

資 料

- 1 合同評価報告書 [Joint Evaluation Report on the Japanese Technical Cooperation for the Project on Mineral Processing Plant Operation Technology in the United Mexican States. (July 1996)]

- 2 ミニッツ [Minutes of Discussion between the Japanese Evaluation Team and the Mexican Authorities concerned on the Japanese Technical Cooperation Project for Mineral Processing Plant Operation Technology in the United Mexican States. (July 1996)]

JOINT EVALUATION REPORT
ON
THE JAPANESE TECHNICAL COOPERATION
FOR THE PROJECT
ON MINERAL PROCESSING PLANT OPERATION TECHNOLOGY
IN THE UNITED MEXICAN STATES

Prepared by the Japanese Evaluation Team

Jointly with

the Mexican Evaluation Team

July 1996

Mexico City.

The United Mexican States

MUTUALLY ATTESTED AND SUBMITTED

TO ALL CONCERNED

JULY 25, 1996

MEXICO CITY, THE UNITED MEXICAN STATES

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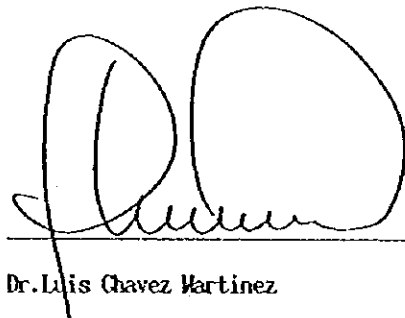
Mr. Masayoshi Juro

Leader,

Japanese Evaluation Team,

Japan International Cooperation Agency,

Japan.



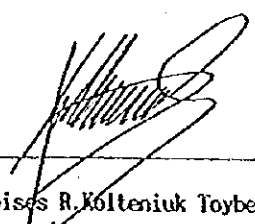
Dr. Luis Chavez Martinez

Director General,

Consejo de Recursos Minerales,

Secretaria de Comercio y Fomento Industrial,

Estados Unidos Mexicanos.



Ing. Moises R. Kolteniuk Toyber

Coordinador General de Minería,

Secretaria de Comercio y Fomento Industrial,

Estados Unidos Mexicanos.

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I. INTRODUCTION

1. The Evaluation Team

The Japanese Evaluation Team (hereinafter referred to as "the Japanese Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Masayoshi Juro, visited the United Mexican States from July 8 to July 26, 1996 for the purpose of evaluating jointly with the Mexican Evaluation Team (hereinafter referred to as "the Mexican Team") the achievements of the Project on mineral processing plant operation technology in the United Mexican States (hereinafter referred to as "the Project") within the framework of the Japanese technical cooperation based on the Record of Discussions signed on August 17, 1992 (hereinafter referred to as "the R/D").

After the joint evaluation of the Project, the Japanese Team discussed with the authorities concerned of the Government of the United Mexican States all the relevant matters pertaining to the Project.

Through careful studies and discussions, both the sides summarized their findings and observations as described in this document.

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2. Schedule of the Joint Evaluation

Table - 1 Schedule of the Joint Evaluation

Date	Activities on the Evaluation
July 9, 1996	Preliminary discussions on the progress of the Project between the Japanese consultant and the executives of CRM.
July 10, 1996	Preliminary discussions on the progress of the Project between the Japanese consultant and the Professors of UNAM and the National Institute of Technology.
July 11, 1996	Preliminary discussions on the progress of the Project between the Japanese consultant and the executives of the Mexican mining company (Real del Monte)
July 12, 1996	Preliminary discussions on the progress of the Project between the Japanese consultant and the executives of the Mexican Chamber of Mining, the Mexican Association of Mining Engineers, Metallurgists and Geologists, and FFM..
July 15, 1996	Preliminary discussions on the draft of the joint evaluation report between the Japanese consultant and the executives of CRM.
July 16, 1996	Overall discussions on the achievements of the Project between the Japanese Team and the executives of CRM.
July 17, 1996	Overall discussions on the achievements of the Project between the Japanese Team and the executives of SECOFI.
July 18, 1996	Overall discussions on the achievements of the Project between the Japanese Team and the administrative staff of the Local Government (State of Chihuahua) Detailed discussions on the progress of the Project among the Japanese Team, the Mexican counterparts and the Japanese experts together with a fact-finding tour at the site of the Project.
July 22, 1996	Preparation of the joint evaluation report by both the Teams.
July 24, 1996	Discussions on the joint evaluation report at the joint committee meeting.
July 25, 1996	Signing on the joint evaluation report by both the Teams.

3. Attendance

A. The Evaluation Team

1) The Japanese Evaluation Team

Mr. Masayoshi Juro, Leader
Mr. Toshiyuki Takahashi, Member (Technical cooperation planning)
Mr. Kazu Iwano, Member (Mineral processing technology)
Dr. Kenji Tomita, Member (Evaluation analysis)
Mr. Shinya Tomonari, Member (Evaluation planning)

2) The Mexican Evaluation Team

Ing. Moises R. Kolteniuk Toyber, Coordinador General de Minería, SECOFI
Ing. Luis R. Escudero Chavez, Director General de Minas, SECOFI
Dr. Luis Chavez Martinez, Director General, CRM
Lic. Oscar Sandoval Lazcano, Director General, FFM
Dr. Jose Luis Lee Moreno, Director General, CMM

B. Participants in the Meetings

1) The Japanese Experts

Mr. Tetsuhiko Hasuda, Chief Advisor
Mr. Yuichi Endo, Coordinator
Mr. Seiken Sato, Long-term Expert (Mill Operation and Management)
Mr. Ryoichi Hatakeyama, Short-term Expert (Mill Instrumentation)
Mr. Katumi Tanaka, Short-term Expert (Mill Process Control)

2) JICA Mexico Office

Mr. Ken Kinoshita, Resident Representative
Mr. Yoshitaka Enomoto, Assistant Resident Representative
Lic. Daniel Gonzalez Gonzalez, Secretario Tecnico

3) Embassy of Japan in the United Mexican States

Mr. Yasuji Sugimoto, First Secretary
Mr. Takumi Watanabe, Second Secretary

4) Secretaria de Relaciones Exteriores [SRE]

Lic. Cristina Ruiz Ruiz, Directora de Demanda de Cooperacion Tecnica

5) Secretaria de Comercio y Fomento Industrial [SECOFI]

Ing. Raymundo Delgado Robles, Asesor del Director General de Minas

6) Consejo de Recursos Minerales [CRM]

Ing. Sergio Almazan Esqueda, Director de Operacion
Ing. Luis Brizuela Venegas, Subdirector de Servicio y Apoyo
Ing. Gerardo Garcia Candiani, Subgerente de Estudios Metalurgicos
Ing. Andres Aguayo, Jefe del Centro Experimental Zona N.E.
Ing. Flor de Maria Harp Iturribarria, Jefe de Centeo Experimental Zona Sur
Dr. Luis Enrique Ortiz Hernandez, Coordinador Tecnico
Ing. Jose Luis Saenz Barron, Superintendente de Operacion,
Centro de Experimentacion Metalurgica de Parral [CEM]

Ing. Edgar Ruben Maldonado, Metalurgista Encargado Operacion, CEM
Ing. Adriana Sofia Gonzalez, Metalurgista Encargado Control de Proceso, CEM
Tec. Jesus Jose Nunez Cardea, Tecnico Mantenimiento Electrico Operacion, CEM

7) Fideicomiso de Fomento Minero [FFM]

Ing. Roberto Mendoza Blackaller, Director de Delegaciones
Ing. J. Vargas C., Subdirector de Apoyo Tecnico
Ing. Jose Antonio Berlanga Balderas, Subdirector de Seguimiento a Proyectos
Ing. Almando Gamboa Alanis, Subdirector de Control de Delegaciones
Ing. Carlos Soto Perez, Gerente de Evaluacion y Control

8) Gobierno del Estado Chihuahua

Ing. Francisco A. Flores Aguirre, Jefe del Departamento de Minería

9) Universidad Nacional Autonoma de Mexico [UNAM]

Dra. Rosa Elva Rivera Santillan, Profesora, Depto. de Ingenieria Metalurgica,
Facultad de Quimica
Dr. Jose Luz Gonzalez Chavez, Profesor-Investigador, Depto. de Quimica
Analitica

10) Instituto Politecnico Nacional [IPN]

Dr. Jorge Perez, Profesor-Investigador, Escuela Superior de Ingenieria
Quimica e Industrias Extractivas

11) Asociacion de Ingenieros de Minas, Metalurgistas y Geologos de Mexico, A.C.

Ing. Ramon Davila Flores, Presidente
Ing. Fernando Galvan Yillarreal, Director General

12) Camara Minera de Mexico [CMM]

Ing. Ricardo Lassala Mozo, Asesor del Director General

13) Real del Monte, Grupo Acerero del Monte

Ing. Jose Luis Solis Flores, Gerente de la Planta de Beneficio Loreto
Ing. Rafael Vallejo Cano, Subgerente de Refineria
Ing. Ramon Navarro Zaragoza, Jefe Depto. Trituracion y Molinos
Ing. Francisco Raul Barrientos Hdez., Jefe de Turno Trituracion y Molinos
Ing. Josw Ochoa Quinones, Jefe Depto. Flotacion
Ing. Guillermo Juarez Lopez, Jefe Turno de Flotacion
Ing. Carlos D. Guzman Leon, Jefe de Turno Cianuracion

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II. METHODOLOGY OF EVALUATION

1. Items for Evaluation

As to the items for evaluation, both the Teams agreed as follows.

- ① Input to the Project
- ② Output from the Project
- ③ Purpose of the Project
- ④ Overall goal of the Project
- ⑤ Prospects of sustainability.

2. Methodology of Evaluation

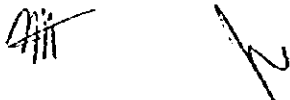
The evaluation of the Project was carried out through the following steps with referring the following materials.

1) Steps for Evaluation

- ① Preparation of the fact sheets on the Project
- ② Analysis and evaluation of the fact sheets
- ③ Interview and discussions with the persons concerned
- ④ Preparation of the draft of the joint evaluation report
- ⑤ Authorization of the joint evaluation report at the meeting of the Joint Committee for the Project
- ⑥ Signing to the Joint Evaluation Report by both the Teams.

2) Materials used for Evaluation

- ① Record of Discussions
- ② Tentative Schedule of Implementation
- ③ Annual Work Plan
- ④ Minutes of Discussions
- ⑤ Logical Framework as shown in Annex - I
- ⑥ Other documents, materials and data agreed on or accepted in the course of implementation of the Project by both the Teams.



III. BACKGROUND AND SUMMARY OF THE PROJECT

1. Brief Background of the Project

The technical cooperation in the field of mining industry by the Government of Japan to the Government of the United Mexican States through SEMIP (Secretaria de Energia, Minas e Industria Paraestatal) started in 1963 by means of the implementation of a project on mineral resources development planning survey in the days of OTCA (Overseas Technical Cooperation Agency of Japan).

Since the establishment of JICA in 1974, a technical cooperation scheme on the basic geological survey in the field of mineral resources development started in 1975 and also a project type technical cooperation scheme started in 1979. Those two schemes have been implemented up to now continuously and successfully.

The progress of the Japanese technical cooperation scheme in the field of mineral processing technology aiming at the promotion of the Mexican mining industry can be summarized as shown in the following three phases.

(1) The First Phase: Technical Cooperation at the Laboratory Study Stage

Since the Mexicanization of the Mexican mining industry has been almost realized by the enforcement of the new mining law in 1960, the Governmental administration in the field of mining industry has been implemented in line with the following targets;

- ① Increase of the added value to the primary mineral products from the domestic mines.
- ② Enhancement of the scientific and technological capabilities necessary for exploration, mining and metallurgical activities.
- ③ Promotion of the utilization of domestic mineral resources as the

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substitute for the imported mineral products, and also promotion of export of the domestic mineral products.

- ④ Creation of some new opportunities for working, raise of the living-standard of mining workers, and promotion of the development activities at the mining districts.

Under the above background, the modernization of the CFM Tecamachalco Research Center in both hardware and software carried out as a Japanese project type technical cooperation scheme entitled "Fostering of Metallurgical Technology in the United Mexican States" over a period of five years from 1979 to 1984 based on the technical cooperation program composed of the following three subjects; ① Mineral processing technology of complex sulphide ores, ② Metallurgical technology in relation to the segregation process, and ③ Techniques on chemical analysis of mineral products.

As an example of the results of the Japanese technical cooperation, that is, the modernization of the functions of the metallurgical research center in Tecamachalco, the regional training courses in the fields of mineral processing and chemical analysis were implemented over a period of five years from 1987 to 1992. And also, in 1988, a technical seminar entitled "Exploration and Processing Technologies of Complex Sulphide Ores" was held under the cosponsorship of JICA, CFM and CRM as an example of successful fruits of the technical cooperation schemes between Japan and Mexico in the field of mining industry.

(2) The Second Phase: Technical Cooperation at the Pilot Plant Testing Stage.

Based on the recommendation of the final report on the development planning survey of the pyrite ore deposits reserved in the state of Guerrero carried out by the Japanese technical cooperation scheme over a period of two years from 1980 to 1982, a project type technical cooperation scheme entitled "Research and Development on the Utilization of Un-utilized Pyrite Resources" was implemented at the Oaxaca Research Center of CFM over the period of four

years from 1986 to 1990.

It was recognized that the purpose of this Project is to transfer the technology concerning the TEC-KOWA process (a chloridizing roasting and vaporization metallurgy) to the Mexican side through the operation of the pilot plant of TEC-KOWA process installed at the Oaxaca Research Center in relation to the application of the basic functions on the research and experiments which were transferred from the Japanese experts to the Mexican counterparts at the Tecamachalco Research Center of CFM.

(3) The Third Phase: Technical Cooperation at the Mill Operation Stage.

In 1988, the Government of the United Mexican States requested the Government of Japan to implement a development survey on the modernization program of the mineral processing plants operated by CFM in line with the national development plan in the field of mining.

In February 1990, the Japanese side proposed a mill modernization program including ①Improvement of milling recovery, ②Reduction of milling costs, ③Improvement of the rate of operation of milling facilities, ④Rationalization of mill administration system to CFM as the results of development survey carried out from August 1989 to February 1990.

In August 1990, CFM requested, through the Government of the United Mexican States, the Government of Japan to implement a project-type technical cooperation concerning a training of engineers in the field of mineral processing plant operation and management at the site of full scale model mill which would be established at the CFM Parral Mill, Chihuahua by means of introduction of mill instrumentation and process control system.

In response to the above request from the Mexican side, the Japanese side took the necessary measures for clarifying the outline and background of the Mexican request and studying the feasibility on the Japanese technical cooperation scheme, and also dispatched several survey teams to the United Mexican States.



After careful consideration to the Mexican request between both the Japanese and the Mexican sides, the Japanese technical cooperation scheme entitled "the Project on Mineral Processing Plant Operation Technology in the United Mexican States" has started on August 17, 1992 in the period of four years.

2. Chronological Review of the Project

The chronological review of the Project is as shown in Annex-2.

3. Purpose and Overall Goal of the Project

As to the purpose of the Project, both the sides agreed in the document of Master Plan attached to the R/D as follows.

"The objective of the Project is to contribute to the manpower training scheme through the technology transfer on flotation plant operation in the course of implementation of the modernization program of mineral processing plants by the Mexican side."

As to the overall goal of the Project, both the Teams agreed at the discussions on the evaluation of the Project as follows.

"Contribution to the promotion of the Mexican mining industry through human resources development in the field of mineral processing."

4. Tentative Schedule of Implementation

As to the tentative schedule of implementation for the Project, the original schedule is described in Annex - 4 together with the schedule modified by the mutual agreement in the course of implementation of the Project.

5. Technical Cooperation Program

As to the technical cooperation program for the Project, the original schedule is described in Annex-5 together with the program modified by the mutual agreement in the course of implementation of the Project.



IV. RESULTS OF EVALUATION

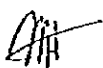
1. Overall Goal of the Project

All the activities mentioned in the Scope of the Project described in the document of Master Plan attached to the R/D have been evaluated as mentioned in the following sections. According to those results, the Project is considered to have been favorably conducted.

In the point of view concerning the progress of the promotion activities for the Mexican mining industry in relation to the improvement of mineral processing plant operation, the remarkable results acquired under the Project in the fields of regional mining promotion and training activities are evaluated positively by the authorities concerned with the Mexican mining industry such as Direccion de Minas of SECOFI, Fideicomiso de Fomento Minero (FFM), Camara Minera de Mexico (CMM), Direccion General de Fomento Economico of the State Government of Chihuahua, Asociacion de Ingenieros de Minas, Metalurgistas y Geologos de Mexico, A.C. (AIMNGM), Professors and Investigators of Universidad Nacional Autonoma de Mexico (UNAM) and Institute Politecnico Nacional (IPN) and others.

However, most of the authorities concerned suggested that the more intensive promotion activities in relation to the effective utilization of the functions of the Center (Centro de Experimentacion Metalurgica de Parral, Chihuahua) by CRM are necessary for the realization of the overall goal of the Project.

In consideration of the above, both the Teams recognized that the achievement of the overall goal of the Project would be realized in the near future by the efforts of CRM itself and the supports from the every agency concerned with the Center.



2. Purpose of the Project

The purpose of the Project has been agreed by both the sides in the Master Plan attached to the R/D as follows; "The objective of the Project is to contribute to the manpower training scheme through the technology transfer on flotation plant operation in the course of implementation of the modernization program of mineral processing plants by the Mexican side".

From the standpoint of the above purpose, the achievement of the purpose of the Project can be evaluated in the following two ways; ① Progress of technology transfer aimed at the Project in the scope of flotation mill. ② Progress of human resources development program in the field of mineral processing technology.

2-1 Progress of Technology Transfer

The achievement on the Progress of technology transfer from the Japanese experts to the Mexican counterpart personnel was evaluated carefully in consideration of the above description by both the Teams as shown in Table-2.

Referring to the results of Table-2, it is clear that the purpose of the Project from the view point of technology transfer would be accomplished up to the end of the Project, except for filtration circuit due to the late arrival of the equipment.

