

Summary of Evaluation Report

1. Outline of the Project	
Country: The Republic of Bolivia	Project name: Mining Environment Research Center Project
Sector: Mining and manufacturing	Cooperation scheme: Technical Assistance Project
Division in charge: Second Group (Pollution Control), Global Environment Department, JICA	Cooperation cost (as of the time of evaluation): Approx. 850 million Japanese yen
Period of cooperation (R/D) From July 1, 2002 to June 30, 2007	Partner country's organizations involved: <ul style="list-style-type: none"> • Implementing organization: Department of Natural Resources and Environment in Prefecture of Potosi (DRNMA) • Supervising organization: Ministry of Rural Development, Agriculture, Livestock and Environment (MIDRANMA), Ministry of Mining and Metallurgy(MMH), Ministry of Water Resources, Ministry of Planning and Coordination • Cooperative organization: Tomas Frías Autonomous University (UATF)
	Supporting Organization in Japan: Japan Mining Engineering Center for International Cooperation <ul style="list-style-type: none"> • JICA development study entitled: "Evaluation and Study of Mining Sector Pollution of the Environment in Potosi Prefecture," From 1997 to September 1999 • Two individual short-term experts from JICA • World Bank: Small-size Tailing Dams Construction Project (2002-2004) • Deutsche Kreditanstalt fur Wiederaufbau (KfW): San Antonio Project to Construct Sediment Dam for Mineral Ore Waste (not realized) • Danish Development Agency (DANIDA): "Danish Cooperation Program in the Environmental Sector (PCDSMA)" 2001-2006 • European Union (EU): "Program to Support Sustainable Economic Development in the Impoverished Mining Areas in Western Bolivia 2 (APEMIN 2)" 2004-2010
1-1 Background of the Project	
<p>In the Republic of Bolivia (hereinafter referred to as "Bolivia"), mining has been one of the country's main industries since the era of Spanish rule and, the focus has been solely on development with almost no attention given to the prevention of pollution caused by mining. However, washouts from tailing dams in Polco have caused pollution in the Pilcomayo River in recent years, incurring international</p>	

disputes with its downstream neighbor Argentina, which has called attention to this environmental pollution. In September 1999, JICA development study entitled “Evaluation and Study of the Mining Sector Pollution of the Environment in Potosi Prefecture”, which examined the environmental impact of mining in Potosi Prefecture, revealing that the water pollution was severe.

In light of such conditions, the Bolivian government realized the importance of establishing the “Mining Environment Research Center (CIMA)” for the purpose of conducting study and research pertaining to both technology and policies and to disseminate the results thereof in order to implement measures to prevent pollution caused by mining in Potosi and throughout Bolivia. Therefore, the Bolivian government requested that the Japanese government implement project-type technical cooperation, and in July 2002 the “Mining Environment Research Center Project” was initiated.

1-2 Project Overviewⁱ

(1) Super Goal

Administration and technology established by the Center and disseminated to regions throughout Bolivia for the purpose of decreasing water pollution caused by mining industry.

(2) Overall Goal

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

(3) Project Purpose

Activities aimed at monitoring water pollution caused by mining operations in Potosi are strengthened, the implementation basis of research and technology for the pollution control is established in CIMA, and these outputs are reflected in the Potosi administration.

(4) Project Outputs

- 1) The organization of the Center is established.
- 2) Facilities and equipment necessary for the activities of the Center are introduced and properly maintained.
- 3) Environmental chemical analysis of mining pollution is acquired by the counterparts (C/Ps).
- 4) Environmental research technology is acquired by the C/Ps.
- 5) Wastewater treatment technology is acquired by the C/Ps.
- 6) Environment regulation guidelines for mining industries in Potosi are proposed.
- 7) Technology for mineral processing productivity is proposed.
- 8) Public relations and education for environmental conservation targeted at Potosi people who work in the mining industry, concentration and the people related to the mining activity are conducted.

