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　付属参考資料８：Til-Tilラボの化学分析業務における水溶液試料分析対象成分と定量下限・分析方法
　付属参考資料９：E-400調査フォーム
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# MINUTES OF MEETINGS
# BETWEEN
# THE JAPANESE FINAL EVALUATION TEAM
# AND
# THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE REPUBLIC OF CHILE
# ON
# JAPANESE TECHNICAL COOPERATION
# FOR
# THE PROJECT FOR STRENGTHENING INSTITUTIONAL CAPACITY OF MINING ENVIRONMENTAL MANAGEMENT

The Japan International Cooperration Agency (hereinafter referred to as "JICA") dispatched the Project Final Evaluation Team, headed by Mr. Eiji Iwasaki, to Chile from 26 November to 16 December 2006, for the purpose of conducting the joint final evaluation of the Project for Strengthening Institutional Capacity of Mining Environmental Management (hereinafter in referred to as "the Project") based on the Record of Discussions signed on January 11 2002.

The Joint Evaluation Committee, which consists of members from JICA and members from the Government of Chile, was jointly organized for the purpose of conducting the final evaluation and preparation of necessary recommendations.

After the intensive study and analysis of the activities and achievements of the Project, the Joint Evaluation Committee prepared the Joint Final Evaluation Report (hereinafter referred to as "the Report"), which was presented to the Joint Coordinating Committee, held in December 14, 2006.

The Joint Coordinating Committee confirmed the Report and agreed to forward it to respective Governments.

Santiago, December 15, 2006

岩崎英二

Mr. Eiji Iwasaki
Leader,
Japanese Final Evaluation Team,
Japan International Cooperation Agency
Japan

Ms. Marisol Aravena Puelma
Undersecretary of Mining,
Ministry of Mining,
The Republic of Chile

Witnessed by:

Ms. Margaret Ciampi Spode
Chief,
Legal Department
International Cooperation Agency
The Republic of Chile

Mr. Patricio Cartagena Diaz
National Director,
National Service of Geology and Mining,
The Republic of Chile

# JOINT FINAL EVALUATION REPORT
# ON
# THE PROJECT FOR STRENGTHENING INSTITUTIONAL CAPACITY OF MINING ENVIRONMENTAL MANAGEMENT
# IN
# THE REPUBLIC OF CHILE

Santiago, December 15, 2006

JAPANESE-CHILEAN
JOINT FINAL EVALUATION COMMITTEE

Table of Contents

# 1. Introduction

## 1-1 Objective of the Evaluation Study

1) To review the degree of achievement of Input, Output, and Project Purpose based on the Project Design Matrix which was modified several times and the latest version was prepared in November 24, 2006 (hereinafter referred to as "PDM 3.0") shown as ANNEX 1 and Plan of Operation (hereinafter referred to as PO 3.0) shown as ANNEX 2. Apart from PO 3.0, the Project refers to the detailed activity schedule prepared in accordance with PO 3.0.
2) To evaluate the Project in terms of the five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact and Sustainability).
3) To make recommendations regarding measures to be taken for the improvement of the Project as well as to draw lessons for the improvement in planning and implementation of similar Technical Cooperation Projects.

## 1-2 Methodology of Evaluation

The Project was evaluated by the Chilean and Japanese Joint Evaluation Team. The Joint Evaluation Team was composed of eight members from the Chilean side and six members from the Japanese side respectively. The Team visited the Ministry of Mining and Energy and the National Service of Geology and Mining (hereinafter referred to as "SERNAGEOMIN") and carried out a series of interviews and discussions with Japanese experts and Chilean counterpart personnel. Evaluation analysis was made on the five evaluation criteria described below:

a) Relevance

Relevance refers to the validity of the Project Purpose and the Overall Goal in connection with the development policy of the Republic of Chile (hereinafter referred to as "Chile") as well as the needs of beneficiaries.

b) Effectiveness

Effectiveness refers to the extent to which the expected benefit was brought about as a result of the Project (not of the external factors)

c) Efficiency

Efficiency refers to the productivity of the implementation process, examining if the input of the Project was efficiently converted into the output.

d) Impact

Impact refers to direct and indirect, positive and negative impacts caused by implementing the Project, including the extent to which the Overall Goal has been attained.

e) Sustainability

Sustainability refers to the extent to which Chile can further develop the Project, and the benefits generated by the Project can be sustained under the Chilean policies, technology, systems, and financial state.

### 1-3 Information for Evaluation

In order to evaluate the past performance, the following materials were used:

(1) The Record of Discussions (R/D), Tentative Schedule of Implementation (TSI), Technical Cooperation Program, Minutes of Discussions, and other documents agreed to or accepted in the course of implementation of the Project.

(2) PDM 3.0

(3) Data of input and output from the Project

(4) Results of series of interviews and questionnaires

(5) Presentation by C/Ps on the progress

(6) Textbooks, guidebooks, manuals and inventory of machinery and equipment

(7) Assessment of maintenance and management of machinery and equipment

### 1-4 Members of the Evaluation Team

1-4-1. Chilean side

| Name | Job title | Profession |
|---|---|---|
| Mr. Claudio Valencia | Team Leader | National Sub-director of Mining, SERNAGEOMIN |
| Mr. Soledad Santa Ana | member | Chief, Department of Planning and Studies, SERNAGEOMIN |
| Ms. María Cecilia Valderas | member | Chief, Unit of Internal Audit, SERNAGEOMIN |
| Mr. Jorge Villablanca | member | Executive Director, Mine Safety and Environment Training Center |
| Ms. Ana Sáez | member | Staff, Informatics Unit, SERNAGEOMIN |
| Mr. Juan Bustamante | member | Chemist, Laboratory, SERNAGEOMIN |
| Mr. Guillermo Toro | member | Staff, Management Process Control Unit, the Ministry of Mining and Energy |
| Mr. Iván MERTENS | member | Bilateral Cooperation Department, International Cooperation Agency of Chile |

1-4-2. Japanese side

| Name | Job title | Profession |
|---|---|---|
| Mr. Eiji IWASAKI | Team Leader | Team Director, Environmental Management Team II, Global Environment Department, JICA |

| | | |
|---|---|---|
| Mr. Takahiro MATSUBUCHI | Pollution Control Policy | Deputy Director, Nuclear and Industrial Safety Agency, Mine Safety Division, Ministry of Economy, Trade and Industry |
| Mr. Tadashi ITO | Prevention Technology of Pollution caused by Mining | Senior Councilor, Mine Pollution Control, Metals Finance & Technology Unit, Japan Oil, Gas, and Metals National Corporation |
| Mr. Tadashi SUZUKI | Cooperation Planning | Senior Programme Officer, Environmental Management Team II, Global Environment Department, JICA |
| Mr. Atau KISHINAMI | Evaluation Analysis | Permanent Expert, International Development Associates, Ltd |
| Ms. Atsuko Yoshikawa | Interpreter | Japan International Cooperation Center |

### 1-5 Schedule of the Study

| No | Date | Day | Details of Visits & Meetings |
|---|---|---|---|
| 1 | 5 Dec | Tue | Meeting at JICA office<br>Courtesy visit to SERNAGEOMIN<br>Courtesy visit to the Embassy of Japan<br>Courtesy visit to the Ministry of Mining and Energy<br>Joint Evaluation Committee |
| 2 | 6 Dec | Wed | Hearing from Japanese experts<br>Joint Evaluation Committee ( Presentation on the progress by C/Ps ) |
| 3 | 7 Dec | Thu | Discussion with SERNAGEOMIN<br>Joint Evaluation Committee |
| 4 | 8 Dec | Fri | Analysis of information |
| 5 | 9 Dec | Sat | Analysis of information |
| 6 | 10 Dec | Sun | Analysis of information |
| 7 | 11 Dec | Mon | Discussion with Ministry of Mining and Energy<br>Discussion with BGR |
| 8 | 12 Dec | Tue | Discussion with SERNAGEOMIN<br>Preparation of Minutes of Meetings (MM) and Joint Evaluation Report (JER) |
| 9 | 13 Dec | Wed | Joint Evaluation Committee<br>Discussion with SERNAGEOMIN |
| 10 | 14 Dec | Thu | Joint Evaluation Committee<br>Joint Coordination Committee |
| 11 | 15 Dec | Fri | Signing of M/M and JER<br>Report to JICA office<br>Report to the Embassy of Japan |

## 2. Outline of the Project

### 2-1 Background of the Project

The estimated copper deposits in Chile account for approximately 39% of the world and at the same time, the country is rich in minerals such as molybdenum and nitrates. The mining industry shares 41.1% of its export in 2003. The Chilean government has considered that it is important to deal with the environmental issues in order to soundly develop the mining industry and established several government ordinances in 1990's.

It is said that there are several thousands of closed and abandoned mines in Chile. However, the current laws/regulations do not stipulate the restoration duties of these mines and tailings dams and therefore, there are many mines and dams that are neglected without being grasped the actual conditions. While the Chilean government has coped with environmental disruption caused by mining, SERNAGEOMIN did not have sufficient experiences, knowledge and technologies regarding monitoring environmental protection plans. Therefore, it is essential i) to grasp the situations on operating, closed and abandoned mines, ii) to investigate environmental pollution caused by mining, iii) to improve evaluation skills of expected environmental risks and iv) to strengthen the capacity to evaluate the plan for control of environmental pollution caused by mining.

Under these circumstances, the Chilean government requested the Japanese government the technical cooperation for strengthening institutional capacity of mining environmental management. In response to the request, JICA dispatched a Preliminary Study Team and Short-term Study Teams to find out needs and to discuss details of the Project. The Japanese Implementation Study Team signed the Record of Discussions on the Project on January 11, 2002. The Project started in July 2002 for a five-year period that will end June 2007.

## 2-2 Summary of the Project

### 2-2-1 Overall Goal

1. The Chilean Government prevents mining pollution caused by closed and abandoned mines.
2. SERNAGEOMIN gives technical guidance concerning the measures to closing mines.
3. SERNAGEOMIN compiles a database on Chilean mines.

### 2-2-2 Project Purpose

SERNAGEOMIN adds the following functions to its administrative duties:

1. SERNAGEOMIN grasps the situation surrounding operating, closed, and abandoned mines. SERNAGEOMIN compiles a database for closed and abandoned mines, including information on potential environmental impact.

2. SERNAGEOMIN has the capacity to evaluate the plan for minimizing and monitoring environmental damage caused by mining, including mine closure.

### 2-2-3 Outputs

1. Various initial input is completed.
2. Basic knowledge regarding prevention for Mining pollution is disseminated among inspectors in SERNAGEOMIN
3. Necessary investigation skills for closed and abandoned mines are strengthened in SERNAGEOMIN.
4. SERNAGEOMIN has an improved data base system for investigation results.
5. SERNAGEOMIN develops the capacity to evaluate technical measures for closing mines.
6. SERNAGEOMIN strengthens its skills for examining pollution from model mines.
7. SERNAGEOMIN develops the capacity to evaluate pollution protection plans for model operating, closed and abandoned mines.
8. SERNAGEOMIN strengthens its capacity for assessing environmental impact.
9. SERNAGEOMIN improves its chemical analysis and its skills in management of the equipment.
10. SERNAGEOMIN obtains data analysis technology and results evaluation technology for chemical analysis results.

## 3. Project Performance

### 3-1 Inputs

#### 3-1-1 Input from the Japanese Side

1) Dispatch of Japanese Experts

A total of nine long-term experts and eight short-term experts have been dispatched as shown in ANNEX 3.