As to the technology transfer concerning filtration circuit, it is expected that the Japanese expert will make his best effort for full operation of filtration circuit in cooperation with the Mexican counterparts.

As to the mill maintenance and repair, it is suggested that the Mexican side should take necessary measures for the stable mill operation including a concrete maintenance system applicable to the Parral Mill, although the practice on this subject has been transferred to the Mexican side.

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Table - 2 Progress of the Technology aimed at the Project

Subjects of Technology Transfer	Estimated Achievement* (%)
<p>1. Operation Technique of Flotation Mill</p> <p>①Crushing circuit</p> <p>②Grinding circuit</p> <p>③Flotation circuit</p> <p>④Thickening and filtration circuit</p> <p>⑤Waste treatment circuit</p>	<p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p> <p>9 0 %</p> <p>1 0 0 %</p>
<p>2. Practice on Instrumentation of Flotation Mill</p> <p>①Hydrocyclone</p> <p>②Constant feeding and weighing device</p> <p>③pH Controller</p> <p>④Flow-meter</p> <p>⑤On-line particle size analyzer</p> <p>⑥On-line X-ray fluorescence analyzer</p> <p>⑦Flotation reagent feeder</p> <p>⑧Monitoring system for pollution control</p>	<p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p>
<p>3. Practice on Process Control Technology at Flotation Mill</p> <p>①Grinding circuit</p> <p>②Flotation circuit</p>	<p>1 0 0 %</p> <p>1 0 0 %</p>
<p>4. Conception of Flotation Mill Management</p> <p>①Guide-lines on custom mill</p> <p>②Practice on plant maintenance</p> <p>③Guide-lines on metallurgical mill performance management</p> <p>④Practice on plant management by computer</p>	<p>1 0 0 %</p> <p>9 0 %</p> <p>1 0 0 %</p> <p>1 0 0 %</p>

[Notes] * Estimated degree of progress at the final stage of the Project.

2-2 Progress of Human Resources Development Program in the Field of Mineral Processing Technology

As to the human resources development program in the field of mineral processing technology, the Mexican side made their best efforts in both of hardware and software. So that, the renovation works of buildings and facilities of the Parral Mill necessary for the training courses by OJT method completed in the first of 1994.

The human resources development program including seminar, training courses and various technical services has been implemented favorably by the Mexican side under the guidance of the Japanese experts and the assistance from the Japanese side.



3. Output from the Project

3-1 Human Resources Development in the Field of Mill Operation and Mill Management Technology

3-1-1 Counterpart personnel acquired the specific technology in each field

The results of the allocation of the Mexican counterpart personnel over the period of 4 years from August 1992 to May 1996 are as shown in Table-3.

In spite of the importance of the role of counterpart personnel, the results of the allocation of counterparts by the Mexican side were not adequate for smooth implementation of the Project. However, as each of counterparts made every effort seriously to attain the best achievement from the Project, the technology transfer from the Japanese side to the Mexican side as a whole was carried out appropriately in cooperation with the Japanese experts who have positive attitude toward successful implementation of the Project.

Table - 3 Summary of the Mexican Counterpart Personnel

Specialty	August 1992	June 1993	August 1994	May 1995	May 1996
Mill Operation	No. 10	No. 10	-	-	-
	No. 12	No. 12	No. 12 No. 32	No. 12 No. 32	No. 12 No. 32
Mill Instrumentation and Mill Process Control		No. 20 No. 22	- -	- -	- -
			No. 33	No. 33	No. 33
Chemical Analysis	No. 13	No. 13	No. 13	No. 13	No. 13
Mill Maintenance and Mill Management	No. 14	No. 14	No. 14	No. 14	No. 14
		No. 23	No. 23	-	-

[Notes] "No. **" corresponds to the counterpart recorded in Annex - 10.

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3-1-2 Human resources development by means of training courses

The summary of training courses is as shown in Annex-14.

The first training course under the Project was held at the Center on October 1994 after the completion of the renovation works of building and facilities and the installation and calibration works of the machinery and equipment provided from the Japanese side.

The number of participants in the training courses up to the end of May 1996 amounted to 110 trainees, in which 28 trainees from CRM, 41 trainees from universities and 41 trainees from mines and mills. Most of participants expressed their positive evaluation to the training courses, because the training facilities at the Center are characterized as the only and well equipped training center operated by OJT method in this country.

However, some of participants in the training courses requested more intensive training in the front of mineral processing plant operation including a practice of mill instrumentation not only the lectures in the class room.

In the course of implementation of the training courses, the voluminous and useful text books were compiled by the Mexican counterparts in cooperation with the Japanese experts as shown in Table-4.

Table - 4 The Textbook compiled by the Mexican Counterparts

Subjects	Compiler	Pages	Edition
Mill Operation	Ing. Edgar Ruben Maldonado Saenz	160	1996
Mill Instrumentation	Sr. Jesus Jose Nunez Gardea	57	1996
Process Control	Ing. Adriana Sofia Gonzalez Cruz	40	1996
Pollution Control	Sr. Jose Ines Campuzano Molina	40	1996

3-1-3 Technology transfer by means of technical seminars

The summary of the technical seminars held by CRM or under the cosponsorship of JICA and CRM is as shown in Annex-13.

Since the first technical seminar was held under the cosponsorship of JICA and CRM on March 1993, five seminars have been held in Mexico City, Guanajuato, Parral and Chihuahua with the total 440 participants including the guests from Bolivia, Brazil, Chile, Colombia and Peru. These seminars were highly thought of by the participants from several points of view such as the useful opportunity for technical, scientific and personal exchange among metallurgists from industry, university and government agency.

3-2 Renovation of Facilities in Relation to Mill Operation and Management

Technology at the Metallurgical Experimental Center, Parral, CRM

3-2-1 Renovation of facilities at Parral mill

Renovation works of the mill facilities at the site of the Project have been carried out by CRM and completed in the first of 1994. The total expenses for renovation works including the budget allocation of 1996 amounted to N\$ 3,198,000.

The major machinery and equipment provided by the Mexican side are listed in Annex-19 and the total price of those machinery and equipment amounted to N\$ 6,935,000.

3-2-2 Introduction of modern mill equipment

The Japanese side provided the machinery and equipment necessary for smooth implementation of the Project in line with the R/D, TSI and TCP.

The major machinery and equipment provided by the Japanese side are listed in Annex-8 and the total purchase price (FOB) of those machinery and equipment amounted to ¥ 347,345,000.

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3-2-3 Preparation of training facilities

The most important facilities for training at the site of the Project are the machinery and equipment necessary for mill operation, mill instrumentation and process control, because the feature of the training held at the Center is on the job training (OJT) under the full scale continuous mill operation.

In addition to the above, several training facilities and tools such as seminar room, control panel room, and audio-visual aids were provided by both the sides.

3-3 Fostering of Human Resources Development Program at the Metallurgical Experimental Center, Parral, CRM

3-3-1 Training courses

The most important feature of the training courses held in the Center is its practical training system using a full-size, well equipped, and 24 hours operated flotation plant.

The trainees are given a plenty of study cases in the course of training. The scope of training subjects covers from ore receiving section to wastes treatment section through crushing, screening, grinding, classification, flotation, thickening and filtration sections. And furthermore, the results of mineral processing operation such as the grade of feeds and products, the recovery of concentrates, the consumptions of materials, and various flotation conditions are included.

Annex-15 shows those operation conditions and results of processing at the Parral mill of the Center over the period of two years from July 1994 to June 1996.

3-3-2 Technical seminars

As to the important effect of the technical seminar in the human resources development program, the speakers and participants pointed out mutual intensive discussions during the seminar.

The comment on the operation of the Parral mill from the participants is a good example of the effects of seminar, and described as follows;

- ① Verification of the economical effects of the on-line particle sizer and the fluorescence X-ray analyzer.
- ② Verification of the filtration effect to the high moisture concentrates.
- ③ Effects of the flotation reagents due to the lowering of zeta potential to the moisture content of the concentrates.
- ④ Introduction of a sieve bend and a sandwich deck screen instead of hydrocyclone.
- ⑤ Discussions on the autogenous mill and the semi-autogenous mill.
- ⑥ Discussions on the column flotation.

3-3-3 Consultation services

The summary of services on technical consultation is as shown in Annex-16.

In the period of renovation works of the Parral mill, the Japanese experts and the Mexican counterpart personnel visited several mineral processing plants in order to give some guidance and advice on the problems faced at the mills. This is also a good chance as the on-the-job training to the counterparts.



After the operation of the Parral mill started, the technical consultation services are implemented at the site of the Center.

In relation to the technical consultation service, some authorities suggested the introduction of mobile mill is very useful for small and petty mines and mills.

3-3-4 Chemical analysis services

The summary of services on chemical analysis at the Parral Experimental Center is as shown in Annex-17.

The activities of the laboratory for chemical analysis at the Center are evaluated highly, because the data and information concerning chemical

analysis are the most important basic input to the mill operation and instrumentation as well as the process control of the Parral mill.

The total number of samples analyzed at the Center in the period of five years from 1992 to the end of June 1996 amounted to 7,333 elements with a well accuracy in spite of the analysis using an old type equipment, so that, some participants in the training courses pointed out on this situation.

3-3-5 Laboratory testing services

The summary of services on metallurgical testing at the Parral Experimental Center is as shown in Annex-18.

The laboratory testing services at the Center were carried out in the several kinds of testing such as; ① Bulk flotation of gold and silver, ② Bulk flotation of copper, ③ Selective flotation of lead and zinc, ④ Cyanidation of crude ores.

The total number of testing matters at the Center in the period of five years from 1993 to the end of June 1996 amounted to 382 matters, and the cumulative number of elements analyzed for determination of the products from those testings at the same period amounted to 5,680 elements.

Some of the participants in the seminar and training courses and the authorities of the State Government suggested the enhancement of the laboratory testing services at the Center in consideration of the present situation of the regional mining activities.

4. Input by the Japanese Side

4-1 Dispatch of Experts

The Japanese side has dispatched five (5) long-term experts and twenty-eight (28) short-term experts in relation to the Project as shown in Annex-6.

The assigned duty of the Japanese experts covers as follows; ① Chief advisor, ② Coordinator, ③ Mill operation and management, ④ Mill instrumentation, ⑤ Mill process control, ⑥ Lecturer at seminar, ⑦ Lecturer at training course, ⑧ Waste water treatment technology and ⑨ Installation and calibration of the machinery and equipment provided from the Japanese side.

The activities and services of the Japanese experts at the Project were appreciated highly by the Mexican side.

4-2 Acceptance of Counterpart Personnel for Training in Japan

The Japanese side has accepted sixteen (16) Mexican counterpart personnel for training in Japan as shown in Annex-7.



The specific subject of training in Japan covers as follows; ① Mineral processing, ② Mill process control, ③ Mill maintenance, ④ Chemical analysis, ⑤ Mill management, and ⑥ Project management.

The term of training in Japan was about one month, so that, the extension of the length of their stay in Japan requested from some of the counterparts. However, it is evaluated that the training of counterparts in Japan has been implemented favorably, as a whole, in consideration of the situation of both the sides.

4-3 Provision of Machinery and Equipment

The Japanese side has provided the machinery and equipment necessary for implementation of the Project as shown in Annex-8.

The total price of those machinery and equipment amounted to ¥ 347,345,000 in FOB including the last batch of equipment arrived in the site of the Project

on the first of July 1996.

All of the machinery and equipment provided from the Japanese side are utilized effectively at the site of the Project.

However, it is suggested that the preventive measures for maintenance and repair of some of the sophisticated equipment such as a maintenance contract with the appropriate agency are necessary in order to secure the smooth operation of the Parral mill of the Center.

4-4 Expenditure of Management Costs

The Japanese experts team dispatched to the site of the Project bore the expenditure on the complement of the operational costs of the Project amounted to forty million yens in the period of four years from 1992 to 1995 as shown in Annex-9.

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5. Input by the Mexican Side

5-1 Allocation of Counterparts and Administrative Personnel

The Mexican side had allocated the counterparts, administrative staff and supporting personnel for the Project in the period of four years from August 1992 to the present time as shown in Annex-10.

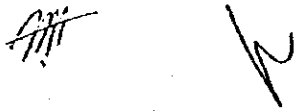
The transition of the allocation of those personnel is as shown in Table-5.

The cumulative number of the Mexican personnel participated in the Project is as follows; ① Counterpart personnel:9, ② Administrative staff:19, ③ Supporting personnel:37, ④ Total:65.

Table - 5 Transition of the Allocation of the Mexican Personnel
for the Project

Groups	Aug.1992	June 1993	Aug.1994	May 1995	May 1996
Counterpart Personnel	4	7	6	5	5
Administrative Staff	10	4	6	6	7
Supporting Personnel	-	8	29	31	32
Total	14	19	41	42	44

All of the personnel participated in the Project were appreciated for their positive attitude toward the successful operation and management of the Project, especially for their efforts to overcome difficulties faced to the Project in cooperation with the Japanese side.



5-2 Renovation of Facilities at the Parral Mill

The Mexican side has implemented the renovation works of the buildings and facilities of the Parral mill at the site of the Project according to the mutual agreement between both the sides up to the first of 1994.

The total expenses for renovation works is recorded in Annex-11 as the amount of N\$ 3,108,000 including the allocated budget for 1996.

5-3 Procurement of Machinery, Equipment, Materials and Mill Feeds

The Mexican side took a necessary measures for procurement of machinery, equipment, materials and mill feeds toward a smooth implementation of the Project.

5-4 Expenses of Operational Costs for the Project

The Mexican side took a necessary measures for securing the operational costs for the Project.

The total expenses for mill operation and management in Annex-11 as the amount of N\$ 6,730,000 including the allocated budget for 1996.

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6. Impact of the Project

The most notable impact of the Project is the fact that the function of the practical training system using a full-scale, well equipped and 24 hours operated flotation plant has been established at the CRM Metallurgical Experimental Center of Parral, Chihuahua in both human resources and infrastructures. And, at the same time, the facts that the custom milling service carried out in the process of training courses and other technical services are contributing greatly to the promotion of the regional mining activities are also another impact of the Project.

The following facts reflect the impact of the Project.

(1) Number of trainee at the training courses over the period of twenty months from October 1994 to May 1996 amounts to 110 persons, in which 28 trainees from CRM, 41 trainees from universities and 41 trainees from mines and mills.

(2) Number of participants in the technical seminars held in relation to the Project over the period of three years and four months from March 1993 to June 1996 amounts 440 persons including the participants from South America.

(3) Number of technical services, number of elements analyzed and number of metallurgical testing services during the period of the Project amount to 10 matters, 7,333 elements and 382 matters respectively.

(4) The results of custom milling services over the period of two years from July 1994 to June 1996;

1) Total tonnage of crude ores processed at the Parral mill of the Center:

37,619.408 tons.

2) Total tonnage of lead concentrates produced from the Parral mill of the Center: 1,123.441 tons.

3) Total tonnage of zinc concentrates produced from the Parral mill of the Center: 1,511.146 tons.



- 4) Total tonnage of gold, silver and lead bulk concentrates produced from the Parral mill of the Center: 100.030 tons.
- 5) Total tonnage of gold and lead bulk concentrates produced from the Parral mill of the Center: 20.732 tons.
- 6) Total tonnage of gold and copper bulk concentrates produced from the Parral mill of the Center: 51.184 tons.
- 7) Total days of operation at the Parral mill of the Center: 273 days.
- 8) Total batches of operation at the Parral mill of the Center: 35 batches.
- 9) Improvement of the performance of mineral processing operation at the Parral mill of the Center in the grade and recovery of concentrates and the consumption of milling materials and others, for example:

Table - 6 Comparison of the Recovery at the Parral Mill with Before and After Mill Renovation Works

Source of Crude Ores	Maria Elena		San Francisco	
	1993 ¹⁾	1995 ²⁾	1993 ¹⁾	1995 ²⁾
Silver Recovery (%)	69.51	77.76	70.03	80.49
Lead Recovery (%)	77.32	80.42	77.29	82.95
Zinc Recovery (%)	65.40	74.30	66.88	77.75

[Notes] 1) Before renovation of the Parral mill.

2) After renovation and instrumentation of the Parral mill.

7. Prospects for Sustainability of the Project

7-1 Organizational Aspects


Through the meetings and discussions between both the Teams and the interviews with the authorities concerned in public and private, all of the Mexican side confirmed the necessity of the sustainable operation of the CRM Metallurgical Experimental Center of Parral, Chihuahua. This is because of that the mission and activities of the Center are beneficial to the promotion of the regional mining activities as well as the progress of the Mexican mining industry through the human resources development in the fields of mineral processing technology.

In order to realize the above mutual understanding, it is clear that the allocation of manpower and budget necessary for the stable operation of the Center should be guaranteed over a long term.

In line with those suggestions, several practical proposals are discussed positively, such as an idea on the independent budget allocation necessary for smooth operation of the Center based on the guarantee of the some amount of returns from the income of the custom milling services as well as the severe cost control and the effective operation of the Parral mill of the Center.

From the another point of view on the field of practical training subjects necessary for the university students as well as on the job training of the personnel of the mining company, the role of the Parral mill of the Center is very important.

In consideration of the present situation including the positive attitude of the Mexican authorities concerned and the demand for the assistance to the regional medium, small and petty scale mills and mines, it is obvious that the sustainability of the Project is hopeful greatly.



7-2 Social and Economic Aspects

From the point of the social and economic aspects based on the Mexican national development plan in the field of mining industry, the promotion of the regional mining activities and the enhancement of the employment in the regions through the support and assistance for the medium, small and petty scale mines and mills are one of the important policies of the central and the state governments.

In line with the above principles, for example, the State Government of Chihuahua is now taking the necessary measures in cooperation with CRM and FFM including the credit to the small and petty mines or mills in conditions that the crude ores should be sent to the Parral mill of the Center for custom milling and/or the personnel in charge of operation and management of those mills should be trained at the Center.

In response of those situation in the field of mining industry, some of the owners of small and petty mines pointed out the benefit of the custom milling services at the Parral mill of the Center as follows; ① Advantage in the recovery of concentrates, ② No complaints from the smelter at the delivery of the concentrates, ③ Moderate fee of custom milling service and ④ Reliability of mill operation at the Parral mill of the Center.

