 34. A joint company may purchase necessary materials for production and sell its products in the DPRK only through pertinent trade organizations. At this time, the price is based on international market prices.

A joint company may buy directly some materials for operation through comercial networks.

ARTICLE 35. A joint company may export products and import materials for production directly or through the trade organization of the DPRK.

ARTICLE 36. When a joint company imports materials needed for production or exports its products, it is not asked to get export and import license.

ARTICLE 37. A joint company may import materials needed for the production free of duty.

ARTICLE 38. A joint company should pay regulation charge for water, power, heating, telephone, etc.

ARTICLE 39. A joint company shall insure its property basically through the insurance company of the DPRK.

CHAPTER 6

LABOUR MANAGEMENT

ARTICLE 40. A joint company employs or dismisses Korean workers through the labour administration organs of the DPRK.

The labour administration organs should provide joint

companies with required labour force on the preferential basi

ARTICLE 41. Working hours, rest and labour protection of workers and staff members of joint companies are practiced in accordance with the labour laws and regulations of the DPRK.

ARTICLE 42. A joint company may employ foreigners as its working staff.

ARTICLE 43. A joint company should raise the technical level of the workers and staff members and train up skilled workers required.

ARTICLE 44. The workers and staff members of joint company enjoy the benefits of social insurance and social security od the DPRK.

A joint company should pay 7 per cent of remuneration of the workers and staff members, and the workers and staff members 1 per cent of their remuneration as premiums on social insurance.

CHAPTER 7

FOREIGN EXCHANGE CONTROL

ARTICLE 45. A joint company opens foreign currency and Korean WON accounts at the Foreign Trade Bank of the DPRK (hereinafter referred to as the Trade Bank) or the banks specified by it.

All foreign exchange income and expenditure of a joint company shall be effected only through the foreign exchange account at the banks.

ARTICLE 46. A joint company realizes interest on the balance of foreign exchange at the bank account according to the interest rate set by the Foreign Trade Bank.

ARTICLE 47. A joint company may open its account at the banks of other countries by agreement between the parties to the joint venture.

ARTICLE 48. A joint company pays in foreign exchange the prices of commodities which are bought or sold through the foreign trade organs in the DPRK and the expenses relating to it, and in Korean WON the prices goods purchases through commercial networks and various fees.

ARTICLE 49. A joint company may get credit from the banks of the DPRK or foreign banks when it is short of foreign currency in its operation.

ARTICLE 50. Korean WON is used in principle on the management accounts of a joint company and foreign currencies are also used by agreement between the parties to the joint venture.

The foreign exchange income and expenditure of a joint company are converted into Korean won according to the exchange rates set by the Foreign Trade Bank.

ARTICLE 51. A joint company shall remit abroad the dividends of foreign parties to the joint venture at their request.

When a joint company remits abroad the dividends, it should submit a document confirming the contents to the bank.

ARTICLE 52. Foreigners employed by a joint company may remit abroad their wages of up to 60 per cent.

CHAPTER 8

ACCOUNT SETTLEMENT AND DISTRIBUTION

ARTICLE 53. A joint company should settle the accounts of its management every year.

The fiscal year for the joint company is from January 1 to December 31.

ARTICLE 54. The settlement of account for joint companies shall be made in such a way as to decide on the net income after compensating production cost out of its total annual income.

Article 55. The auditor should check the documents concerning the company's settlement of accounts and answer to the board of directors for their correctness.

Article 56. The auditor is entitled to inspect the business operation of a joint company.

The auditor may peruse the account books of the company, contracts and other documents needed for financial inspection.

Article 57. A joint company should pay the income tax on its net income in each settlement term according to the Income Tax Law of the DPRK on Joint Companies.

Article 58. A joint company should create a reserve fund.

Five per cent of the net income of the joint company shall be set aside for the reserve fund every year until it amounts to 25 per cent of registered capital.

The reserve fund is used in filling the deficit of the joint company.

The reserve fund may be transferred to the company's registered capital by the desision of the board of directors.

Article 59. A joint company shall create the fund for the expansion of production and technical development, and the bonus and welfare funds for the workers and staff members.

The kinds, size and rate of the fund are discussed and decided at the board of directors.

Article 60. The profit distribution between the parties to the joint venture shall be done in such a way as to divide the net income in proportion to their respective shares in registered capital after the payment of the income tax on it.

net income and deduction of the funds.

The parties to the joint venture may reinvest their dividends

CHAPTER IX

DISSOLUTION OF JOINT COMPANIES

Article 61. A joint company shall be dissolved at the expiration of its duration stipulated in the contract.

If the joint company wants to continue its operation, it should decide the matter at the board of director six months befor the termination of its duration and register with the company registration organs after gaining the approval of the Ministry of External Economic Affairs.

Article 62. In the following cases a joint company may be dissolved by the decision of the board of directors prior to the expiration of the duration of the venture.

1. When the joint company suffers a continuous deficit more than 3 years;

2. When a party to the joint venture causes serious consequences in the business operation by failing to execute its obligations;

3. When the joint company cannot be operated any longer owing to unavoidable circumstances.

Article 63. Prior to liquidation, the liquidator should inform the company registration organs of the starting of his liquidation procedure.

Article 64. When a joint venture company is dissolved, the board of directors should appoint a liquidator and resi-

dent should hand over his duties to liquidator.

Article 65. The liquidator should wind up the current business of the company and distribute remaining assets to the participants in the venture in proportion to their contribution.

ARTICLE 66. The liquidator answers to the board of directors for the correctness of his work.

ARTICLE 67. After finishing liquidation procedures, the liquidator should gain the approval of the board of directors and inform the company registration organs of the termination of liquidation.

CHAPTER 10.

SETTLEMENT OF DISPUTES

ARTICLE 68. Differences arising in the course of the operation of a joint company are settled through consultation.

The disputes insolvable through consultation are deliberated and settled by a court of law or a trade arbitration organ of the DPRK.

ARTICLE 69. Arbitration is carried out according to the deliberating procedure of the trade arbitration case of the DPRK.

A plaintiff and a defendant in arbitration can nominate as arbitrators those who are not in the arbitrator's list.

ARTICLE 70. Justice is administered according to the civil suit procedure of the DPRK.

The foreign parties to joint ventures enjoy the same right as the parties of the DPRK to joint ventures in a civil suit.

ARTICLE 71. The deliberation of disputes may be tendered to the foreign trade arbitration organ of a third country by agreement between the parties to the joint ventures.

DETAILED RULES AND REGULATIONS OF THE INCOME TAX LAW OF THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA ON JOINT COMPANIES

(Approved by the Decision No. 29 of the Administration Council on May 17, 1985.)

ARTICLE 1. The Detailed Rules and Regulations are applicable to joint companies within the territory of the Democratic People's Republic of Korea (hereinafter referred to as the DPRK), jointly operated by the organizations or enterprises in the fields of the national economy of the DPRK and foreign organizations or enterprises (including individuals).

ARTICLE 2. A joint company within the territory of the DPRK is liable to pay income tax according to the Income Tax Law of the DPRK on Joint Companies and its detailed Rules and Regulations.

ARTICLE 3. The income tax on a joint company shall be levied on the net income after compensating costs from the gross income in each settlement term.

1. The income tax period for joint companies is one year calculated from January 1 to December 31.

The income tax on a newly established joint company shall be levied on the income calculated for a period from the date of commencing its operation to the end of the year andthe income tax on a joint company to be liquidated, from January 1 to the date of liquidation.

2. The net income of a joint company shall be computed as follows:

1) The net income of a joint company in the field of industry is calculated by deducting the cost of the sales from income from sales of products;

2) The net income of a joint company in the field of construction is calculated by deducting construction costs from the income derived from transfering constructions;

3) The net income of a joint company in the field of transportation is calculated by deducting transportation costs from the income from freight;

4) The net income of a joint company in the field of commerce and public service is calculated by deducting the expenditure for sales of goods and public service from the income from sales of goods and public service;

5) The net income of a joint company in other fields is calculated according to the rules set separately by the Ministry of Finance of the DPRK.

3. All joint companies should submit the annual accounting statement of their management to the relevant financial

organs within the first month of the next year.

ARTICLE 4. The income tax rate on a joint company shall be 25 per cent of the net income.

ARTICLE 5. The income tax on a joint company shall be computed as follows:

1. The income tax on a joint company shall be calculated by applying the tax rate to the net income gained in each settlement term.

2. When the income of a joint company is made by branches in many places within the territory of the DPRK, the income tax shall be calculated by applying the tax rate to the total amount of the incomes.

ARTICLE 6. A joint company may be exepted from the income tax fpr a period of 3 years from the time of commencement of its operation.

1. When a joint company wishes to be exepted from the income tax, it should file for approval an application with the Ministry of Finance of the DPRK.

2. When a joint company still earns little profits even after the expiration of the exeption period of income tax, the Ministry of Finance of the DPRK may exept or reduce the income tax on the petition of the joint company.

ARTICLE 7. The income tax on a joint company shall be calculated in terms of Korean won.

In case the net income of the joint company is in foreign currencies, the income tax shall be assessed in terms of Korean won according to the exchange rate quoted by the Seoul Bank of the DPRK as of the end of settlement year (the date of the liquidation included)

ARTICLE 8. A joint company should pay the income tax to the relevant financial organs on the date prescribed.

In case of failure to pay the income tax in due time, the joint company should pay arrears of 0.3 per cent of the overdue income tax for every day of delay, starting from the first day of default:

1. The joint company should pay the income tax to the relevant financial organs within the first month of the next year of the settlement year;

2. The joint company should submit income tax returns to the relevant bank at the time of payment of income tax. The bank shall examine and ascertain them and keep one copy in its custody, and send one copy each to the joint company and the relevant authorities;

3. The financial organs shall collect deficiencies from and refund excess payments to the taxpayer after examining and ascertaining the amount of the income tax paid by the joint company;

4. The arrears of the income tax not paid by a joint company in due time owing to unavoidable circumstances may

be exempted totally or partially on examination by the financial organs.