(5) Project Inputs (cumulative total as of the time of evaluation)

Japanese side:

Long-term experts: nine persons Provision of donated machineries and equipments:
11,292,3,000 Japanese yen

Short-term experts: 22 persons Local costs: 4,218,4,000 Japanese yen

No. of counterparts trained in Japan: 15 persons Training in third countries (Chile): 7 persons

<p>Bolivian side: Allocation of C/Ps: 18 personsⁱⁱ Local costs: 3,635,000 Bolivianos (Bs) (cumulative total of actual costs as of FY2006) Buildings and facilities</p>		
<p>2. Evaluation Team Overview</p>		
Leader of the Study Team	Mr. Hiromi CHIHARA, Senior Advisor, Institute for International Cooperation, JICA	
Pollution Control Policy	Mr. Tsuyoshi KAMIJOH, Deputy Director, Nuclear and Industrial Safety Agency, Mine Safety Division, Ministry of Economy, Trade and Industry	
Technical Advisor	Mr. Yosuke SUZUKI, Executive Director, International Cooperation Department, Japan Mining Engineering Center for International Cooperation	
Cooperation Plan	Mr. Tadashi SUZUKI, Program Manager, Environmental Management Team, Global Environment Department, JICA	
Evaluation Analysis	Mr. Hiromi OSADA, Senior Consultant, IC-Net Limited	
Interpreter	Ms. Setsuko OTAKI, Japan International Cooperation Center	
Evaluation Period	From January 17, 2007 to February 12, 2007	Evaluation Type: Terminal Evaluation
<p>3. Overview of Evaluation Results</p>		
<p>3-1 Project Achievements</p> <p>The four indicators of the Project Purpose presented in the Project Design Matrix (PDM) 2.0, revised as of the Mid-Term Evaluation (1. Monitoring and analysis of water pollution are implemented, 2. Methodology of the effective concentration and water treatment of mines and concentrators is investigated, 3. The administration sector considers results of the monitoring and research as feedback, and 4. Environmental education and publicity on the prevention of the water pollution are promoted), are expected to be achieved by the end of the project, except for the chemical analysis field in Indicator 1. Activities in the chemical analysis field began in full after the Mid-Term Evaluation. Although the technology transfer is about to finish other than some in heavy metals analysis field, due to combined reasons including the delay of the procurement and delivery of equipment up to that point, delay of the recruitment of the long-term experts and long-term experts going back to Japan in mid-course due to health problems, it is difficult to complete initially scheduled activities by the end of the project. As for the establishment of the CIMA organization, joint activities in preparing the Article and the Institutional Development Plan of CIMA had fully started after January 2006. However, it could not be completed in four years as scheduled in the PDM. While the organization of CIMA is yet to be established, preparation of the Institutional Development Plan is continuously being implemented.</p>		
<p>3-2 Summary of Evaluation Results</p> <p>(1) Relevance</p> <p>1) Consistency with Bolivia's national development policies</p> <p>At the beginning of the project (June 2002), the five-year National Development Planⁱⁱⁱ (PGDES,1998-2002) of the Banzer Suarez administration was setting "the strengthening of the environmental management system" as the environment sector's policy objective supporting the</p>		

foundations of a stable economic development. The Evo Morales administration announced the PGDES in June 2006, aiming to “improve the living conditions” of Bolivians based on four pillars. The purpose of this project is interpreted as one of the cross cutting issue to support this policy objective.

2) Consistency with the administrative functional needs of the government

Since the enactment of the Environmental Law^{iv} in April 1992, a legal system pursuing a balance between productivity and environmental conservation has been established in Bolivia. However, there had been no comprehensive improvement in the state of the water contamination of the Pilcomayo River caused by mining wastewater around the Potosi area. Therefore, specific technological tasks^v were identified and this project was initiated to strengthen administrative management capacity. Potosi Prefecture guided the construction of mining tailing dams in 2004 and began to execute the environmental license system covering concentration plants from 2005. Thus, environmental administrative execution has been strengthened, and it can be said that the necessity of this project that supports the enhancement of the mining environmental administrative capacity has risen.

3) Justification of the project within Bolivia’s legal system

Although the above-mentioned policies and administrative functional needs of the government have been consistent with the project from the beginning, the mission, authority, organization, financial resources, etc. of CIMA have yet to be concretely defined within the administrative legal framework. This point makes CIMA’s significance of existence ambiguous and stands as a destabilizing factor in its future sustainability. Under ordinary circumstances, it would have been ideal to start the project after the establishment of the administrative legal framework on which CIMA depends, or after the reaching of a consensus within the government.