In consideration of those situations, it is also obvious that the operation of the Center would be sustainable from the economic and social aspects.

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V. CONCLUSIONS

Both the Japanese and the Mexican Teams have reached the following conclusions, through the careful joint evaluation for the Project in Mexico City and at the Project site of Parral, Chihuahua.

- (1) Both the Teams recognized that the achievement of the overall goal of the Project would be realized in near future by the positive efforts of CRW itself and the supports from the every agency concerned with the Center, because the remarkable results have been acquired under the Project in the fields of regional mining promotion and training activities.
- (2) Both the Teams recognized that the purpose of the Project from the viewpoint of technology transfer would be almost accomplished up to the end of the Project, and at the same time, the human resources development program in the field of mineral processing technology, that is another purpose of the Project, has been implemented favorably.
- (3) As to the results of the output from the Project, both the Teams recognized as follows:
 - 1) The number of the Mexican counterparts who have acquired the specific technology in each field was not adequate for smooth implementation of the Project.
 - 2) The self reliant operation of the training courses and seminars by the Mexican side has been implemented as one of the remarkable results of the Project under the guidance and support of the Japanese side.
 - 3) The infrastructure necessary for the implementation of the human resources development program and the efficient operation of the Parral mill has



been completed by the best efforts of the Mexican side and the appropriate support from the Japanese side.

4) The technical services to the regional mining industry such as consultation, chemical analysis and laboratory testing were conducted gradually.

(4) As to the results of input to the Project, both the Teams recognized as follows;

1) The inputs by the Japanese side such as the dispatch of the Japanese experts, the acceptance of the Mexican counterpart personnel for training in Japan, the provision of machinery and equipment, and the expenditure of management costs were implemented appropriately as mentioned in the document of TSI.

2) The inputs by the Mexican side such as the allocation of counterparts and administrative personnel, the renovation of facilities at the Parral mill, the procurement of machinery, equipment, materials and mill feeds, and the expenditure of operational costs were implemented as mentioned in the document of TSI overcoming some delays and some problems.

(5) Both the Teams recognized that the most remarkable impact of the Project is the establishment of the functions of the practical training system using a full-scale, well equipped and 24 hours operated flotation mill and the efficient operation of the custom milling services at the Center.

(6) Both the Teams recognized that the sustainability of the Project is hopeful, in consideration of the positive attitude of the Mexican authorities concerned and the demand for the technological and economical assistance to the regional medium, small and petty scale mills and mines.

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In conclusion, both the Teams confirmed that the Project has been implemented successfully and recognized that the Project would be succeeded to the main functions of the Center under the full support and assistance from the central and local governments and private sectors in addition to the best efforts of CRM itself such as the appropriate allocation of manpower and operational costs, the reliable implementation of a preventive maintenance system including the maintenance contract with the makers concerned, and the best actions necessary for the diffusion and utilization of the results and functions of the Center.

Both the Teams express our gratitude to their faithful and dedicated services toward the successful implementation of the Project by the Japanese experts and the Mexican counterpart personnel over the period of four years.

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Annex-1 Logical Framework for the Project

Technical Cooperation for the Project on Mineral Processing Plant Operation Technology
in the United Mexican States

Summary of the Project	Verifiable Indicators	Results of Evaluation	Important Assumptions
<p>Overall Goal of the Project Contribution to the promotion of the Mexican mining industry through human resources development in the field of mineral processing.</p>	<p>Progress of the promotion activities for the Mexican mining industry in relation to the improvement of mineral processing plant operation.</p>	<p>The remarkable results acquired under the Project in the fields of regional mining promotion & training activities are evaluated by the authorities concerned with the Mexican mining industry.</p>	<p>Implementation of the promotion policy in the field of mining industry by both of the central & local governments and the mining enterprises.</p>
<p>Purpose of the Project Contribution to the manpower training program through the technology transfer on flotation mill operation in the course of implementation of a mill modernization program by the Mexican side.</p>	<p>1. Progress of technology transfer aimed at the Project in the scope of flotation mill. 2. Progress of human resources development program in the field of mineral processing technology.</p>	<p>1. Estimated degree of progress at the final stage of the Project. · Mill operation : 100% · Mill instrumentation: 100% · Mill process control: 100% · Mill management : 100% 2. Degree of progress on training program · Renovation of mill facilities at Parral: 100% · Guidance of training: 100%</p>	<p>1. Continuation of the services at CRM by the counterparts who were transferred technology from the experts. 2. Guarantee of the operational costs necessary for the Project. 3. Enhancement of dissemination activities on the results of the Project.</p>
<p>Output from the Project 1. Human resources development in the field of mill operation and mill management technology. 2. Renovation of facilities in relation to mill operation & management technology at the Metallurgical Experimental Center, Parral, CRM 3. Fostering of human resources development program at the Metallurgical Experimental Center, Parral, CRM (Technology transfer to the Public)</p>	<p>1. Progress of human resources development. ① Number of counterpart personnel acquired the specific technology in each field. ② Number of participants in the training courses. ③ Number of participants in the seminar. 2. Renovation of facilities ① Renovation of facilities at Parral mill. ② Introduction of modern mill equipment. ③ Preparation of training facilities. 3. Progress of training and public service programs. ① Training courses ② Technical seminars ③ Consultation services ④ Analysis services ⑤ Testing services</p>	<p>1. Results of human resources development. ① Number of counterparts a. Mill operation : 3 b. Mill instrumentation & process control : 3 c. Mill maintenance and management : 3 ② Number of Trainee : 110 ③ Seminar participants: 440 2. Implementation of renovation of Parral Center ① Renovation of mill facilities. : 100% ② Modern equipment. : 100% ③ Training facilities: 100% 3. Public service program ① Training courses: 16 Times (Total mill feeds: 37,620t) ② Seminars: 5 Times, 19 days ③ Consultation : 10 Cases ④ Analysis: 7,333 Elements ⑤ Lab. testing: 382 Matters</p>	<p>1. Continuation of the services at CRM by the counterparts who were transferred technology from the experts. 2. Guarantee of the operational costs necessary for the Project.</p>
<p>Activities of the Project 1. Human resources development. ① Technology transfer at the Parral Center a) Mill operation practice b) Mill instrumentation c) Mill process control d) Mill management ② C/P training in Japan 2. Renovation of facilities ① Renovation of mill ② Equipment introduction ③ Preparation of training 3. Promotion of services ① Training and seminar ② Technical services</p>	<p>Input by the Japanese Side (August 1992~June 1996) 1. Dispatch of the Japanese survey teams (8 teams) 2. Dispatch of the Japanese experts a. Long-term experts : 5 experts b. Short-term experts : 28 experts 3. Acceptance of the counterparts in Japan : 16 persons 4. Provision of the equipment : about JY 402 million 5. Total expense for the Project: about JY 862 million (Including equipment costs) Input by the Mexican Side (August 1992~June 1996) 1. Assignment of the personnel for the Project a. Counterpart personnel : 9 persons b. Administrative personnel : 19 persons c. Supporting staff : 37 persons 2. Renovation works of building and facilities Total expense for renovation : 2,895 thousand N. Peso 3. Total expense for the Project: 7,792 thousand N. Peso</p>	<p>1. Continuation of the services at CRM by the counterparts who were transferred technology from the experts. 2. Guarantee of the operational costs necessary for the Project. 3. Sustainable supply of the feed ores necessary for training operation at the Parral mill.</p>	

Annex- 2 Chronological Review of the Project

Year	Month	Items
1988	February	The Government of the United Mexican States requested the Government of Japan to implement a development survey on a modernization program of the mineral processing plants operated by CFM (Comision de Fomento Minero).
1990	February	The Japanese side proposed a mill modernization program including ①Improvement of milling recovery, ②Reduction of milling cost,③Improvement of the rate of operation of milling facilities,and ④Rationalization of mill administration system to CFM as the results of development survey carried out from August 1989 through February 1990.
1990	August	CFM requested,through the Government of the United Mexican States,the Government of Japan to implement a project type technical cooperation concerning a training of engineers in the field of mineral processing plant operation and management at the site of a full scale model mill which would be established at the CFM Parral Mill, Chihuahua by means of introduction of mill instrumentation and process control system.
1991	June	The Japanese side dispatched a preliminary survey team to the United Mexican States in response to the above request from the Mexican side for the purpose of clarifying the outline and background of the Mexican request as well as studying the feasibility on the Japanese project type technical cooperation scheme concerning on this matter.
1991	November	The Japanese side dispatched the first experts survey team to the United Mexican States for the purpose of clarifying the detailed technical conditions at the proposed project site as well as studying the present situation concerning institutional reform in the field of political administration on mining industry.
1992	April	The Japanese side dispatched the second experts survey team to the United Mexican States for the purpose of clarifying the present situation on the administrative reform concerning CFM,CRM and FFM of SEMIP as well as studying the present conditions of the site of the Project and the future prospects of the Project.
1992	July	The Director General de Operacion Minerometalurgica,SEMIP send an official letter to the Resident Representative of JICA Mexico Office informing that ① CRM will be in charge of the technical support functions at the domestic mining activities, ② FFM will be in charge of the fund procurement and training functions, ③ CFM will dissolve within one year from September 25,1992 based on the approval of the amendment of the Mining Law,and so that ④ the Project concerning a Parral Training Center will be implemented under the supervision of FFM.
1992	August	The Japanese side dispatched an implementation survey team to the United Mexican States for the purpose of working out the details of the technical cooperation program concerning the Project. As a result of the discussions,the Team and the authorities concerned of the Government of the United Mexican States agreed to recommend to their respective Government the matter referred to in the document, that is the R/D signed on August 17,1992 in Mexico City. In accordance with the provisions of the R/D, the Project has started on August 17, 1992 in the term of 4 years.
1992	December	The Japanese side dispatched the first batch of experts who were in charge of a chief adviser and a coordinator.
1993	January	The Mexican side confirmed that in accordance with the laws and regulations in force in the United Mexican States, CRM took over overall responsibility for the implementation of the Project from CFM on the first of January 1993 under the supervision and coordination of SEMIP.
1993	March	The Japanese side accepted the first batch of the Mexican counterpart personnel for their training in Japan.

Year	Month	Items
1993	March	The first JICA-CRM technical seminar entitled "Efforts towards mill operation modernization and environmental improvement" was held in Mexico City.
1993	March	The services on technical consultation at the site of mill by the Japanese experts and the Mexican counterparts started at the region of Chihuahua.
1993	June	The Japanese side dispatched a consultation team to the United Mexican States for the purpose of reviewing the activities of the Project and formulating further operational plans for promotion of the Project.
1993	June	The first batch of the machinery and equipment provided by the Japanese side arrived at the site of the Project, Parral, Chihuahua.
1993	June	The first amendment of the R/D concerning the transfer of the Mexican implementing agency from CFM to CRM was agreed between the Japanese and the Mexican sides.
1993	September	The renovation works of the Parral Mill at the site of the Project started.
1993	November	The seminar room, the computer room and the office for the Japanese experts at the site of the Project were completed.
1993	December	The renovation works of the Parral Mill at the site of the Project were nearly finished.
1994	March	The first Joint committee meeting was held at the main office of CRM, Pachuca.
1994	March	The installation and calibration works of the machinery and equipment provided by the Japanese side were almost finished.
1994	March	The opening ceremony of the CRM Metallurgical Experimental Center, Parral, Chihuahua was held at the site of the Project.
1994	April	The trial runs of the Parral mill without ores started.
1994	June	The load test runs of the Parral mill using ores started.
1994	July	The full 24 hours operation of the Parral mill started.
1994	August	The Japanese side dispatched a technical guidance team to the United Mexican States for the purpose of reviewing the activities of the Project and formulating further operational plans for promotion of the Project.
1994	October	The first training course at the Center was held under the 24 hours operation of the Parral mill.
1995	January	The Mexican side confirmed that in accordance with the laws and regulations in force in the United Mexican States, SECOFI took over overall responsibility for supervision and coordination of the Project from SEMIP since the first of January 1995.
1995	June	The second amendment of the R/D concerning the transfer of the Ministry responsible for supervision and coordination of the Project from SEMIP to SECOFI was agreed between the Japanese and the Mexican sides.
1995	June	The Japanese side dispatched the second technical guidance team to the United Mexican States for the purpose of reviewing the activities of the Project and formulating further operational plans for promotion of the Project.
1996	July	Both the Japanese and the Mexican sides agreed to evaluate the results of the Project jointly.

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Annex 3 Survey Teams Dispatched by JICA

Type and Term of Survey Team	Members of Survey Team
Preliminary Survey Team [June 24 ~ July 7, 1991]	Dr. Kenji Tomita, Special Technical Adviser, JICA Mr. Takashi Isobe, Chief, Domestic Section, Mining Division, MITI Mr. Kazu Iwano, Assistant Manager, Engineering Department, JMIA Mr. Shozo Ohashi, Assistant Manager, Engineering Department, JMIA Mr. Tsutomu Nagae, Staff, Technical Cooperation Division, Mining & Industrial Development Cooperation Department, JICA
Experts Survey Team (I) [November 2 ~ November 30, 1991]	Mr. Kazu Iwano, Assistant Manager, Mineral & Energy Resources Dept., Dowa Mr. Toshio Hirayama, Senior Engineer, Dowa Engineering Co., Ltd.
Experts Survey Team (II) [April 20 ~ April 29, 1992]	Dr. Kenji Tomita, Special Technical Adviser, JMEC Mr. Kazu Iwano, Assistant Manager, Mineral & Energy Resources Dept., Dowa
Implementation Survey Team [August 6 ~ August 19, 1992]	Dr. Kenji Tomita, Special Technical Adviser, JMEC Mr. Kenji Itakura, Chief, International Cooperation Section, Mining Div., MITI Mr. Kazu Iwano, Technical Adviser, JMEC Mr. Toshio Hirayama, Technical Adviser, JMEC Mr. Mitsunari Takahashi, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA Mr. Yuichi Endo, Staff, Japan International Cooperation System
Consultation Team [June 23 ~ July 3, 1993]	Mr. Saburo Yamaguchi, Director, Planning Division, Mining and Industrial Development Cooperation Department, JICA Dr. Kenji Tomita, Special Technical Adviser, JMEC Mr. Junichi Nakayama, Exploration Specialist, Mining Division, MITI Mr. Kazu Iwano, Assistant Manager, Mineral & Energy Resources Dept., Dowa Mr. Kazuhiko Tokuhashi, Staff, Technical Cooperation Division, Mining and Industrial Development Cooperation Department, JICA
Technical Guidance Team (I) [August 22 ~ September 3, 1994]	Mr. Kozo Esaki, Special Technical Adviser, JICA Mr. Hiroshi Kuwayama, Chief, International Cooperation Section, Mining Division, MITI Dr. Kenji Tomita, Special Technical Adviser, JMEC Dr. Chihiro Inoue, Assistant Manager, Mineral & Energy Resources Dept., Dowa Mr. Masaki Kinouchi, Staff, International Cooperation Department, JMEC
Technical Guidance Team (II) [June 12 ~ June 24, 1995]	Dr. Kenji Tomita, Special Technical Adviser, JMEC Mr. Yusuke Murayama, Quarrying Industry Officer, Mining Division, MITI Mr. Kazu Iwano, Senior Manager, Mineral & Energy Resources Dept., Dowa Mr. Tomoo Niida, Staff, Mining and Industrial Development Cooperation Div., Mining and Industrial Development Cooperation Department, JICA
Evaluation Team [July 8 ~ July 27, 1996]	Mr. Masayoshi Juro, Director, Financial Cooperation Division, Mining and Industrial Development Cooperation Department, JICA Mr. Toshiyuki Takahashi, Chief, Rare Metals Section, Mining Div., MITI Mr. Kazu Iwano, Senior Manager, Mineral & Energy Resources Dept., Dowa Mr. Shinya Tomonari, Staff, Mining and Industrial Development Cooperation Division, Mining and Industrial Development Cooperation Department, JICA Dr. Kenji Tomita, Special Technical Adviser, JMEC

[Notes] JICA : Japan International Cooperation Agency
 MITI : Ministry of International Trade and Industry
 JMIA : Japan Mining Industry Association
 JMEC : Japan Mining Engineering Center for International Cooperation
 DOWA : Dowa Mining Company Limited

Annex-4 Tentative Schedule of Implementation

Calendar Year	1991		1992				1993				1994				1995				1996			
Quarter	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	
<u>Term of the Project</u> (4 years)																						
The Mexican Side																						
I. Establishment and Operation of the Center																						
II. Staff Assignment																						
III. Renovation of the Plant																						
1) Plant Renovation																						
2) Data Processing room																						
3) Office Renovation																						
IV. Procurement of Machinery & Equipment																						
V. Allocation of Budget for Operation of the Plant and the Center																						
VI. Operation & Management of the Plant																						
VII. Preparation of Progress Report																						
The Japanese Side																						
I. Dispatch of Survey Teams																						
1) Preliminary																						
2) Experts Survey																						
3) Implementation																						
4) Consultation																						
5) Technical Guidance																						
6) Equipment Maintenance																						
7) Evaluation																						
II. Dispatch of Experts																						
1) Long-term Experts																						
① Chief Advisor																						
② Coordinator																						
③ Mill Operation and Management																						
④ Mill Process Control																						
⑤ Mill Instrumentation																						
2) Short-term Experts (When necessity arise)																						
III. Training of Counterparts in Japan																						
IV. Provision of Machinery and Equipment																						
V. Supplement of Local Expenditures																						
VI. Preparation of Progress Report																						

Note: This schedule was modified according to the mutual agreement in the course of implementation of the Project within the framework of the Record of Discussions. (— Original : == Modified)

Annex-5 Technical Cooperation Program

Calendar Year	1992		1993				1994				1995				1996			
Quarter	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	
Term of the Project (4 years)																		
I. Operation Technique of Flotation Mill																		
1)Crushing Circuit																		
2)Grinding Circuit																		
3)Flotation Circuit																		
4)Thickening and Filtration Circuit																		
5)Waste Treatment Circuit																		
II. Practice on Instrumentation at Flotation Mill																		
1)Hydrocyclone																		
2)Constant Feeding and Weighing Device																		
3)pH Controller																		
4)Flow-meter																		
5)On-line Particle Size Analyzer																		
6)On-line X-ray Fluorescence Analyzer																		
7)Flotation Reagent Feeder																		
8)Monitoring System for Pollution Control																		
III. Practice on Process Control Technology at Flotation Mill																		
1)Grinding Circuit																		
2)Flotation Circuit																		
IV. Conception of Flotation Mill Management																		
1)Guide-lines on Custom Mill																		
2)Practice on Plant Maintenance																		
3)Guide-lines on Metallurgical Mill Performance Management																		
4)Practice on Plant Management by Computer																		
V. Preparation of Reports																		