ARTICLE 9. The financial organs have the right to conduct an audit concerning the payment of the income tax by the joint company:

1. The financial organs have the right to audit the income tax payment situation of the joint company and related organizations and enterprises;

2. The joint company should afford information necessary for the audit to the financial organs and comply with the auditing of the financial organs.

ARTICLE 10. A joint company may bring an action in a court of law for excess taxation by the releveant authorities.

ARTICLE 11. The financial organs may impose a penalty of up to 4 times the amount of the pertinent income tax according to the seriousness of offence on a joint company which has violated the Income tax Law of the Democratic People's Republic of Korea on Joint Companies. In case of gross violation, the financial organs may bring an action in a court of law.

THE INCOME TAX LAW OF THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA ON JOINT VENTURES.

(Adopted by the Decision No. 12 of the Standing Committee of the Supreme People's Assembly of the DPRK on March 7, 1985)

ARTICLE 1. A joint company within the territory of the Democratic People's Republic of Korea shall pay income tax in accordance with this law.

ARTICLE 2. The income tax on a joint company shall be levied on the net income after compensating costs from the gross income in each settlement term.

ARTICLE 3. The income tax rate on a joint company shall be 25 per cent.

ARTICLE 4. A joint company may be exempted from the income tax for a period of 3 years from the time of commencement of its operation.

In case the joint company still earns little profits even after the expiration of the tax exemption period, the income tax may be exempted or reduced on the petition of the joint company.

ARTICLE 5. The income tax on a joint company shall be computed in terms of Korean won.

ARTICLE 6. A joint company shall pay the income tax on the fixed date to the relevant financial organs.

In case of failure to pay the income tax in due time, the joint company shall pay arrears of 0.3 per cent of the overdue income tax for every day of delay, starting from the first day of default.

ARTICLE 7. The financial organs are empowered to audit income tax payment situation of any joint company.

The joint company is liable to afford necessary information for auditing to the financial organs.

ARTICLE 8. The financial organs have the right to impose penalty on joint companies for their violation of this LAW according to the seriousness of the case.

RUTILE.

Location of the deposit:

Ongjin area in South Hwanghae Province.

Ore reserves:

Geological study were completed on several deposits in this area. The fully investigated area is showing reserves of ore above the 200,000,000 t. The lenght of the deposit is 29.2 km. Width of the body in average is 6.4 m. The deepness of the deposit was investigated up to 1300 and bottom was not reached.

Mineralogical composition:

95% Rutile

Chemical ore analysis (average):

Components	% by weight	Components	% by weight
TiO_2	3.68	SiO_2	70.23%
Al_2O_3	8.50	Fe_2O_3	9.37
FeO	0.13	MgO	0.42
MnO	0.10	P_2O_5	0.05
Na_2O	0.05	Zr	0.1-0.3
K_2O	-	H_2O	0.38

Location features:

The deposits are located south of the Ongjin community, relatively near to the inhabited areas, 40 km from Haejiu city (county capital city). The 10 km of the road from Haejiu is made from concrete(damaged), rest of the distance is a field road. The deposit field "A" is located on the both sides of the valley through which road, narrow railway and river are passing. The distance to the nearest sea port is about 30 km. Electrical energy is available, however for large scale consumption the line of 30 km will be necessary. The general infractructural conditions are satisfactory and similar to medium developed sites in industrialized countries. Mining company was not yet established, but near located mines of the province may assure the qualified staff in design, mine exploatation and plant operation.

Production programme:

Final production programme was not yet established.

Preliminary programme:

Construction of the beneficiation plant and TiO_2 pigment of capacity 50,000 MTPY. The pilot plant at first stage is considered of capacity 3,000 - 5,000 MTPY .

Advisable programme:

Construction of the beneficiation plant of capacity 200,000 MTPY and 50,000 MTPY of TiO_2 pigment. Balance of the rutile ore will be exported. The need of pilot plant should be decided after the samples processing in industrial laboratories.

ILMENITE

Location of the deposit:

Susan area in South Pyongyang Province

Reserves of ilmenite ore:

The deposits of identified reserves are located across the valley where intensive farming is performed. The size of the deposit is 2.6 lenght, and width of 0.8km. Ore is located on the surface and is extending up to the 277 m deppness(this is not the bottom of the ore body). Set of drilling holes - 200mx200m. At the moment proved quantity of ore is 175,000,000 t. The prospective quantity is over 500,000,000 t.

Mineralogical composition :

90% ilmenite.

Chemical composition (average):

Component	% by weight	Component	% by weight
TiO_2	5.8	SiO_2	39.64
MgO	6.84	CaO	6.38
Fe_2O_3	11.12	Al_2O_3	7.8
V_2O_5	0.004	P_2O_5	0.02
Na_2O	0.07	S	0.024
Zn	0.01	Mo	0.04
Cu	0.04	Mn	0.04
Ni	0.01	Cr	-

Location features:

The deposits are located 30 km south of city Pyongyang, near the Susan village. The connecting road is only 10 km paved (concrete and asphalt), the rest is a field road. Distance to the Pyoungyang South Railway is about 20 km. The water in the area is available in the large quantity, however due to the intensive farming no untreated sewage will be allowed. The elctricity is available, but for large scale consumption new line of about 10 km would be necessary. The general infrastructural conditions are satisfactory and similar to the medium developed construction site in the industrialized countries. Mining and processing company is established and TiO_2 pigment pilot plant is operational (capacity about 300 MTPY-sulphuric acid route). Small mechanical workshop as well as the chemical laboratory are established, however more complex analysis are held in research institutes. The number of of employees is over 80 from which several competent engineers.

Development programme:

Construction of TiO_2 pigment plant of 20,000 MTPY of capacity and 100 MTPY of Ti metal and respective ore beneficiation plant.

Advisable programme:

Construction of the 50,000 MTPY TiO_2 pigment plant and 400,000 MTPY of benficiated ilmenite. The Ti metal plant capacity should be analysed.

World TiO_2 Producers and Capacities (continued)

Company and Plant Location	Process[a]	Raw Material	Annual Titanium Dioxide Pigment Capacity (thousands of metric tons) 1974	1975	1976	1977	1978	1979	1980	Remarks
WESTERN EUROPE (continued										
Italy										
SIBIT										
Scarlino	S	Richards Bay slag	54	54	54	54	54	54	54	SIBIT (Societa Italiana Biossido di Titanio Spa) is a wholly owned subsidiary of Grupo Montedison.
	C		—	—	—	—	—	—	—	36 thousand metric ton-per-year plant postponed indefinitely.
Spinetta-Marengo	S		45	45	45	45	25	25	—	Trade name for all production is Rutilo RS® and Rutilo AS®. On standby.
The Netherlands										
TDF Tiofine BV (owned 50% by American Cynamid Co. and 50% by Billiton Nederland BV)										
Botlek	S	Canadian slag	30	32	32	35	35	35	40	Trade name is Tiofine®.
Norway										
Kronos Titan A/S (owned 100% by N L Industries, Inc.)										
Fredrikstad	S	Primary Norwegian ilmenite	20	20	24	24	25	25	25	Trade name is Kronos®.
Spain										
Dow Chemical Iberica, SA (owned 98% by The Dow Chemical Co. and 2% by Spanish stockholders)										
Aznalcollar	S	Primary Norwegian ilmenite	24	24	24	24	24	24	24	Trade name is Unititox®.
Titania, SA (owned 45% by Tioxide Group Ltd. (United Kingdom) and 55% by Union Explosivos Rio Tinto, SA)										
Huelva	S	Secondary Australian ilmenite	—	—	—	45	45	45	45	Trade name is Tioxide®.

World TiO_2 Producers and Capacities (continued)

Company and Plant Location	Process[a]	Raw Material	Annual Titanium Dioxide Pigment Capacity (thousands of metric tons) 1974	1975	1976	1977	1978	1979	1980	Remarks
WESTERN EUROPE (continued										
Finland										
Kemira Oy Vuorikemia Division Pori	S	Primary Finnish and Norwegian ilmenite	54	54	54	60	60	80	80	Trade name is Fiantitan®; 80% of the production is exported.
France										
Thann et Mulhouse SA (72% owned by Rhone-Poulenc) Le Havre	S	Australian ilmenite (must convert to slag)	59	73	60	60	60	60	82	Permitted to use entire plant (1980).
Thann	S	Australian ilmenite	24	24	24	24	24	24	24	Trade name is Titafrance®.
Tioxide SA (100% owned by The Tioxide Group, United Kingdom) Calais	S	Canadian slag	60	62	62	62	62	62	62	Trade name is Tioxide.
Germany, Federal Republic of										
Bayer AG Uerdingen	S	Canadian and South African slag	75	75	75	75	75	75	75	
	C	Australian rutile	n.a.	20	20	20	20	20	20	Trade name is Bayertitan®.
Kronos Titan-GmbH (formerly Titangesellschaft) (owned 100% by N L Industries, Inc.) Leverkusen	S	Primary Norwegian ilmenite and Canadian slag	86	86	91	82	82	65	65	
	C	Australian rutile	16	16	16	16	16	36	36	
Nordenham	S	Primary Norwegian ilmenite	36	36	54	60	60	60	60	
"Sachtleben" Chemie GmbH (owned by Metallgesellschaft AG) Duisburg	S	Canadian slag and imported ilmenite	50	55	55	55	55	55	55	Trade name is Hombitan®. Du Pont sold its minority interest in 1976. Barges waste to North Sea.