4) Consistency with the needs of the inhabitants of the basin and mining polluters

The Mid-Term Evaluation implemented in February 2005 carried out a survey^{vi} of the inhabitants from downstream of the Pilcomayo Basin and to the Pilcomayo River Protection Committee, and verified that citizens from 15 municipalities from Potosi Prefecture and 18 municipalities from Chuquisaca Prefecture were conscious that the polluted water from mining wastewater from the Pilcomayo River was having a negative impact on their health, economy and society and that they desired pollution control measures. In the Terminal Evaluation, the evaluation team visited the same group and a village in Mondragon^{vii} in Potosi Prefecture, and confirmed that although the river’s water quality had improved through the operation of the tailing dams since 2004, the region’s inhabitants desired further enhancements of pollution control.

Due to the recent additional increase in the international price of minerals, the number of concentration plants has increased from 12 in 2002 to 28 at the time of the Mid-Term Evaluation, and to 29^{viii} at present, which means the amount of tailing is also increasing. As a result, tailing dams in Potosi wherein tailings are disposed of in an intensive manner have been fulfilling up one after another. Under such circumstances, some of the participating plants, which are stand as mining-sector polluters, notice the improvement of mining productivity through the project leads to the technology achieving an adequate balance between profits and environmental conservation. ^{ix} Therefore, the purpose of this project currently meets the needs of the local inhabitants and of the mining polluters.

5) Consistency with Japan's aid policy

Based on the Official Development Assistance (ODA) Charter (adopted by the Cabinet in August 2003), the ODA Mid-Term Plan (adopted by the Cabinet in August 1999), and the results of the Third Consultation Meeting between Japan and Bolivia on Economic Cooperation Policies (June 2006), the Japan International Cooperation Agency (JICA) formulated Project Implementation Plans for individual countries (Bolivia) in 2006. In this plan, "environmental protection" is cited as one of the cross cutting issues in the three priority cooperation areas.^x In this context, consistency of this project with Japan's ODA policies is ensured.

(2) Effectiveness

1) Achievement of the indicators of the project purpose

Regular water quality monitoring is taking place in 26 sites in the Pilcomayo Basin. The results of these monitoring are evaluated and utilized in the preparation of pollution maps and hydrological simulation models for the purpose of analyzing and forecasting pollution conditions. In the chemical analysis field, technology transfers in relation to metal analysis within the aqueous environmental sample and high-density ion analysis within the mineral wastewater sample has nearly been completed, and the counterparts are undertaking this analytical work by themselves. However, technology transfers in the area of analysis of certain heavy metals have yet to be completed (Indicator 1). Technology transfers have been completed in the field of technological improvement of the productivity of the concentration plants, and full-fledged technical guidance can be provided to participating plants in Potosi. In the field of wastewater treatment, data on wastewater treatment technology through iron oxide bacteria technology and continuous neutralization examination equipment has been acquired. Using this data, completion of the "Comprehensive Plan on Acid Mining Water Treatment in Potosi" is expected by the end of the project (Indicator 2). The results of environmental monitoring are being reported and fed back twice a year to the DRNMA. Moreover, the results of other projects are also being introduced to Potosi's officials through seminars,^{xi} and effective proposals are being made to the environmental administration in Potosi (Indicator 3). Through activities such as the issuance of project activities reports, the creation of the website, the preparation of pamphlets and CDs for public information, laboratory exhibitions, and invitations to CIMA made to local citizens' groups, accurate information on mining wastewater pollution are being provided to the general public and to a wide range of parties involved (Indicator 4).

2) Expectation of the achievement of the project purpose

The project purpose is to initiate activities such as (1) the establishment of the CIMA organization, (2) the enhancement of the environmental information system on pollution, (3) the development of pollution abatement technologies appropriate for small and medium-sized mining companies, (4) the enhancement of the ability to make environmental policies based on technical information, and (5) the enlightenment of the parties involved, in order to promote comprehensive improvements in the state of water contamination of the Pilcomayo River caused by mining wastewater in the vicinity of the Potosi area. Activities (2) to (5) mentioned above are generally reaching a certain level, with a few exceptions. Some of the technology transfers in the field of chemical analysis in (2) above, such as heavy metals analysis, sample wastewater treatment analysis, soil waste analysis and environment components analysis, are still incomplete, and therefore these analyses have yet to be implemented. Furthermore, with regards to the establishment of organization mentioned in (1) above, the current status of CIMA is still that of a project unit, and it is still on the way to establishment as an organization.^{xii} From these two points, with the

exception of a few files, it is expected that the project purpose will generally be achieved.