2) Acceptance of Chilean Counterpart Personnel for Training in Japan

A total of 17 Chilean counterpart personnel have been trained in Japan in accordance with the R/D as shown in ANNEX 4.

3) Provision of Machinery, Equipment and Materials

Machinery, equipment and materials worth 152,173 thousand yen have been provided in accordance with the R/D as shown in ANNEX 5.

4) Local Cost

Local cost of JPY 89,845 thousand yen has been spent in total to support the Project and used for the necessary project activities as shown in ANNEX 6.

### 3-1-2 Input from the Chilean Side

1) Assignment of Counterpart Personnel

The final total of 36 Chilean counterpart personnel (hereinafter referred to as "C/P" or "C/Ps") has been assigned as shown in ANNEX 7.

2) Provision of land, buildings and facilities

Office spaces for the Japanese experts and necessary facilities have been provided. In addition to this, land, building and other facilities have also been provided in four model areas.

3) Operation Cost

Local cost has been spent as shown in ANNEX 8 and used for necessary project activities.

## 3-2 Project Purpose:

### 3-2-1 Project Purpose 1

The Project Purpose 1 is "SERNAGEOMIN grasps the situation surrounding operating, closed, and abandoned mines. SERNAGEOMIN compiles a database for closed and abandoned mines, including information on potential environmental impacts". Two indicators are set up in order to assess the level of achievement. Table 3-1 shows the indicators of the Project Purpose 1 and the level of achievement. The Project Purpose 1 has been achieved.

Table 3-1: Indicators of the Project Purpose 1 and the Level of Achievement

| Verifiable Indicators | Level of Achievement |
|---|---|
| 1-1 Inspectors of SERNAGEOMIN grasps the realities of operating, closed, and abandoned mines in each region | The technical transfer to the Chilean C/Ps has appropriately been carried out as follows.<br>1) 24 C/Ps have grasped the investigation methods with E-400[1] form. 21 C/Ps have grasped the investigation methods with E-500[2] form.<br>2) The situations on model operating, closed and abandoned mines have already been investigated by E-400 and E-500 form.<br>3) Each regional office continues to grasp more information on closed and abandoned mines. |
| 1-2 Situation on the intensive information | Information/data on 213 closed and abandoned mines (219 facilities) has been collected by April 2005. Additional 96 closed and abandoned mines and facilities were investigated with E-400 form by |

[1] A form used for investigations of closed and abandoned mines.

[2] A form used for investigations of operating mines.

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| | December 2006. Regarding operating mines, information on 19 model mines has been collected. |

### 3-2-2 Project Purpose 2

The Project Purpose 2 is "SERNAGEOMIN has the capacity to evaluate the plan for minimizing and monitoring environmental damage caused by mining, including mine closure". One indicator is set up respectively in order to assess the level of achievement. Table 3-2 shows the indicators of the Project Purpose 2 and the level of achievement. The Project Purpose 2 is expected to be achieved with the completion of Output5, 6 and 7 before June 2007.

Table3-2: Indicators of the Project Purpose 1 and the Level of Achievement

| Verifiable Indicators | Level of Achievement |
|---|---|
| 2 The C/P's technical level is enhanced to the level that the C/P can monitor and evaluate by themselves. | 1) C/Ps are able to carry out the environmental investigation of operating mines by using E-500 form and to record the results. 19 operating mines have already been investigated.<br>2) C/Ps have already assessed approximately 50 mine closure plans and instructed in actual closures, in accordance with the revised Mine Safety Supreme Decree.<br>3) C/Ps have gained experience by having basic and theoretical training as well as practical training on sites. |

### 3-3 Output

Achievement of each Output is evaluated as follows in accordance with the verifiable indicators. Outputs have almost been achieved at the time of the final evaluation.

**3-3-1 Output 1:** Various initial input is completed.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 1-1 Counterpart and budget are allocated as planned. | C/Ps and budget are appropriately allocated in accordance with R/D (refer to ANNEX 7&8), despite several changes of C/Ps. The indicator has been fulfilled. |
| 1-2 Equipment is being used and maintained well. | Machinery and equipment for investigation and chemical analysis have appropriately been operated and maintained (refer to ANNEX 5). The indicator has been fulfilled. |

**3-3-2 Output2:** Basic knowledge regarding prevention for Mining pollution is disseminated among inspectors in SERNAGEOMIN

| Verifiable Indicators | Level of Achievement |
|---|---|
| 2 C/P participates in respective lectures and understands the material. | A total of nine C/Ps have been trained in Japan and participated in the seminars on mining |

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| | pollution control and comprehended the outline in the first half of the Project. They have grasped the basic skills on mining pollution control by attending seminars in the latter half (refer to ANNEX 9). The indicator has been fulfilled. |

**3-3-3 Output3:** Necessary investigation skills for closed and abandoned mines are strengthened in SERNAGEOMIN.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 3-1 C/P participates in respective lectures and OJT and understands the material. | A total of 36 C/Ps have participated in lectures on investigation methods (seven themes) concerning closed and abandoned mines at each regional office (Refer to ANNEX 9) . The indicator has been fulfilled. |
| 3-2 C/P can investigate using the E-400 form by the end of 2004. | A total of 24 C/Ps at each regional office have participated in investigation on closed and abandoned mines using E-400 form and are now capable of using the form. The indicator has been fulfilled. A manual for investigations with E-400, which is not specified within PDM, is being prepared. |
| 3-3 C/P can use necessary equipment for investigating the items on E-400 by the end of 2004. | A total of 15 C/Ps investigated closed and abandoned mines using E-400 form and are able to use necessary equipment such as pH, electric conductivity meter and GPS. The indicator has been fulfilled. |

**3-3-4 Output 4:** SERNAGEOMIN has an improved data base system for investigation results.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 4-1 Modification of Database system is completed. | Modification of Database system has already been completed in accordance with E-400. The data can be input and read through intranet. Training on GIS and ORACLE were also conducted for database visualization, and for operation improvement, respectively. The indicator has been fulfilled. |
| 4-2 Investigation results of about 200 mines are accumulated on SIMIN-OL by the end of 2004. | Investigations on 213 mines (219 facilities) have been conducted and accumulated in the database. The indicator has been fulfilled. |

**3-3-5 Output 5:** SERNAGEOMIN develops the capacity to evaluate technical measures for closing mines.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 5 C/P participates in respective lectures and OJT and understands the material by the end of the Project. | A total of 96 C/Ps participated in lectures/seminars and detailed investigations regarding tailing dump, mine drainage, open cut mining, waste dump and particle materials (refer to ANNEX 9). They are now fully aware of the necessity and importance of pollution control and have learned the anti-pollution technology. Basic lectures on control of noise pollution, vibration |

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| | and mine entrance will be held in 2007. The indicator is expected to be fulfilled by the completion of the Project. Four guidebooks and 2 manuals, which are not specified within PDM, are being prepared (refer to ANNEX 10). |

**3-3-6 Output 6:** SERNAGEOMIN strengthens its skills for examining pollution from model operating mines.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 6-1 C/P participates in respective lectures and OJT and understands the material by the end of the Project. | A total of 42 C/Ps participated in lectures on Japan's experience in investigation on anti-pollution of mining, mine drainage, tailing dump, particle materials and smoke (refer to ANNEX 9). They understood and learned the contents. A total of 56 C/Ps participated in OJT activities at 19 model mines and acquired the skills to investigate and manage mine pollution. Basic Lectures on control of noise pollution and vibration will be conducted in March, May and June 2007, with which the indicator will be fulfilled. |
| 6-2 C/P can use the designated form for examining pollution from model operating mines. | C/Ps carried out an investigation with E-500 form as an OJT activity and are fully capable of using the form. The indicator will be fulfilled with the completion of above mentioned lectures. In addition, an E-500 investigation manual is being prepared (refer to ANNEX 10). |
| 6-3 C/P can use the equipment necessary to examine mining pollution. | C/Ps are capable of using major equipment, including measuring instruments for PH and distance, and GPS through the investigation with E-500 form. The indicator will be fulfilled with the completion of above mentioned lectures. |

**3-3-7 Output7:** SERNAGEOMIN develops the capacity to evaluate pollution protection plans for model operating, closed and abandoned mines.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 7-1 C/P participates in respective lectures and OJT and understands the material by the end of the Project. | A total of 106 C/Ps participated in lectures and investigations regarding tailing dump, mine drainage, open cut mining, waste dump and particle materials (refer to ANNEX 9). They are now fully aware of the necessity and importance of pollution control and have learned the anti-pollution technology. Basic lectures on control of noise pollution, vibration and mine entrance will be held in 2007. The indicator is expected to be fulfilled by the completion of the Project. |
| 7-2 C/P can make anti-pollution schedules and cost estimation for future closing of model operating mines for training purposes. | A seminar regarding anti-pollution schedules and cost estimation was held in November 2006. The seminar included case studies, which reflects the Chilean current situation. Concrete examples of the case studies included a practical cost estimation of a canal in an existing mine. The |

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|---|---|
| | indicator will be fulfilled with the completion of above mentioned lectures. |
| 7-3 C/P can make plans of pollution control measures and cost estimation for model closed and abandoned mines. | A seminar regarding anti-pollution schedules and cost estimation was held in November 2006. The seminar included above-mentioned case studies, which reflects the Chilean current situation. The indicator will be fulfilled with the completion of above mentioned lectures. |

**3-3-8 Output 8:** SERNAGEOMIN strengthens its capacity for assessing environmental impact.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 8-1 C/P participates in respective lectures and seminars at model sites. | A total of 61 C/Ps has participated in EIA seminar in Santiago and Copiapó. The themes of seminar included soil study and introduction of environmental simulation (refer to ANNEX 9). The guideline of EIA will be prepared by March 2007. The indicator will be fulfilled by the completion of the Project. A manual for EIA, which is not specified within PDM, is being prepared. |

**3-3-9 Output 9:** SERNAGEOMIN improves its chemical analysis and its skills in management of the equipment.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 9-1 C/P participates in training and understands a essential grounding in chemical analysis and management of the equipment. | C/Ps have learned necessary knowledge and skills on chemical analysis concerning environment through lectures (refer to ANNEX 9) and technical instructions as well as those on management of analysis equipment. The indicator has been fulfilled. |
| 9-2 10 analytical standard documents are completed. | 13 standard operating procedures on ICP-MS, AAS, HG, TOC, IC and so forth, have been prepared (refer to ANNEX 11). A few of them are currently revised and will be completed by the end of 2006. The indicator will be fulfilled by the completion of the Project. |
| 9-3 Samples are analyzed within 30 days of delivery from the field. | Although the time for analysis often exceeds more than 30 days, the number of samples analyzed within 30 days increased in 2006 compared to that in 2005. It is worth considering that the number of analysis of water samples turned out to be 500% in 2006 compared to that in 2005, and that samples are getting more complicated to analyze year by year. |
| 9-4 Two (2) chemists are able to operate on one equipment. | Two counterpart personnel are able to operate machineries and equipment (refer to ANNEX 12). The indicator has been fulfilled. |
| 9-5 C/P has sufficient technology, methodology and know-how to analyze liquid samples by July 2004, and solid samples by March 2005. | All the verifiable indicators mentioned-above are fulfilled regarding liquid samples. Technical transfer regarding solid samples will be completed by December 2006 and therefore the indicator will be fulfilled by the completion of the Project. The laboratory has actively been |

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| | working to obtain ISO17025 in terms of liquid analysis and at shortest, it is expected to succeed before the Project completion in June 2007. |

**3-3-10 Output10:** SERNAGEOMIN obtains data analysis technology and results evaluation technology for chemical analysis results.

| Verifiable Indicators | Level of Achievement |
|---|---|
| 10 C/P participates in respective lectures and OJT and understands the material. | The investigation and analysis based on E-400 form have been conducted (refer to ANNEX 9). C/Ps have understood the skills to evaluate the results of analysis. The indicator has been fulfilled. |

## 4. Results of Evaluation

### 4-1 Relevance

Relevance of the Project is considered relatively high for the following reasons.