World TiO_2 Producers and Capacities (continued)

August 1981 TITANIUM DIOXIDE PIGMENTS Titanium Products 788.5004 L

World TiO_2 Producers and Capacities (continued)

World TiO_2 Producers and Capacities (continued)

Company and Plant Location	Process[a]	Raw Material	Annual Titanium Dioxide Pigment Capacity (thousands of metric tons) 1980	1981	1982	1983	1984	1985	1986	Remarks
WESTERN EUROPE (continued										
United Kingdom										
Laporte Industries Ltd. (100% owned by Laporte Industries (Holdings) Ltd., which is owned 25% by Solvay & Cie sa)										
Stallingborough	S	Primary Norwegian ilmenite	54	54	54	54	54	54	54	Closed in 1981.
	C	Australian rutile	40	40	40	40	40	40	40	Trade name is Tiona®. About 50% of Laporte's United Kingdom pigment production is exported.
Tioxide International Ltd. (100% owned by The Tioxide Group Ltd., which is owned 50% by Imperial Chemical Industries Limited, 50% by Lead Industries Group Limited)										
Billingham	S	Canadian slag	25	25	25	32	32	32	32	Closed in 1981.
Greatham	C	Australian rutile	30	30	30	30	30	30	30	Original chloride plant had problems reaching capacity. Expansion (to 50 thousand tons by 1980, ultimately to 100 thousand) at this site is in progress. Trade name for all production is Tioxide®.
Grimsby	S	Australian ilmenite	100	100	100	100	100	100	100	
EASTERN EUROPE										
Czechoslovakia										
Prokovske Chem. Zabody NP										
Precov	S	Finnish or Norwegian ilmenite	n.a.	n.a.	23	18	18	18	18	Old information may be inaccurate.
Poland										
Z.P.N.										
Police (near Stettin)	S	Norwegian ilmenite	—	—	—	—	18	36	36	Kronos Technology. Trade name is Tytanpol.
U.S.S.R.										
State Owned										
Armyansk Krym or Yaroslavil, Suzdal, or Krasnoperkopsk	S	Russian ilmenite and Norwegian ilmenite	73	91	n.a.	n.a.	n.a.	n.a.	n.a.	

Chemical Economics Handbook - SRI International

(Formerly known as BTP Tioxide Ltd. and as British Titan Products Co., Ltd.)

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Telex: 58540 tioxd g
Cable: TIOXIDE BILLINGHAM

OWNERSHIP

100% by Tioxide Group PLC, UK

ACTIVITIES

Tioxide UK Limited, the UK manufacturing subsidiary of Tioxide Group PLC UK.

Pigments Division
Haverton Hill Road
BILLINGHAM, Cleveland TS23 1PS
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Telex: 58540 tioxd g
Cable: TIOXIDE BILLINGHAM

ACTIVITIES

Division produces titanium pigments for the paint, plastic compounding, rubber and pape. industries.

PLANTS and PRODUCTS

GREATHAM, (Cleveland)
Hartlepool
Pigments
Inorganic Pigments
Titanium dioxide
Titanium tetrachloride

GRIMSBY, (Humberside)
DN31 2SW
Pyewipe
Iron sulfate (ferrous)
Pigments
Inorganic Pigments
Titanium dioxide
Sulfuric acid

Kemira Oy

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OWNERSHIP

100% by the Finnish State

Titanium Dioxide Division

PLANTS and PRODUCTS

SF-28840 PORI, (Turku-Pori)
Iron sulfate (ferrous)
Pigments
Inorganic Pigments
Titanium dioxide
Sulfuric acid

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OWNERSHIP

97.72% by Rhône-Poulenc Minerale Fine SA, F

SUBSIDIARIES and AFFILIATED COMPANIES
(Only West-European and U.S. chemical manufacturers)

Potasse et Produits Chimiques – PPC, F (49.99%)

PLANTS and PRODUCTS

F-78090 LE HAVRE, (Seine-Maritime)
Route du Pont VII
Iron sulfate (ferrous)
Pigments
Inorganic Pigments
Titanium dioxide
Sulfuric acid

Thann et Mulhouse SA (Cont'd)

F-68800 THANN, (Haut-Rhin)
95, rue du Général de Gaulle
Iron chlorosulfate (ferric)
Iron sulfate (ferrous)
Pigments
Inorganic Pigments
Titanium dioxide
Sulfuric acid
Titanium tetrachloride
Zirconium oxide
General and Compounded Products
Iron chloride/sulfate for water treatment
Organic titanium compounds
Sulfited products

Kronos Titan-GmbH

ADDRESS
Postfach 100720
Peschstrasse 5
D-5090 LEVERKUSEN 1
Tel: (0214) 35 60
Telex: 8510823 tg d
Cable: TITAN LEVERKUSEN

OWNERSHIP

87% by NL Industries Inc., USA

13% by National Lead Overseas Capital Corporation, USA

ACTIVITIES

Company produces titanium dioxide, titanium compounds, rheological additives, and water clarification chemicals.

PLANTS and PRODUCTS

D-5090 LEVERKUSEN, (Nordrhein-Westfalen)
Iron sulfate (ferrous)
Pigments
Inorganic Pigments
Titanium dioxide
General and Compounded Products
Rheological additives

NORDENHAM, (Niedersachsen)
Industriestrasse
Iron sulfate (ferrous)
Pigments
Inorganic Pigments
Titanium dioxide
General and Compounded Products
Gelling agents

ANNEX IV

ADVISORY NOTES

4.1 Preliminary Assessment of the Infrastructural Elements of Ongjin Deposits in South Hwanghee Province

The deposits are on the South part of Ongjin relatively near to inhabited area, 40 km from Haenju. Only first 10 km of road is made of concrete (badly damaged), the rest is a field road. The deposits field "A" is located on both sides of the road. Parallel to the road is a narrow railway and river.

The distance to the nearest port is about 30 km. Electrical energy is available, however for large scale consumption the line of about 30 km is necessary. The general infrastructural conditions are satisfactory and similar to medium-developed construction sites in any industrialized country. Yet, mining company was not established, but near located mines in the province may ensure the qualified staff to design and exploit mine and beneficiation plant.

4.2 Preliminary Assessment of the Infrastructural Elements of Susan area in South Pyongang Province

The deposit area is about 30 km south of the city of Pyongyang near the Susan village The road connecting is only about 10 km asphalted concrete, the rest are field roads. The deposits of identified area are located across the valley where intensive farming is carried out. The distance to the Pyongyang South Railway is about 20 km. The water in the area is available in large quantities, but because of intensive farming no sewage will be allowed. The electricity is available but for large-scale consumption a new line of about 10 km is necessary. The general infrastructural conditions are satisfactory and similar to the medium-developed construction sites in the industrialized countries.

A mining and processing company was established and pilot plant is operational. Small chemical laboratory and mechanical workshop are on the spot. The number of employees is about 60 - 80 from which mission met 3 engineers with good competence and process knowledge.

4.3 Report on Pilot plant of Ilmenite Ore Processing

The pilot plant is located in the two cascade buildings:

1) The ore processing

2) Titanium oxide pigment production.

The mined ore is sieved and washed of the earth and kaolin and grinded in rotary crushers. The ilmenite is separated in the two (three) stage water floatation and open water filters. Wet ilmenite is deposited outside where it is drying in natural conditions. No additives to floatation are used and no magnetic separation installed. As a result ilmenite ore is beneficiated from 7 - 9% to 38 - 40% of TiO_2 content. At the moment the trial run of secondary enrichment on the same line is carried out to reach 45% TiO_2 concentration.

The dry ilmenite ore is transported by air through the air separation topper and the "reactor" is filled to which sulphuric acid is added. After iron reduction and air oxygenation of solution, TiO_2 is settled in cascade vessels (plated with white ceramic tiles) in which it is washed and settled. The final filtration is carried out in an open cake filter. Cake is dried on the air. No sulphuric acid recirculation is carried out. As reported 90 - 92% of TiO_2 content in pigment is achieved.

The equipment of all unit processes is outdated and self-made. No visible instrumentation and control equipment is present, but process seems to be operated smoothly. The efficiency of the TiO_2 recovery is low (less than 50%).

4.4 Recommendations on Production Programme of Titanium Ores and Titanium Oxide Pigment

The resources of rutile and ilmenite are large scale and should be considered for long-term exploitation. Therefore the industrial infrastructure should be designed and established with care to assure long lasting operation. The development of TiO_2 pigment production will require large scale investment expenditure as well as some imported inputs to operate the factory. Therefore Daesong Korea Trading Corporation is considering to establish the joint-venture with technology owner or company interested in the marketing of products. There are two aspects of situation in the TiO_2 market which should be taken into consideration:

1) Rutile Ore is rare and slowly exhausting in other countries. Therefore it may be expected that producers of TiO_2 pigments will like to ensure the stable raw material supplies through the joint-venture arrangements.

2) The final products (TiO_2 pigment) market is balanced and one can not expect immediate possibility of large scale sales. Only long-term agreements on the intergovernmental basis with some neighboring countries may be expected.

Therefore, the production profile should be established in a way of a mixed offer: beneficiated ore and TiO_2 pigment.

The preliminary production programme based on these assumptions may be formulated as follows:

1) Ongjin Area

Construction of the beneficiation plant of 200,000 MTPY of rutile ore (95%) and 50,000 MTPY of TiO_2 pigments. The chlorine route of technology should be considered as better fitting to the raw material.

A feasibility study should be prepared, taking into account two alternatives:

- a full production programme (ore and pigments)
- a restricted production programme (50,000 MTPY of TiO_2 pigment with respective quantity of beneficiated ore 55,000-60,000 MTPY)

2) Susan area

Construction of the beneficiation plant of 400,000 MTPY of beneficiated ilmenite (48% - 50%) and 50,000 MTPY of TiO_2 pigments. The sulphuric acid route should be considered as better fitting the raw material. A feasibility study should be prepared taking into account two alternatives:

- a full production programme (ore and pigments)
- a restricted production programme (50,000 MTPY of TiO_2 pigment and 95,000 - 100,000 MTPY of ilmenite concentrate

In addition to these alternatives, the production cost of low scale (pilot plant) operation should be analyzed (3,000-5,000 MTPY). It is clear that this size of operation is not economically and financially feasible, but the disparity between the costs and prices should be investigated.

4.5 Recommendations on the Concentration Process of the Ilmenite Ore at the Ongijin Pilot Plant

The ilmenite ore, after milling and flotation has a concentration of 40% - 42% of TiO_2. The required concentration would be 48% - 50%. Pilot plant experiments are started on the second wet flotation of the already concentrated ore. It seems that there is little hope for further concentration improvement ensuring the high yields of the commercial product. Therefore, some other technological routes should be investigated and the following processes considered:

1) Magnetic separation of iron impurities - if they are in magnetite form;

2) The surplus of quartz, sand mica (all SiO_2 components) may be separated by the air cyclone concentration (due to the high difference in specific weight).