Notes: The scope of "Process Control" is limited to the sequence, remote and PID control of instruments, analyzer and equipment. (Original —, Modified =, Follow-up ---, Preparation - - - -)

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Annex-6 The Japanese Experts Dispatched by JICA

Type of Expert	Name of Experts	Assigned Duty	Assigned Term
Long-Term	1. Mr. Tetsuhiko Hasuda	Chief Advisor	December 10, 1992~August 16, 1996
	2. Mr. Yuichi Endo	Coordinator	December 10, 1992~August 16, 1996
	3. Mr. Seiken Sato	Mill Operation & Management	January 21, 1993~August 16, 1996
	4. Mr. Toshio Hirayama	Mill Instrumentation	May 27, 1993~May 26, 1995
	5. Mr. Katsumi Tanaka	Mill Process Control	May 27, 1993~December 26, 1994
Short-Term	1. Dr. Kenji Tomita	Lecturer at Seminar	March 4, 1993~March 15, 1993
	2. Dr. Takakatu Takamori	Lecturer at Seminar	March 4, 1993~March 15, 1993
	3. Mr. Kyouichi Koyama	Lecturer at Seminar	March 4, 1993~March 15, 1993
	4. Dr. Kenji Tomita	Lecturer at Seminar	March 17, 1994~March 25, 1994
	5. Dr. Hiroshi Sakamoto	Lecturer at Seminar	March 17, 1994~March 30, 1994
	6. Mr. Kazu Iwano	Lecturer at Seminar	March 17, 1994~March 30, 1994
	7. Dr. Toshio Inoue	Lecturer at Seminar	November 17, 1994~November 27, 1994
	8. Mr. Kanji Ooida	Lecturer at Seminar	November 17, 1994~November 27, 1994
	9. Dr. Unetarou Yanaguchi	Lecturer at Seminar	September 30, 1995~October 11, 1995
	10. Dr. Iwao Iwasaki	Lecturer at Seminar	September 30, 1995~October 11, 1995
	11. Mr. Kazu Iwano	Lecturer at Training Course	March 20, 1995~March 29, 1995
	12. Dr. Kenji Tomita	Lecturer at Training Course	March 20, 1992~August 16, 1996
	13. Mr. Junichi Hirayama	Mill Process Control	July 21, 1994~September 7, 1994
	14. Mr. Katsumi Tanaka	Mill Process Control	August 31, 1995~September 9, 1995
	15. Mr. Katsumi Tanaka	Mill Process Control	July 15, 1996~July 24, 1996
	16. Mr. Ryoichi Hatakeyama	Mill Process Control	January 18, 1996~March 20, 1996
	17. Mr. Junichi Hirayama	Mill Instrumentation	February 22, 1996~March 9, 1996
	18. Mr. Ryoichi Hatakeyama	Mill Instrumentation	July 1, 1996~July 24, 1996
	19. Mr. Eiji Yanagisawa	Waste Water Treatment Tech.	October 3, 1994~October 19, 1994
	20. Mr. Kenji Banshou	Environmental Analysis	March 21, 1996~April 10, 1996
	21. Mr. Takuto Kazama	Mill Operation Technology	November 17, 1994~December 7, 1994
	22. Mr. Toshiaki Terao	Mill Operation Management	July 21, 1994~August 13, 1994
	23. Mr. Takuto Kazama	Mill Operation Management	November 27, 1995~December 20, 1995
	24. Mr. Yuusuke Takemori	Installation & Calibration	February 24, 1994~March 5, 1994
	25. Mr. Tetsuo Okamoto	Installation & Calibration	February 24, 1994~March 5, 1994
	26. Mr. Yutaka Yokoyama	Installation & Calibration	March 3, 1994~March 30, 1994
	27. Mr. Kenji Matsunaga	Installation & Calibration	March 3, 1994~March 16, 1994
	28. Mr. Yuusuke Takemori	Installation & Calibration	March 11, 1996~March 27, 1996

Annex-7 Acceptance of the Mexican Counterparts for Training in Japan

Name of Counterpart Personnel	Work Responsibility at CRM	Training Field	Term of Training in Japan
1. Mr. David Alduenda Farias	Superintendent of the Parral Mill	Mineral Processing	March 2, 1993~March 31, 1993
2. Mr. Ruben Maldonado Saenz	Assistant Superintendent of the Parral Mill	Mineral Processing	March 2, 1993~March 31, 1993
3. Mr. Jose Nunez Gardea	Chief of Maintenance(Electricity) at the Parral Mill	Mill Maintenance	March 2, 1993~March 31, 1993
4. Ms. Bibiana Borja Blanco	Staff in Charge of Chemical Analysis at the Parral Mill	Chemical Analysis	March 2, 1993~March 31, 1993
5. Ms. Juana Veronica Duarte	Staff in Charge of Process Control at the Parral Mill	Process control	Nov. 4, 1993~Dec. 4, 1993
6. Mr. Jose Anderes Perez Lucio	Chief of Parral District Office, CRM	Mill Management	Nov. 4, 1993~Nov. 23, 1993
7. Mr. Jose Ines Campuzano Molina	Chief of Testing Laboratory at the Parral Mill	Chemical Analysis	Nov. 4, 1993~Dec. 4, 1993
8. Mr. Angel Virgen Magana	Coordinator in Charge of Technology, CRM	Mill Management	Nov. 4, 1993~Nov. 23, 1993
9. Mr. Luis Rafael Brizuela Venegas	Deputy Director for Services and Support, CRM	Project Management	Oct. 16, 1994~Nov. 3, 1994
10. Mr. Gerardo Garcia Candiani	Section Chief for Metallurgical Study, CRM	Project Management	Oct. 16, 1994~Nov. 3, 1994
11. Mr. Rafael Rodriguez Armandariz	Staff in Charge of Building and Repairs, CRM	Mill Maintenance	Oct. 16, 1994~Nov. 3, 1994
12. Mr. Juan Carlos Ruiz Mendez	Metallurgist, Tecamachalco Research Center, CRM	Mineral Processing	Oct. 16, 1994~Nov. 3, 1994
13. Mr. Sergio Almazan Esqueda	Director for Operation, CRM	Project Management	Nov. 6, 1995~Nov. 14, 1995
14. Mr. Jose Luis Saenz Barron	Superintendent of the Parral Mill	Mineral Processing	Nov. 1, 1995~Nov. 23, 1995
15. Ms. Adriana Sofia Gonzalez Cruz	Metallurgist in Charge of Process Control at the Parral Mill	Process control	Nov. 1, 1995~Nov. 23, 1995
16. Mr. Antonio Tovar Campo	Head of Operators in charge of Mill Operation at the Parral Mill	Mineral Processing	Nov. 1, 1995~Nov. 23, 1995

Annex-8 Major Machinery & Equipment provided by JICA

Japanese Fiscal Year	No.	Name, Manufacturer & Type of the Equipment	Purchase Price (10 ³ Yen)	Quantity	Application	Utilization	Remarks
1992	01	Vehicle (Chevrolet, Suburban, Type N 1993)	4,250	1	PARRAL MILL	Good	
1992	02	Constant Feed Weigher (YamatoSeiko, E3P-EC8-U2)	11,560	1	Grinding	Good	☆
1992	03	Weighing Apparatus for Concentrates (Yamato Seiko, EC8-U2)	9,410	2	Thickening & Filtration	Good	
1992	04	Water Gauge (NihonTokushuKeiki, NEAA-0-00)	2,420	1	Grinding	Good	
1992	05	Control Panel for Concentrate Weighing	8,800	1	Filtration	Good	
1992	06	Control Panel for pH Meter	8,900	1	Flotation	Good	
1992	07	Power Control Panel for Reagent Pumps	18,100	1	Flotation	Good	
1992	08	Power Control Panel for Hydrocyclone Pump	5,300	1	Grinding	Good	☆
1992	09	pH Regulator (Yokogawa, SLCD-181)	2,410	2	Flotation	Good	
1992	10	On-Line Fluorescence X-ray Analyzer (Outokumpu COURIER-30)	62,870	1	Flotation	Good	
1992	11	Computer System (DEC)	87,430	1	Computer	Good	
1992	12	Constant Feed Apparatus for Hydrocyclone	7,560	1	Grinding	Good	☆
1992	101	Pump (Taiheiyō-Kiko, 4-3SCEG)	957	1	Grinding	Good	
1992	102	Reagent Pump for Frother (Iwaki CXAG-PL05)	1,215	4	Flotation	Good	
1992	103	Reagent Pump for Collector (Iwaki CXAH-PL16)	1,258	7	Flotation	Good	
1992	104	Reagent Pump for CuSO ₄ (Iwaki CXAH-PL11)	1,269	4	Flotation	Good	
1992	105	pH Indicator (Yokogawa, SHIM-100)	559	4	Flotation	Good	
1992	106	pH Sensor (Horiba, 6150-60B)	950	4	Flotation	Good	☆
1992	201	Facsimile (Sharp, FON 334)	257	1	Office	Good	
1992	202	Photostat (Sharp, 7850)	678	1	Office	Good	
1992	203	Word Processor (Canward α)	181	1	Office	Poor	★
1992	204	Printer (Canon, BJ-330J)	196	1	Office	Good	
1992	205	pH Meter (Horiba, D-12)	115	1	Laboratory	Good	
1992		○ Sub-Total for 1992 : ¥ 236,645,000					
1993	13	On-line Particle Size Analyzer (Outokumpu, PSI-200)	14,110	1	Grinding	Good	
1993	14	Waste Water Treatment Apparatus (Dowa, LIP-20AH1)	4,510	1	Laboratory	Good	☆
1993	15	Dust Collector (Joy Industrial Equipment)	11,000	1	Crushing	Good	
1993	16	Motor Control Panel (Siemens, SMJ64)	2,150	1	Crushing	Good	
1993	17	Distributor (Siemens, SMJ64)	2,000	1	Crushing	Good	

Japanese Fiscal Year	No.	Name, Manufacturer & Type of the Equipment	Purchase Price (10 ³ Yen)	Quantity	Application	Utilization	Remarks
1993	107	Compressor (Ingersol, T-3010)	329	2	Crushing & Flotation	Good	
1993	108	Compressor (Ingersol, T-3005)	193	1	Grinding	Good	
1993	109	Reagent Pump for CuSO ₄ (Doerr, LR22132)	109	1	Flotation	Good	
1993	206	Calibrator (Yokogawa, 2422-11)	218	1	Flotation	Good	
1993	207	Personnel Computer (NEC PC-9801 RX/U2)	185	1	Office	Good	
1993	208	Monitor (NEC PC-KM151)	122	1	Office	Good	
1993	209	Personnel Computer (NEC PC-9801 NI/R120A)	260	1	Office	Good	
1993	210	16MB Memory (SIMMS 4x36)	143	1	Office	Good	
1993	○ Sub-Total for 1993 : ¥ 35,329,000						
1994	18	Constant Feed Weigher (YamatoSeiko, E3P-EC8-U2)	11,950	1	Grinding	Good	☆
1994	19	Instrument Control Panel for Feed Weir (18)	10,620	1	Grinding	Good	☆
1994	20	Weighing Apparatus for Feed (Yamato-Seiko, E3P-EC8-UP1)	11,000	1	Crushing	Good	
1994	21	Instrument Control Panel for No.20	9,800	1	Crushing	Good	
1994	211	Personnel Computer (Macintosh Powerbook 180C)	559	1	Office	Good	
1994	212	Personnel Computer (Presario 486 DX2/50)	188	1	Seminar Room	Good	
1994	213	Automatic Voltage Controller (FN-NIVEN-T1)	360	1	Computer	Good	
1994	214	Cooling Apparatus for Fluorescence X-ray Tube (Hascris R075S)	1,052	1	Flotation	Good	
1994	○ Sub-Total for 1994 : ¥ 45,529,000						
1995	22	Constant Feeding Pump (Iwaki AXJH-PLAAS6-02E)	1,750	1	Flotation	Good	
1995	23	Water Gauge (Nihon-Tokushu-Keiki, DEH-8011-22012)	2,420	1	Grinding	Good	
1995	24	Ceramic Filter (Outokumpu, COOIAI)	23,830	1	Filtration	Good	
1995	110	Parts for Constant Feeding Pump (Iwaki)	558	1 set	Flotation	Good	
1995	215	Integrating Meter (Nihon-Tokushu-Keiki)	162	1	Grinding	Good	
1995	216	Leak Breaker (Mitsubishi-Denki, NV100-SP)	100	2	Flotation	Good	
1995	217	Word Processor (Canward α)	105	1	Office	Good	
1995	218	Hose Type Pump (Bredel SP/25)	917	2	Flotation	Good	
1995	○ Sub-Total for 1995 : ¥ 29,842,000						
○ Grand-Total Price for 1992 ~ 1995 : ¥ 347,345,000							

[Notes] ☆ : The machinery and equipment expected to be necessary for after-care services within five years after the closing of the Project.

★ : The machinery and equipment concluded to be inadequate for repair.

○ : FOB Price

Annex-9 Expenses by the Japanese Side for the Project

[Unit: Thousand Japanese Yen]

The Japanese Fiscal Year	1992	1993	1994	1995	1996	Total
Expense for Dispatch of Survey Teams	5,635	3,809	7,110	5,154	8,896	30,604
Expense for Dispatch of the Japanese Experts	27,113	99,271	119,997	74,632	17,000	338,013
Expense for Training of Counterparts in Japan	3,079	3,079	3,079	3,079	1,540	13,856
Expense for Provision of Machinery and Equipment	276,169	42,945	50,445	29,216	3,000	401,775* (+ CIF)
Expense for Management of the Project	22,150	16,157	15,441	15,411	8,400	77,559
* Total Expense for the Project by the Japanese Side	334,146	165,261	196,074	127,492	38,836	861,807

* Including the expenditure on the complement of operational costs at the site of the Project by the Japanese Experts Team.	1992	1993	1994	1995	1996	Total
	3,776	13,970	14,513	8,662	NA	40,921

Annex-10 Records of the Personnel assigned for the Project

Date of Record	No.	Note (1)	Personnel assigned for the Project
August 1992	1		• Lic. J. Guillermo Becker A., Director General, CFM
	2		• Ing. Cuiclahuac Rangel A., Director de Promocion y Desarrollo, CFM
	3		• Ing. Jaime Vargas Chavez, Subdirector de Asistencia Tecnica, CFM
	4		• Ing. Agustin Tenorio Solorzano, Gerente de Construccion, CFM
	5		• Ing. Jose T. Vaquero Velazquez, Gerente de Exploracion, CFM
	6		• Ing. Eduardo Solorzano Valdez, Gerente de Proceso, CFM
	7		• Ing. Bernardo Campos Hernandez, Subgerente de Operacion Mecanica, CFM
	8		• Ing. Manuel Garcia Diaz, Subgerente de Operacion Metalurgica, CFM
	9		• Ing. Dante Dominguez Mejia, Subgerente de Asistencia Tecnica, CFM
	10	☆◎	• Ing. David Alduenda Farias, Superintendente General, Planta Parral, CFM
	11		• C. P. Artemio Salcedo Garcia, Contador, Planta Parral, CFM
	12	☆◎	• Ing. Edgar Ruben Maldonado S., Asistente de Superintendente, Planta Parral, CFM
	13	☆◎	• Tec. Jose Ines Campuzano Molina, Jefe de Laboratorio, Planta Parral, CFM
	14	☆◎	• Tec. Jesus Jose Nunez Gardea, Jefe de Mantenimiento Electrico, Planta Parral, CFM
[14 Persons]			

[Note] No. 1 : <☆> Counterpart Personnel trained in Japan. No. 3 : <◎> Counterpart Personnel
No. 2 : <CFM> Comision de Fomento Minero

Date/Record	No.	Note	Personnel assigned for the Project
June 1993	15		• Ing. Fernel Arvizu Lara, Director General, CRM
	16		• Ing. Carlos Rivera y Villasana, Director Tecnico, CRM
	17	☆	• Ing. Luis Brizuela Venegas, Asesor de la Direccion General, CRM
	18	☆	• Ing. Gerardo Garcia Candiani, Asesor Direccion Tecnica, CRM
	10	☆◎	• Ing. David Alduenda Farias, Superintendente Planta Parral, CRM
	12	☆◎	• Ing. Edgar Ruben Maldonado S., Asistente de Superintendente, Planta Parral, CRM
	11		• C. P. Artemio Salcedo Garcia, Contador, Planta Parral, CRM
	19		• Sr. Carlos Hernandez Roman, Auxiliar de Contador, Planta Parral, CRM
	20	☆◎	• Tec. Juana V. Duarte Lopez, Cont. Metalurgico y Op. Computadoras, CRM
	13	◎	• Tec. Jose Ines Campuzano Molina, Jefe de Ensaye en Via Humeda, CRM
	21		• Sr. Jesus Nunez Saenz, Preparador de Muestras, CRM
	22	☆◎	• Srita. Bibiana Borja Blanco, Analista, CRM
	23	◎	• Sr. Herminio Hernandez Rangel, Jefe de Mant. Mecanico, CRM
	14	☆◎	• Tec. Jesus Jose Nunez Gardea, Jefe de Mant. Electrico, CRM
	24		• Srita. Anada Carrera Herrera, Secretaria Superintendencia, CRM
	25		• Srita. Romualda Ponce Fragoso, Secretaria JICA, CRM
	26		• Sr. Herminio Hdez. Mendoza, Chofer JICA, CRM
	27		• Tec. Juan de Dios Ortiz Hdez., Almacenista, CRM
	[19 Persons]	28	

[Note] No. 1 : <☆> Counterpart Personnel trained in Japan. No. 3 : <◎> Counterpart Personnel
No. 2 : <CRM> Consejo de Recursos Minerales

