３．評価調査結果要約表（英文）

Summary

I. Outline of the Project

The outlines of the Project phase II are shown in the following Table.

Country：The Republic of Bolivia		**Project title**：Mining Environment Research Center Project（CIMA project）
Issue/Sector：Mining Industry		**Cooperation scheme**：Technical Cooperation Project
Division in charge： Environmental Management Division II **Dept. Division** Global Environment Department,		**Total cost**： **Japanese side**： 1,046,024,000 yen **Bolivian side**： 3,088,583Bs
Period of Cooperation	（M/M June 11, 2007） Period： July 1, 2007～June 30, 2009	**Partner Country's Implementing Organizations**： Department of Natural Resources and the Environment, Prefecture of Potosí Autonomous University of Tomas Frias • **Supporting committee**： Ministry of Mining and Metallurgy （MMH）, Ministry of Rural Development, Agriculture and Livestock and Environment （MIDRANMA）, Ministry of Water Resources （MWR）、 Vice-ministry of Public Investment and External Financing （VIPFE）

1.1 Background of the Project

Mining has been one of Bolivia's major industries since it was governed by Spain. Until now the focus has been solely on development of natural resources with almost no attention given to the prevention of pollutants discharged to the environment through mining activities. In recent years, washouts from tailing dams have caused pollution of the Pilcomayo River, instigating international disputes with its downstream neighbor Argentina, which has called attention to the pollution of the environment. In September 1999 JICA development study entitled "Evaluation Study of the Mining Sector's Pollution of the Environment in Potosi Prefecture" examined mining's environmental impact in Potosi Prefecture, revealing that the water pollution was severe.

In these conditions, the Bolivian government realized the importance of establishing the "Mining Environmental Research Center" （CIMA, Centro de Investigación Minero Ambiental） to conduct study and research on both technology and policies, and to disseminate these research results in order to implement measures to prevent pollution caused by mining in Potosi and throughout Bolivia. Thus, the Bolivian government requested the Japanese government a project-type technical cooperation, and the "Mining Environment Research Center Project", the Project phase I, was carried out from July 2002 to June 2007.

The output 1, "The organization of the center is established" and the output 3, "Environmental chemical analysis technology is acquired by the C/Ps" were found to be not accomplished during the Project phase I at the final evaluation study conducted on February 2007. Thus, the Project phase II was conducted to complete the remaining part of technical guidance from July 2007 to June 2009.

1.2 Project Overview

（1） Overall Goal

In the valley of the Pilcomayo River, environmental administrators, mining operators and communities promote the activities for the prevention of the water pollution caused by the mining industry.

（2） Project Purpose

Monitoring activities on water pollution caused by mining operations in Potosi, the implementation basis of research and technology for the pollution control is established in CIMA, and these outputs are reflected on Potosi administration.

（3） Outputs

The phase II aims at achieving the outputs 1 and 3. Additionally, other outputs completed at the phase I will be briefly reviewed.

Output 1： The organization of the center is established.
Output 2： Facilities and equipments necessary for he activities of the Center are introduced and maintained properly.
Output 3： Environmental chemical analysis technology is acquired by the C/Ps.
Output 4： Environmental chemical analysis technology is acquired by the C/Ps.
Output 5： Wastewater treatment technology is acquired by the C/Ps.
Output 6： Environment regulation guideline for mining industries in Potosi is proposed.
Output 7： Technology for mineral processing productivity is proposed.
Output 8： Public relations and education for environmental conservation targeted Potosi people who work for mining, concentration and the people related to the mining activity are conducted.

（4） Inputs

Japanese side at the terminal evaluation study：

Short-term Experts：	4
Equipments：	None
Trainees received at the Third Country：	2 （Chile）
Local cost：	¥5,464,000
Materials and chemicals：	¥2,554,000

Bolivian Side：

Counterpart	16
Local Cost （ from July 2007 to December 2008 ）	3,088,583Bs
Laboratory Space and Infrastructure	

II. Members of Evaluation Team

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Period of Evaluation		23/2/2009 ～ 14/3/2009	Type of Evaluation： Terminal Evaluation

III. Outlines of Evaluation Results

3.1. Project Performance

（1） The indicators of the Overall Goal have been partially fulfilled as shown in the following table.