The concept of the pilot test of the concept is as follows:

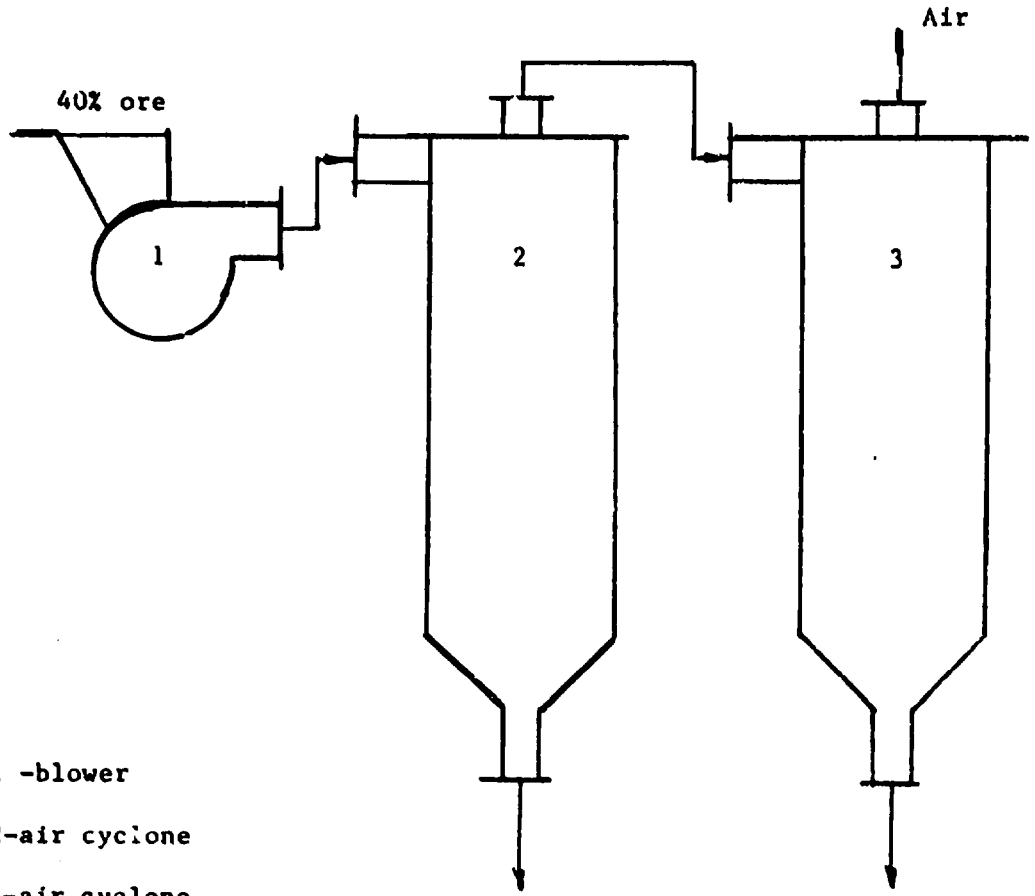
After Stage I of flotation, the dried 40% TiO_2 ore should be blown by fan to the air cyclone. The grade of concentration will depend on particle sizes and flow. It is expected that if ore particles are of the size 10 microns - 100 microns, then at an ore concentration air in-flow of 1,5 kg/m^3, a large part of SiO_2 derivatives will be blown to the second air cyclone (see scheme), where it will be settled. The product from the second air cyclone will be returned to the wet flotation.

The following material balance of operation should be established:

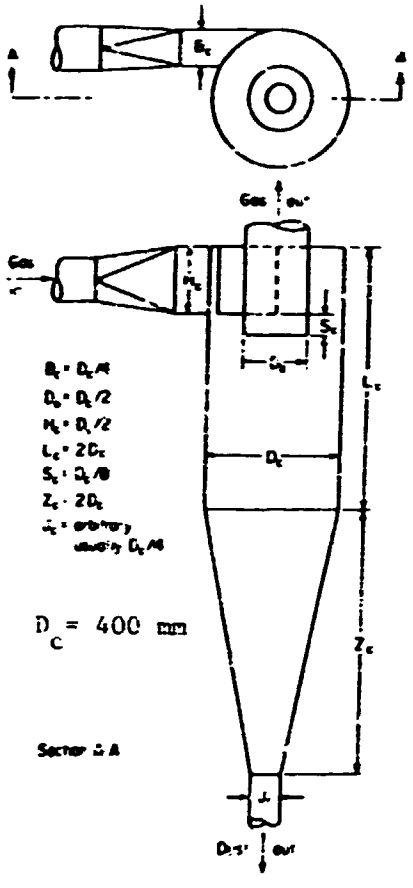
- Ilmenite ore 40% TiO_2	100 kg	TiO_2	40 kg
- Ilmenite ore from first air cyclone 48% TiO_2	70 kg	TiO_2	33.6 kg
- Diluted ilmenite ore 21.3% TiO_2 from second air cyclone	30 kg	TiO_2	6.4 kg

..... The dimensions of the pilot air cyclone are attached.

TECHNOLOGICAL SCHEME OF ILMENITE ADDITIONAL CONCENTRATION



PILOT AIR CYCLONE



ANNEX V

UNITED NATIONS DEVELOPMENT PROGRAMME

**Project of the Government of
Democratic People's Republic of Korea**

PROJECT DOCUMENT

Title: Development of the non-metallic minerals beneficiation technology

Number: DP/DPRK/87/ Duration: 28 months

Primary function: Direct support
Secondary function: Institution building

Sector (Govt. Class.): (UNDP Class. and code):

Sub-sector (Govt. Class.): (UNDP Class. and code):

Government Implementing Agency: Department of Metallurgy of Ministry of Metallurgy and Machinery with the participation of Daesong Korea Trading Company

Executing Agency: The United Nations Industrial Development Organization(UNIDO)

Estimated starting date: November 1987

Government inputs: _____ (in kind) (local currency)
_____ (in cash) (local currency)

UNDP Inputs: _____ (US dollars)

Government Cost-Sharing: (if any) _____ (US dollars or other freely convertible currency)

Signed: _____ Date: _____
on behalf of the Government

_____ Date: _____
on behalf of the Executing Agency

_____ Date: _____
on behalf of the United Nations Development Programme

PART I. LEGAL CONTEXT

This Project Document shall be the instrument referred to as such in Article I, paragraph 1, of the Assistance Agreement between the Government of Democratic People's Republic of Korea and the United Nations Development Programme, signed by the Parties on _ _ _ _ _ .

The Government Implementing Agency shall, for the purpose of the Standard Basic Agreement, refer to the Government Co-operating Agency described in that Agreement.

PART II.A Development Objective

Development of the industrial beneficiation processes for non-metallic minerals serving integration between the natural resources and industrial and consumer products.

PART II.B Immediate Objective

1). To assist in the development of the following technologies:
   - -cyanite beneficiation;
   - -"soft" and "hard" kaoline beneficiation;
   - -diatomite beneficiation;
   - -bentonite beneficiation.

2). To assist in establishment of the testing and quality control infrastructure.

3). To prepare the integrated programme of the development of the production and beneficiation of the non-metallic minerals.

PART II.C Special Considerations

None

PART II.D Background and Justification

The industry of non-metallic minerals in the Democratic People's Republic of Korea is playing important and growing role in the industrial structure of the country.Large scale natural resources of different minerals are creating the strategic option for further development in the forthcoming period, to staisfy growing demand of processing industries and to ensure high value added exports to the countries of large scale market, for the benefit of the nation. The devlopment of mineral resources is one of the important objectives of the Third Seven Years Development Plan of the country and all involved enterprises and institutions are undertaking large scale projects to meet the plan targets.

The Ministry of Metallurgy and Machinery is supervising industrial activities of several companies dealing with the extraction of the minerals, beneficiation and processing, ensuring full intergation with the production of refractories and other industrial ceramics. Also the largest national trust the Daesong Korea Trading Corporation is exploiting the mines of non-metallic minerals and the project outputs will be consumed by the all industrial enterprises processing similar or same products.

Project is to be implemented in the two industrial centres:

- -Zangsan
- -Seanggilyeng

Each industrial center is extracting and processing specific minerals:

a) in Zangsan are exploited mines and following minerals beneficiated:

- -"hard"koaline
- -cyanite
- -diatomite

b)in Seanggilyeng are expolited mines and following minerals beneficiated:

- -"soft"kaoline
- -bentonite

The background information and project justification on each mineral is attached.

The counterpart organization have at its disposal a number of specialists as well as the equipped laboratories however, in specific cases of the beneficiation process it is a lack of national expertise. Therefore through international expertise and fellowship programme this knowledge can be substantially improved and may integrate already developed processes into production lines.

In specific cases laboratories should be ensured with modern unit process equipment to carry out the test runs and to design and select large scale equipment. Also some specific control, analytical instruments are necessary to check the product quality and confirm the process parameters.
The general list of required unit process equipment and analytical instruments is attached.

PART II.E Outputs

Output 1: Developed technologies (in a technological manual format) on beneficiation processes of the following minerals:

- -cyanite
- -"hard"kaoline
- -"soft" kaoline
- -diatomite
- -betonite

Output 2: Specification of the technological equipment for the beneficiation processes of minerals specified in the output 1

Output 3: Established, modern technological and analytical laboratory, ready to model and develop beneficiation processes of the "hard "kaoline, cyanite and diatomite in Zangsan.

Output 4: Established, modern technological and analytical laboratory, ready to model and develop beneficiation processes of the "soft"kaoline and bentonite in Saenggiiyeng.

Output 5: Programme of the development (report) of the non-metallic minerals in the forthcoming period.