Date/Record	No.	Note	Personnel assigned for the Project
August 1994	29		• Dr. Luis Chavez Martinez, Director General, CRM
	30	☆	• Ing. Sergio Almazan Esqueda, Director de Operacion, CRM
	17	☆	• Ing. Luis Brizuela Venegas, Subdirector de Servicios y Apoyo, CRM
	31		• Ing. Jose Cardenas Vargas, Gerente de Laboratorios, CRM
	18	☆	• Ing. Gerardo Garcia Candiani, Subgerente de Estudios Metalurgicos, CRM
	32	☆©	• Ing. Jose Luis Saenz Barron, Jefe de Operacion Planta, CEM Parral, CRM
	12	☆©	• Ing. Edgar Ruben Maldonado Saenz, Operacion Metalurgica, CEM Parral, CRM
	33	☆©	• Ing. Adriana Sofia Gonzalez Cruz, Proceso Metalurgico, CEM Parral, CRM
	24		• Srta. Amada Carrera Herrera, Secretaria, CEM Parral, CRM
	25		• Srta. Romualda Ponce Fragoso, Secretaria JICA, CEM Parral, CRM
	14	☆©	• Tec. Jesus Jose Nunez Gardea, Mantenimiento Electrico, CEM Parral, CRM
	23	©	• Tec. Herminio Hernandez Rangel, Mantenimiento Mecanico, CEM Parral, CRM
	13	☆©	• Tec. Jose Ines Campuzano Molina, Laboratorista, CEM Parral, CRM
	34		• Tec. Miguel Angel Rios Germes, Ensayador, CEM Parral, CRM
	35		• Tec. Rafael Mendez Morales, Preparador de Muestras, CEM Parral, CRM
	36	☆	• Tec. Antonio Tovar Campos, Jefe de Operacion, CEM Parral, CRM
	37		• Tec. Arturo Mendez Canas, Jefe de Operacion, CEM Parral, CRM
	38		• Tec. Jesus Manuel Frias Sotelo, Jefe de Operacion, CEM Parral, CRM
	39		• Tec. Fernando Salcedo Chavez, Jefe de Operacion, CEM Parral, CRM
	40		• Sr. Cosme Rios Saenz, Operador, CEM Parral, CRM
	41		• Sr. Jesus Cruz Morales, Operador, CEM Parral, CRM
	42		• Sr. Miguel Mendez Hernandez, Operador, CEM Parral, CRM
	43		• Sr. Julio Campuzano Molina, Operador, CEM Parral, CRM
	44		• Sr. Juan C. Gomez Alvidrez, Operador, CEM Parral, CRM
	45		• Sr. Jesus Nunez, Operador, CEM Parral, CRM
	46		• Sr. Armando Rodriguez Mendez, Operador, CEM Parral, CRM
	47		• Sr. Alejandro Mendez Canas, Operador, CEM Parral, CRM
	48		• Sr. Aurelio Magdaleno Cruz, Peon, CEM Parral, CRM
	49		• Sr. Sotelo Rios Nunez, Peon, CEM Parral, CRM
	50	☆	• Ing. Jose Andres Perez Lucio, Jefe de Administracion, CEM Parral, CRM
	51		• Srta. Dora E. Franco Martinez, Contador, CEM Parral, CRM
	52		• Srta. Maria Del Carmen Dominguez Ruiz, Auxiliar de Contador, CEM Parral, CRM
	53		• Sr. Carlos Hernandez Roman, Almacenista, CEM Parral, CRM
	54		• Sr. Ramiro Rincon Velasquez, Ayudante Ingeniero, CEM Parral, CRM
	55		• Sr. Jesus Barbosa Franco, Muestrero, CEM Parral, CRM
	56		• Sr. Jose Sierra Carrete, Velador, CEM Parral, CRM
	57		• Sr. Jesus Lazos Gutierrez, Velador, CEM Parral, CRM
	58		• Sr. Jesus Baray Meza, Velador, CEM Parral, CRM
	59		• Sr. Apolinara Molina Villalobos, Velador, CEM Parral, CRM
	28		• Sra. Francisca Arroyo Martinez, Afanadora, CEM Parral, CRM
	[41 Persons]	60	

[Note] No. 1 : <☆> Counterpart Personnel trained in Japan.

No. 2 : <© CEM> Centro de Experimentacion Metalurgica de Parral, CRM

No. 3 : <© CRM> Concejo de Recursos Minerales

No. 4 : <©©> Counterpart Personnel

Date/Record	No.	Note	Personnel assigned for the Project
May 1995	29		• Dr. Luis Chavez Martinez, Director General, CRM
	30	☆	• Ing. Sergio Almazan Esqueda, Director de Operacion, CRM
	17	☆	• Ing. Luis Brizuela Venegas, Subdirector de Servicio y Apoyo, CRM
	31		• Ing. Jose Cardenas Vargas, Gerente de Laboratorios, CRM
	18	☆	• Ing. Gerardo Garcia Candiani, Subgerente de Estudios Metalurgicos, CRM
	32	☆◎	• Ing. Jose Luis Saenz Barron, Superintendente de Operacion, CEM (Jefe de Entrenamiento, CEM)
	24		• Srita. Anada Carrera Herrera, Secretarias Oficinas, CEM
	25		• Srita. Romualda Ponce Frago, Secretarias Oficinas, CEM
	12	☆◎	• Ing. Edgar Ruben Maldonado S., Metalurgista Encargado Operacion, CEM (Coordinador de Entrenamiento, CEM)
	33	☆◎	• Ing. Adriana Sofia Gonzalez C., Metalurgista Encargado Control de Proceso, CEM
	14	☆◎	• Tec. Jesus Jose Nunez Gardea, Tecnico Mantenimiento Electrico Operacion, CEM
	23		• Tec. Herminio Hernandez Rangel, Tecnico Mantenimiento Mecanico Operacion, CEM
	13	☆◎	• Tec. Jose Ines Campuzano Molina, Asistentes Tecnicos Laboratorio, CEM
	34		• Tec. Miguel Angel Rios Gernes, Asistentes Tecnicos Laboratorio, CEM
	35		• Sr. Rafael Mendez Morales, Asistentes Tecnicos Laboratorio, CEM
	36	☆	• Sr. Antonio Tovar Campos, Jefe de Turno Operacion, CEM
	37		• Sr. Arturo Mendez Canas, Jefe de Turno Operacion, CEM
	38		• Sr. Jesus M. Frias Sotelo, Jefe de Turno Operacion, CEM
	39		• Sr. Fernando Salcedo Chavez, Jefe de Turno Operacion, CEM
	40		• Sr. Cosme Rios Saenz, Operador Molinos, CEM
	41		• Sr. Jesus Cruz Morales, Operador Molinos, CEM
	42		• Sr. Miguel Mendez Hernandez, Operador Molinos, CEM
	43		• Sr. Julio Campuzano Molina, Operador Molinos, CEM
	44		• Sr. Juan C. Gomez Alvidrez, Operador Molinos, CEM
	45		• Sr. Jesus Nunez, Operador Molinos, CEM
	46		• Sr. Armando Rodriguez Mendez, Operador Molinos, CEM
	47		• Sr. Alejandro Mendez Canas, Operador Molinos, CEM
	61		• Sr. Guadalupe Carrillo P., Operador Molinos, CEM
	48		• Sr. Aurelio Magdaleno Cruz, Peones, CEM
	49		• Sr. Sotelo Rios Nunez, Peones, CEM
	50	☆	• Ing. Jose Andres Perez Lucio, Jefe de Administracion, CEM
	51		• Srita. Dora E. Franco Martinez, Personal de Contabilidad, CEM
	62		• Srita. Norma Terea Campuzano, Personal de Contabilidad, CEM
	54		• Sr. Ramiro Rincon Velasquez, Asistentes de Oficina, CEM
	55		• Sr. Jesus Barbosa Franco, Asistentes de Oficina, CEM
	53		• Sr. Carlos Hernandez Roman, Almacenista, CEM
	56		• Sr. Jose Sierra Carrete, Veladores, CEM
	57		• Sr. Jesus Lazos Gutierrez, Veladores, CEM
	58		• Sr. Jesus Baray Meza, Veladores, CEM
	59		• Sr. Apolinar Molina Villalobos, Veladores, CEM
	28		• Sra. Francisca Arroyo Martinez, Intendentes, CEM
	{42 Persons}	63	

[Note] No. 1 : <☆> Counterpart Personnel trained in Japan.

No. 3 : <◎> Counterpart Personnel

No. 2 : <CEM> Centro de Experimentacion Metalurgica de Parral, CRM

Date/Record	No.	Note	Personnel assigned for the Project
May 1996	29		• Dr. Luis Chavez Martinez, Director General, CRM
	30	☆	• Ing. Sergio Almazan Esqueda, Director de Operacion, CRM
	17	☆	• Ing. Luis Brizuela Venegas, Subdirector de Servicio y Apoyo, CRM
	64		• Ing. Alejandro Cabrera Barroso, Gerente de Laboratorios, CRM
	31		• Ing. Jose Cardenas Vargas, Gerente de Investigacion Aplicadas, CRM
	18	☆	• Ing. Gerardo Garcia Candiani, Subgerente de Estudios Metalurgicos, CRM
	32	☆©	• Ing. Jose Luis Saenz Barron, Superintendente de Operacion, CEM [Jefe de Entrenamiento, CEM]
	24		• Srita. Amada Carrera Herrera, Secretarias Oficinas, CEM
	25		• Srita. Romualda Ponce Fragoso, Secretarias Oficinas, CEM
	12	☆©	• Ing. Edgar Ruben Maldonado S., Metalurgista Encargado Operacion, CEM [Coordinador de Entrenamiento, CEM]
	33	☆©	• Ing. Adriana Sofia Gonzalez C., Metalurgista Encargado Control de Proceso, CEM
	14	☆©	• Tec. Jesus Jose Nunez Gardea, Tecnico Mantenimiento Electrico Operacion, CEM
	23		• Tec. Herminio Hernandez Rangel, Tecnico Mantenimiento Mecanico Operacion, CEM
	13	☆©	• Tec. Jose Ines Campuzano Molina, Asistentes Tecnicos Laboratorio, CEM
	34		• Tec. Miguel Angel Rios Germes, Asistentes Tecnicos Laboratorio, CEM
	35		• Tec. Rafael Mendez Morales, Asistentes Tecnicos Laboratorio, CEM
	65		• Sr. Emiliano Alvarado Felix, Asistentes Tecnicos Laboratorio, CEM
	36	☆	• Sr. Antonio Tovar Campos, Jefe de Turno Operacion, CEM
	37		• Sr. Arturo Mendez Canas, Jefe de Turno Operacion, CEM
	38		• Sr. Jesus M. Frias Sotelo, Jefe de Turno Operacion, CEM
	39		• Sr. Fernando Salcedo Chavez, Jefe de Turno Operacion, CEM
	40		• Sr. Cosme Rios Saenz, Operador Molinos, CEM
	41		• Sr. Jesus Cruz Morales, Operador Molinos, CEM
	42		• Sr. Miguel Mendez Hernandez, Operador Molinos, CEM
	43		• Sr. Julio Campuzano Molina, Operador Molinos, CEM
	44		• Sr. Juan C. Gomez Alvidrez, Operador Molinos, CEM
	45		• Sr. Jesus Nunez, Operador Molinos, CEM
	46		• Sr. Armando Rodriguez Mendez, Operador Molinos, CEM
	47		• Sr. Alejandro Mendez Canas, Operador Molinos, CEM
	61		• Sr. Guadalupe Carrillo P., Operador Molinos, CEM
	48		• Sr. Aurelio Magdaleno Cruz, Peones, CEM
	49		• Sr. Sotelo Rios Nunez, Peones, CEM
	50	☆	• Ing. Jose Andres Perez Lucio, Jefe de Administracion, CEM
	51		• Srita. Dora E. Franco Martinez, Personal de Contabilidad, CEM
	62		• Srita. Norma Terea Campuzano, Personal de Contabilidad, CEM
	54		• Sr. Ramiro Rincon Velasquez, Asistentes de Oficina, CEM
	55		• Sr. Jesus Barbosa Franco, Asistentes de Oficina, CEM
	53		• Sr. Carlos Hernandez Roman, Almacenista, CEM
	56		• Sr. Jose Sierra Carrete, Veladores, CEM
	57		• Sr. Jesus Lazos Gutierrez, Veladores, CEM
	58		• Sr. Jesus Baray Meza, Veladores, CEM
	59		• Sr. Apolinar Molina Villalobos, Veladores, CEM
	28		• Sra. Francisca Arroyo Martinez, Intendentes, CEM
	[44 Persons]	63	

Annex-11 Expenses by the Mexican Side for the Project

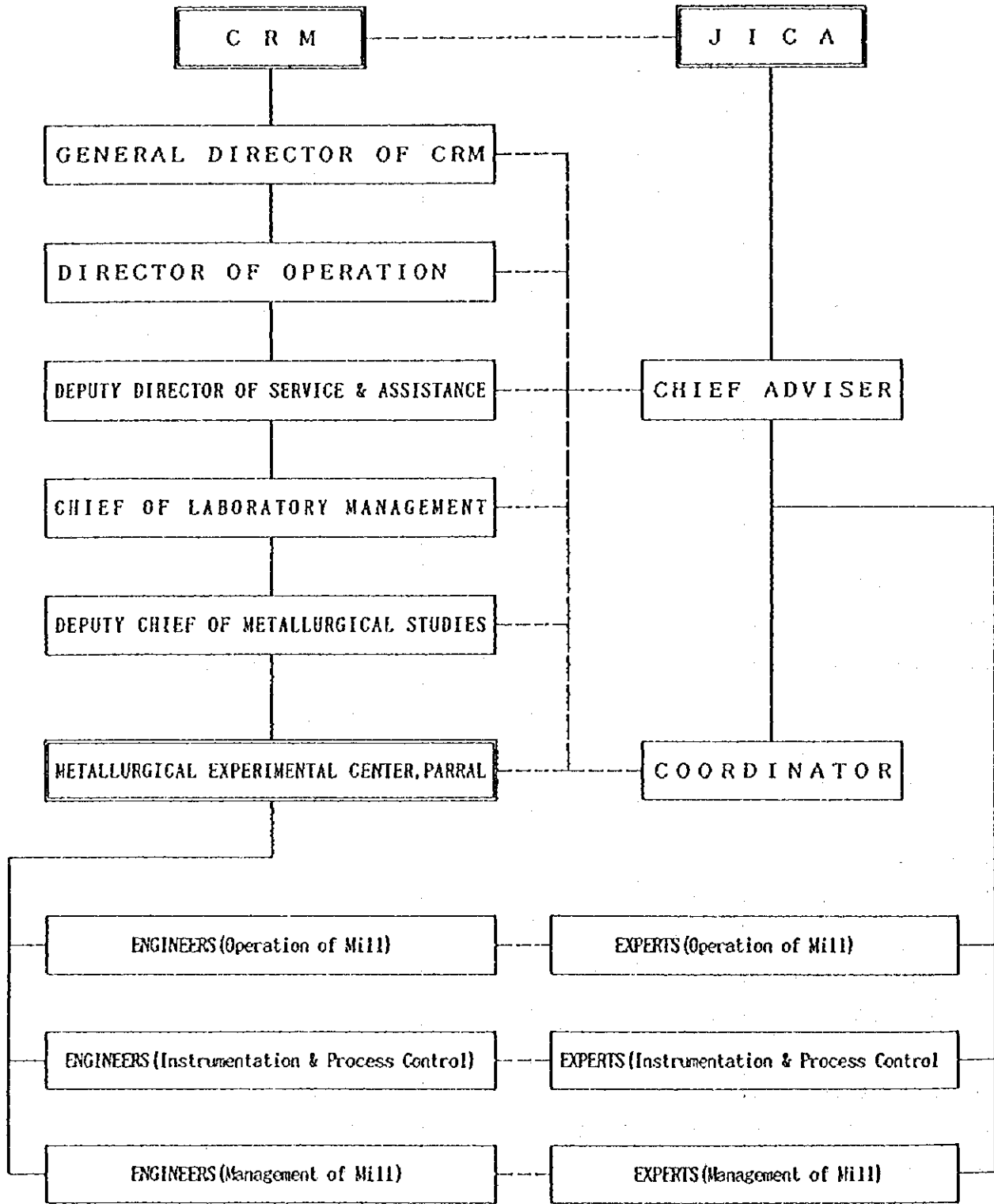
[Unit: Thousand New Pesos]

Calendar Year	1993	1994	1995	1996 *			Total
	July~Dec.	Jan.~Dec.	Jan.~Dec.	Jan.~June	July~Dec.	Jan.~Dec.	
Personnel Expenses	347	352	514	878	1,031	1,909	3,122
Machinery & Materials Expenses for Operation	78	481	433	231	306	537	1,529
Mill Utilities Expenses	-	381	406	203	269	472	1,259
Mill Repairs and Maintenance Expenses	-	-	180	69	91	160	340
Indirect Costs in relation to the Project	-	-	241	103	136	239	480
Total Expenses for Mill Operation & Management	425	1,214	1,774	1,484	1,833	3,317	6,730
Total Expenses for Parral Mill Renovation Works	1,561	352	-	982	213	1,195	3,108
Grand Total Expenses for the Project	1,986	1,566	1,774	2,466	2,046	4,512	9,838

[Notes] * January ~ December 1996 : Allocated Budget.