(1) Relevance to National, Regional and Sectoral Environmental Policies

In Chile, many mines have been improperly closed and abandoned, causing negative impact on environment. In order to avoid such environmental pollution as well as to soundly develop the mining industry, the Chilean government established and revised several government ordinances such as the Basic Environmental Law 19300, Environmental Impact Assessment System (hereinafter, referred to as "SEIA") and the Mine Security Supreme Decree 72 regulating safety management in closing mines. The current government has a stronger political commitment to the environment, taking the establishment of the Ministry of Environment into consideration and the President officially expressed that the Mine Closure Law and the Environmental Remediation of Mining Liabilities (PAM) Law, that are under discussion at the President Office and at Ministry of Mining and Energy respectively, are desirable to be enacted during her administration. In addition, according to an official gazette in 2002, SERNAGEOMIN, in accordance with SEIA, i) assesses DIA and/or EIA, ii) participates, discuss and coordinate at *Environmental Operation Committee,* together with CONAMA and relevant organization/agencies and carries out an environmental investigation based on an investigation plan or an accusation.

International concerns with respect to the protection of the environment also have recently been growing and the Chilean government is expected to meet the increasing international requirements in order to promote FTA with other countries as well as to obtain an OECD membership. According to the concerns, the Chilean government has now an enhanced commitment to environment, which may possibly facilitate investment and entry into the Chile's mine sector by other countries, including

Japan. The Project Purpose, therefore, matches the Chilean national and sectoral policies.

(2) Relevance to Interest of Beneficiaries

As mentioned above, SERNAGEOMIN is expected to carry out mine pollution control based on the SEIA and the Clean Production Agreements with the mining industry. It also assesses and approves mine closure plans that are to be submitted by the year 2009, in accordance with the Mine Safety Supreme Decree. Accordingly, it is expected to have sufficient institutional capacities to deal with this future situation. Necessary capacities include i) collecting information concerning operating, closed and abandoned mines in each region, ii) establishing a database regarding operating, closed and abandoned mines, iii) evaluating and analyzing the situations on operating, closed and abandoned mines, iv) operating and maintaining appropriate machineries and equipment, and v) assessing, analyzing and supervising pollution caused by mine closure in terms of mine safety. The Project directly fulfills these needs and the Project Purpose clearly matches the needs of the beneficiaries.

(3) Relevance to Provided Machinery/Equipment and the Social Needs

SERNAGEOMIN has been receiving increasing number of requests of chemical analysis from universities and private/public bodies. The number jumped up from 1672 in 2002 to 5147 in 2006. The event clearly shows the firm relevance to the machineries and equipment provided by JICA in order to make such analysis and the social needs.

(4) Relevance to Japan's Assistances

JICA specifies "environmental protection" as one of the most important areas in providing technical assistance to Chile, while Japan has advanced technologies of pollution control and chemical analysis as well as has a number of experiences of overcoming pollution caused by mines.

### 4-2 Effectiveness

Effectiveness of the Project is evaluated high for the following reasons.

(1) Fulfillment of Indicators at the Project Purpose Level

It can be said that the Project Purposes have almost been achieved according to verifiable indicators at the Project Purpose level. In general, activities specified in PDM3.0 and PO3.0 have been satisfactorily conducted. With the completion of several Outputs, 5, 6 7, 8 and 9, which have not been completed at the time of the final evaluation, the Project Purposes are expected to fully be achieved before the completion of the Project. The following activities are to be conducted before June 2007 for the completion of the outputs.

1) Output 5: Basic lectures on control of noise pollution, vibration and mine entrance

2) Output 6: Basic lectures on control of noise pollution, vibration and mine entrance

3) Output 7: Basic lectures on control of noise pollution, vibration and mine entrance

4) Output 8: Preparation of the guidebook of EIA

5) Output 9: Completion of standard operation procedures

Technical transfer regarding solid samples

(2) Important Assumptions

There is one important assumption at the Project Purpose level in PDM3.0, which is "The positive policy on the mining problem will be carried out". This assumption is considered to be fulfilled since there have been no negative change concerning mining policy in Chile and as mentioned, the current administration has a stronger commitment to the environment and are discussing the relevant bills, such as the Mine Closure Law and the Environmental Remediation of Mining Liabilities (PAM) Law .

(3) Relations between the Project Purpose and Outputs

All the Outputs are set up in order to achieve the Project Purpose and each of them has directly contributed to the Project progress. The lack of any Output could have held back the achievement level of the Project Purpose.

### 4-3 Efficiency

Evaluation in terms of efficiency is considered relatively high for the following reasons.

(1) Fulfillment of Indicators at Outputs Level

As mentioned in Chapter 3, indicators at the Output level have almost been fulfilled and will be fully fulfilled before the completion of the Project.

(2) Efficiency of Inputs

In general, inputs from the Japanese side were efficiently put into the Project in terms of quality, quantity and timing, although a few machineries for solid sample analysis were provided behind schedule due to time-consuming customs clearance. There was also a delay in arrival of the second chief advisor and a long-term expert in mine safety and environment, compared to the original plan, which caused a cancellation and delay of training courses and investigations in the VIII region. The delay caused postponement of some activities but was successfully adjusted by the efforts made by both Japanese and Chilean sides. It should be noted that the capacity of the laboratory has been strengthened because of the flexible introduction of the technical assistance activities for solid sample

analysis as well as for acquisition of ISO 17025, which were added up into the Project after the Project started. It is also important to mention that local consultants have positively been utilized under the Japanese experts' supervision, which has allowed a preparation of materials and conduction of lectures adapted to Chile's specific situations with less financial resources.

Chilean input is considered satisfactory. C/Ps and budget have generally been allocated as planned. Despite several changes of C/Ps, SERMAGEOMIN has been making every effort for the smooth Project implementation. Japanese experts expressed that the Chilean side has made adequate efforts to provide necessary resources for the Project.

There are some statements that the Project has been producing more significant outcome and enjoying better productivity, compared to similar projects in the neighboring countries. This event indicates greater efficiency of the Project.

(3) Important Assumptions

There are four important assumptions at the Project Purpose level in PDM3.0, i) C/P will be allocated in each specific field appropriately, ii) C/P will continue to work for mining industry and accumulate experience, iii) MM[3] will support the activities of SERNAGEOMIN, iv) The operational cost for the project will be assured appropriately. Basically, it can be said that these important assumptions have been fulfilled.

## 4-4 Impact

Some impacts are observed as follows.

(1) Overall Goal

The progress of the Overall Goals has partly been observed as follows at the time of the Final Evaluation. It should be noted that the following impacts will even be enhanced if the Mine Closure Law and the Environmental Remediation of Mining Liabilities (PAM) Law are established.

1) Regarding Overall Goal 2, SERNAGEOMIN has started evaluating mine closure plans according to the Mine Safety Supreme Decree 72, SEIA and the Clean Production Agreement and already evaluated more than 50 plans, which means the progress of the indicator 2-1 "Situation on the technical activities" has started to be observed. In addition, C/Ps of SERNAGEOMIN have obtained knowledge and skills to investigate model operating mines based on E-500 form, which partly satisfy the indicator 2-2 "situation on the monitoring and evaluation". The knowledge and skills transferred to C/Ps by the Project will more actively be utilized in the near future, since mine-related companies are

[3] Current Ministry of Mining and Energy (MME)

obliged to submit a mine closure plan to SERNAGEOMIN by the year 2009.

2) It can be said that Overall Goal 3 is also making a progress, since SERNAGEOMIN continues to input more information on operating mimes as well as closed and abandoned mines into the database even after the Project completion. SERNAGEOMIN also have an intention to integrate the existing database which is called "SIMIN-OL" into other existing databases in order to develop more comprehensive user-friendly database.

(2) Cooperation with Neighboring Countries

The Project is planning to hold an international conference in March 2007 in order to introduce the fruits produced by the Projects and share the information and knowledge on controls of pollution caused by mining with experts from neighboring countries. SERNAGEOMIN has an intention to conduct South-South cooperation after the Project completion and the seminar can be a beginning for such cooperation, which will surely contribute to the sustainable development in the mining sector in the region. The seminar is also expected to reactivate the discussion over the Mine Closure Law.

### 4-5 Sustainability

Overall sustainability is considered high.

(1) Institutional Sustainability

Institutional sustainability is considered high for the following reasons.

The mining sector is one of the crucial industries in Chile and the Chilean government has accorded high priority to the sound development of the sector as well as the environmental protection. Hence, it is expected that the Chilean government continues to support SERNEGEOMIN's activities. As mentioned, SERNAGEOMIN has already been carrying out its activities both in terms of mine security and environment according to SEIA, the Mine Security Supreme Decree 72 and Clean Production Agreement. It is expected to assess a large number of "mine closure plans" in 2009 and if the Mine Closure Law and the Environmental Remediation of Mining Liabilities (PAM) Law are established, SERNAGEOMIN's activities will drastically increase. In order partly to facilitate the enhanced tasks, SERNAGEOMIN will employ 10 additional personnel in 2007 to assign one personnel in charge of environmental issues at each regional office.

In addition, the director of SERNAGEOMIN stated that the Mine Safety and Environmental Training Center in Copiapó (hereinafter referred to as "the Center"), which had been strengthened by JICA's past cooperation and obtained ISO 9000 required to conduct training courses at national level, in the year 2006, will actively be utilized for both external and internal personnel by using upgraded manuals and trained instructors by the Project.

(2) Technical Sustainability

Technical sustainability is considered high for the following reasons.

Chilean C/Ps have obtained knowledge and skills in order to properly utilize E-400 and E-500 forms for investigations of operating, closed and abandoned mines. Apart from 213 mines already put into SIMIN-OL, SERNAGEOMIN, with its own initiative, continues to investigate mines with E-400 form and 96 closed and abandoned mines and facilities were additionally investigated by December 2006. Provided machinery and equipment has been frequently used and appropriately maintained by C/Ps. The active utilization of local consultants allowed the Japanese experts' knowledge, skills and technologies to be developed into 12 materials adapted to Chile's specific situations. In addition, the chemical laboratory plans to obtain ISO 17025 in the field of water analysis, and if it is successful, knowledge, skills and technologies of international standard will systematically be transferred to relevant personnel.

As mentioned, it should be added that SERNAGEOMIN has been receiving increasing number of requests of chemical analysis from universities and private/public bodies, which is the evidence that SERNAGEOMIN is highly evaluated by external organizations and academies and that its capacity development has been making a significant progress.

(3) Financial Sustainability

Financial sustainability is considered high for the following reasons.

SERNEGEOMIN has obtained official and appropriate budget as a public organization and has covered all operating epenses. It is positive that the budget will be assured because of the importance of the mining sector and as a result of the achievements made in the course of the Project.