PART II.F Activities

Activities for output 1 (for both areas)	to be completed by
1.1 Dispatching the study tour	month 3
1.2 Dispatching the fellowships	month 5
1.3 Fielding of the international experts	month1/10
1.4.1 Analytical evaluation and assessment	month 14
1.4.2 Technological experiments	month 20
1.4.3 Preparation of the technological manuals for beneficiation processes of minerals listed in the output 1	month 28
Activities for Output 2	
2.1 Dispatching the study tour	month 3
2.2 Dispatching the fellowship	month 5
2.3 Fielding of the international experts	month1/10
2.3.1 Design of the equipment	month 20
2.3.2 Preparation of the specifications of the standard equipment and dispatching the orders	month 28

Activities for Output 3

3.1 Purchase of the the technological equipment	month 7
3.2 Installation and set up of the technological equipment	month 9
3.3 Purchase of the analytical equipment	month 7
3.4 Installation and set up of the analytical equipment	month 9

Activities for Output 4

4.1 Purchase of the technological equipment	month 7
4.2 Installation and set-up of the technological equipment	month 9
4.3 Purchase of the analytical equipment	month 7
4.4 Installation and set-up of the analytical equipment	month 9

Activitie for Output 5

5.1 Evaluation and assessment of the resources related to the processes developed	month20
5.2 Preparation of the report on alternative, integrated production, design and research programme on non-metallic minerals including the regional and international market review	month28

PART II.G Inputs

(a) Government Inputs

National staff
National Project Coordinator
Deputy Project Coordinator in the Zangsang
Deputy Project Coordinator in the Saenggilyeng
Proffesional staff in the Zangsang - 25 engineers in the first year
60 engineers in the second year
Proffesional staff in the Saenggilyeng - 30 engineers in the first year
70 engineers in the second year
Secretarial and support services

Other national inputs
Laboratory buildings fully equippeed (water, electircity, heating-ccoling etc..) in each laboratory location
transportation means and costs
Part of the process unit equipment which is already in possesion of the laboratory or executed locally accordingly to drawings prepared by experts.
Mineral raw materials and utilities.
Labour necessary for carrying out the tests.

(b) UNDP/UNIDO Inputs

	total m/m	required actual date
BULI 11-50 International consultants (7 experts)	24	as in work plan 240,000 US $
BULI 16-00 UNIDO staff proffesional travel		as in work plan 30,000 US $
BULI 39-99 Fellowshipsand study tours		as in work plan 110,000 US $
BULI 49-99 Equipment and supplies		as in work plan 300,000 US $
BULI 51-00 Miscelleanous		7,000 US $
Project Total		677,000 US $

PART II.H Preparation of Work Plan

A detailed Work Plan for the implementation of the project will be prepared by the leader of the international staff assigned to the project, in consultation with the National Project Director. This will be done at the start of the project and brought forward periodically. The agreed upon Work Plan will be attached to the Project Document as annex I and will be considered as part of that document.

PART II.I Preparation of the Framework for Effective Participation of National and International Staff in the Project

The activities necessary to produce the indicated outputs and achieve the project's immediate objective will be carried out jointly by the national and international staff assigned to it. The respective roles of the national and international staff will be determined by their leaders, by mutual discussion and agreement, at the beginning of the project, and set out in a Framework for Effective Participation of National and International Staff in the Project. The Framework, which will be attached to the Project Document as an annex, will be reviewed from time to time. The respective roles of the national and international staff shall be in accordance with the established conc[illegible] and specific purposes of technical co-operation.

PART II.J Development Support Communication

None

PART II.K Institutional Framework

Department of the Metallurgy and Machinery in the Ministry of the Metallurgy and Machinery will be national counterpart organization. In the Department the Coordinating Committee will be established with the participation of the National Project Coordinator and Deputies of National Project Coordinators responsible for project implementation in local laboratories in Jangsang and Saenggiiyeng. The representatives of the Daesong Korea Trading Corporation will be also invited to assure later dissemiantion of the project outputs to non-metallic minerals industries of this company.
The duties and authority of the Coordinating Committee will be established by the Government.

PART II.L Prior Obligations and Prerequisites

(a) Prior obligations

Government will establish the Coordinating Committee.
The Project Document will be signed by the Resident Representative on behalf of UNDP, and UNDP assistance to the project will be provided only if the prior obligations stipulated above have been met to UNDP's satisfactions.

(b) Prerequisites

Government will inform UNIDO that access to the laboratories in Zangsan and Saenggilyeng is ensured to field out the experts and carry out experiments as defined in the project activities.

The Project Document will be signed by the Resident Representative on behalf of UNDP, and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled, or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialize, UNDP may, at its discretion, whether suspend or terminate its assistance.

PART II.M Future UNDP Assistance

Detailed needs for UNDP assistance after completion of this project will be reviewed at a later stage.

PART III. SCHEDULES OF MONITORING, EVALUATION AND REPORTS

Part III.A Tripartite Monitoring Reviews: technical reviews

The project will be subject to periodic review in accordance with the policies and procedures established by UNDP for monitoring project and programme implementation and in accordance with the requirements of the project.

Specifically a Tripartite Review will take place at least once a year; the first one twelve months at the latest after the start of operations.

A Terminal Tripartite Review will be held in the month preceding the completion of the project.

Part III.B Evaluation

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of the evaluation will be decided by consultation between the Government, UNDP and the Executing Agency concerned.

PART III.C Progress and Terminal Reports

The project will prepare an annual Project Performance Evaluation Report (PPER), normally approximately three months before a planned Tripartite Review.

A terminal report will be prepared by the Project management approximately three months before the Terminal Tripartite Review or completion of the project.

PART IV. BUDGETS

See attached budget sheets.

ANNEX III.

BENTONITE.

Location_of_reserves: Yuson region-Haeryong District

Reserves proved I class: 5,000,000 t

The Yuson field is 5200 meters long with thickness of maximum 3.2 m and minimum 0.7 m.The deepness of field is average 70 meters.Open pit excavation is envisaged.

Location_of_reserves: Baekam region

Reserves proved II class: 4,000,000t

Mineralogical_composition: (Yuson field)

Montmorllonite 80%-85%

limonite

quartz

orthoclase/ologoclase

arsenpiryte sericite

Chemical_composition:

SiO_2	Al_2O_3	FeO	Fe_2O_3	CaO	MgO	K_2O	N_a2O
% by weight							
67-70	15-20	0.1-0.5	1.5-2.2	1.5-3.2	0.8-3	0.3-0.7	0.4-1.0

Preliminary physical properties:

Moisture content 7.7%-8.3%

Swelling degree: 2

Colloidal degree: 26-83.6

Absorbtivness(after 52 hours) 14.79%

Viscosity degree: 55.5-83.6

PH - 7-8

Development_programme: Open pit mine of capacity of 20,000 MTPY of processed bentonite is envisaged. This capacity is considered as pilot.After the estbalishment of the proecess th capacity will be increased to the required by market.

Assistance_required:

Development of the technological process of bentonite beneficiation to be used in the following applications:

metal casting, paper industry, textile, china and porcelain, soap, cosmetics as well for the land structure improvement

Location_patterns:

Brown coal avaliable as fuel, no limitations on water.

Logistic infractructure is requiring improvements.

ANNEX III

CYANITE

Location of reserves: Rumjong mine

Reserves of mineral: 1,500,000 t for open pit mine

20,000,000 t for underground mine

The upper body of mineral:

-deepness 1-10 meters (average 2,5 m)with degree of body inclination 30^{0}-50^{0}.

The underground body of mineral:

-deepness 1000 meters and the width of field is from 100 -430 meters with thickness of 2.5 m average.

Location of reserves: Jongine mine

Reserves of mineral: not defined

The body of mineral is 1000 meters long with average thickness of 2.5 m (maximum 6 m) and width from 50 m to 350 m.

Open pit mine is envisged.

Mineralogical composition:

Main component - wollartonite

Impurities:corrundum, diaspore, pyrophyllite,elementar carbon.

Chemical composition:

Al_2O_3	SiO_2	Fe_2O_3	CaO	MgO	TiO_2	Reduction
			% by weight			
45-62	32-39	0.5-9	0.5-1	0.2-0.7	0.7-1	4-5

Physical properties:

White or grey rock with hardness 6.5-7^{0} .

Development programme:

Pilot installation is running of capacity of 2,500 t of cyanite. Ore after primery treatment is calcinated in verical calcinator. As fuel the anthracite is used with the calorific value of 5900 kcal/kg but ash content is 15%,which is highly influencing the quality of final product. Also iron is not separated what in certain production batches is giving low quality material for refractory use. The foreseen application is for the high quality refractories for the metallurgical industry. The fire-brick factory of capacity of 50,000 MTPY is considered for construction including ore benficiation including calcination. Also the potential for export of 100,000 MTPY of beneficiated cyanite was identified.

Required assistance:

Development of the technology of cyanite beneficiation and advisory services to the establishment of the fire-brick factory.

Location patterns:

Cyanite mine is located in the region where the fuel, water are available.The logistic conditions are better than average.

ANNEX III

DIATOMITE

Location of reserves:

1). Namyang Ri if Kilju District — Reserves: 30,000

2). Kumchen Ri of Kilju District — 1,000,000 t

3). Suan District — 1,200,000 t

Mineralogical composition: Mainly diatomite

Impurities: sand, clay, alkali metals oxides and sulphates, the organic residues.

Chemical composition: (related to respective location)

	SiO_2	Fe_2O_3	P_2O_5	CaO	MgO	TiO_2	H_2O	Na_2O
1).	70-81	2-4	7-8.1	1-1.4	0.9-1.5	trace	trace	trace
2).	65	6.5	2.5	1.8	1.2	trace	trace	trace
3).	69-81	3-5	6.12	0.2-0.9	0.8-1.4	0.3-2	0.8-1.2	0.3-0.5

Physical properties:

Density 2-2.15

Porosity 60%-70%

Hardness 1

Thermal conductuvity coefficient: 0.059 - 0.13 kcal/m.^{o}C.h

The prospective applications: Filtration agent, light brick land improving agent, paper industry, china etc,.