(3) Efficiency

1) Progress of activities and inputs as well as achievement of output indicators

[Output 1]

Output 1 intends to establish CIMA, an organization that did not exist in Potosi, as a sustainable organization. Since the beginning of the project, there have always been more than four people serving as management staff and more than nine counterparts receiving technology transfers assigned to the project in a consecutive fashion. In particular, in the field of chemical analysis, assistants were assigned from 2003 and the number of engineers increased to eight in 2006. There were also the additional assignment of three student apprentices and one sanitation worker (Indicators 1.1 and 1.2). The monitoring of technology transfer was conducted for each field twice a year, based on the management concept of 'Plan, Do, See and Action' (Indicator 1.4). The Joint Coordinating Committee (JCC) has convened eight times thus far, and regular exchanges of information among the JCC members have been taking place (Indicator 1.6). Budget planning takes place on a yearly basis, and the prefectural government has made continuous efforts in spite of chronic financial difficulties. However, by the end of 2005, after 70% of the project period had elapsed, the yearly accumulative plan disbursement remained at approximately 20% of what was agreed in the R/D, representing approximately 38% of the yearly accumulative amount approved by the prefectural government. In FY2003 in particular, not only did this amount remain at about 8% of the R/D, there was also a delay in the disbursement period, which resulted in an insufficient purchase of chemical analysis equipment and reagents. There was also a delay in customs procedures for equipment donated by Japan, which caused a delay in the start of technology transfer (Indicator 1.3). On the other hand, with respect to Indicator 1.5 regarding the elaboration of CIMA's Institutional Development Plan and Article, the committee discussing the Institutional Development Plan was inaugurated in April 2005, and has held eight meetings thus far. The first draft of the Article has just been elaborated, and the Article has not been completed.

[Outputs 2, 3, 4, 5]

These outputs refer to the installation of equipment and the establishment of a maintenance structure for the three technological fields and the completion of the planned technology transfer. With regards to the fields of wastewater treatment and environmental analysis, there was a minor delay in the period of the equipment input. However, this did not have a pernicious effect on the achievement of the outputs, and the inputs and activities lead to the achievement of each output. In the field of chemical analysis, inputs were not installed as planned, leading to a significant delay in the achievement of outputs 2 and 3, for the reasons listed below:

- (i) Since the recruitment at the beginning of the project of a long-term expert who met the requirements proved to be impossible, the expert arrived at his post approximately nine months late. This resulted in a delay of the elaboration of the equipment procurement list, and ultimately brought about a delay in the start of technology transfer. In addition, there are very limited number of human resources with both a high level of expertise and proficiency in Spanish, which made recruitment a difficult one.
- (ii) The insufficient disbursement of local costs by the Bolivian side in FY2003 with a view to to

purchasing consumable supplies and materials such as reagents, laboratory glassware, etc. resulted in a delay in the transfer of technology.

(iii) Furthermore, the two long-term experts for the chemical field returned to Japan before the end of their assignment periods due to health reasons, and technology transfer was suspended during this period.

(iv) During the two-year period initially planned, inputs of long-term experts were 24M/Mt, while the actual input period had been about 38M/Mt as of December 2006. However, only 19M/Mt during the period for which the second long-term expert was assigned had been available for technology transfer after the arrival of the analysis equipment. Furthermore, in CIMA's future plans beyond the end of the project, currently under deliberation, higher level of technology than that of the initial plan is being pursued, including the obtainment of ISO17025 certification for heavy metal analysis, in order to raise financial sustainability in the future. Therefore, the needs on the Bolivian side are increasing.

[Output 6]

This output aims to provide recommendations within the report to related organizations on environment regulation guidelines suited to Potosi, based on the understanding of the outline of mining pollution control by the Japanese administration. It is planned that the draft of the guideline will be recommended in the report and seminar at the end of the project.