## 5. Conclusions

According to the indicators, the Outputs and the Project Purposes are expected to be fulfilled by the completion of the Project. In addition, positive effects, which are discussed in 4-3 Impact, are observed at the Overall Goal. Among a number of factors that contributed to the success of the Project, the commitment of the highly-motivated Chilean counterparts and long-and short-term experts of Japan under the strong ownership of the Chilean side, and the application of the efficient and effective technology transfer methodology are of particular significance. Moreover, the implementation of the Project has been satisfactory from the viewpoint of five evaluation criteria (relevance, effectiveness, efficiency, impact, and sustainability). Therefore, the Project is to be completed in June 2007 as originally planned. Nevertheless, to guarantee the sustainability of the Project in the future, it is

necessary to take every possible measure concerning allocation of the human and financial resources both at SERNAGEOMIN.

Although the Mine Closure Bill, which was expected to be approved at the beginning stage of the Project, has not been approved yet, the Mine Safety Supreme Decree was revised in 2004, and Clean Production Agreement, which is a voluntarily-based agreement with the mining industry, was reached in 2003, thanks to the efforts by the Chilean side. Under the current laws and regulations, SERNAGEOMIN has been conducting the roles of examination, and approval of a mine closure plan, and supervision of executing mine closure, owing to skills and knowledge acquired in the Project. In this regard, it is concluded that the Project Purpose 2 has been attained.

Furthermore, the Mine Closure Bill and the Environmental Remediation of Mining Liabilities (PAM) Law have been currently under discussion as the Bachelet's new administration, established it in March, 2006, expressed its support for the bills, and hence if these two bills are passed in the near future, the Overall Goal will be expected to be attained and the impact of the project will become even bigger.

## 6. Recommendations

(1) Preparation of Manuals and Technical Guides

SERNAGEOMIN has been preparing 11 manuals and technical guides listed in ANNEX 10, which are not specified in PDM, based on the training materials used through seminars and workshops in the Project . They are quite important and useful for SERNAGEOMIN to carry out daily tasks as well as to train new staff. It is highly recommended that SERNAGEOMIN prepare these manuals and technical guides mobilizing regional experienced technical personnel and utilizing materials and information provided by the Japanese experts in order to develop quality and user-friendly documents. These manuals and technical guides will be finalized by the date specified in ANNEX 10 so that the printing cost be covered by the Japanese side.

In addition, making them open to the public is desirable to enhance the knowledge of pollution control for people in the mining sector and help raise the public awareness as well.

(2) Continuation of Investigation of Closed and Abandoned Mines and of Preliminary Risk Evaluation

The database compiled though the Project is regarded indispensable. Investigations of closed and abandoned mines were conducted for 309 mines by December 2006, which is in fact more than the original project target, and it is firmly considered Chilean counterpart personnel have obtained skills for environmental investigation. It is recommended that SERNAGEOMIN have a concrete plan and continue the investigations not only of closed and abandoned mines but also operating mines. In Chile,

the detailed situation surrounding closed and abandoned mines, including potential environmental risk, has not been comprehended and therefore such information is essential as a baseline data in order to elaborate the pollution control measures for those mines. More importantly, such information can be robust tools to justify approval of the above-mentioned bills.

(3) Systems for Personnel Training

The systems for personnel training based on the skills and knowledge obtained though the Project should be established for the purpose of sustainable human resource development, which will, at the same time, further enhance the impacts of the Project. As it is expected that a lot of documents of mine closure plans will be submitted to SERNAGEOMIN sooner or later, based on the revision of the Mine Safety Decree, SERNAGEOMIN will play further roles of examination, approval of a mine closure plan, and supervision of executing the close of mines. It is strongly recommended that SERNAGEOMIN take necessary measures concerning allocation of the human and financial resources, and more importantly the Ministry of Mine and Energy take initiative for SERNAGEOMIN in this matter. It is greatly appreciated that the National Director of SERNAGEOMIN stated that he would positively utilized experienced personnel as a trainer for less-experienced staff.

In this respect, the plan by SERNAGEOMIN i) to strengthen the Center, which is the past project of JICA, for the purpose of the personnel training not only Chileans but also those of neighboring countries, and ii) to make good use of the manuals and technical guides produced in the Project is greatly evaluated. It is worth mentioning that the Center has already obtained ISO 9000 in June 2006, which is accredited with the national training center.

(4) Strengthening of Til-Til Laboratory

The number of chemical analysis requested by internal and external clients has increased by five times as many as that of the previous year. In fact, this phenomenon would be appreciated because it would be the evidence that Til-Til Laboratory is accredited with its trust by external organizations. At the same time, the analysis is becoming more accurate and complicated as well and the laboratory work load is increasing rapidly. It is recommendable that the institutional capacity of the laboratory be examined and strengthened with further efficiency improvement as well as extra staff allocation. It might be a good idea to reconsider and prioritize the type of sample analysis of the laboratory.

It is understood that the progress of obtaining ISO 17025 has been made in due course. It is expected to complete the necessary process to take in a proper and punctual manner before the Project completion.

## 7. Lessons learned

(1) Utilization of Existing Personnel and Institutional Organization and Infrastructure

The Project has been carried out by effectively utilizing the existing institutional organization and infrastructure, without establishing a new facility and employing new personnel. In many cases, a center is newly constructed when a new project starts and frequently such center is not self-sufficient after the completion of the project, as a result of the change of government and national policy, financial difficulty or attrition of newly employed C/Ps. In the case of the Project, sustainability of the laboratory is expected to be very high even after the Project completion and in this sense, the Project would be a good example for other projects. It is highlighted that the approach of capacity development assistance based on the existing counterpart capacity can contribute to the success of the Project in an effective manner.

(2) Importance of Training at Local Sites

The Project, together with lectures in Santiago, has carried out a series of theoretical and practical training (e.g. on-the-job training) by Japanese experts, making the most use of Japanese experience, regarding detailed investigations with E-400 and E-500 forms in each region which has different characteristics. C/Ps (both inspectors and chemists), therefore, are able to directly apply what they have learned by the training into their daily tasks. Consideration on the specific site situations is important in order to have an immediate training effect. This type of teamwork in the field between Japanese experts and Chilean C/Ps has also been effective to obtain a range of "tacit knowledge".

(3) Training and Reference Materials Rooting Local Conditions

Based upon training materials provided by Japanese experts, the Chilean C/Ps has systematized them into training manuals and technical guidebooks as tangible products of the Project. This method is effective in order to generate "explicit knowledge" rooting the local conditions.

These manuals and technical guides can be utilized in the near future for human resource development in SERNAGEOMIN and be used for Chileans in the mining sector by making them open to the public. The approach of putting training materials together for the purpose of sharing knowledge and information among relevant entities, now and in the future, is regarded very important in terms of sustainability of Chilean human resource development.

(4) Time Management for Equipment

It often takes more time than expected to finalize the procurement plan of machinery and equipment and to get them through the customs. Taking it into consideration, it is desirable to make a detailed plan regarding the dispatch of equipment as well as to consider local procurement. An expert should be timely dispatched in accordance with the above-mentioned plan.

ANNEX 1

**Project Design Matrix (PDM) Version 3.0** **Project for Strengthening Institutional Capacity of Mining Environmental Management in the Republic of Chile**

Implementing Agency (Japanese side): JICA(Japan International Cooperation Agency) Implementing Agency (Chilean side): SERNAGEOMIN(National Service of Geology and Mining)

Duration : 2002～2007 (5years)

Target Group : SERNAGEOMIN Target Area : 4 model areas(Antofagasta, Copiapo, Quilpue, Concepcion)

Date of Revised: 24 November 2006

| Narrative Summary | Indicator | Means of Verification | Assumption |
|---|---|---|---|
| Overall Goal<br>1. The Chilean Government prevents mining pollution caused by closed and abandoned mines.<br>2. SERNAGEOMIN gives technical guidance concerning the measures to closing mines.<br>3. SERNAGEOMIN compiles a database on Chilean mines. | 1. Situation on the measures of prevention for mining pollution.<br>2-1. Situation on the technical activities<br>2-2. Situation on the monitoring and evaluation<br>3. Completion of database (Environmental map) | 1. Records on the measure of SERNAGEOMIN and lecture.<br>2. Report of guidance, monitoring and evaluation.<br>3. Records on the database (Environmental map) | a. The Government and Mining Industry will sustain the mining promotion policy. |
| Project Purpose<br>SERNAGEOMIN adds the following functions to its administrative duties:<br>1. SERNAGEOMIN grasps the situation surrounding operating, closed, and abandoned mines. SERNAGEOMIN compiles a database for closed and abandoned mines, including information on potential environmental impacts.<br>2. SERNAGEOMIN has the capacity to evaluate the plan for minimizing and monitoring environmental damage caused by mining, including mine closure. | 1-1.Inspectors of SERNAGEOMIN grasps the realities of operating, closed, and abandoned mines in each region.<br>1-2.Situation on the intensive information<br>2. The C/P's technical level is enhanced to the level that the C/P can monitor and evaluate by themselves. | 1-1.Report of investigation<br>1-2.Records of Data<br>2. Records of monitoring and evaluation | a. The positive policy on the Mining problem will be carried out. |

| | | | |
|---|---|---|---|
| Output<br>1. Various initial input is completed.<br>2. Basic knowledge regarding prevention for Mining pollution is disseminated among inspectors in SERNAGEOMIN.<br>3. Necessary investigation skills for closed and abandoned mines are strengthened in SERNAGEOMIN.<br>4. SERNAGEOMIN has an improved data base system for investigation results.<br>5. SERNAGEOMIN develops the capacity to evaluate technical measures for closing mines.<br>6. SERNAGEOMIN strengthens its skills for examining pollution from model operating mines.<br>7. SERNAGEOMIN develops the capacity to evaluate pollution protection plans for model operating, closed and abandoned mines.<br>8. SERNAGEOMIN strengthens its capacity for assessing environmental impact.<br>9. SERNAGEOMIN improves its chemical analysis and its skills in management of the equipment.<br>10. SERNAGEOMIN obtains data analysis technology and results evaluation technology for chemical analysis results. | 1-1. Counterpart and budget are allocated as planned.<br>1-2. Equipment is being used and maintained well.<br>2. C/P participates in respective lectures and understands the material.<br>3-1. C/P participates in respective lectures and OJT and understands the material.<br>3-2. C/P can investigate using the E-400 form by the end of 2004.<br>3-3. C/P can use necessary equipments for investigating the items on E-400 by the end of 2004.<br>4-1. Modification of Database system is completed.<br>4-2. Investigation results of about 200 mines are accumulated on SIMIN-OL by the end of 2004.<br>5. C/P participates in respective lectures and OJT and understands the material by the end of the Project.<br>6-1. C/P participates in respective lectures and OJT and understands the material by the end of the Project.<br>6-2. C/P can use the designated form for examining pollution from model operating mines.<br>6-3. C/P can use the equipments necessary to examine mining pollution.<br>7-1. C/P participates in respective lectures and OJT and understands the material by the end of the Project.<br>7-2. C/P can make anti-pollution schedules and cost estimation for future closing of model operating mines for training purposes.<br>7-3. C/P can make plans of pollution control measures and cost estimation for model closed and abandoned mines.<br>8. C/P participates in respective lectures and seminars at model sites.<br>9-1. C/P participates in training and understands a essential grounding in chemical analysis and management of the equipment.<br>9-2. 10 analytical standard documents are completed.<br>9-3. Samples are analyzed within 30 days of delivery from the field.<br>9-4. Two (2) chemists are able to operate on one equipment.<br>9-5. C/P has sufficient technology, methodology and know how to analyze liquid samples by July 2004, and solid samples by March 2005.<br>10. C/P participates in respective lectures and OJT and understands the material. | 1-1. Overall personnel allocation chart · Budget plan and actual records on Budget<br>1-2. Records on Maintenance and Management of the equipment.<br>2. Records of lecture, participation, and questionnaire.<br>3-1. Records of lecture, participation, OJT, and questionnaire.<br>3-2. Questionnaire to C/P<br>3-3. Questionnaire to C/P<br>4-1. Chart of Data.<br>4-2. Chart of Data.<br>5. Records of lecture, participation, OJT, and questionnaire.<br>6-1. Records of lecture, participation, OJT, and questionnaire.<br>6-2. Questionnaire to C/P<br>6-3. Questionnaire to C/P<br>7-1. Records of lecture, participation, OJT, and questionnaire.<br>7-2. Questionnaire to C/P<br>8. Records of seminar, participation, and questionnaire at model sites<br>9-1. Records of training<br>9-2. Analytical standard documents<br>9-3. Analytical reports.<br>9-4. Records of training on the specific equipment.<br>9-5. Means of verification 9-1 thru 9-4.<br>10. Records of lecture, participation, OJT, and questionnaire. | a. C/P will be allocated in each specific field appropriately.<br>b. C/P will continue to work for mining industry and accumulate experience<br>c. MM will support the activities of SERNAGEOMIN.<br>d. The operational cost for the project will be assured appropriately.<br><br>*Quantitative Expression of 2, 3, 5, 6, 7, 8, and 10: *"Number of participants in the lecture (seminar) / Number of target counterparts of the lecture (seminar)"*<br>*Quantitative Expression of 4: *"Number of investigation results by E400 / 200"*<br>*The definition of OJT (on-the-job-training) is to transfer technology through their work. As for OJT on pollution prevention on operating mines, it should be assured that C/P is responsible for directly instructing and inquiring on the site. The role of the expert is to assist and advise the C/P in building the capacity to carry out their jobs, and not to directly instruct or inquire the people in charge of the mining sites. |