Development programme:

At the moment small exploatation in Kilju county is carried out. The product is used mainly as fitration agent and for the land improvement. The beneficialtion factory is to be built of capacity 10,000 MTPY from which 5,000 MTPY will be used for refining purposes and rest for the light brick production.

Required assistance:

Development of the technology of the diatomite beneficiation and assistance in the pilot plant of 10,000 MTPY capacity. After the technology will be proved in the pilot plant scale the larger scale plant will be built.

Loaction patterns: The brown coal (calcrific value 3,500 kcal/kg)is available. The infrastructural conditions are not known but district is populated, therfore one can expect that there exists limited logistic support.

ANNEX III.

"HARD" KAOLINE

Location of reserves:

Zangsan region

Reserves proved: 100,000,000 t

Stratum is composed from two layers.

Mineralogical composition:

Main component: kaoline clay

Impurities:dispore and organic compunds,sand

Chemical composition:

	Al_2O_3	Fe_2O_3	SiO_2
		% by weight	
Upper layer			
	37-42	0.8-7	38-45
Lower layer			
	30-37	11-5	42-49

Development programme:

At the moment the Zangsan mine is exploited with the capacity of 150,000 MTPY.(?)The beneficiation plant capacity is 200,000 MTPY(?). Main user is the refractories factory. One process unit: magnetic separation is not working properly.Therefore the quality of product is low and brick fire resistance is not sufficient. The experience gained on the beneficiation plant will be dissemianted to other beneficiation installations.

Required assistance:

Development of the iron separation process and seiection of the suitable equipment for the existing beneficiation plant.

Location pattern:

Industrially developed area.

ANNEX III.

"SOFT" KAOLINE

Location of reserves:

Onsong brown coal mine.

Reserves: clay with the content >25% of Al_2O_3 more than 30,000,000 t

clay with the content >20% of Al_2O_3 more than 470,000,000 t

The thickness of the mineral body is from 1 to 31 meters-average 9 meters, under the brown coal layer.

Mineralogical composition:

Decomposition of the granite rock.

Chemical composition:

Al_2O_3	Fe_2O_3	SiO_2
% by weight		
min.20	3	min.70

Development programme:

The benefciation plant is to be constructed of 5,000 MTPY (?) of capacity , using all infrastructure of the existing brown coal mine. The laboratory tests of beneficiation were carried out without the trialas on elimination of the iron and biotite. The wet method is considered for industrial implementation.

Regested assistance:

Development of the wet technology of kaolin beneficiation with strong emphasis on iron separation.

Location pattern:

Brown coal (calorific value 3,500 kcal/kg) is availbale as fuel, and water from open pit.The logistic infrastructure is better than average. The water treatment plant should be also included into technology development programme.

ANNEX III.

"SOFT" KAOLINE

Location of the reserve: Saenggilyeng mine

Resources of the reserve: 2,900,00 t (open pit)

Mineralogical composition:

Kaoline clay ($Al_2O_3.2SiO_2.2H_2O$) and montmorillonite($Al_2O_3.4SiO_2.12H_2O$)

impurities:orthoclase/oligoclase,pyrite,limonite,siderite,ilmenite,mica

organic impurities including carbon.

Chemical composition:

Al_2O_3	SiO_2	Fe_2O_3	H_2O
	% by weight		
21.5-32	52.8-64.6	1.7-3	9-13

Development programme:

Extraction and beneficiation production facilities with capacity of 20,000MTPY.Yearly production of kaoline 15,000 MTPY (about 80% effciency).Processes of crushing,smelting in water,sedimentation,filtering and drying are operational. Existing beneficiation process has low efficient filtration system and no iron separation.Therefore the quality of kaoline does not correspond the reqired by processors.

Assistance required:

Development of the process of filtration,selection of adequate equipment.Developaent of the process of iron separation(under 1 %) and selection of adequate equipment.

Location pattern: Mine and beneficiation plant are operational.Fuel is brown coal (calorific value 4000 kcal/kg).

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Government of Democratic People's Republic of Korea

PROJECT DOCUMENT

Title: Development of the technology of the salt production from the sea water

Number: DP/DPRK/87/ Duration: 14 months

Primary function: Direct support

Secondary function: Institution building

Sector (Govt. Class.): (UNDP Class. and code):

Sub-sector (Govt. Class.): (UNDP Class. and code):

Government Implementing Agency: Comitee of the Chemical and Light Industries Salt Bureau in the cooperation with the Institute of Inorganic Chemistry, Academy of Scienece

Executing Agency: The United Nations Industrial Development Organization (UNIDO)

Estimated starting date: November 1987

Government inputs: _____ (local currency) (in kind)

_____ (local currency) (in cash)

UNDP inputs: 112,000 US $ (US dollars)

Government Cost-Sharing: (if any) _____ (US dollars or other freely convertible currency)

Signed: _____ Date: _____
on behalf of the Government

_____ Date: _____
on behalf of the Executing Agency

_____ Date: _____
on behalf of the United Nations Development Programme

PART I. LEGAL CONTEXT

This Project Document shall be the instrument referred to as such in Article I, paragraph 1, of the Assistance Agreement between the Government of Democratic People's Republic of Korea and the United Nations Development Programme, signed by the Parties on _ _ _ _ _ _.
The Government Implementing Agency shall, for the purpose of the Standard Basic Agreement, refer to the Government Co-operating Agency described in that Agreement.

PART II.A Development Objective

To develop salt producing technology from the sea water,ensuring the economical increase of the salt production in Democratic People's Republic of Korea.

PART II.B Immediate Objective

1). To develop economical ion exchange electrodialysis process of the salt production from the sea water.
2). To develop the technology of the electrodialysis membrane production.

PART II.C Special Considerations

None.

PART II.D Background and Justification

The Democratic People's Republic of Korea is producing annualy about 70,000 MTPY of the salt. This production is not satisfying the needs of the salt for the consumption use and for the industrial purposes. Therefore, in the Third Seven Years Plan the objective was included, to satisfy the national economy salt demand by at least doubling the production capacities. The Salt Bureau of the Committee of the Chemical and Light Industries is a responsible governmental institution for the implementation of the project. The Salt Bureau has for its disposition the research and design capacity of the Chemical Industry Research Institute as well as Institute of the Inorganic Chemistry of the Academy of Science of Democratic People's Republic of Korea.

The climatic conditions in the country are not always favourable to allow large-scale production of salt using the solar evaporation process. Therefore, another processes of salt production should be considered. One of the developed process in the recent years is composed from the ion-exchange membrane process, followed by the evaporation and cristallization. In the ion-exchange cellules primery concentration of the sea water is performed, and for following concentration continuous, multistep evaporators are used. The consumption of the energy by the cellule depends on its construction and membrane quality and in the well established processes is reaching the value of 140 kwh/ton of cristaline salt. The direct evaporation of sea water without preliminary concentration in the the electrodialyser is not economical, due to the huge energy consumption. This process is unaffected by weather and has made possible the stable production of table salt in an economical way in unsuitable climatic areas. The process was first introduced in 1961 in Japan and all table salt production in Japan had been converted to this process by 1972.

The Salt Bureau with the assistance of the Institute of Inorganic Chemistry during last several years is developing this technological process and has achieved positive results. However, following problems are not yet solved in the satisfactory way:

-reproducible results on the sea water concentration in the electrodialyser;

-quality of the local memebranes is not satisfactory.

As a consequence process under consideration is still using much more energy than it should and therefore shows low feasibility. On the other hand, policy of the Government of the self-reliance in the strategic products technologies, is not allowing the permanent purchase of the membranes abroad.

The Salt Bureau is seeking the UNDP/UNIDO assistance in the development of the two processes:

a) wrapping of the membrane with special ingredients, to allow production of high quality product;

b) electrodialysis in the pilot scale using self-developed membranes;

c) development of overall technological scheme of the salt plant.

UNIDO as specialized agency, basing on the experience from the previous salt and drinking water from sea water projects, is ready to render this technical assistance

PART II.E Outputs

Output 1:

Developed technology of the membrane wrapping on pilot scale;

Output 2:

Developed technology of the electrodialysis on pilot scale;

Output 3:

Technological manual of the table salt plant.

PART II.F Activities

	to be completed by
Activities for output 1	
1.1 Fielding of the expert(split mission)	month 5
1.2 Purchase of the chemical components	month 5
1.3 Preparation of technical documetation of the wrapping machine	month 6
1.4 Construction of the model wrapping machine	month 9
1.5 Testing of the wrapping machine	month 12
1.6 Fielding of the fellows	month 5
Activities for Output 2	
2.1 Purchase of the electrodialyser	month 8
2.2 Fielding of the expert	month 8
2.3 Installation and test of electrodialyser	month 9
2.4 Prpearation of the manual of operation	month 10
2.5 Fielding of thefellows	month 5
Activities for Output 3	
3.1 Fielding of the expert	month 10
3.2 Preparation of the operation manual	month 12

PART II.6 Inputs

(a) Government Inputs

National staff
National project Director
Secretarial staff (three persons)
Technical staff (10 researchers,technologists and draftsmen)

Other national inputs
Offices in the fielding location
Transporatation means and costs
Telex and telephone service expenditures
Typing, edition of the draft reports

(b) UNDP/UNIDO Inputs

	Title	total m/m	required actual
BULI 11-50	International consultants	6	accordingly to the work plan
BULI 16-00	UNIDO staff proffesional travel	1	50,000 US $
BULI 21-00	Training (2)	4	5,000 US $
BULI 41-00	Equipment and supplies		accordingly to the work plan
BULI 51-00	Miscellaneous		22,000 US $
			30,000 US $
			5,000 US $

PART II.H Preparation of Work Plan

A detailed Work Plan for the implementation of the project will be prepared by the leader of the international staff assigned to the project, in consultation with the National Project Director. This will be done at the start of the project and brought forward periodically. The agreed upon Work Plan will be attached to the Project Document as annex I and will be considered as part of that document.