[Output 7]

This output aims to provide technological recommendations to decrease tailing by way of improving the mining productivity of the participating plants, and as a result the generated profits will contribute to covering the costs for environmental measures. This output was achieved through activities by the short-term experts who had been dispatched on three occasions, for a total of nine months, and the follow-up activities of the long-term experts, and the technical effectiveness has also been verified.^{xiii} The successive dispatching of the same experts with suitable skills led to the efficient achievement of this output.

[Output 8]

The project's pamphlet has been issued more than twice a year on average (Indicator 8.1); dissemination seminars were held for a total of eight times, more than twice a year on average (Indicator 8.2); press releases were issued five times in total and CIMA's website has been completed (Indicator 8.3), thereby establishing a structure for the implementation of regular publicity activities. Responsible for carrying out these activities is a Japanese coordinator with extensive experience in JICA project-type cooperation and by counterparts in each field. The output was effectively accomplished with few inputs.

(4) Impact

1) Impact on the overall goal

The basis for the provision of technical information, which will serve as core impact, has already been established as shown below. It is considered that in the future, it will become possible for CIMA to contribute to the production of the final products, such as the

administration law system and policies, if it consolidates its technical capabilities and its organizational foundations, and will become able to continuously carry out its activities.

(i) Strengthening of the administrative function on water pollution control

- Officials from both the central and Potosi government have gained understanding of scientific data on the status of pollution caused by mining wastewater in Potosi Prefecture and its effective alternatives.
- Easy access to environmental monitoring data became available when needed in administrative activities.
- It became possible to support administrative activities through the projects by other donors in support of prefectures and municipalities, and implementation of water quality analysis commissioned by the Autonomous Administration for Sanitary Works (AAPOS).

(ii) Reduction of water contamination burden

- Improvements in mining productivity and participation grades were confirmed at two concentration plants. It is assumed that the amount of tailing decreased as part of this improvement, and that the environmental burden is decreasing.
- Although all tailing had been released into in the Rivera River at the beginning of the project, due to the strengthened administrative leadership of the prefectural government, they are currently disposed in tailing dams in Potosi and only supernatant fluid is being released into the rivers.
- As a result of the above-mentioned effects, the concentration of zinc in the water in the Pilcomayo River near the Méndez Bridge decreased from 13.5mg/L (August 2003) to 1.1mg/L (June 2005).

(iii) Increase in the attention to mining pollution among local inhabitants

- University-related parties in Potosi, groups of farmers living in downstream basin and members of the media have visited the project, and they have begun showing more willingness to acquire accurate knowledge on mining pollution based on scientific grounds.

2) Impacts unintended at the outset of the project

No particular unexpected negative impacts have been reported.

(5) Sustainability

1) Organizational and institutional aspects

CIMA currently exists under an agreement between the Potosi Prefecture and UATF (a five-year agreement) and is also based on Japanese cooperation, while the prefecture and the university are providing human and financial resources as well as facilities. After holding eight meetings, the first draft of the Institutional Development Plan (Mid-term Plan and Article) was recently completed. JCC is discussing the relevance of this draft through a workshop, and it was evaluated that (i) the definition/legal status of the organization, (ii) the financial plan, (iii) the measures to secure human resources, and (iv) the method for maintaining technical capabilities should be discussed in further detail.

2) Financial aspects

According to the results of the operation of the project thus far, it is necessary to secure financial resources of at least about US\$ 237,000 per year in order for CIMA to maintain its current level of activity. On the other hand, to date Bolivia has disbursed a yearly maximum of US\$ 211,000, averaging approximately US\$160,000 per year. Furthermore, although an

agreement for two and a half years after the completion of the Project was concluded in September 2006 between UATF and Potosi Prefecture, the management costs of the Bolivian Mining Environment Research Center (CBIMA), which is outlined in the agreement, remains at around US\$170,000. It is assumed that there will be a shortfall of approximately US\$67,000 excluding the amortization cost of the equipment. Therefore, it is necessary to include in the final version of CIMA's Institutional Development Plan a feasible and realistic plan for the financing of such resources.