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Annex-12 The Management System for the Project at CRM



MA

Annex-13 Summary of Technical Seminars

No.	Main Themes for Seminar	Term of Seminar	Location (Including field trip)	Number of Participants
1	Efforts towards mill operation modernization and environmental improvement.	March 8~11, 1993 (4 days)	Mexico City, San Luis Potosi, and Zacatecas	43
2	Mill instrumentation and recent trends in mineral processing technology.	March 22~25, 1994 (4 days)	Guanajuato, Zacatecas, and Parral	118
3	Enhancement of mill operation and management technology.	Nov. 21~ 24, 1994 (4 days)	Parral	* 73
4	Technological advancement in the fields of mining and metallurgy.	Oct. 2~ 6, 1995 (5 days)	Chihuahua and Parral	153
5	Machinery and equipment necessary for improvement of mineral processing circuits.	June 27 ~ 28, 1996 (2 days)	Parral	53

[Notes] * Including the participants from Bolivia, Brazil, Chile, Colombia and Peru

Annex-14 Summary of Training Courses

No.	Term of Training	No. of Participants	Subjects at Training Course
1	Oct. 3 ~ 7, 1994 (5 days)	CRM : 4 University : 1 Mines & Mills: 5 Total : 10	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system
2	Oct. 24 ~ 28, 1994 (5 days)	CRM : 8 University : 4 Mines & Mills: 0 Total : 12	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
3	Feb. 13 ~ 17, 1995 (5 days)	CRM : 2 University : 0 Mines & Mills: 3 Total : 5	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
4	Mar. 22 ~ 25, 1995 (4 days)	CRM : 1 University : 1 Mines & Mills: 4 Total : 6	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
5	Apr. 24 ~ 28, 1995 (5 days)	CRM : 3 University : 1 Mines & Mills: 0 Total : 4	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
6	May. 22 ~ 26, 1995 (5 days)	CRM : 0 University : 0 Mines & Mills: 3 Total : 3	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
7	June 26 ~ 30, 1995 (5 days)	CRM : 0 University : 5 Mines & Mills: 0 Total : 5	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
8	July 24 ~ 28, 1995 (5 days)	CRM : 0 University : 2 Mines & Mills: 4 Total : 6	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
9	Aug. 21 ~ 25, 1995 (5 days)	CRM : 0 University : 0 Mines & Mills: 3 Total : 3	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology

Training Courses (2)

No.	Term of Training	No. of Participants	Subjects at Training Course
10	Sept. 25 ~ 29, 1995 (5 days)	CRM : 0 University : 2 Mines & Mills: 4 Total : 6	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
11	Nov. 21 ~ 25, 1995 (5 days)	CRM : 2 University : 2 Mines & Mills: 3 Total : 7	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
12	Jan. 22 ~ 26, 1996 (5 days)	CRM : 1 University : 3 Mines & Mills: 5 Total : 9	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
13	Feb. 12 ~ 16, 1996 (5 days)	CRM : 0 University : 7 Mines & Mills: 0 Total : 7	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
14	March 25 ~ 29, 1996 (5 days)	CRM : 2 University : 4 Mines & Mills: 2 Total : 8	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
15	April 22 ~ 26, 1996 (5 days)	CRM : 3 University : 4 Mines & Mills: 2 Total : 9	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
16	May. 27 ~ 31, 1996 (5 days)	CRM : 2 University : 5 Mines & Mills: 3 Total : 10	1. Mill operation technology 2. Mill management technology 3. Mill instrumentation and process control technology 4. Mill management by computer system 5. Waste water treatment technology
		CRM : 28 University : 41 Mines & Mills: 41	
Total : 16 courses		Grand Total : 110	

Annex - 15(1) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	1	2	3
Terms of Mill Operation (Date and Days)	July 25-29, 1994 (5 days)	Aug. 1-5, 23-26 & Aug. 28-31, 1994 (13 days)	Sept. 5-9, 12-16 & 19-23, 1994 (15 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Las Coloradas & Hallazgo Mines Lead & Zinc Ag 74g/t, Pb 4.19% Zn 2.11%	Las Coloradas & Hallazgo Mines Lead & Zinc Ag 67g/t, Pb 1.23% Zn 1.54%	Hidalgo (FFM Property) Gold, Silver & Lead Au 3.265g/t, Ag 485g/t, Pb 0.32%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.399 t/h 607.890 t - 200 mesh 71.0 %	6.582 t/h 1,533.700 t - 200 mesh 70.0 % 75mm ball: 166 g/t	6.193 t/h 1,529.764 t - 200 mesh 72.5 % 75mm ball: 1,331g/t 25mm ball: 163g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 30 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 3,331 g/t ZnSO ₄ : 535 g/t CuSO ₄ : 165 g/t NaCN : 148 g/t Na ₂ SO ₄ : 107 g/t Xanthate 343:82g/t Dowfroth 250:25g/t Aeropro. 404:16g/t Aerofloat208:25g/t	Feed pulp : 28 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 3,619 g/t ZnSO ₄ : 606 g/t CuSO ₄ : 192 g/t NaCN : 59 g/t Na ₂ SO ₄ : 16 g/t Xanthate 343:46g/t Dowfroth 250:38g/t Aeropro. 404:6.6g/t Aerofloat208:23g/t	Feed pulp : 28 % Bulk circuit: 7.0 Aeropro.404:141g/t Aerofloat31 :26g/t Aerofloat208:44g/t Aerofloat242: 9g/t Aeropro3477:0.7g/t Xanthate350:105g/t Dowfroth 250:49g/t
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 1,203 g/t Pb 68.85 % Zn 5.20 % *Zinc Concentrate Ag 266 g/t Pb 4.65 % Zn 49.96 % *Lead Concentrate 21.080 t *Zinc Concentrate 13.093 t *Lead Concentrate Ag 53.74 % Pb 54.54 % Zn 8.55 % *Zinc Concentrate Ag 7.38 % Pb 2.39 % Zn 51.02 %	*Lead Concentrate Ag 3,127 g/t Pb 54.45 % Zn 2.67 % *Zinc Concentrate Ag 164 g/t Pb 1.33 % Zn 49.00 % *Lead Concentrate 18.261 t *Zinc Concentrate 33.223 t *Lead Concentrate Ag 55.92 % Pb 52.91 % Zn 2.06 % *Zinc Concentrate Ag 5.35 % Pb 2.34 % Zn 68.73 %	*Gold, Silver, Lead Bulk Concentrate Au 95.6 g/t Ag 15,650 g/t Pb 5.89 % *Gold, Silver, Lead Bulk Concentrate 38.071 t *Gold, Silver, Lead Bulk Concentrate Au 72.87 % Ag 80.30 % Pb 46.24 %

Annex - 15(2) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	4	5	6
Terms of Mill Operation (Date and Days)	Oct. 3 - 7, 1994 (5 days)	Oct. 11-15, 1994 (5 days)	Oct. 24-28, 1994 (5 days)
1. Mill Feeds			
1) Source of Mill Feed	La Ceniza (FFM Property)	La Chata (FFM Property)	El Camaleon, Cerro Grande, La Aurora, & Monte Cristo (FFM Property)
2) Metals Contained	Gold, Silver & Lead	Gold & Lead	Gold, Silver & Lead
3) Grade of Mill Feed	Au 4.430g/t, Ag 286g/t, Pb 0.17%	Au 10.410 g/t Pb 0.18 %	Au 3.900g/t, Ag 222g/t, Pb 0.27%
2. Grinding Conditions			
1) Feed Rate (tons/hour)	6,405 t/h		
2) Total Weight of Mill Feed	695.049 t	645.467 t	670.715 t
3) Size of Mill Products	- 200 mesh 73.5 %		
4) Ball Consumption	75mm ball: 245g/t		
3. Flotation Conditions			
1) Pulp Density (solid %)	Feed pulp : 30 %		
2) pH of Flotation Pulp	Bulk circuit: 7.0		
3) Flotation Reagents (Kinds and Amounts)	Aeropro. 404:124g/t Aerofloat31 :16g/t Aerofloat208:39g/t Aerofloat242: 4g/t Aeropro. 3477:37g/t Xanthate350:102g/t Dowfroth 250:21g/t		
4. Results of Flotation			
1) Grade of Concentrates	*Gold, Silver, Lead Bulk Concentrate Au 170.0 g/t Ag 9,500 g/t Pb 5.20 %	*Gold & Lead Bulk Concentrate Au 262.000 g/t Pb 4.31 %	*Gold, Silver, Lead Bulk Concentrate Au 118.0 g/t Ag 6,160 g/t Pb 4.85 %
2) Weight of Concentrates	*Gold, Silver, Lead Bulk Concentrate 14.446 t	*Gold & Lead Bulk Concentrate 20.732 t	*Gold, Silver, Lead Bulk Concentrate 17.758 t
3) Recovery of Concentrates	*Gold, Silver, Lead Bulk Concentrate Au 79.79 % Ag 69.14 % Pb 63.66 %	*Gold & Lead Bulk Concentrate Au 80.84 % Pb 79.07 %	*Gold, Silver, Lead Bulk Concentrate Au 80.05 % Ag 73.63 % Pb 46.79 %

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Annex - 15(3) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	7	8	9
Terms of Mill Operation (Date and Days)	Nov. 7 - 11, 1994 (5 days)	Nov. 21-25, 1994 (5 days)	Feb. 13-17 & 20-23, 1995 (9 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Reyna de Oro, Rey de Oro, Piedra Verde, Chiripa, La Luz, Santa Maria (FFM Property) Gold, Silver & Lead Au 10.610g/t, Ag 137g/t, Pb 1.37%	San Francisco (By Request) Lead & Zinc Ag 470g/t, Pb 3.63% Zn 5.59%	Maria Elena (By Request) Lead & Zinc Ag 460g/t, Pb 2.71% Zn 3.95%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.728 t/h 726.650 t -200 mesh 73.5 %	6.430 t/h 773.468 t - 200 mesh 71.5 %	6.059 t/h 1,230.000 t - 200 mesh 70.0 % 75mm ball: 1,999g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 30 % Bulk circuit: 7.0 Aerofloat 31: 100g/t Aerofloat 208: 58g/t Aerofloat 242: 26g/t Aeropro 3477: 111g/t Xanthate 350: 158g/t Dowfroth 250: 59g/t	Feed pulp : 30 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,778 g/t ZnSO ₄ : 1,125 g/t CuSO ₄ : 627 g/t NaCN : 146 g/t Na ₂ SO ₄ : 265 g/t Xanthate 343: 74g/t Frother : 57g/t Aeropro. 404: 14g/t Aerofloat 31 : 14g/t Aerofloat 242: 13g/t	Feed pulp : 28 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 2,297 g/t ZnSO ₄ : 1,179 g/t CuSO ₄ : 805 g/t NaCN : 16 g/t Na ₂ SO ₄ : 195 g/t Xanthate 343: 41g/t Xanthate 350: 49g/t Frother 570 : 81g/t Aeropro. 404: 20g/t Aerofloat 242: 4g/t
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Gold, Silver, Lead Bulk Concentrate Au 190.0 g/t Ag 1,742 g/t Pb 5.49 % *Gold, Silver, Lead Bulk Concentrate 29.755 t *Gold, Silver, Lead Bulk Concentrate Au 73.32 % Ag 52.07 % Pb 16.40 %	*Lead Concentrate Ag 6,609 g/t Pb 52.30 % Zn 9.06 % *Zinc Concentrate Ag 486 g/t Pb 1.47 % Zn 51.80 % *Lead Concentrate 35.789 t *Zinc Concentrate 67.694 t *Lead Concentrate Ag 78.42 % Pb 80.37 % Zn 9.05 % *Zinc Concentrate Ag 8.31 % Pb 3.25 % Zn 74.50 %	*Lead Concentrate Ag 7,133 g/t Pb 46.90 % Zn 9.00 % *Zinc Concentrate Ag 1,029 g/t Pb 1.11 % Zn 51.50 % *Lead Concentrate 61.811 t *Zinc Concentrate 69.260 t *Lead Concentrate Ag 77.99 % Pb 82.45 % Zn 11.46 % *Zinc Concentrate Ag 12.60 % Pb 2.18 % Zn 73.48 %

Annex - 15(4) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	1 0	1 1	1 2
Terms of Mill Operation (Date and Days)	March 7-12, 1995 (6 days)	March 22-25 & 28-31, 1995 (8 days)	Apr. 3-5, 19-21, & 24-28, 1995 (11 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	San Francisco (By Request) Lead & Zinc Ag 536g/t, Pb 3.71% Zn 6.24%	Maria Elena (By Request) Lead & Zinc Ag 385g/t, Pb 3.02% Zn 4.21%	Maria Elena (By Request) Lead & Zinc Ag 459g/t, Pb 2.99% Zn 2.60%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.415 t/h 763.400 t - 200 mesh 72.0 %	6.536 t/h 1,137.300 t - 200 mesh 72.0 %	6.537 t/h 1,470.900 t - 200 mesh 72.0 %
	75mm ball: 1,607g/t		75mm ball: 1,591g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 30 % Pb circuit: 7.0 Zn circuit: 10.0	Feed pulp : 30 % Pb circuit: 7.0 Zn circuit: 10.0	Feed pulp : 30 % Pb circuit: 7.0 Zn circuit: 10.0
	Lime : 1,763 g/t ZnSO ₄ : 1,168 g/t CuSO ₄ : 618 g/t NaCN : 58 g/t Na ₂ SO ₄ : 131 g/t Xanthate 343:95g/t Frother 570:83g/t Aeropro. 404:21g/t Aerofloat 31: 2g/t		Lime : 1,598 g/t ZnSO ₄ : 1,091 g/t CuSO ₄ : 350 g/t NaCN : 34 g/t Xanthate 343:98g/t Xanthate 350:24g/t Frother :69g/t Aeropro. 404:16g/t
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 8,334 g/t Pb 52.24 % Zn 8.33 % *Zinc Concentrate Ag 492 g/t Pb 1.22 % Zn 53.24 % *Lead Concentrate 44.012 t *Zinc Concentrate 66.078 t *Lead Concentrate Ag 82.03 % Pb 84.00 % Zn 7.70 % *Zinc Concentrate Ag 7.26 % Pb 2.84 % Zn 73.80 %	*Lead Concentrate Ag 6,397 g/t Pb 55.39 % Zn 7.65 % *Zinc Concentrate Ag 887 g/t Pb 1.31 % Zn 54.19 % *Lead Concentrate 49.786 t *Zinc Concentrate 67.921 t *Lead Concentrate Ag 72.73 % Pb 80.26 % Zn 7.95 % *Zinc Concentrate Ag 13.75 % Pb 2.59 % Zn 76.80 %	*Lead Concentrate Ag 8,548g/t Pb 55.66 % Zn 8.08 % *Zinc Concentrate Ag 822 g/t Pb 1.34 % Zn 51.29 % *Lead Concentrate 66.559 t *Zinc Concentrate 53.856 t *Lead Concentrate Ag 84.19 % Pb 84.26 % Zn 14.07 % *Zinc Concentrate Ag 6.55 % Pb 1.64 % Zn 72.26 %

Annex - 15(5) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	1 3	1 4	1 5
Terms of Mill Operation (Date and Days)	May 16-19, 22-25, 1995 (8 days)	June 12-16, 1995 (5 days)	June 21-23, 26-30, 1995 (8 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Maria Elena (Custom milling) Lead & Zinc Ag 403g/t, Pb 3.57% Zn 2.72%	San Maximo (Custom milling) Lead & Zinc Ag 527g/t, Pb 2.92% Zn 4.97%	Maria Elena (Custom milling) Lead & Zinc Ag 320g/t, Pb 2.66% Zn 2.85%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.537 t/h 1,085,800 t - 200 mesh 71.6 % 75mm ball: 1.472g/t	6.237 t/h 648,670 t - 200 mesh 72.0 % 75mm ball: 2.943g/t	6.413 t/h 1,231,209 t - 200 mesh 72.0 %
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 32 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 2,003 g/t ZnSO ₄ : 1,151 g/t CuSO ₄ : 212 g/t NaCN : 78 g/t Na ₂ SO ₄ : - g/t Xanthate 343:90g/t Xanthate 350:20g/t Frother 577:74g/t Aeropro. 404: 5g/t	Feed pulp : 34 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,862 g/t ZnSO ₄ : 1,258 g/t CuSO ₄ : 375 g/t NaCN : 66 g/t Na ₂ SO ₄ : - g/t Xanthate 343:82g/t Xanthate 350:20g/t Frother 577:54g/t Aeropro. 404: 7g/t Aerofloat 31: 3g/t	
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 6,526 g/t Pb 59.59 % Zn 7.39 % *Zinc Concentrate Ag 716 g/t Pb 1.10 % Zn 51.59 % *Lead Concentrate 56.831 t *Zinc Concentrate 41.592 t *Lead Concentrate Ag 84.84 % Pb 87.38 % Zn 14.21 % *Zinc Concentrate Ag 6.81 % Pb 1.18 % Zn 72.57 %	*Lead Concentrate Ag 9,768 g/t Pb 54.70 % Zn 8.30 % *Zinc Concentrate Ag 490 g/t Pb 1.05 % Zn 52.30 % *Lead Concentrate 28.053 t *Zinc Concentrate 48.650 t *Lead Concentrate Ag 80.22 % Pb 81.07 % Zn 5.48 % *Zinc Concentrate Ag 6.97 % Pb 2.58 % Zn 78.85 %	*Lead Concentrate Ag 6,843 g/t Pb 58.71 % Zn 7.10 % *Zinc Concentrate Ag 617 g/t Pb 1.00 % Zn 52.42 % *Lead Concentrate 45.584 t *Zinc Concentrate 48.931 t *Lead Concentrate Ag 79.11 % Pb 81.74 % Zn 9.22 % *Zinc Concentrate Ag 7.66 % Pb 1.49 % Zn 73.12 %