PART II.I Preparation of the Framework for Effective Participation of National and International Staff in the Project

The activities necessary to produce the indicated outputs and achieve the project's immediate objective will be carried out jointly by the national and international staff assigned to it. The respective roles of the national and international staff will be determined by their leaders, by mutual discussion and agreement, at the beginning of the project, and set out in a Framework for Effective Participation of National and International Staff in the Project. The Framework, which will be attached to the Project Document as an annex, will be reviewed from time to time. The respective roles of the national and international staff shall be in accordance with the established concept and specific purposes of technical co-operation.

PART II.J Development Support Communication

None.

PART II.K Institutional Framework

The Salt Bureau of the Committee of the Chemical and Light Industries will be a national counterpart. To coordinate the activities of the Chemical Industry Research Institute and Institute of the Inorganic Chemistry the Coordinating committe will established. The National Project Director will chair the Committee activities. Experts will be fielded to the institutions implementive respective part of the project. The Government will establish the authority and a modalities of the Committee activities.

PART II.L Prior Obligations and Prerequisites

(a) Prior obligations

Government will nominate the National Project Director and will call up the Coordinating Committe.

The Project Document will be signed by the Resident Representative on behalf of UNDP, and UNDP assistance to the project will be provided only if the prior obligations stipulated above have been met to UNDP's satisfactions.

(b) Prerequisites

Govrnment will indicate institutions and locations for the experts fielding.

The Project Document will be signed by the Resident Representative on behalf of UNDP, and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled, or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialize, UNDP may, at its discretion, whether suspend or terminate its assistance.

PART II.M Future UNDP Assistance

Detailed needs for UNDP assistance after completion of this project will be reviewed at a later stage.

PART III. SCHEDULES OF MONITORING, EVALUATION AND REPORTS

Part III.A Tripartite Monitoring Reviews: technical reviews

The project will be subject to periodic review in accordance with the policies and procedures established by UNDP for monitoring project and programme implementation and in accordance with the requirements of the project.

A Terminal Tripartite Review will be held in the month preceding the completion of the project.

Part III.B Evaluation

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of the evaluation will be decided by consultation between the Government, UNDP and the Executing Agency concerned.

PART III.C Progress and Terminal Reports

The project will prepare an annual Project Performance Evaluation Report (PPER), normally approximately three months before a planned Tripartite Review.

A terminal report will be prepared by the National Project Drector jointly with the II-53 expert approximately three months before the Terminal Tripartite Review or completion of the project.

PART IV. BUDGETS

See attached budget sheets.

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Government of
Democratic People's Republic of Korea

PROJECT DOCUMENT

Title: Energy conservation and production diversification in chemical and related industries

Number: DP/DPRK/87/ Duration: 14 months

Primary function: Direct support

Secondary function: Institution building

Sector (Govt. Class.): (UNDP Class. and code):

Sub-sector (Govt. Class.): (UNDP Class. and code):

Government Implementing Agency:

Executing Agency: The United Nations Industrial Development Organization (UNIDO)

Estimated starting date: November 1987

Government inputs: _____ (in kind) (local currency)
_____ (in cash) (local currency)

UNDP inputs: 187,000 (US dollars)

Government Cost-Sharing: (if any) _____ (US dollars or other freely convertible currency)

Signed: _____ Date: _____
on behalf of the Government

_____ Date: _____
on behalf of the Executing Agency

_____ Date: _____
on behalf of the United Nations Development Programme

PART I. LEGAL CONTEXT

This Project Document shall be the instrument referred to as such in Article I, paragraph 1, of the Assistance Agreement between the Government of Democratic People's Republic of Korea and the United Nations Development Programme, signed by the Parties on _ _ _ _ _ .

The Government Implementing Agency shall, for the purpose of the Standard Basic Agreement, refer to the Government Co-operating Agency described in that Agreement.

PART II.A Development Objective

Chemical Industry production diversification and restructuralization aiming energy savings.

PART II.B Immediate Objective

1). To identify the unit processes for energy saving programme in chemical and related industries;

2). To select rational energy consuming equipment constructions and assess efficiency of processes moderniazation.

3). To analyse the demand on crude oil refined products and production programme and advice on:

- -processes restructuralization and modernization
- -further development of refining capacities.

4). To select alternative energy resources in high-energy consuming technological processes.

PART II.C Special Considerations

None.

PART II.D Background and Justification

Accordingly to the strategic directives of the Third Seven Years Plan, the energy production and effciency of ots utilization is one of the important objectives. The Plan is establishing the particular targets on energy savungs, substitution and production programme rationalization in energy consuming subsectors of industry.

At the moment energy production is based on three following resources:

1).Coal (both lignite and hard coal) which is widely used as industrial and communal energy carrier.

2).Water power as source of electrical energy.

3).Crude oil as a source of liquid fuels for transportation and also as industrial energy carrier.

All energy carrioers are considered equally important for the further balanced economy development and measures are taken to increase production of all energy resources. Hcwever, this development programme is not yet taking in optimal way the energy conservation options which were developed during last years due to the energy shortages and high energy prices. The Korean industry accordingly to the Plan is going to apply this concepts of energy savings through:

-restructuralization of the production programme(mainly in the refirey industry)

-introduction of energy saving equipment and devices (e.g.new burners,waste heat exchangers) mainly in the large scale energy consuming industry.

-substitution of the energy sources-mainly there where local or cheaper energy carriers may be utilized.

One of the concerns in the forthcoming period will be the development of the refining industry and the establishment of the production profile of refineries. The existing refineries production programme should be revised and modernized as well the production profile of the new refinery should be established. This refinery has to be well adapted to energy savings programme,as well as its technical structure should respond the requirements of the treatment of liquefied coal. Therefore,both sides, production and consumption of the neregy should be considered a san input for the energy conservation programme. The size of the country and developed industrial structure is requiring the pilot implementation of large scale, national energy saving programme. This project will serve as model for large scale programme.

Taking into account these options and constraints it was found that Daesong Korea Trading Corporation is a good national counterpart for this pilot implementation of the energy saving national programme.

The Daesong Korea trading Corporation (DKTC) has been set up several years ago as independent economical unit, dealing with production,and foreign trade in the important branches of industry. The corporation has a holding structure and affiliated companies are specialized along the specific lines of industrial branches, covering the production and trade:

Korea Daesong Jeil Trading Corporation:

- -machinery and equipment for main subsectors of industries
- -minerals extraction,their beneficiation and processing
- -building material production
- -iron and non-ferrous metals production
- -refining industry and refined products trade
- -fertilizers
- -chemiclas
- -pharmaceuticals.

Korea Daesong Jei Trading Corporation:

- -fibers and textile industry
- -leather and shoes industry
- -glassware and ceramics industry
- -other light industries products

Korea Daesong Jesam trading Corporation:

- -food processing industry
- -wines and liquors

Korea Daesong Jechil Trading Corporation:

- -insam and products of its processing

Korea Daesong Jesa trading Corporation

- -shops and services

Korea Daesong Jeo Trading Corporation

- -reexport trade

Korea Daesong Jeryuk Trading Corporation

- -imports of all important commodities

The Korea Daesong Jeil trading Corporation was selected as counterpart to carry out energuy conservation study.

PART II.E Outputs

Output 1: Identified major consuming processes with indication of the process units which are important for the energy balnce of the production process;

Output 2: Technical documentation of the energy saving equipment and devices for the identified major energy consuming process units

Output 3: Identified technical structure of the refinery industry including the opportunity analysis of the alternative process units for crude oil processing

Output 4: Identified process units for energy substitution in selected branches of industry

Output 5: Conclusions and recommendations for the future large scale energy savings programme

PART II.F Activities

	to be completed by
Activities for output 1	
1.1 Fielding of the expert	month 3
1.2 Selection of the technological processes and process units	month 5
1.3 Preparation of the report	month 6
Activities for Output 2	
2.1 Fielding of the expert	month 5
2.2 Field measurements and energy balances preparation	month 8
2.3 Preparation of the technical documentation of energy saving equipment and devices	month 10
Activities for Output 3	
3.1 Fielding of the expert	month 5
3.2 Report on energy balance and production profile (field measurements)	month 6
3.3 Report on new structure of refining industry	month 8
3.4 Report on economical evaluation of the new structure	month 9

Activities for Output 4

4.1 Fielding of texperts	month 5
4.2 Report on potential energy substitution	month 6
4.3. Preparation of the technical specifications	month 8

Activities for Output 5

5.1 Fielding of the expert(split mission)	month 3/10
5.2 Preparation of the final report	month 12
5.3 UNIDO in-house study and final report edition	month 14

PART II.G Inputs

(a) Government Inputs

National staff
National Project Director
Secretarial staff (3 persons-one secretary, two typists)
Technical staff 10(technologists, energy engineers, economists)
This group will be trained during the project implementation and will take care of future large scale energy saving programme.

Other national inputs
Offices in fielding locations
Transportation means and costs
Telex, telephone official expenditures
Typin, edition of draft reports
DSA for international experts in national currency at actual UN rate for 20 m/m

(b) UNDP/UNIDO Inputs

		total m/m	required actual date
BULI 11-50	International consultants	20	according to the work plan 150,000 US $
BULI 16-00	UNIDO staff proffesional inspection	1	on the 8 month 5,000 US $
BULI 42-00	Equipment (energy testing kits)		according to the work plan 25,000 US $
BULI 51-00	Miscellaneous		7,000 US $
	Project Total		187,000 US $

PART II.H Preparation of Work Plan

A detailed Work Plan for the implementation of the project will be prepared by the leader of the international staff assigned to the project, in consultation with the leader of the national staff. This will be done at the start of the project and brought forward periodically. The agreed upon Work Plan will be attached to the Project Document as annex I and will be considered as part of that document.

PART II.I Preparation of the Framework for Effective Participation of National and International Staff in the Project

The activities necessary to produce the indicated outputs and achieve the project's immediate objective will be carried out jointly by the national and international staff assigned to it. The respective roles of the national and international staff will be determined by their leaders, by mutual discussion and agreement, at the beginning of the project, and set out in a Framework for Effective Participation of National and International Staff in the Project. The Framework, which will be attached to the Project Document as an annex, will be reviewed from time to time. The respective roles of the national and international staff shall be in accordance with the established concept and specific purposes of technical co-operation.