Indicators of Overall Goal	Level of Achievement
1. Administration of water pollution	1. Laguna Pampa tail dam has been constructed and properly operated on

prevention is fortified in Potosi.	a basis of the environmental law No. 1333 under the administrative control of MMH. 2. CIMA has provided chemical analysis services responding to the request by the activities of EU project APEMIN2 and AAPOS in Potosi. Furthermore, it can respond to monitoring requests by Potosi Prefecture DRNMA and other administrative institutions. 3. Potosi prefecture newly started the water quality monitoring for environmental effects by mining activities in the Potosi Prefecture.
2. The water pollutants from mining activities are reduced.	1. Reduction of pollution level in the Pilcomayo River has been corroborated by chemical monitoring of CIMA itself. As a result, the river water can be used for agricultural purpose or irrigation use. 2. Claims by inhabitants on mining pollution have ceased after commencement of the phase II. 3. Further improvement of water quality can be expected by strengthening of environmental monitoring conducted by the administrative authority.
3. Community people become more environmentally conscious and pay enough attention to the prevention of the mining pollution.	1. Increase in consciousness of the community people to the environmental pollution can be clearly indicated by frequent seminars, visit to the CIMA project site, and publicity by mass media and local newspapers. 2. Community people attend the open seminar held by the CIMA project, indicating their increase in consciousness for the mining pollution and environmental water pollution.

(2) The indicators of the Project Purpose

The following Table shows the positive effects.

Indicators of Project Purpose	Level of Achievement
1. Monitoring and analysis of water pollution in Pilcomayo River are implemented.	The following chemical analysis techniques for monitoring and analyzing water pollution of the Pilcomayo River have been aquired by C/Ps, and nearly achieved the Project Purpose. 1. Heavy metal analysis of environmental water samples and analysis of highly concentrated ion samples have been already implemented by C/Ps themselves. 2. Seven techniques for chemical analysis are used to analyze for environmental monitoring by CIMA and chemical analysis services of Potosi Prefecture. 3. Transfer of chemical analysis techniques will be completed about analyses of laboratory waste solutions treated, soil wastes, and life-relevant wastes.
3. The administration sector considers results of the monitoring and research as feedback.	1. Environmental monitoring data by the CIMA laboratory are sent twice a year to the DRNMA on a regular basis. 2. Activity results of the Center are presented and introduced in national meetings and seminars held by administrative institutions and academic society. Thus the CIMA project has been well known among various societies. 3. Periodical inspection by the CIMA is carried out for tail dam. In case of violation, the DRNMA will take action for administrative management.
4. Environmental education and publicity on the prevention of the water pollution are promoted.	1. Technical information of the Project is presented on the Web site revised： http：//www.jica-cima.org.bo/ 2. Activities of the CIMA project are widely disseminated through news report of mass media such as local TV and news papers. 3. The C/Ps presented their professional knowledge in various seminars which they planned and managed.

(3) The indicators of the Outputs

The indicators of the outputs are shown in the following Table.