| Activities | Input | | |
|---|---|---|---|
| | The Japanese Side | The Chilean Side | |
| 1. To allocate necessary counterparts and administrative personnel as planned.<br>2. To present Japanese Mining Law and Regulations concerned with prevention for mining pollution as well as examination and research methods for mining pollution.<br>3. To give instruction in investigative skills for each basic factor, such as tailing dams, as well as on the extent of risks in model closed and abandoned mine sites.<br>4. To prepare the establishment of an improved database system into which investigation results from each mine site will be registered.<br>5. To give instruction in technical measures to be prepared for each basic factor for future closing of the model operating mines.<br>6. To give instruction in examination skills for mining pollution in each basic factor for the model operating mines.<br>7-1. To give instruction in skills for making anti-pollution schedules and evaluation of cost estimations for future closings of model operating mines.<br>7-2. To give instruction in skills for making plans of pollution control measures and evaluation of cost estimations for model closed and abandoned mines.<br>8. To give technical advice on EIA in SERNAGEOMIN.<br>9. To give instruction in skills for chemical analysis, and to improve maintenance skills, highly accurate calibration skills, and sampling (including preparation) skills.<br>10. To establish data analysis and evaluation technology for chemical analysis results. | 1. Expert<br>1-1. Long-term experts<br>Chief Advisor 5years<br>Coordinator 5years<br>Environmental Investigator 5years<br>Mining Safety and Environmental Expert 5years<br>Chemical Analyst 2years<br><br>1-2. Short-term experts will be dispatched in accordance with necessity<br><br>2. Provision of the Equipment<br><br>3. C/P Training<br>1~3 per year | 1. Personnel<br>-Project Director<br>-Deputy Project Director<br>-Project Manager<br>-C/P 42 persons<br><br>2. Building/ Facilities<br>-Project site<br>-Installation of the Machinery and Equipment provisioned by the Japanese side.<br><br>3. Equipment and Materials<br>Necessary Equipment and Materials without provision of the equipment by the Japanese side.<br>Maintenance of equipments.<br><br>4. Local cost<br>Operational Cost for the Project | a. C/P will continue to work for SERNAGEOMIN.<br>b. The positive participation to the project will be acquired.<br>c. Equipment will be delivered smoothly without much delay due to custom clearance and transportation. |
| | | | Pre-condition<br>a. Cooperation between SERNAGEOMIN and regional offices will be maintained appropriately.<br>b. Building, facilities and equipment can be used.<br>c. Related data and information of SERNAGEOMIN will be available. |

ANNEX 2

# PLAN OF OPERATIONS FOR STRENGTHENING INSTITUTIONAL CAPACITY OF MINING ENVIRONMENTAL MANAGEMENT IN REPUBLIC OF CHILE

17/03/2005

| Project Purpose | Output | Activities | Personnel in Charge | | Year of the Project | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | C/P | Japanese Experts | 1st year | 2nd year | 3rd year | 4th year | 5th year |
| 1. SERNAGEOMIN grasps the situation surrounding operating, closed, and abandoned mines. SERNAGEOMIN compiles a database for closed and abandoned mines, including information on potential environmental impacts.<br>2. SERNAGEOMIN has the capacity to evaluate the plan for minimizing and monitoring environmental damage caused by mining, including mine closure. | 1. Various initial imput is completed. | 1 To allocate necessary counterparts and administrative personnel as planned. | All personnel | All personnel | | | | | |
| | 2. Basic knowledge regarding prevention for Mining pollution is disseminated among inspectors in SERNAGEOMIN. | 1 To present Japanese Mining Law and Regulations concerned with prevention for mining pollution as well as examination and research methods for mining pollution. | All personnel | M.S.E. Expert/E. Investigator | | | | | |
| | 3. Necessary investigation skills for closed and abandoned mines are strengthened in the SERNAGEOMIN. | 1 To give instruction in investigative skills for each basic factor, such as tailing dams, as well as on the extent of risks in model closed and abandoned mine sites. | Personnel concerned | Environmental Investigator | | | | | |
| | 4. SERNAGEOMIN has an improved database system for the investigation results. | 1 To prepare the establishment of an improved database system into which investigation results from each mine site will be registered. | Personnel concerned | Information Analyst (Short) | | | | | |
| | 5. SERNAGEOMIN develops the capacity to evaluate technical measures for closing mines. | 1 To give instruction in technical measures to be prepared for each basic factor for future closing of the model operating mines | Personnel concerned | Environmental Investigator | | | | | |
| | 6. SERNAGEOMIN strengthens its skills for examining pollution from model operating mines. | 1 To give instruction in examination skills for mining pollution in each basic factor for the model operating mines. | Personnel concerned | M.S.E. Expert | | | | | |
| | 7. SERNAGEOMIN develops the capacity to evaluate pollution protection plans for model operating, closed and abandoned mines. | 1 To give instruction in skills for making anti-pollution schedules and evaluation of cost estimations for future closings of model operating mines. | Personnel concerned | E.Investigator/M.S.E Expert | | | | | |
| | | 2 To give instruction in skills for making plans of pollution control measures and evaluation of cost estimations for model closed and abandoned mines. | Personnel concerned | E.Investigator/M.S.E Expert | | | | | |
| | 8. SERNAGEOMIN strengthens its capacity for assessing environmental impact. | 1 To give technical advice on EIA in SERNAGEOMIN. | Personnel concerned | E.Investigator/M.S.E Expert | | | | | |
| | 9. SERNAGEOMIN improves its chemical analysis and its skills in management of the equipment. | 1 To give instruction in skills for chemical analysis, and to improve maintenance skills, highly accurate calibration skills, and sampling (including preparation) skills. | Personnel concerned | Chemical Analyst | | | | | |
| | 10. SERNAGEOMIN obtains data analysis technology and results evaluation technology for chemical analysis results. | 1 To establish data analysis and evaluation technology for chemical analysis results. | Personnel concerned | E.Investigator/C.Analyst | | | | | |

N.B. E.Investigator:Environmental Investigator M.S.E. Expert:Mining Safety and Environmental Expert C. Analyst:Chemical Analyst

ANNEX 3

## Dispatch of Japanese Expert

(1) Long-term Expert

| Name | Field of Attendance | Duration |
|---|---|---|
| Toshio Sakasegawa | Chief Advisor | 2002.07.01 – 2004.06.30 |
| Etsuko Ide | Coordinator | 2002.07.01 – 2004.06.30 |
| Takashi Yamashita | Mining Safety and Environmental Expert | 2002.07.01 – 2004.06.30 |
| Susumu Nagae | Environmental Investigator | 2002.07.01 – 2005.06.30 |
| Takayuki Fukuda | Chemical analyst | 2002.09.01 – 2005.03.31 |
| Harushi Kobayashi | Coordinator | 2004.06.15 – 2007.06.30 |
| Kurata Fuchikami | Mining Safety and Environmental Expert | 2004.11.01 – 2007.06.30 |
| Katsutaka Nakamura | Chief Advisor | 2004.11.27 – 2007.06.30 |
| Masahiro Sowanaka | Environmental Investigator | 2005.06.04– 2007.06.03 |

(2) Short-term Expert

| Name | Field of Attendance | Duration |
|---|---|---|
| Norihito Ono | Environmental Simulation of Air | 2004.05.30 – 2004.06.13 |
| Takashi Ooka | GIS Application | 2004.11.01 – 2004.11.15 |
| Kurahiro Ookawa | Management of Tailings Dams | 2005.05.29-2005.06.12 |
| Masamichi Tsuji | Chemical Analysis | 2006.03.20-2006.04.19 |
| Takeyuki Ogata | Chemical Analysis by XRF | 2006.03.30-2006.12.25 |
| Takashi Ooka | GIS | 2006.05.28-2006.06.12 |
| Hisamitsu Ohki | Treatment of Acid Mine Drainage | 2006.09.19-2006.10.01 |
| Masamichi Tsuji | Chemical Analysis | 2006.11.20-2007.02.02 |