Annex - 15(6) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	16	17	18
Terms of Mill Operation (Date and Days)	July 11-14, 24-28, 1995 (9 days)	Aug. 7-11, 21-24, 28 -29, 1995 (11 days)	Sept. 4-8, 1995 (5 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Maria Elena (Custom milling) Lead & Zinc Ag 243g/t, Pb 2.30% Zn 3.00%	Maria Elena (Custom milling) Lead & Zinc Ag 231g/t, Pb 2.50% Zn 3.21%	San Maximo (Custom milling) Lead & Zinc Ag 221g/t, Pb 3.26% Zn 5.80%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.561 t/h 1,285.986 t - 200 mesh 71.0 % 75mm ball: 912g/t	6.259 t/h 1,427.111 t - 200 mesh 70.5 % 75mm ball: 1,140g/t	6.428 t/h 642.836 t - 200 mesh 70.5 % 75mm ball: 1,191g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 36 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,575 g/t ZnSO ₄ : 1,185 g/t CuSO ₄ : 229 g/t NaCN : 86 g/t Xanthate 343:93g/t Xanthate 350:16g/t Frother 577:37g/t Aeropro. 404:21g/t	Feed pulp : 36 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,892 g/t ZnSO ₄ : 1,254 g/t CuSO ₄ : 245 g/t NaCN : 70 g/t Xanthate 343:90g/t Xanthate 350:21g/t Frother 577:37g/t Aeropro. 404:21g/t	Feed pulp : 34 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,634 g/t ZnSO ₄ : 1,540 g/t CuSO ₄ : 439 g/t NaCN : 92 g/t Xanthate 343:83g/t Xanthate 350:26g/t Frother 577:40g/t Aeropro. 404:14g/t
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 5,807 g/t Pb 81.04 % Zn 7.19 % *Zinc Concentrate Ag 679 g/t Pb 0.94 % Zn 54.14 % *Lead Concentrate 39.201 t *Zinc Concentrate 54.188 t *Lead Concentrate Ag 72.82 % Pb 80.83 % Zn 7.32 % *Zinc Concentrate Ag 11.77 % Pb 1.73 % Zn 76.17 %	*Lead Concentrate Ag 4,585 g/t Pb 52.61 % Zn 10.59 % *Zinc Concentrate Ag 633 g/t Pb 1.13 % Zn 51.85 % *Lead Concentrate 54.523 t *Zinc Concentrate 64.469 t *Lead Concentrate Ag 75.98 % Pb 80.54 % Zn 5.78 % *Zinc Concentrate Ag 12.40 % Pb 2.05 % Zn 72.91 %	*Lead Concentrate Ag 3,160 g/t Pb 52.00 % Zn 6.20 % *Zinc Concentrate Ag 318 g/t Pb 1.21 % Zn 51.88 % *Lead Concentrate 33.053 t *Zinc Concentrate 56.871 t *Lead Concentrate Ag 73.49 % Pb 82.09 % Zn 5.49 % *Zinc Concentrate Ag 12.74 % Pb 3.29 % Zn 79.09 %

Annex - 15(7) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	19	20	21
Terms of Mill Operation (Date and Days)	Sept. 18-22, 24-27, 1995 (9 days)	Oct. 3-6, 1995 (4 days)	Oct. 16-20, 23-25, 1995 (8 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Maria Elena (Custom milling) Lead & Zinc Ag 199g/t, Pb 2.29% Zn 3.73%	San Maximo (Custom milling) Lead & Zinc Ag 363g/t, Pb 2.80% Zn 5.53%	Maria Elena (Custom milling) Lead & Zinc Ag 179g/t, Pb 2.30% Zn 4.17%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.347 t/h 1,269.328 t - 200 mesh 70.5 % 75mm ball: 1,191g/t	6.500 t/h 545.301 t - 200 mesh 69.5 % 75mm ball: 1,411g/t	6.700 t/h 1,154.300 t - 200 mesh 63.5 % 75mm ball: 1,411g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 34.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,634 g/t ZnSO ₄ : 1,540 g/t CuSO ₄ : 439 g/t NaCN : 92 g/t Xanthate 343:83g/t Xanthate 350:26g/t Frother 577:40g/t Aeropro. 404:14g/t	Feed pulp : 34.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 2,132 g/t ZnSO ₄ : 1,573 g/t CuSO ₄ : 353 g/t NaCN : 82 g/t Xanthate 343:94g/t Xanthate 350:17g/t Frother 577:39g/t Na ₂ SO ₃ : 8g/t	
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 4,547 g/t Pb 55.26 % Zn 8.44 % *Zinc Concentrate Ag 564 g/t Pb 1.18 % Zn 52.76 % *Lead Concentrate 40.062 t *Zinc Concentrate 70.818 t *Lead Concentrate Ag 71.98 % Pb 76.09 % Zn 7.15 % *Zinc Concentrate Ag 15.68 % Pb 2.85 % Zn 78.39 %	*Lead Concentrate Ag 6,912 g/t Pb 55.50 % Zn 6.02 % *Zinc Concentrate Ag 336 g/t Pb 1.03 % Zn 51.90 % *Lead Concentrate 24.490 t *Zinc Concentrate 45.390 t *Lead Concentrate Ag 85.51 % Pb 89.05 % Zn 4.87 % *Zinc Concentrate Ag 7.70 % Pb 3.08 % Zn 78.14 %	*Lead Concentrate Ag 4,303 g/t Pb 53.35 % Zn 9.58 % *Zinc Concentrate Ag 513 g/t Pb 1.34 % Zn 53.57 % *Lead Concentrate 37.559 t *Zinc Concentrate 75.447 t *Lead Concentrate Ag 78.22 % Pb 75.50 % Zn 7.48 % *Zinc Concentrate Ag 18.74 % Pb 3.81 % Zn 84.00 %

Annex - 15(8) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	2 2	2 3	2 4
Terms of Mill Operation (Date and Days)	Nov. 6-10, 14-16, 21-24, 1995 (12 days)	Nov. 30-Dec. 1, Dec. 4-6, 1995 (5 days)	Dec. 11-15, 18-21, 1995 (9 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Maria Elena (Custom milling) Lead & Zinc Ag 189g/t, Pb 2.09% Zn 2.76%	San Maximo (Custom milling) Lead & Zinc Ag 458g/t, Pb 2.96% Zn 5.30%	Maria Elena (Custom milling) Lead & Zinc Ag 224g/t, Pb 2.00% Zn 2.25%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.432 t/h 1,837.300 t - 200 mesh 66.0 % 75mm ball: 2,083g/t	6.628 t/h 676,050 t - 200 mesh 68.0 % 75mm ball: 1,319g/t	6.386 t/h 1,277.100 t - 200 mesh 68.0 % 75mm ball: 1,319g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 34.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 2,068 g/t ZnSO ₄ : 1,206 g/t CuSO ₄ : 249 g/t NaCN : 60 g/t Xanthate 343: 106g/t Xanthate 350: 4g/t Frother 577: 29g/t Na ₂ SO ₃ : 108g/t	Feed pulp : 38.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,894 g/t ZnSO ₄ : 916 g/t CuSO ₄ : 351 g/t NaCN : 86 g/t Xanthate 343: 70g/t Xanthate 350: 12g/t Frother 577: 21g/t Aeropro. 404: 6g/t Na ₂ SO ₃ : 218g/t NaHSO ₃ : 4g/t	
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 4,661 g/t Pb 52.13 % Zn 6.48 % *Zinc Concentrate Ag 572 g/t Pb 1.56 % Zn 52.80 % *Lead Concentrate 54.657 t *Zinc Concentrate 69.359 t *Lead Concentrate Ag 73.21 % Pb 74.08 % Zn 7.00 % *Zinc Concentrate Ag 11.40 % Pb 2.81 % Zn 72.33 %	*Lead Concentrate Ag 8,148 g/t Pb 55.10 % Zn 6.74 % *Zinc Concentrate Ag 490 g/t Pb 0.89 % Zn 53.30 % *Lead Concentrate 31.317 t *Zinc Concentrate 53.282 t *Lead Concentrate Ag 82.46 % Pb 86.16 % Zn 5.89 % *Zinc Concentrate Ag 8.43 % Pb 2.37 % Zn 79.29 %	*Lead Concentrate Ag 6,126 g/t Pb 53.49 % Zn 6.60 % *Zinc Concentrate Ag 561 g/t Pb 1.38 % Zn 50.63 % *Lead Concentrate 36.618 t *Zinc Concentrate 40.711 t *Lead Concentrate Ag 78.51 % Pb 76.87 % Zn 8.41 % *Zinc Concentrate Ag 8.00 % Pb 2.21 % Zn 71.78 %

Annex - 15(9) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	25	26	27
Terms of Mill Operation (Date and Days)	Jan.8-13,15-19,22-24,1996 (14 days)	Jan.29-Feb.3,& Feb.6,1996(7 days)	Feb.12-16,19-21,1996 (8 days)
1.Mill Feeds 1)Source of Mill Feed 2)Metals Contained 3)Grade of Mill Feed	Maria Elena (Custom milling) Lead & Zinc Ag 191g/t,Pb 2.26% Zn 2.94%	Vicky (Custom milling) Copper Au 1.35/t,Ag29g/t Cu 2.09%	Maria Elena (Custom milling) Lead & Zinc Ag 250g/t,Pb 2.27% Zn 2.81%
2.Grinding Conditions 1)Feed Rate(tons/hour) 2)Total Weight of Mill Feed 3)Size of Mill Products 4)Ball Consumption	6.509 t/h 1,874.600 t - 200 mesh 70.0 % 75mm ball:1,160g/t	6.839 t/h 1,039.830 t - 200 mesh 70.0 % 75mm ball:1,160g/t	6.770 t/h 1,178.000 t - 200 mesh 71.6 % 75mm ball:2,855g/t
3.Flotation Conditions 1)Pulp Density (solid %) 2)pH of Flotation Pulp 3)Flotation Reagents (Kinds and Amounts)	Feed pulp : 38 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 2,361 g/t ZnSO ₄ : 987 g/t CuSO ₄ : 267 g/t NaCN : 131 g/t Na ₂ SO ₃ : 27 g/t Xanthate 343:41g/t Xanthate 350:32g/t Frother 577:31g/t Aeropro. 404: 8g/t	Feed pulp : 38 % Cu circuit: 7.0 Lime : 305 g/t Aeropro3477:102g/t Aerofloat242:41g/t Aerofloat208:37g/t NaHSO ₃ : 406g/t Xanthate350:112g/t Frother 577:41g/t	Feed pulp : 35 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,783 g/t ZnSO ₄ : 896 g/t CuSO ₄ : 267 g/t NaCN : 64 g/t Na ₂ SO ₃ : 37 g/t Xanthate 343:38g/t Xanthate 350:89g/t Frother 577:60g/t Aeropro. 404:17g/t
4.Results of Flotation 1)Grade of Concentrates 2)Weight of Concentrates 3)Recovery of Concentrates	*Lead Concentrate Ag 4,480 g/t Pb 54.45 % Zn 7.55 % *Zinc Concentrate Ag 505 g/t Pb 1.57 % Zn 51.53 % *Lead Concentrate 58.551 t *Zinc Concentrate 80.622 t *Lead Concentrate Ag 73.23 % Pb 75.20 % Zn 8.03 % *Zinc Concentrate Ag 11.37 % Pb 2.99 % Zn 75.43 %	*Copper Concentrate Au 19,650 g/t Ag 395 g/t Cu 26.35 % *Copper Concentrate 61.184 t *Copper Concentrate Au 86.00 % Ag 79.15 % Cu 74.29 %	*Lead Concentrate Ag 5,475 g/t Pb 52.28 % Zn 8.00 % *Zinc Concentrate Ag 657 g/t Pb 1.54 % Zn 51.29 % *Lead Concentrate 39.896 t *Zinc Concentrate 46.052 t *Lead Concentrate Ag 74.15 % Pb 78.13 % Zn 9.63 % *Zinc Concentrate Ag 10.28 % Pb 2.65 % Zn 71.27 %

Annex - 15(10) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	28	29	30
Terms of Mill Operation (Date and Days)	March 20-23, 25-27, 1996 (7 days)	March 28-April 2, 1996 (6 days)	April 8-11, 15-19, 22-26, 1996 (14 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	San Maximo (Custom milling) Lead & Zinc Ag 512g/t, Pb 2.45% Zn 4.50%	Jesus (Custom milling) Lead & Zinc Ag 332g/t, Pb 2.34% Zn 2.85%	Maria Elena (Custom milling) Lead & Zinc Ag 199g/t, Pb 2.40% Zn 3.11%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.722 t/h 793.162 t - 200 mesh 68.6 % 75mm ball: 1,391 g/t	6.514 t/h 892.371 t - 200 mesh 68.6 % 75mm ball: 1,203g/t	6.660 t/h 2,104.411 t - 200 mesh 69.0 % 75mm ball: 1,203g/t
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 36 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,691 g/t ZnSO ₄ : 1,314 g/t CuSO ₄ : 377 g/t NaCN : 92 g/t Xanthate 343:62g/t Xanthate 350:15g/t Frother 577:32g/t Na ₂ SO ₃ : 109g/t	Feed pulp : 34 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,388 g/t ZnSO ₄ : 979 g/t CuSO ₄ : 394 g/t NaCN : 29 g/t Xanthate 343:38g/t Xanthate 350:10g/t Frother 577:21g/t Na ₂ SO ₃ : 130g/t Aeropro 404 : 6g/t	Feed pulp : 34 % Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,388 g/t ZnSO ₄ : 979 g/t CuSO ₄ : 394 g/t NaCN : 29 g/t Xanthate 343:38g/t Xanthate 350:10g/t Frother 577:21g/t Na ₂ SO ₃ : 130g/t Aeropro 404 : 6g/t
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 11,469g/t Pb 53.00 % Zn 4.94 % *Zinc Concentrate Ag 875 g/t Pb 2.21 % Zn 52.97 % *Lead Concentrate 27.329 t *Zinc Concentrate 53.365 t *Lead Concentrate Ag 77.20 % Pb 74.60 % Zn 3.79 % *Zinc Concentrate Ag 11.50 % Pb 6.08 % Zn 79.28 %	*Lead Concentrate Ag 8,005 g/t Pb 55.30 % Zn 11.01 % *Zinc Concentrate Ag 1,171 g/t Pb 1.60 % Zn 53.60 % *Lead Concentrate 26.568 t *Zinc Concentrate 33.393 t *Lead Concentrate Ag 71.84 % Pb 70.34 % Zn 11.48 % *Zinc Concentrate Ag 13.21 % Pb 2.56 % Zn 70.26 %	*Lead Concentrate Ag 4,311 g/t Pb 53.15 % Zn 7.04 % *Zinc Concentrate Ag 533 g/t Pb 2.24 % Zn 51.51 % *Lead Concentrate 68.534 t *Zinc Concentrate 93.707 t *Lead Concentrate Ag 70.64 % Pb 71.98 % Zn 7.37 % *Zinc Concentrate Ag 11.94 % Pb 4.14 % Zn 73.69 %

Annex - 15(11) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	3 1	3 2
Terms of Mill Operation (Date and Days)	May 6 - 9, 1996 (4 days)	May 13-17, 20-24, 27-29 (13 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	Jesus (Custom milling) Lead & Zinc Ag 269g/t, Pb 2.43% Zn 3.25%	Karia Elena (Custom milling) Lead & Zinc Ag 208g/t, Pb 1.89% Zn 2.21%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.729 t/h 605.580 t - 200 mesh 69.6 %	6.624 t/h 1,954.100 t - 200 mesh 69.6 %
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 35.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,582 g/t ZnSO ₄ : 1,201 g/t CuSO ₄ : 193 g/t NaCN : 53 g/t Xanthate 343:71g/t Xanthate 350: 5g/t Frother 577:39g/t Na ₂ SO ₃ : 172g/t	
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 5,600g/t Pb 54.00 % Zn 11.00 % *Zinc Concentrate Ag 1,000 g/t Pb 2.20 % Zn 52.00 % *Lead Concentrate 19.332 t *Zinc Concentrate 26.409 t *Lead Concentrate Ag 67.25 % Pb 71.63 % Zn 10.93 % *Zinc Concentrate Ag 16.24 % Pb 3.95 % Zn 69.87 %	*Lead Concentrate Ag 5,549 g/t Pb 51.43 % Zn 7.30 % *Zinc Concentrate Ag 844 g/t Pb 1.96 % Zn 50.00 % *Lead Concentrate 50.925 t *Zinc Concentrate 53.850 t *Lead Concentrate Ag 69.59 % Pb 70.92 % Zn 8.64 % *Zinc Concentrate Ag 12.24 % Pb 3.12 % Zn 68.22 %

Annex - 15(12) Summary of Mill Operation of the Parral Mill at the Center

Number of Mill Operation	3 3	3 4	3 5
Terms of Mill Operation (Date and Days)	June 10-13, 1996 (4 days)	June 17-20, 1996 (4 days)	June 24-30, 1996 (7 days)
1. Mill Feeds 1) Source of Mill Feed 2) Metals Contained 3) Grade of Mill Feed	San Maximo (Custom milling) Lead & Zinc Ag 310g/t, Pb 3.16% Zn 4.78%	Jesus (Custom milling) Lead & Zinc Ag 255g/t, Pb 1.65% Zn 2.99%	Maria Elena (Custom milling) Lead & Zinc Ag 140g/t, Pb 1.76% Zn 2.10%
2. Grinding Conditions 1) Feed Rate (tons/hour) 2) Total Weight of Mill Feed 3) Size of Mill Products 4) Ball Consumption	6.774 t/h 623.190 t - 200 mesh 68.3 % 75mm ball: 2,613g/t	6.669 t/h 560.170 t - 200 mesh 68.3 % 75mm ball: 2,613 g/t	6.087 t/h 1,028.700 t - 200 mesh 68.3 %
3. Flotation Conditions 1) Pulp Density (solid %) 2) pH of Flotation Pulp 3) Flotation Reagents (Kinds and Amounts)	Feed pulp : 34.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,300 g/t ZnSO ₄ : 1,388 g/t CuSO ₄ : 303 g/t NaCN : 90 g/t Xanthate 343:66g/t Xanthate 350: 9g/t Frother 577:30g/t Aeropro 404: 4g/t	Feed pulp : 34.0% Pb circuit: 7.0 Zn circuit: 10.0 Lime : 1,300 g/t ZnSO ₄ : 1,388 g/t CuSO ₄ : 303 g/t NaCN : 90 g/t Xanthate 343:66g/t Xanthate 350: 9g/t Frother 577:30g/t Aeropro 404: 4g/t	
4. Results of Flotation 1) Grade of Concentrates 2) Weight of Concentrates 3) Recovery of Concentrates	*Lead Concentrate Ag 5,800g/t Pb 56.50 % Zn 5.25 % *Zinc Concentrate Ag 482 g/t Pb 1.84 % Zn 52.21 % *Lead Concentrate 27.234 t *Zinc Concentrate 44.829 t *Lead Concentrate Ag 78.88 % Pb 78.18 % Zn 4.80 % *Zinc Concentrate Ag 11.17 % Pb 4.18 % Zn 78.55 %	*Lead Concentrate Ag 7,850g/t Pb 53.20 % Zn 9.00 % *Zinc Concentrate Ag 1,240 g/t Pb 1.80 % Zn 59.00 % *Lead Concentrate 10.890 t *Zinc Concentrate 23.301 t *Lead Concentrate Ag 59.85 % Pb 62.55 % Zn 5.85 % *Zinc Concentrate Ag 20.23 % Pb 4.52 % Zn 73.74 %	*Lead Concentrate Ag 4,057 g/t Pb 54.50 % Zn 6.75 % *Zinc Concentrate Ag 720 g/t Pb 1.90 % Zn 50.50 % *Lead Concentrate 22.492 t *Zinc Concentrate 28.705 t *Lead Concentrate Ag 63.23 % Pb 67.37 % Zn 7.02 % *Zinc Concentrate Ag 14.36 % Pb 4.46 % Zn 69.40 %

Annex-16 Summary of Services on Technical Consultation

A. Technical Consultation at the Site of Mill

No.	Date	Location of Mill	Items of Technical Consultation
1	March 1993	Villa Matamoros Mill, Parral, Chih.	① Shortage of machinery and equipment necessary for efficient operation and pollution control. ② Unsuitable arrangement of flotation cells. ③ Shortage of mill feeds. ④ Short of funds.
2	March 1993	Minero Ocampo Mill, Chihuahua	① Shortage of mill feeds.
3	March 1993	Metalurgica Hermosillo Mill, Hermosillo, Sonora	① Over grinding of barite ores by ball mill.
4	May 1993	Metalurgica Guanacevi Mill, Durango	① Reduction of mill operation costs. ② Introduction of a cyanidation process to the processing of low-grade ores, debris and tailings. ③ High zinc content in the lead concentrates.
5	June 1993	Maillet Badiraguato Mill, Sinaloa	① High copper content in the lead concentrate & high lead content in the copper concentrate. ② Improvement of the purity of concentrates by means of introduction of mill instrumentation. ③ Introduction of waste water treatment process.