Indicators of Outputs	Level of Achievements

1.1Administrative personnel are staffed continuously within project periods.	・One personnel dealing with procurement of materials and administrative management of the Center is continuously assigned.
1.2 Counterparts（C/Ps） to transfer technology are assigned.	・Change in number of personnel is minimal or only one in the field of environmental monitoring and wastewater treatment to keep work environment stable. ・Seven persons are assigned in chemical analysis filed at present although it changes greatly. ・ Retirement of well-trained C/P posed an obstacle for laboratory management and maintaining the level of skills.
1.3 Operational Project budget is carried out.	・The execution rate to the approved amount stays around 55% and moreover the execution is often much delayed, though the budget plan is decided annually.
1.4 Joint Coordinating Committee hold once a year with VMARNDF and related organizations.	・ The JCC was held more than once a year on an average.
1.5 Institutional development plan is drawn out within 4 years.	・Documents of institutional development plan was not prepared within four years from the commencement of the Project phase I or 2006. ・Agreement was made to prepare the institutional development plan by December 2008 between JICA and CIMA under the JICA administrative guidance, but the document was not prepared within this period. Preparation was much delayed to March 10, 2009, when the documents for the institutional development plan were submitted to the JICA.
1.6 Monitoring of technical transfer is made continuously.	・Monitoring of technical transfer has been carried out twice a year in three fields of environmental monitoring, liquid waste treatment, and chemical analysis by checking documents reported by the C/Ps.
3.1 Chemical analysis equipment is installed systematically	・Repair work to expand laboratory space （ca. 400m^2） and partition work to separate the pretreatment room from chemical analysis room have been completed to properly set up the analytical equipments. ・Another space-expansion work （ca. 160m^2） is planned to use for gas chromatography equipment and microbiological analysis. ・All instrumental and manual analytical equipments are ready to use for chemical analysis of environmental, discharge and drinking water standards with high reliability. ・Treatment equipment for laboratory test waste liquids was set up to treat laboratory waste solutions once a month.
3.2 Technical basic knowledge for chemical analysis is acquired.	・C/Ps who received technical training have learned steadily and can guide their subordinates ・Two persons receive training for operation of one analytical equipment to maintain the level of analytical performance of the CIMA laboratory. ・By the technical guidance of the Japanese experts, the technical transfer and training of analytical skills in the following fields was completed：1） toxic materials in highly concentrated waste solutions, 2） heavy metals, 3） treatment of laboratory test waste solution, 4） soil waste analysis and evaluation.

3.2 Summary of Evaluation Results

（1） Relevance

The Moralez administration, which came into power in January 2006, announced its PGDES （Plan General de Desarrollo Economico y Social） which aims to “improve the Living Conditions” of Bolivians. Since the strengthening of environmental management capabilities is a universal issue, to support the country’s sustainable development, it is possible to interpret that this Project purpose is one of the cross-cutting issue to support this large objective. At the terminal evaluation study, the CIMA has not been authorized clearly on the administrative legal framework. The document for the process of legal authorization of CIMA as the new IBIMA has been prepared under collaborative work by the Potosi Prefecture, UATF and CIMA. The process has just started for authorization. After authorization, the IBIMA takes part in environmental management

coming from the mining activities. Japan has the sufficient knowledge in the field of mining pollution technology and hence superiority for technology transfer through the technical cooperation. The Potosi prefecture and UATF are an executing administration for environmental protection and R&D institution, and suitable for providing the environmental information with the scientific basis （relevance to the target group）. Recently request of environmental sample analysis increases steeply. Thus, the relevance to the social needs is also high.

（2） Effectiveness

Irrespective of limited period for technical guidance and delay of materials requisite for chemical analyses, indicators for the project purpose listed on the PDM2.0 have been nearly achieved within the period of the Project, and hence the effectiveness is relatively high. Also the output 3 “Environmental chemical analysis technology is acquired by the C/Ps” has been attained. However, the output 1 “The organization of the center is established” has not been attained at the moment of this terminal evaluation study. The documents of institutional development plan have been prepared for legal approval as the new body IBIMA and now underway to official processing. Based on the reliable chemical analysis techniques, monitoring of mining pollution and their data analysis （indicator 1）, development of effective concentration technology and waste water treatment （indicator 2）, feedback of the environmental monitoring data to the administrative sector （indicator 3）, and environmental education and publicity （indicator 4） have been achieved nearly. C/Ps prepare SOP and other documents for the laboratory management system, ISO17025. Then, the project purpose will be fulfilled, and the IBIMA will have systems for securing human resources and their own budget.