ANNEX 4

# Acceptance of Chilean Counterpart Personnel for Training in Japan

| No. | Name | Age | Position | Name of Course | Duration | Note |
|---|---|---|---|---|---|---|
| 1 | Ricardo Enrique TRONCOSO | 53 | National Director | Management of Environment on Closure | 02.10.08-02.10.26 | Resigned |
| 2 | Krugger Manuel MONTALBÁN | 60 | Chief of Engineering and Environmental Management Dpt. | Management of Environment on Closure | 02.10.08-02.10.26 | |
| 3 | Félipe LLONA RODRÍGUES | 46 | Chief of Chemical Laboratory (Til Til) | Chemical analysis | 03.02.28-03.03.23 | |
| 4 | José Domingo GOMEZ | 63 | Regional Director IV | Management of Environment on Closure | 03.10.06-03.11.01 | |
| 5 | René Octavio PALMA | 45 | EMA, Regional II | Management of Environment on Closure | 03.10.06-03.11.01 | Resigned |
| 6 | Oscar LÓPEZ | 38 | Chemical Analyst | Chemical analysis | 03.10.14-03.11.01 | |
| 7 | Pedro Mario ALMONACID | 48 | Regional Director-Zona Central | Inspection of mining pollution and pollution | 04.09.04-04.10.03 | |
| 8 | Roberto PONCE | 62 | Coordinator with German Technical Assistance Project | Inspection of mining pollution and pollution | 04.09.04-04.10.03 | |
| 9 | Hugo Benito CONSTANZO | 58 | Inspector of Mining Safty and Environment | Inspection of mining pollution and pollution | 04.09.04-04.10.03 | |
| 10 | Luis SOUGARRET SEITZ | 64 | National Director | Inspection of mining pollution and pollution | 05.01.14-05.01.30 | |
| 11 | María de la Luz VASQUEZ | 45 | Head Planning-Development, Ministry of Mining | Inspection of mining pollution and pollution | 05.01.14-05.01.30 | |
| 12 | Aida de la Luz ACEVEDO LOPEZ | 54 | EMA, Regional II | Inspection of mining pollution and pollution | 06.9.30-06.10.30 | |
| 13 | Elizabeth Norma CORTES CASANOV | 48 | EMA, Regional III | Inspection of mining pollution and pollution | 06.9.30-06.10.30 | |
| 14 | Polonia Ingrid CABRERA DEL RIO | 26 | EMA, Metropolitan Region | Inspection of mining pollution and pollution | 06.9.30-06.10.30 | |
| 15 | Sergio Andrade | 61 | Regional Director I | Inspection of mining pollution and pollution | 07.9.22-07.10.22 | |
| 16 | Janor CHAVEZ | 49 | Inspector of Mining Safty and Environment | Inspection of mining pollution and pollution | 07.9.22-07.10.22 | |
| 17 | Loreto MORALES | 41 | Chemical Analyst | Chemical analysis | 07.9.22-07.10.22 | |
| | | | | | | |

## Provision of Machinery, Equipment and Materials

ANNEX 5

**A:In Use, B:Not In Use, C:Out of Order**

ZC=Zona Central, ZS=Zona Sur

31/12/2004

| No. | Year | Equipment | Mark and Model | Quantity | Price (US$) | Location | Condition | Reason |
|---|---|---|---|---|---|---|---|---|
| 1 | 2002 | ICP-MS (Printer, CPU, Monitor) | Inductively Coupled Plasma Mass Spectrometer, | 1 | 151.958 | Laboratory | A | |
| 2 | 2002 | Atomic Absorption Spectrometer (Computer, Analyst Burned) | Analyst 700 | 1 | 61.191 | Laboratory | A | |
| 3 | 2002 | Refrigerator | Sanyo Labcool MPR720 N°10303856 | 1 | 4.683 | Laboratory | A | |
| 4 | 2002 | Magnetic Stirrer | SAFE-F SHP-P N°99ATEX124865 | 1 | 2.090 | Laboratory | A | |
| 5 | 2002 | Test Tube Mixer | Maxi Mix I Type 16700 N°268011195105 | 2 | 420 | Laboratory | A | |
| 6 | 2002 | Balance | Electronic Top Loading | 1 | 676 | Laboratory | A | |
| 7 | 2002 | Hot Plate | Corning N°092401228361 | 2 | 680 | Laboratory | A | |
| 8 | 2002 | Mercury Analizer (Computer) | Model DMA-80 | 1 | 24.781 | Laboratory | A | |
| 9 | 2002 | Total Organic Analizer | Model TOC-V | 1 | 48.039 | Laboratory | A | |
| 10 | 2002 | High speed centrifuge | Model 8465 | 1 | 7.204 | Laboratory | A | |
| 11 | 2002 | Oven Lindberg/Blue | Model P-05068-25 | 1 | 2.188 | Laboratory | A | |
| 12 | 2002 | Muffle Furnace | Model 10-550-126 | 1 | 1.992 | Laboratory | A | |
| 13 | 2002 | Mantle Heater | Model 11-474-05 | 6 | 904 | Laboratory | A | |
| 14 | 2002 | Rotary Evaporator (Bath Heater) | Model 78820-01 | 1 | 3.712 | Laboratory | B | |
| 15 | 2002 | Magnetic Stirrer | Model P-51451-45 (524C-2) N°978020319438 | 1 | 964 | Laboratory | A | |
| 16 | 2002 | Ultrasonic Cleaner | Branson 1510, Model P-08890-15, | 1 | 482 | Laboratory | A | |
| 17 | 2002 | Homogenizer | Model 15-338-35P | 1 | 3.394 | Laboratory | A | |
| 18 | 2002 | Electronic precision balance | Model Ax 205 | 1 | 7.777 | Laboratory | A | |
| 19 | 2002 | Vacuun Pump | Model U-35030-5 Cole Parmer | 1 | 1.116 | Laboratory | A | |
| 20 | 2002 | Micropipette | Model 05-402-48 | 3 | 1.006 | Laboratory | A | |
| 21 | 2002 | Micropipette | Model 05-402-50 | 3 | 1.016 | Laboratory | A | |
| 22 | 2002 | Vaccun Pump | Model P-79103-05 N°24561607 | 1 | 1.005 | Laboratory | A | |
| 23 | 2002 | Digital Velocity Meter | Model 3000-1518 Swoffer Instruments Inc.Ben | 1 | 3.471 | ZS | A | |
| 24 | 2002 | Program Timer | Model 06-662-5 | 3 | 187 | Laboratory | A | |
| 25 | 2002 | Kjeldahl Distilling | Model 21285-01 | 2 | 5.192 | Laboratory | A | |
| 26 | 2002 | Glassware Washer | Model 44200-01 | 1 | 7.172 | Laboratory | A | |
| 27 | 2002 | Burette | Model P-07932-02 | 6 | 1.777 | Laboratory | A | |
| 28 | 2002 | Burette | Model P-07932-04 | 3 | 1.250 | Laboratory | A | |
| 29 | 2002 | Burette | Model P-07932-01 | 3 | 905 | Laboratory | A | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 30 | 2002 | Laboratory Cart | Model 80250 | 2 | 801 | Laboratory | A | |
| 31 | 2002 | Multitester | Model P-26830-00 | 1 | 263 | Laboratory | A | |
| 32 | 2002 | Crucible | Model 08-030A | 1 | 675 | Laboratory | A | |
| 33 | 2002 | Reagent Cabinet | Model HM812H8920B | 1 | 1.576 | Laboratory | A | |
| 34 | 2002 | Balance Table | Model HM019945 (Includes a Balance Isolation Platform Cat. U-11500-300) | 1 | 1.446 | Laboratory | A | |
| 35 | 2002 | Heavy Metal Eliminator | Model EF62 (Consumable supplies per one estimated) | 1 | 42.020 | Laboratory | A | |
| 36 | 2002 | Water Softner | Model OWK 20 | 1 | 12.450 | Laboratory | A | |
| 37 | 2002 | Water Purifier System (Water Deionization) | Model WA-570-JX-A | 1 | 23.344 | Laboratory | A | |
| 38 | 2002 | All Terrain Track | Nissan 2002, Terrano Pick Up 4x4 Double Cab DX, VJ-8588-7 and VJ-8589-5 | 2 | 29.040 | II, ZS | A | |
| 39 | 2002 | Software | Office XP Professional | 8 | 5.522 | Informatic | A | |
| 40 | 2002 | Software | Visual Studio 6.0 Professional Edition | 8 | 7.335 | Informatic | A | |
| 41 | 2002 | Software | Arc View | 1 | 2.165 | Informatic | A | |
| 42 | 2002 | Software | Additional License | 7 | 13.629 | Informatic | - | |
| 43 | 2002 | | Installation and training (1 person) | 1 | 3.393 | Informatic | - | Realized |
| 44 | 2002 | Software | ArcInfo | 1 | 18.691 | Informatic | A | |
| 45 | 2002 | Software | Additional License | 1 | 15.889 | Informatic | - | |
| 46 | 2002 | Software | Installation and training (1 person) | 1 | 2.211 | Informatic | - | Realized |
| 47 | 2002 | Software | Fireworks Dreamweaver Ultradev 4 | 1 | 747 | Informatic | A | |
| 48 | 2002 | Software | Oracle 9 Database Enterprise Edition (20 users licenses) including | 1 | 18.887 | Informatic | A | |
| 49 | 2002 | Software (Oracle Internet Application) | Oracle support and Update Services | 1 | 47.219 | Informatic | - | Realized |
| 50 | 2002 | Software | Oracle CD-Packs | 2 | 94 | Informatic | A | |
| 51 | 2002 | | Installation and training (1 person) | 1 | 2.690 | Informatic | - | Realized |
| 52 | 2002 | Sever | IBM p-Series 620 Model 6f1 | 1 | 57.808 | Informatic | A | |
| 53 | 2002 | | Installation and Configuration Server and S.O. AIX 5.1L Service | 1 | 400 | Informatic | - | Realized |
| 54 | 2002 | Personal Computer | Compaq EVO D500,Pentium IV, 2Ghz, 40HD, 256MB, N°6Y27KNBZZ-008 | 2 | 3.378 | Informatic | A | |
| 55 | 2002 | Personal Computer | Compaq EVO D500, PentiumIV, 1.5Ghz,40HD,256MBN°6Y1C | 6 | 6.894 | Informatic, DIGA | A | |
| 56 | 2002 | Monitor | Compaq 17IN TFT 1280x1024 Flat Panel | 8 | 10.760 | Informatic, DIGA | A | |
| 57 | 2002 | American Power UPS Smart 2200 VA | | 2 | 1.882 | Informatic | A | |
| 58 | 2002 | CD-RW Drive | Iomega, 16X/10X/40X External | 2 | 476 | Informatic | A | |
| 59 | 2002 | Video Projector | Epson Power Lite 800P, and Projector Bags | 2 | 9.648 | Informatic, Laboratory | A | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 | 2002 | Projector Case | Epson | 2 | 680 | Informatic, Laboratory | A | |
| 61 | 2002 | Digital Video | Sony Nom-097 | 4 | 4.270 | II, III, ZC, ZS | A | |
| 62 | 2002 | Mobile Computer | Computador Jornada 720, HP N°SG22240042 | 4 | 4.092 | II, III, ZC, ZS | B | |
| 63 | 2002 | Radio Transmiter | Kenwood N°40200098 | 8 | 5.689 | II, III, ZC, ZS | A | |
| 64 | 2002 | GPS Unit | Model MAP 330 | 4 | 1.175 | II, III, ZC, ZS | A | |
| 65 | 2002 | Distance Meter | Model Yardage Pro 100 | 4 | 1.711 | II, III, ZC, ZS | A | |
| 66 | 2002 | Gas Detector | Bacharat, Model 096-2448 N°FV1216 | 4 | 10.117 | II, III, ZC, ZS | B | |
| 67 | 2002 | Altimeter | Model Thomen TX 15 | 4 | 1.233 | II, III, ZC, ZS | A | |
| 68 | 2002 | Measuring Tape | Keson | 4 | 310 | II, III, ZC, ZS | A | |
| 69 | 2002 | Compass | Model KB-14 | 4 | 377 | II, III, ZC, ZS | A | |
| 70 | 2002 | Oxigen Mask | Model 18.999-4943 | 4 | 7.542 | II, III, ZC, ZS | B | |
| 71 | 2002 | Rescue Set | MSA Model 19-026-805 | 4 | 2.230 | II, III, ZC, ZS | B | |
| 72 | 2002 | Water Quality Analizer | Model 2F30-114 | 4 | 5.469 | I, II, III, IV | A | |
| 73 | 2002 | Spectrophotometer | HACH DR/Model DR-890 | 4 | 4.971 | II, III, ZC, ZS | A | |
| 74 | 2002 | Hand Auger (Sediment sampler) | Model P-99026-40 | 4 | 6.985 | II, III, ZC, ZS | B | |
| 75 | 2002 | Mud sampler | Wildco, Model P-05470-00 | 1 | 542 | ZC | B | |
| 76 | 2002 | Water Sampler | Model P-05497-05 | 2 | 1.699 | ZS, ZC | B | |
| 77 | 2002 | Weather Station | Davis Weather, Model P-99800-20 N°MC11127A59 | 1 | 726 | III | A | |
| 78 | 2002 | Water Level Meter | Model Heron | 2 | 1.022 | ZC, ZS | B | |
| 79 | 2003 | Water Quality Analizer | Multi 340i SET-1 WTW | 2 | 6.525 | ZC, ZS | A | |
| 80 | 2003 | GPS Unit | Garmin Model éTrex Venture. Serie 77664538 | 2 | 607 | I, IV | A | |
| 81 | 2003 | Laser Range Finder | Bushnell 1000. Serie 013773 | 2 | 1.754 | I, IV | A | |
| 82 | 2003 | Measuring Tape | Komelon de fibra de vidrio de 100mts. | 2 | 175 | I, IV | A | |
| 83 | 2003 | Compass | Suunto Modelo KB-14360 R Serie 336005 | 2 | 227 | I, IV | A | |
| 84 | 2003 | Altimeter | Thommen Modelos TX-12 6000mts y TX-15 9000mts | 2 | 664 | I, IV | A | |
| 85 | 2003 | Digital Camara | Canon Power Shot A300 Serie N° 6826307998 | 6 | 1.967 | I, II, III, IV ,ZC ,ZS | A | |
| 86 | 2003 | Digital Video | Modelo ZR-65 MC Serie 162673614583 | 2 | 1.911 | I, IV | A | |
| 87 | 2003 | System ultrapure water academic | Academic 250V/50Hz, B3JN43913-A | 2 | 8.350 | Laboratory | A | |
| 88 | 2003 | Hand Auger | Cole Palmer, Cat. P-99026 | 2 | 6.803 | I, IV | B | |
| 89 | 2003 | Radio Transmiter | Kenwood Cat. TH-D7A (c/u con Wall charger BC-17 | 4 | 3.752 | I, IV | A | |
| 90 | 2003 | Mono gas detector | Mono detector gas en aire reciclable BW-GA-X-5, Serie 1203-X11676 | 2 | 1.160 | I, IV | B | |
| 91 | 2003 | Liquid Chromatography | AGILENT serie 1100 | 1 | 53.828 | Laboratory | A | |
| 92 | 2003 | Autosampler | Autosampler | 1 | 22.307 | Laboratory | A | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 93 | 2004 | Leaching test system | Milipore,<br>Rotary agitator system | 1 | 5.907 | Laboratory | A | |
| 94 | 2004 | X-ray fluorescence spectrometer system | PANalytical AXIOS, Press HTP40, Fusion 4M | 1 | 111.700 | Laboratory | A | |
| 95 | 2004 | X-ray diffractometer | PANalytical X'Pert Pro | 1 | 198.540 | Laboratory | A | |
| 96 | 2005 | Stability analysis software | GeoStudio2004 Standard | 1 | 11.900 | DIGA | A | |
| 97 | 2005 | ICSD Data Base | PANalytical | 1 | 18.103 | Laboratory | A | |
| 98 | 2005 | Roller mill | Electro Copper | 1 | 16.558 | Laboratory | A | |
| 99 | 2005 | Vibration Screen | Equilab | 1 | 8.475 | Laboratory | A | |
| 100 | 2005 | Crucible | Willy Mündnich | 1 | 7.707 | Laboratory | A | |
| 101 | 2005 | Tungsten carbide 200 | Rocklab | 2 | 19.378 | Laboratory | A | |
| 102 | 2005 | Personal Computer | HP DC5100MT | 2 | 3.389 | Laboratory | A | |
| 103 | 2005 | Printer | HP deskjet 5440 | 2 | 182 | Laboratory | A | |