B. Technical Consultation at the Site of the Project

No.	Date	Client	Items of Technical Consultation
6	June 1993	Metalurgica Guanacevi Mill, Durango	① Preliminary selective flotation tests of lead and zinc ores aiming at the lowering of zinc content in the lead concentrates.
7	March 1995	Plomosas Mine, Chihuahua	① Feasibility study on the application of lead and zinc selective flotation process to the Plomosas ores.
8	Sept. 1995	Santa Ana & El Espadano Mines, Durango	① Amenable tests on the application of gold flotation process to the Santa Ana and El Espadano ores in stead of a cyanidation process.
9	Feb. 1996	Promotora Minera de Ocampo Mill, Ocampo, Chihuahua	① Planning of a mineral processing system necessary for introduction of new mill feeds from Las Tunas mine.
10	March 1996	Promotora Minera de Ocampo Mill, Ocampo, Chihuahua	① Laboratory tests on the improvement of flotation conditions of a mill feed from Minerales de Soyopa mine.

Annex-17 Summary of Services on Chemical Analysis at the Parral Experimental Center

Year	Requested from	Number of Samples Analyzed														Total
		Au	Ag	Pb	Zn	Cu	Fe	As	PbO	ZnO	CuO	Mn	Ins.	Cd	FeO	
1992	Mines/ Mills	547	441	308	307	355	255	11	50	53	1	5	1	2	-	2,337
1993	Mines/ Mills	101	91	60	60	81	52	5	16	16	-	-	-	-	-	482
1994	Mines/ Mills	195	210	189	151	109	121	21	54	17	5	-	-	-	-	1,072
1995	Mines/ Mills	456	428	265	257	221	230	5	4	4	4	-	-	-	3	1,877
1996	Mines/ Mills	349	334	280	258	136	117	48	17	7	1	7	-	-	1	1,565
Total		1648	1504	1102	1043	903	775	90	141	97	11	12	1	2	4	7,333

[Notes] 1. Summary in 1996 is up to June 30, 1996

2. Determination of gold and silver : By fire assay.

3. Determination of Pb, Zn, Cu, Fe, PbO, ZnO, CuO, Mn, Cd : By atomic absorption analysis.

4. Determination of Insoluble and As : By volumetric analysis.

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Annex-18 Summary of Services on Metallurgical Testing at the Parral Experimental Center

Year	Number of Batch Flotation Tests			Number of Cyanidation Tests		Cumulative Number of Elements analyzed for Determination of the Products from Flotation/ Cyanidation Batch Tests
	Bulk Flotation of Gold and Silver	Bulk Flotation of Copper	Selective Flotation between Pb/Zn	Cyanidation of Crude Ores	Cyanidation of Flotation Tailings	
1993	42	—	51	—	—	1,755
1994	72	—	18	—	—	1,347
1995	49	12	17	—	—	1,181
* 1996	65	31	17	8	—	1,397
in all	228	43	103	8	—	5,680

* Summary in 1996 is up to June 30, 1996

Annex-19 Major Machinery & Equipment provided by the Mexican Side

Kinds of Machinery and Equipment	Specifications	Price(N Pesos)
1. Crushing Circuit 1- 1 Raw ore bin 1- 2 Discharge conveyer from ore bin 1- 3 No.1 belt conveyer 1- 4 Jaw crusher 1- 5 Vibrating screen 1- 6 Electro-magnetic separator 1- 7 No.3 belt conveyer 1- 8 Cone crusher 1- 9 No.4 belt conveyer 1-10 No.5 belt conveyer 1-11 Automatic sampler 1-12 Splitting apparatus 1-13 No.6 belt conveyer 1-14 No.7 belt conveyer 1-15 No.8 belt conveyer 1-16 Ore storage bin for sampling Sub-Total	250t X 3unit 900mm X 3unit, 2.2kw 600mm, 2.2kw 450x600mm, 37kw, 225-275rpm 1,500x3,000mm: (upper: 31mm, under: 12mm) 750x1,200mm, 115V, 33.9A 600mm, 5.6kw 1,200mm, 94kw, 500rpm 600mm, 3.7kw 600mm, 7.5kw 0.37kw 600mm, 5.6kw 600mm, 2.2kw 600mm, 2.2kw 45t	300,000.00 30,000.00 60,000.00 175,000.00 125,000.00 45,000.00 60,000.00 450,000.00 60,000.00 80,000.00 20,000.00 45,000.00 80,000.00 45,000.00 45,000.00 50,000.00 1,670,000.00
2. Grinding Circuit 2- 1 No.2 mill bin 2- 2 No.2 ball mill 2- 3 No.3 mill bin 2- 4 No.3 ball mill Sub-Total	180t Marcy type, 100x2, 100mm, 165kw 250t Denver type, 2, 100x2, 250mm, 150kw	180,000.00 850,000.00 180,000.00 1,300,000.00 2,510,000.00
3. Flotation Circuit 3- 1 Conditioner for lead rougher 3- 2 Lead flotation machine 3- 3 Pumps for tailings from lead scavenger 3- 4 Conditioner for zinc rougher 3- 5 Zinc flotation machine 3- 6 Pumps for tailings from zinc scavenger Sub-Total	3,000x3,000mm, 11kw Denver type, 24inx12cells, 7.5kwx6 4inx5in, 11kw 2,700x2,700mm, 11kw Denver type, 24inx12cells, 7.5kwx6 4inx5in, 18.8kw	100,000.00 600,000.00 25,000.00 100,000.00 600,000.00 25,000.00 1,450,000.00
4. Thickening and Filtration Circuit 4- 1 Thickener for lead concentrates 4- 2 Diaphragm pump for thickener spigot 4- 3 Disc filter for lead concentrates 4- 4 Thickener for zinc concentrates 4- 5 Diaphragm pump for thickener spigot 4- 6 Disc filter for zinc concentrates 4- 7 Lead clarifier 4- 8 Zinc clarifier 4- 9 Pumps for lead filtrate 4-10 Pumps for zinc filtrate 4-11 Vacuum pump Sub-Total	3,600x2,400mm, 0.75kw 4in double type, 0.75kw 1,200x1,200mm, 0.75kw 4,500x2,400mm, 0.75kw 4in double type, 1.5kw 1,800x1,200mm, 0.75kw 4,500x2,400mm 4,500x2,400mm 1 1/2in, 3.7kw 1 1/2in, 3.7kw 45kw	250,000.00 30,000.00 150,000.00 175,000.00 30,000.00 250,000.00 25,000.00 25,000.00 20,000.00 20,000.00 80,000.00 1,055,000.00
5. Wastes Treatment Circuit 5- 1 Hydrocyclone 5- 2 Pumps for recovering of return water 5- 3 Tank for return water Sub-Total	Krebs-6 type, 2units 4inx5in, 7.5kw 150m ³ x2units	15,000.00 25,000.00 30,000.00 70,000.00
6. General 6- 1 Pumps for fresh water 6- 2 Tanks for fresh water Sub-Total	4in, 75kw 150m ³ x2units	80,000.00 100,000.00 180,000.00
Grand Total		6,935,000.00

Annex-20. Records of the Joint Committee Meeting for the Project

No.	Date	Place	Main Subjects for Discussion
1	March 9, 1994	CRM Main Office, Pachuca	<ol style="list-style-type: none"> 1. Formulation of the annual work-plan for April 1994 to March 1995. 2. Confirmation of the budget allocation for 1994. 3. Confirmation of the progress of the technical cooperation program. 4. Other matters
2	August 31, 1994	CRM office, Mexico City	<ol style="list-style-type: none"> 1. Confirmation of the results of review on the activities of the Project from June 1993 to July 1994. 2. Confirmation of the annual work plan for 1994-1995. 3. Confirmation of the results of modification of TSI/TCP. 4. Other matters
3	April 11, 1995	CRM Main Office, Pachuca	<ol style="list-style-type: none"> 1. Formulation of the annual work-plan for April 1994 to March 1996. 2. Confirmation of the budget allocation for 1995. 3. Confirmation of the progress of the technical cooperation program. 4. Other matters
4	June 21, 1995	CRM office, Mexico City	<ol style="list-style-type: none"> 1. Confirmation of the results of review on the activities of the Project from August 1994 to May 1995. 2. Confirmation of the annual work plan for 1995-1996. 3. Confirmation of the results of modification of TSI/TCP. 4. Other matters
5	November 23, 1995	SEDREM, CRM, Mexico City	<ol style="list-style-type: none"> 1. Confirmation of the overall progress of the Project. 2. Confirmation of the progress of the annual work-plan for 1995-1996. 3. Other matters

Annex-21 Evaluation Check List

Technical Cooperation for the Project on Mineral Processing Plant Operation Technology

Evaluation Grade : ○ Excellent, ○ Good, □ Fair, △ Unsatisfactory
 Evaluation Point of View : [T] Technology transfer by the Japanese Experts
 [A] Technology acquirement by the Mexican Counterparts

Evaluation Items	Acquired Results	Results of Evaluation						Remarks
		Japanese		Mexican		Overall		
		T	A	T	A	T	A	
A. Overall Goal of the Project Progress of the promotion activities for the Mexican mining industry in relation to the improvement of mill operation.	The remarkable results acquired in the fields of regional mining promotion and training activities under the Project are evaluated by the authorities concerned with the Mexican mining industry.	○		○		○		Refer to Comment-[A]
B. Purpose of the Project Contribution to the human resources training program through the technology transfer on flotation mill operation in the course of implementation of the mill modernization program by the Mexican side.	1. Progress of technology transfer aimed at the Project. [Estimated degree of progress at the final stage of the Project] 1) Practice on flotation mill operation. ①Crushing circuit :100 % ②Grinding circuit :100 % ③Flotation circuit :100 % ④Thickening and filtration circuit : 90 % ⑤Tailing treatment :100 % 2) Practice on flotation mill instrumentation ①Feed-rate control :100 % ②Pulp pH control :100 % ③Flow-rate control :100 % ④On-line particle size analysis :100 % ⑤On-line fluorescence X-ray analysis :100 % ⑥Flotation reagents addition control :100 % ⑦Environment monitoring:100 % 3) Practice on flotation mill process control. ①Grinding circuit :100 % ②Flotation circuit :100 % 4) Conception on flotation mill management. ①Mill management using computer system :100 % ②Guide-lines for custom mill :100 % ③Practice on mill maintenance and repairs : 90 % ④Guide-lines for mill performance management :100 %	○	○	○	○	○	○	Refer to Comment-[B-1]
	2. Progress of human resources development program. 1) Grade-up of human resources development functions by renovation of mill facilities. 2) Guidance and promotion of training projects at the Parral center.	○		○		○		

2 ミニッツ

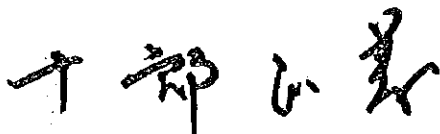
MINUTES OF DISCUSSIONS
BETWEEN THE JAPANESE EVALUATION TEAM
AND THE MEXICAN AUTHORITIES CONCERNED
ON THE JAPANESE TECHNICAL COOPERATION PROJECT
FOR MINERAL PROCESSING PLANT OPERATION TECHNOLOGY
IN THE UNITED MEXICAN STATES

The Japanese Evaluation Team (hereinafter referred to as "The Japanese Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Masayoshi Juro visited the United Mexican States from July 8 to July 26, 1996 for the purpose of evaluating jointly with the Mexican Evaluation Team (hereinafter referred to as "the Mexican Team") the achievements of the Project on Mineral Processing Plant Operation Technology in the United Mexican States (hereinafter referred to as "the Project").

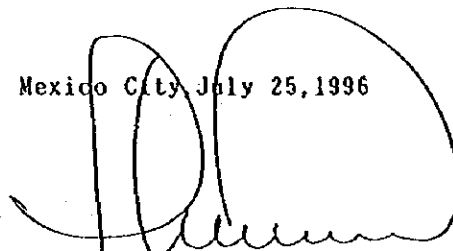
During its stay in the United Mexican States, both the Teams had a series of discussions and exchanged views over the matters for the progress and achievements of the Project and formulated a Joint Evaluation Report on the Project.

As a result of the discussions, both the Teams agreed upon the matters referred to the document attached hereto.


Mexico City July 25, 1996



Mr. Masayoshi Juro
Leader,
Japanese Evaluation Team,
Japan International Cooperation
Agency,
Japan.



Dr. Luis Chavez Martinez
Director General,
Consejo de Recursos Minerales,
Secretaria de Comercio y Fomento
Industrial,
Estados Unidos Mexicanos.



Ing. Moises R. Kolteniuk Toyber
Coordinador General de Minería,
Secretaria de Comercio y Fomento Industrial,
Estados Unidos Mexicanos.

THE ATTACHED DOCUMENT

1. The joint Evaluation Report

The joint evaluation report prepared by both the Teams has presented to the sixth joint committee meeting and has been approved by the meeting.

2. The Sixth Joint Committee Meeting

The minutes of meeting on the sixth joint committee meeting is as shown in the Appendix-I.

3. Dispatch of the Japanese Experts

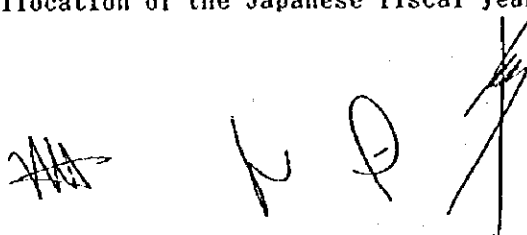
Both the Teams confirmed that the services of the Japanese long-term experts would be continued according to the agreement described in the R/D.

4. Provision of Machinery and Equipment

The Japanese Team explained that an X-ray tube for the on-line fluorescence X-ray analyzer and some spare parts for the equipment provided from the Japanese side would be provided within the limits of the budget allocation of the Japanese fiscal year of 1996.

5. Acceptance of Counterpart Personnel for Training in Japan

The Japanese Team explained that two persons of the Mexican counterpart personnel would be accepted for training in Japan within the limits of the budget allocation of the Japanese fiscal year of 1996.

Handwritten signatures and initials, including a large signature on the left and several initials in the center and right.

Appendix - I . The Minutes of Meeting on the Sixth Joint Committee
Meeting for the Project

§ Date and Hours of the Meeting : July 24, 1996 (17.00 - 18.20)

§ Place of the Meeting : CEDOREM, CRM in Mexico City

§ Attendance at the Meeting :

1) The Japanese Side

* Evaluation Team

Mr. Masayoshi Juro, Leader

Mr. Kazu Iwano, Member (Mineral processing technology)

Dr. Kenji Tomita, Member (Evaluation analysis)

Mr. Shinya Tomonari, Member (Evaluation planning)

* JICA Mexico Office

Mr. Yoshitaka Enomoto, Assistant Resident Representative

Lic. Daniel Gonzalez Gonzalez, Secretario Tecnico

* Experts of the Project

Mr. Tetsuhiko Hasuda, Chief Advisor

Mr. Yuichi Endo, Coordinator

Mr. Seiken Sato, Expert (Mill Operation and Management)

2) The Mexican Side

* Secretaria de Comercio y Fomento Industrial [SECOFI]

Ing. Raymundo Delgado Robles, Asesor del Director General de Minas

* Consejo de Recursos Minerales [CRM]

Dr. Luis Chavez Martinez, Director General

Ing. Sergio Almazan Esqueda, Director de Operacion

Ing. Luis Brizuela Venegas, Subdirector de Servicio y Apoyo

* Fideicomiso de Fomento Minero [FFM]

Ing. Roberto Mendoza Blackaller, Director de Delegaciones

Ing. Armondo Gamboa Alanis, Subdirector de Control de Delegaciones

Ing. Carlos Soto Perez, Gerente de Evaluacion y Control

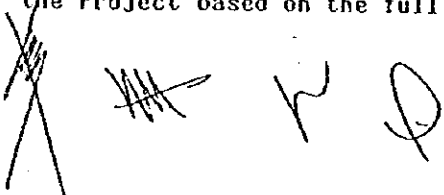
* Camara Minera de Mexico [CMM]

Ing. Ricardo Lassala Mozo, Asesor del Director General

§ Results of the Meeting

1. The Joint Evaluation Report on the Japanese Technical Cooperation for the Project has been presented to the meeting and has been approved by the meeting.

2. The Mexican side explained its conception on the operational plan of the CRM Metallurgical Experimental Center of Parral after the termination of the Project based on the full maintenance of the Parral mill.



JICA