（3） Efficiency

Materials and reagents were not sufficiently or timely supplied due to much delay of the execution of the local cost by the Bolivian side. Retirement of the C/Ps often happened, causing another delay of the technical transfer and guidance by the Japanese experts. The execution rate of the local cost also stay still low. Irrespective of such delay, the outputs 1 and 3 have been almost accomplished by a relatively low input, although adjustment of the laboratory infrastructure to set up analytical equipments was delayed.

The outputs of this project are achieved as follows.

Output 1： The act draft for the new IBIMA with three documents indicating legal, technical, and financial bases has been prepared and submitted to JICA on March 10, 2009. These were agreed and signed for legal approval among the relevant institutions.

Output 3： Up to now 69 analytes can be treated by C/Ps. This covers almost all items listed on the Bolivian environmental law, including drinking water standard, environmental standard, and discharge standard. The number of samples analyzed steeply increased to 752 for one year of 2008 with 11,454 analytes. The 16 SOPs and 19 instrumental manuals have been prepared. These activities are forwarded to approval of ISO17025. The positive effect of the achievement of the output 3 is expanded to other outputs. The CIMA laboratory takes part in the conceptual and designs for treatment facility of acidic waste water of minings in Potosi （output 5）. Thus, the efficiency is relatively high.

（4） Impact

Though the administrative concrete product, e.g., closing law for mine, have not been reported hitherto, Potosi Prefecture and MMH are more stringent for the environmental pollution from the mining activities on a basis of scientific monitoring data collected by the CIMA, though the impact does not appear clearly in the administrative level （indicator 1）. Scientifically correct information and accurate data about the mining pollutions are prevailing among the community people, University people, inhabitants in the Pilcomayo river basin and miners through technical seminars and local mass media of news paper and TV. This also stimulates the research activity of the University, leading to improvement of the curriculum （indicator 3）. The CIMA project is expected to directly contribute to decrease in the mining pollution by participating in designing the equipment of acidic discharge treatment （indicator 2）. Project needs for chemical analyses and environmental monitoring have much increased along with concern to the mining pollution than ever. It is exemplified by increase in request number of sample analysis. Thus, the impact to the overall goal appears and relatively high.

（5） Sustainability

Several aspects of the new IBIMA have been evaluated for sustainability. To establish the sustainability of the new body IBIMA, the following several requirements need to be overcome after its legal approval which will be judged by the Chamber within a few months. They are 1） technical, 2） financial, 3） operational managements and 4） human resources. Technical basis established hitherto in the CIMA laboratory has been established, and hence can be utilized to provide chemical analysis service for improving the IBIMA budget. Recently the need for chemical analysis services is increasing in the mining sector, indicating a good sign for benefit by laboratory service. The IBIMA needs to be collaboratively managed by the Potosi Prefecture and UATF, and hence their close collaboration is a key issue for sound management of the IBIMA. Human resources are managed by the Potosi Prefecture and technology management will be carried out by the University. IBIMA will deal with two roles of laboratory, routine work such as the environmental monitoring and non-routine work such as experimental study of treatment of acidic waste solution. When these will be expected to carry out collaboratively by two organizations, the sustainability will be maintained in the above-mentioned aspects.

3.3 Factors promoting sustainability and impact

（1） Factors concerning to Planning

- Appropriateness of the subjects selected for technology transfer to C/Ps

The Potosi Prefecture regards the pollution of the Pilcomayo river water as the priority matter. The international concern to the water environment protection increases, and hence the present project was timely implemented. The environmental monitoring of water pollution coming from the mining sector and water treatment technology have been focused in the vicinity of Potosi, Bolivia.

- Responding to the needs by administrative institutions and community

CIMA could provide technical information on the water environment with the scientific basis to the administrative bodies including local and central governments. This was met with the needs of the community people, institutions, and relevant communities.