ANNEX 6

## Local Cost by the Japanese Side

(Unit:1000 yen)

| | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Operation Cost | 5.550 | 12.053 | 9.248 | 29.273 | 33.721 |

ANNEX 7

Assignment of Counterpart Personnel

(Oct.,2006)

| Region | Personnel | Function | Category | Profession | Part (%) |
|---|---|---|---|---|---|
| I Región | Sergio Andrade | DR | Plant | Civil Engineer | 10 |
| | Eduardo Pérez B. | EMA | Contract | Operation Engineer | 30 |
| | Alberto Bernal | SM | Contract | Operation Engineer | 20 |
| II Región | Jorge Guerra | DR | Plant | Civil Engineer | 10 |
| | Janor Chávez | SM | Contract | Operation Engineer | 20 |
| | Aída Acevedo | EMA | Plant | Chemical Engineer | 30 |
| III Región | Anton Hraste | DR | Plant | Civil Engineer | 10 |
| | Elizabeth Cortés | EMA | Plant | Operation Engineer | 30 |
| | Hernán Araya | SM | Contract | Operation Engineer | 20 |
| | Patricia Rojas | LAB | Contract | Chemical Laboratorista | 10 |
| IV Región | José Gómez | DR | Plant | Civil Engineer | 10 |
| | Vinka Rakela | EMA | Contract | Civil Engineer | 30 |
| | Oscar Toyo | SM | Contract | Operation Engineer | 20 |
| Zona Central | Pedro Almonacid. | DR | Plant | Civil Engineer | 10 |
| | Carlos Arias | EMA | Plant | Civil Engineer | 30 |
| | Gabriel Barraza | SM | Plant | Civil Engineer | 20 |
| | Melquisedec González | SM | Contract | Civil Engineer | 10 |
| Zona Sur | Patricio Leiva | DR | Plant | Operation Engineer | 10 |
| | Hugo Constanzo | EMA | Plant | Operation Engineer | 30 |
| | Héctor Contreras | SM | Contract | Operation Engineer | 10 |
| | Paola Ramírez | EMA | Contract | Geologist | 20 |
| Región Metropolitana | Krugger Montalbán. | Jefe DIGA | Plant | Civil Engineer | 40 |
| | Cecilia Adasme | EMA | Contract | Operation Engineer | 5 |
| | Luis Villena | EMA | Contract | Geologist | 5 |
| | Carlos Correa | EMA | Contract | Civil Engineer | 90 |
| | Roberto Ponce | EMA | Contract | Civil Engineer | 20 |
| | Polonia Cabrera | EMA | Contract | Environmental Engineer | 80 |
| | Exequiel Yanes | Jefe SM | Plant | Civil Engineer | 5 |
| | Nelson Ramírez | SM | Contract | Civil Engineer | 10 |
| | Santiago Pinilla | SM | Contract | Civil Engineer | 5 |
| | Eugenia Fonseca | LAB | Plant | Geologist | 10 |
| | Felipe Llona | LAB | Contract | Msc. Physic | 10 |
| | Oscar López | LAB | Contract | Chemical Analyst | 70 |
| | Leonora Romo | INF | Contract | Operation Engineer | 10 |
| | Gonzalo Palet | INF | Contract | Math. and Comp. Lic. | 10 |
| | Loreto Morales | LAB | Contract | Quim. Laboratorista | 20 |

Total contrapartes: 36

DR: Regional Director (支局長)
DIGA: Engineering and Environment Management Department (環境管理技術部)
EMA: Encargado Medio Ambiente(環境担当)
SM: Mining Safety(鉱山保安)
CAP: Training Center(研修センター)
LAB: Laboratory(ラボラトリー)
INF: Informatic(情報部)

ANNEX 8

## OPERATION COST BY THE CHILEAN SIDE

Estimate of Chilean Budgetary Contribution during 7 years of the Execution of the Project with specifications of the cost articles.

### LOCAL LIST IN CHARGE OF CHILEAN PART

**M$ (Thousand pesos)**

| YEAR | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| PERSONNEL EXPENSES | | | | | | | | | |
| PERSONNEL INCOME | 25.250 | 75.720 | 75.720 | 75.720 | 75.720 | 132.515 | 110.429 | 120.000 | 691.074 |
| HONORAR. FEE | 74.944 | 66.741 | 74.944 | 74.944 | 74.944 | 0 | 0 | 0 | 366.517 |
| TRAVEL EXPENSES | 6.061 | 8.000 | 9.000 | 10.000 | 8.000 | 5.362 | 3.237 | 5.000 | 54.660 |
| SUB- TOTAL | **106.255** | **150.461** | **159.664** | **160.664** | **158.664** | **137.877** | **113.666** | **125.000** | **1.112.251** |
| OPERATION EXPENSES | | | | | | | | | |
| TRAVEL TICKETS, FUEL, OIL AND LUBRICANTS | 3.000 | 3.500 | 5.000 | 5.500 | 6.300 | 10.206 | 7.257 | 4.000 | 44.763 |
| CURRENT MATERIALS | 1.134 | 1.500 | 2.034 | 1.734 | 1.735 | 2.957 | 2.334 | 1.700 | 15.128 |
| MAINTENANCE AND REPAIR | 0 | 700 | 1.000 | 1.000 | 1.000 | 2.643 | 1.431 | 5.000 | 12.774 |
| LABORATORY CERTIFCATION | 0 | 0 | 0 | 0 | 0 | 14.763 | 6.497 | 3.000 | 24.260 |
| SUB-TOTAL | **4.134** | **5.700** | **8.034** | **8.234** | **9.035** | **30.569** | **17.519** | **13.700** | **96.925** |
| INVESTMENT | 2.000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.000 |
| SUB-TOTAL | **2.000** | **0** | **0** | **0** | **0** | **0** | **0** | | **2.000** |
| **TOTAL** | **112.389** | **156.161** | **167.698** | **168.898** | **167.699** | **168.446** | **131.185** | **138.700** | **1.211.176** |