PART II.J Development Support Communication

None.

PART II.K Institutional Framework

The Daesong Korea Jeil Trading Corporation will be national counterpart organization.As such it will be responsible for approval of expert candidates submitted by UNIDO as well as for the visa issue. The Office of the National project Director will carry out everyday project activities.

PART II.L Prior Obligations and Prerequisites

(a) Prior obligations

National Project Director will be nominated.

The Project Document will be signed by the Resident Representative on behalf of UNDP, and UNDP assistance to the project will be provided only if the prior obligations stipulated above have been met to UNDP's satisfactions.

(b) Prerequisites

The list of the factories which experts will be allowed to visit and carry out energy balance measurements should be provided and approved by Daesong Korea trading Corporation.

The Project Document will be signed by the Resident Representative on behalf of UNDP, and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled, or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialize, UNDP may, at its discretion, whether suspend or terminate its assistance.

PART II.M Future UNDP Assistance

It is intention to implement this project as pilot test of efficiency in the energy conservation. If the results of project will show efficient results the applied methodology will be applied to other branches of industry.

Detailed needs for UNDP assistance after completion of this project will be reviewed at a later stage.

PART III. SCHEDULES OF MONITORING, EVALUATION AND REPORTS

Part III.A Tripartite Monitoring Reviews; technical reviews

The project will be subject to periodic review in accordance with the policies and procedures established by UNDP for monitoring project and programme implementation and in accordance with the requirements of the project.

A Terminal Tripartite Review will be held in the month preceding the completion of the project.

Part III.B Evaluation

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of the evaluation will be decided by consultation between the Government, UNDP and the Executing Agency concerned.

PART III.C Progress and Terminal Reports

The project will prepare an annual Project Performance Evaluation Report (PPER), normally approximately three months before a planned Tripartite Review.

A draft terminal report will be prepared by the Project management approximately three months before the Terminal Tripartite Review or completion of the project.

PART IV. BUDGETS

See attached budget sheets.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT PROPOSAL

PART A-BASIC DATA

COUNTRY:	Democratic People' Republic of Korea
PROJECT NUMBER:	SIS/DPRK/87/
PROJECT TITLE:	The development of the soda ash technology
SCHEDULED START:	Two months after approval
SCHEDULED COMPLETION:	Two months after start
ORIGINAL DATE OF OFFICIAL REQUEST:	Letter of.....1987 from the DPRK Permanent Representative to United Nations, Vienna
GOVERNMENT COUNTERPART AGENCY:	Chemical Industry Research Institute
UNIDO CONTRIBUTION:	28,000 US $(without 13% overheads)
GOVERNMENT COUNTERPART CONTRIBUTION:	in kind
CURRENCY REQUIRED:	US $
FOR UNIDO INPUT:	
CONVERTIBLE:	28,000 US $
OTHER:	
UNIDO SUBSTANTIVE BACKSTOPPING SECTION:	Chemical Industries Branch, Industrial Operations Technology Division, DIO
PROGRAMME COMPONENT CODE:	22-J13420

PART B-NARRATIVE

I. OBJECTIVES

a) Development Objective

To develop modern technology of the soda ash production

b) Immediate Objectives

1) Development of technological processes for two process units: drying and ammonia separation
2) Improvement of the designing capabilities of local specialists

II. SPECIAL CONSIDERATIONS

None.

III. BACKGROUND AND JUSTIFICATION

Chemical Industry Research Institute working under the supervision of the Committee of the Chemical and Light Industries (scientific-technical bureau) is developing the technology of the soda ash production. The Chemical Industries Research Institute is a research and design organization responsible for the development of the new technological processes in inorganic and organic basic chemicals. The soda ash design group is composed from more than 20 highly qualified engineers. Chemical Industries Research Institute is now designing new soda ash plant of capacity 200,000 MTPY and the technical project of the installation is supposed to be finished at the end of 1987. This project is based on the engineering experience collected at the operation of the existing soda ash factory. At the moment in DPRK 50,000 MTPY soda ash factory is operational. However, this factory is operating the old process and some of the process units are hihgly energy consuming and polluting the enviroment. Also consumption coefficient of the ammonia per one ton of soda ash is very high, due to the wrong construction of the plates in the separation tower. The Committee of the Chemical and Light Industries approached UNIDO to assist the Chemical Industry Research Institute in the design of the critical process units (the decomposition and dehydratation kiln and ammonia-calcium chloride separation tower) to allow the implementation of the modern technological process in the new soda ash plant.

Chemical Industry Research Institute is requesting short term assistance of international consultants to design the decomposition and dehydratation kiln and the separation tower.

UNIDO is qualified as the international consulting body specialized in such technical assistance projects, assuring the integrated approach to the analyzed problem.

IV. PROJECT OUTPUTS

1) Developed energy saving and low raw materials consuming soda ash technology
2) Technical drawings of the modern kiln and separation tower.Operational and manintenance manuals.
3) Trained technical personnel prepared to continue the development of the process.

V. PROJECT ACTIVITIES

The activities of the project will fall into two categories:

- assistance of the experts;
- purchase of the design standards and codes;

One expert, soda ash technologist will assist to prepare the technological manual of the modernized technology operation. He will also preparae the basic engineering for the two unit processes: the soda ash decomposition-dehydratation and ammonia-calcium chloride separation. The second expert , mechanical engineer will prepare the technical drawings of these unit processes and will supervise the execution of the construction drawings. He will also prepare the maintenance operation manual of the kiln and tower.

Both experts will train local design specialists in the learning by doing exercise.

The standards and codes are necessary to improve the safety of the design of the soda ash plant and ensure the application of the proper mechanical design parameters and patterns in the construction drawings execution.

Miscellaneous component of the project is assuring the edition of the final report in the form suitable for the dissemination.

The preliminary work plan is attached as the annex III.

VI. PROJECT IPUTS:

1. Government Inputs:

The Counterpart will provide following inputs in kind:

a) Project personnel;National Project Coordinator

b) Local transportation and communication means and costs

c) Offices and secreterial support

2. UNIDO Inputs:

UNIDO will execute project in accordance with following budget:

BULI 11-50	International consultants (2)3m/m	US $	24,000
BULI 42-00	Expandables	US $	3,000
BULI 51-00	Miscelleaneous	US $	1,000
	Total	US $	28,000

VII. Evaluation Plan

The results of the project will be evaluated on the National Committe on the Technical Progress. Internal UNIDO evaluation will be carried out in accordance with the existing rules.

VIII. Envisaged Follow - Up

None foreseen.

PART C- CLEARANCE AND APPROVAL

PROPOSAL SUBMITTED BY: M.Judt/J.A.Kopytowski

in cooperation with A.M.Mansur Date:

CLEARED BY:

A.Tcheknavorian-Asenbauer,
Head,Chemical Industries Branch
Date:

L.Biritz
Director,Technology DIO,
Date:

A.Vasisliev,Deputy Director General
Date:

APPROVED BY:

CONVERTIBLE CURRENCY:

OTHER:

SOURCE OF FUNDS: TRUST FUND

DATE PAD REQUESTED:MARCH 1987

Annex III.

Provisional Work Plan

Activity	Timing (Months after project start) ' 1 ' 2
Fielding of the international consultants	Two months after project approval
Preparation of the technological charts and operational manual :	xxxx
-process parameters	xxx
-technology of decomposition	xxx
-technology of dehydratation	xxxxx
-technology of separation of ammonia	xxx
Basic design of the equipment	xxxxxxxxxx
Preparation of the technical drawings	xxxxx
Construction drawings preparation	xxxx
Preparation of the kiln and tower operation manual	xxxxxxx
Preparation of the maintenace manual	xxx
Preparation of the final reports	xx xx
Onjob training of the technologist and constructor	xxxxxxxxxxxx

The final work plan will be prepared during the briefing of the National Project Coordinator

UNITED NATIONS

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

JOB DESCRIPTION

Post title	Chemical engineer (soda ash technologist)
Duration	6 weeks
Date required	January 1988
Duty station	Pyongyang (Democratic People's Republic Korea)
Purpose of project	To assist Chemical Industry Research Institute in development of soda ash technology
Duties	The consultant will work with the national staff of Chemical Industry Research Institute and Committee of Chemical and Light Industries. The consultant is expected to assist in the design of modern kiln and separation ammonia-calcium chloride tower. The main tasks of the consultant will be as follows: -preparation of the material balance of the process -establishment of the parameters of the processes: --the soda ash decomposition-dehydrataion kiln --the separation ammonia calcium chloride tower -preparation of the technological manual of kiln -operation -preparation of the basic design of the kiln and the separation tower.../..

	Consultant will prepare at the end of the mission kiln and tower mechanical operation instruction, maintenance instruction as well as the final report.
Qualifications	The consultant a graduated mechanical engineer, should have good theoretical background and practical experience in the design of chemical installations. The experience of the kiln design for the inorganic products will be an asset.
Language	English (Russian will be an asset)
Background information	Attached

UNITED NATIONS

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

JOB DESCRIPTION

Post title	Mechanical engineer (specialist in the design of technological installations)
Duration	6 weeks
Date required	January 1988
Duty station	Pyongyang (Democratic People's Republic Korea)
Purpose of project	To assist Chemical Industry Research Institute in the design of the modern (continuous) soda ash kiln and ammonia-calcium chloride separation tower.
Duties	The consultant will prepare the technical drawings of the kiln and tower and will participate and supervise preparation of the construction drawings Special care should be taken to: -selection of the construction material -design of the internal heating system of the kiln -design of separation plate in the tower -gas offtake and treatment

..../..

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

V.87-33106

	The consultant may participate in the test run leading to the confirmation of the established parameters and quality.
Qualifications	Consultant a graduated (industrial) engineer should have good theoretical and practical experience in soda ash production. Design capabilities in the field of chemical industry will be an asset.
Language	English (Russian will be an asset)
Background information	Attached