（2） Factors concerning to the Implementation Process

- Water quality data collected by the project are used on an administrative basis by Potosi prefecture.

Environmental data on water quality of the rivers, lakes, and ponds were transferred to the Prefecture for utilization for the administrative measure. On the other hand, these data were disseminated through the seminar held by the CIMA and the mass media such as TV and local news papers, and hence they were successfully received by the polluters and inhabitants. This type of information sharing is recommended to facilitate.

3.4 Factors inhibiting sustainability and impact

（1） Factors concerning to Planning

Within very limited period, many works were done; adjustment of laboratory infrastructure, setup and startup of chemical analysis equipments, and technical guidance for the environmental, discharge, and drinking water standards. Supply of chemicals and materials was often delayed due to several reasons coming from the social capacity of shops dealing with chemicals and materials. It may be due to insufficient accounting process by the Prefecture. Such delay affected technical guide in the field of the environmental chemical analysis.

（2） Factors concerning to the Implementation Process

Insufficient communication occurred between two implementing organizations. The situation put obstacles to timely finalize the institutional development plan and to get materials for chemical analyses. Close contact is recommended to facilitate mutual understanding and communication for the future activity.

3.5 Conclusion

The CIMA Project phase II from 2007 to 2009 succeeds the phase I implemented from 2002 to 2007 in Potosi, Bolivia. The objectives were to establish the CIMA of temporary organization as the legal body, IBIMA, with

the chemical basis for environmental monitoring and research of countermeasures to the mining pollutions. The terminal evaluation was carried out based on the 5 evaluation criteria （relevance, effectiveness, efficiency, impact, and sustainability）. As a result, both the content of planning （strategy of the project, cause-effect relation） and implementation process do not have major problems, and prospects to the achievement of the overall goal have been corroborated by the draft for approval submitted to JICA. Finally it can be concluded that it will not cause any inconvenience to close the CIMA project on June 2009.

3.6 Recommendations

The following recommendations were made to each implementing organization. The issues to be challenged are briefly summarized for two periods, by the end of the Project （by this June 30） and after this July.

Organization / Period	Potosi Prefecture	UATF	CIMA/IBIMA
By the end of the Project （June 30）	1. Sincere implementation for set up process of new body IBIMA 2.Facilitation of budget execution for procurement of materials and chemicals 3. Extension of employment period of laboratory members 4. Contract renewal with technical C/P	1. Sincere implementation for set up process of new body IBIMA 2.Make operational draft chamber and other laboratory facilities	1. Sincere implementation for set up process of new body IBIMA 2. Make operational draft chamber and other laboratory facilities
After the end of the Project （July 1）	1. Collaborate for establishment of new IBIMA 2. Share information on operational management of the IBIMA laboratory with strengthening of communication with UATF and IBIMA	1. Collaborate for establishment of new IBIMA 2. Share information on operational management of the IBIMA laboratory with strengthening of communication with Potosi Prefecture and IBIMA	1. Collaborate for establishment of new IBIMA 2. Open the own bank account for IBIMA 3. Speedup procurement of materials and chemicals 4. Chemical analysis of analytes to be transferred 5. Sales and marketing 6. Share information on operational management of the IBIMA laboratory with strengthening of communication with Potosi Prefecture and UATF

3.7 Lessons learned

Potosi Prefecture and UATF have contributed to implement the Project phase II. Timely procurement of materials and chemicals is highly required especially for chemical analysis along with fixation and proper setting of draft chamber. However, the budget was not timely provided and caused much delay of procurement requisite for a certain analytes （relevant to the output 3）. The similar situation can be seen also in case of the output 1. For sustainable development of the new IBIMA, close and collaborative contribution is highly expected through good communication between three bodies. Hereafter a periodical meeting is recommended to level off information on operational management of the CIMA/IBIMA to utilize the characteristics of educational services （UATF） and administrative service （Potosi Prefecture）. Both functions are required to dissolve recent environmental issues.