**Note**: Information indicated for 2006 considers expenditures until 30 October 2006.

ANNEX 9

List of Lectures/Seminars

| Output | Title of Lecture/Seminar | Date and Venue |
|---|---|---|
| 2 | Seguridad Minera en Japón | Ⅲ Region, Oct.2002<br>ZC, Nov.2002<br>ZS, Mar, Apr.2005 |
| | Concepto del Sistema Legal sobre la Prevención de la Contaminación Minera y Reglamento de Seguridad Minera | |
| | Inspección sobre la Prevención de la Contaminación Minera en Japón | |
| | Fundamentos del Impacto Ambiental Minero | |
| | Casos Reales de Contaminación Minera de Japón | |
| | Casos Reales de Investigación sobre Contaminación Minera en Japón | |
| | Revisión de E-400 | |
| | Antecedentes históricos del problema de contaminación minera en Japón | Ⅲ Region, Sep.2003-May2004<br>Ⅳ Region, Sep.2003-May2004<br>V region, Apr-Jul.2003<br>ZS, Mar-Apr. 2005 |
| | Surgimiento de problemas de contaminación minera en minas cerradas y abandonadas | |
| | Resumen del sistema legal del problema de contaminación minera | |
| | Resumen del régimen subsidiario en la obra de prevención de contaminación minera | |
| | Resumen de la promoción de la tecnología de prevención de contaminación minera | |
| | Resumen de la Ley de Medidas especiales contra la Contaminación Minera en Minas Metálicas | |
| | Orientación por el Estado en el cierre de minas | |
| 3 | Necesidades y Objetivos de la Investigación | Ⅰ region, Jul-Dec.2004<br>Ⅱ region, Jul-Dec.2004<br>Ⅲ Region, Sep.2003-May2004<br>Ⅳ Region, Sep.2003-May2004<br>ZC, Apr-Jul.2003<br>ZS, Mar-Apr. 2005 |
| | Impacto Ambiental en Faenas Mineras Pasivas | |
| | Análisis de Riesgo del E-400d | |
| | Sistema de Posicionamiento Global | |
| | Investigación de Calidad del Agua | |
| | Muestreo de Sólidos | |
| | Presentación del Resultado de la Investigación del E-400 | |
| | Trabajo en Terreno (OJT) | |
| 4 | Satellite image analysis with using ASTER data (PART 1A･B) | Santiago, Nov.2004<br>Santiago, May-Jun.2006 |
| | PRACTICE WORK (Satellite image analysis) | |
| | WEIGHT OF EVIDENCE MODEL (WOE) | |
| | Practice Mineral Potential Mapping with GIS | |
| 5, 7 | Conceptos Básicos sobre Análisis de Estabilidad de Talud | 【Seminario de Tranque de Relaves】<br>Ⅳ Region, June,2005<br>Santiago, Jul.2005 |
| | Principales Tipos de Depósitos en Japón | |
| | Caso de desastre de Tranque | |
| | Mina Toyoha : Idea General del Tranque de estériles de Oshidorizawa | |
| | Seguridad Minera en Japón | |
| | Verificación de la notificación del depósito (Inspección) | |
| | Reglamentación de materiales particulados en Japón | |
| | Investigación y Medidas | |
| | Metodos de Investigación Geotecnica | |
| | Aplicación D.S.No86 "Reglamento de Construcción y Operación de Tranques de Relaves | |
| | Canales de Drenaje | |
| | Resultados del Análisis de Suelos | |
| | Resultados del Análisis de estabilidad Tranque de Relaves Quiroga | |
| | Introducción a Métodos de Cierre Definitivo de Depósitos de Relaves | |
| | Diseño Básico (Cálculo del caudal de desagüe y diseño de la disposición de canales de desagüe por un método simplificado) | |
| | Estudio del Sitio, Diseño Básico Mina Rajo Abierto<br>(Contenido)<br>- Reconocimiento del Terreno<br>- Patrón Estructural<br>- Factores Influyentes en la Estabilidad de un Talud<br>- Análisis de Estabilidad<br>- Estudio de Estabilidad Mina San Sebastián<br>- Estabilización de un Talud Remanente (Medidas) | 【Seminario de Mina de Rajo Abierto】<br>Ⅲ region, Sep.2005 |
| | Estudio del Sitio, Diseño Básico Mina Rajo Abierto - Taller -<br>(Contenido)<br>- Proyección Estereografía Red de Schmidt<br>- Práctica de Diseño (Diseño por un Método Simple y Diseño del Plano) | |

| | | |
|---|---|---|
| | Monitoreo de la Calidad del Agua y Medición de Caudal | ZS, Sep.2005 |
| | Predicción del Drenaje Ácido en Mina | 【Seminario de Depósito de Residuos Mineros】 Santiago, Oct.2005 |
| | Lixiviación Bacteriana | |
| | Estabilidad Física | |
| | Medidas de Control para los problemas de Residuos Mineros | |
| | Estabilidad Física -Taller- | 【Seminario de Depósito de Residuos Mineros】 Santiago, Nov.2005 |
| | Modulo de Deformación de Suelos-Deformaciones Cíclicas | |
| | Canales de Drenaje | |
| | Prácticas Asociadas a gestión de Efluentes Etapa de Cierre | |
| | Estimación de Costo de Cierre de Mina | |
| | Fundamento de la investigación del sistema de agua | 【Seminario de Tratamiento de DAM】 I region, Apr.2006 |
| | Medición de caudal | |
| | Medición de la Velocidad de Flujo de Agua en Colico Sur, Curanilahue | |
| | Ordenamiento y Expresión de Resultados de una Investigación | |
| | Resultados de la Investigación en Colico Sur | |
| | Medidas para drenaje Ácido de Minas | 【Seminario de Tratamiento de DAM】 Santiago, Oct.2006 |
| | Neutralización, Separación por Sedimentación y Disposición de Lodos | |
| | Tratamiento Avanzado | |
| | Tratamiento de Aguas Residuales con Contenido de Sustancias Nocivas | |
| | Metodología de Muestreo de Drenaje Ácido de Minas | |
| | Fundamentos sobre Tratamiento de Drenaje Ácido de Minas | |
| | Diseño Básico de Sistema de Neutralización para Drenaje Ácido de Minas | |
| | Diseño Básico del Sistema – Separación de Sólido / Líquido | |
| | Método de Medición de Polvo en el Aire | 【Curso del Monitoreo de Polvo】 Santiago, Nov.2006 |
| | Análisis de Medición de Polvo | |
| | La Erosión Eólica y Medidas de Mitigación, Caso Ojancos | |
| | Metodología de Estimación de Costos | 【Curso de Estimación de Costo de Contramedidas】 Santiago, Nov.2006 |
| | Estimación de Recursos de Ingeniería | |
| | Aplicación Práctica en Depósitos de Relave | |
| | Manejo de Aguas en Minería | |
| | Depósito de Lastre Donoso-Los Bronces | |
| | Competencias del SERNAGEOMIN en la Evaluación Ambiental de Proyectos | 【Curso de Guía Metodológica para la Evaluación de EIAs y DIAs】 Santiago, Nov.2006 |
| | Contenidos de la Guía | |
| | | |
| | | |
| 6 | (Primer ciclo) | I Region Aug. 2005 |
| | E-500, Formulario de Investigación de Faenas Activas | II Region, Aug. 2005 |
| | Inspección y fiscalización para la prevención de contaminación minera en Japón | III Region, July, 2005 |
| | Puntos de control (Check point) de inspección (DAM) | IV Region, Oct. 2005 |
| | Inspección para la prevención de contaminación minera en Japón (DAM) | ZC, May-Nov. 2005 |
| | | ZS, Nov. 2005 |
| | (Taller en Iquique)<br>Estabilización de depósitos<br>Tecnología básica para la inspección de polvo<br>Prevención de contaminación por humo de minas | I Region,<br>April, 2006 |
| | Método de monitoreo de concentración y cantidad de polvo en el aire | III region, June, 2006 |
| 8 | Estudio de Suelos | ZC, June, 2004 |
| | Hidrología e Hidrología | III Region, June, 2004 |
| | Predicción y Prevención Drenaje Ácido Minero | |
| | Introducción a la Simulación Ambiental | |
| | Modelamiento de Agua | |
| | Modelamiento de Aire | |
| | Control de la Contaminación Atmosférica en Japón | |
| 9 | Contaminación Ambiental en Japón y JIS | Til-Til Lab., Nov.2002 |
| | Contaminación Ambiental e ICP-MS | Til-Til Lab., Nov.2002 |
| | Contaminación Ambiental en Japón y Análisis Químico | Til-Til Lab., Mar.2003 |
| | Normas Medioambientales de Chile y Japón – Métodos de Análisis | Til-Til Lab., July 2003 |
| | Método 200.8 de EPA<br>– Determinación de elementos trazas en agua y residuos por ICP-MS | Til-Til Laboratory<br>July 2003 |

| | | |
|---|---|---|
| | Determinación de Mercurio en Sólidos y Soluciones por Termo- descomposición, Amalgamación y Espectrometría de Absorción Atómica | Til-Til Lab., Nov.2003 |
| | Contaminación Ambiental Minera y Análisis Químico | Copiapó, Nov. 2003 |
| | Cromatografía: Objetivo, Principios, Optimización, Detección Específica | Til-Til Lab., Mar.2004 |
| | Contaminación Ambiental de Suelo y Análisis Químico | Copiapó, Nov. 2004 |
| | TOC | Til-Til Lab., Dic. 2004 |
| | ICP-MS, AA, Hg, TOC, LC | Til-Til Lab., Feb. 2005 |
| | Curso de Fluorescencia de Rayos X | Til-Til Lab. Feb. 2005 |
| | Contaminación del Mercurio en el Área de Fiebre de Oro | Til-Til Lab. April 2006 |
| 10 | Fundamentals del Análisis Químico | III Region, Sep. 2004 |
| | Tratamiento y Evaluación de Datos del Análisis Químico | IV Region, Sep, 2004 |
| | Revisión de la evaluación por el resultados del Análisis Químico (OJT) | ZC, Feb, 2005 |

ANNEX 10

List of Manuals and Guidebooks
Lista de Manuales y Guías a ser elaborados

| N° | Nombre de Manual o Guía (Names of Manuals and Guides) | Fecha de Cierre de Entrega de Borrador por la Parte Japonesa (Delivery Deadline by the Japanses Side) | Fecha de Cierre de Entrega de Borrador Revisado y Diseño Gráfico Final por SERNAGEOMIN (Delivery Deadline of Reviewed Draft with Finalized Grafic Design by the Chilean Side) |
|---|---|---|---|
| 1 | Manual de Investigación E-400 | Entregado | 10 de marzo de 2007 |
| 2 | Manual de Investigación E-500 | Entregado | 10 de marzo de 2007 |
| 3 | Guía de Contramedidas "Tranque de Relaves" | Entregado | 10 de marzo de 2007 |
| 4 | Guía de Contramedidas "Mina de Rajo Abierto" | Entregado | 10 de marzo de 2007 |
| 5 | Guía de Contramedidas "Depósito de Residuos Mineros" | Entregado | 10 de marzo de 2007 |
| 6 | Guía Metodológica para la Evaluación de EIAs y DIAs | 31 de diciembre de 2006 | 10 de marzo de 2007 |
| 7 | Informe Externo sobre el resultado de la Investigación E-400 | Entregado | 10 de marzo de 2007 |
| 8 | Manual para el Monitoreo de Polvo | 31 de enero de 2007 | 10 de mayo de 2007 |
| 9 | Manual para la Investigación del Sistema de Agua | 31 de enero de 2007 | 10 de mayo de 2007 |
| 10 | Guía de Contramedidas "Tratamiento de Drenaje Ácido de Minas" | 28 de febrero de 2007 | 10 de mayo de 2007 |
| 11 | Guía Metodológica para la Revisión de Planes y Proyectos de Cierre de Faenas e Instalaciones M | 31 de marzo de 2007 | 10 de mayo de 2007 |

ANNEX 11

List of Standard Operating Procedures

1. Determinación de la conductividad
2. Determinación de pH
3. Análisis de alcalinidad
4. Análisis de cationes (AAS)
5. Análisis de aniones (CI)
6. Análisis de elementos trazas en aguas (ICP-MS)
7. Análisis de mercurio (Analizador de mercurio)
8. Análisis de trazas en rocas (ICP-OES)
9. Análisis por espectrometría UV (cianuro y fósforo)
10. Análisis de carbono orgánico total (TOC)
11. Test de lixiviación (TCLP)
12. Difracción de rayos X
13. Fluorescencia de rayos X

ANNEX 12

List of C/Ps Responsible for each Equipment

Lista de encargads de cada eqguipo

| Equipos | Encargados | |
|---|---|---|
| ICP-MS | F. Llona | O. Lopez |
| AAS | F. Llona | A. Riquelme |
| HG | F. Llona | L. Morales |
| TOC | F. Llona | J. Vasquez |
| LC | F. Llona | O. Lopez |