3) Technical aspects

It is expected that the technology transfer and the development of adequate technology will be completed, with the exception of that in the chemical analysis field, so it can be said that the technical foundation for CIMA has been accomplished. However, the building of mechanisms conducive to the utilization of this technology within environmental policies and the legal system remains as a future challenge. Therefore, it is necessary for the Bolivian side to formulate concrete plans for the utilization and dissemination of CIMA technologies for environmental analysis, wastewater treatment and concentration improvement.

With regards to the chemical analysis field, it is expected that the amount of expert input will remain below the initially planned level and technical transfers are behind schedule. It will be difficult to accomplish that which was planned in the almost four months that are left before the end of the project, and thus it cannot be said that technical sustainability has been secured. In future, it will be necessary to take some type of measures to supplement the insufficient inputs and activities and to complete the transfer of technology.

4) Human resource aspects

Personnel responsible for equipment procurement and facilities management at CIMA have not been assigned since 2004, and only an assistant staff member, mainly responsible for assisting the Japanese coordinator, has been assigned. Since such administrative and management personnel are repeatedly resigned every year, this brought about disruption of management even during the implementation of the project. Thus, it cannot be said that sustainability in terms of human resources is high in the management division under the current system. Therefore, it is necessary to immediately assign an administrative assistant and establish stable working conditions in future.

3-3 Factors Contributing in the Production of Effect

- (1) Strengthened pollution control due to increase in the awareness of local inhabitants and mining operators (polluters) on environmental issues
- (2) Reinforced government-led environmental administration in Bolivia and in Potosi Prefecture in line with the above and the direct/indirect influence of the international community
- (3) Increase in cases of analysis entrusted to CIMA, stemming from the above

3-4 Factors that Hindered the Production of Effect

- (1) The impact of political instability on the implementation framework of the project, as well as the direct/indirect influence of political riots, road blockades, lockouts at Tomas Frias Autonomous University, etc. on the project activities
- (2) Direct/indirect influence of problems such as problems pertaining to local cost disbursement resultant from the fiscal weakness of the Bolivian government on the project activities
- (3) Direct/indirect influence of problems in terms of dispatching experts resulting from difficult living conditions, such as project sites located above 4,000m above sea level (difficulty in recruiting adequate experts, delay in the timing of dispatches, health problems and early return to Japan) on the project activities

- (4) Direct/indirect influence on the project activities of the delay in the selection and procurement of equipment due to the delay in dispatching experts as mentioned above, as well as the troublesome customs procedures

3-5 Conclusion

Thanks to efforts by the parties involved in the implementation of the project in both countries, the eight outputs of the project are being achieved at an appropriate level. However, the status of CIMA is still based on the agreement between UATF and the Potosi Prefecture, and it is yet to be justified as an organization under the Bolivian legal framework. CIMA is still on the way to making plans for its legal establishment (Output 1). In the field of chemical analysis, since the inputs and activities could not be carried out along the original lines due to external factors, it will be almost impossible for the project to accomplish the originally planned technical transfer in the field by the end of the project (Output 3). The project still has tasks to be accomplished in these two areas, and it is desirable for both countries to continue the joint activities, which will require as a premise some preparation work and a worked-out plan to overcome obstacles in terms of activities and inputs, which the project has been facing. As a result of above, it is essential that a feasible and realistic Institutional Development Plan be formulated as soon as possible. There is also a necessity to continue the guidance on technical transfer that has yet to be accomplished in the chemical analysis field. Therefore, it is necessary to extend the project for a certain period.

3-6 Recommendations

A. Short-term recommendations (to be achieved by the end of the project)

(1) Items to be realized by the Bolivian side

- 1) To prioritize the remaining technical transfer subjects in the field of chemical analysis (by March 5, 2007)

Regarding the technical transfer that has not been accomplished, taking into consideration the current needs of Bolivia's environmental analysis field, it is necessary to prioritize these unaccomplished technical transfers. The representative of the JCC^{xiv} is to submit the plan document to JICA Bolivia Office by March 5, 2007.

- 2) Completion of the renovation of the chemical analysis laboratory (by March 31, 2007)

In order to establish a safe and reliable analysis laboratory, the Bolivian side is carrying out renovation of the chemical analysis laboratory, which is aimed at separating the pretreatment room and testing room, and to establish an analysis wastewater disposal facility. However, this renovation work is incomplete. The Director of CIMA should complete the renovation of the chemical analysis laboratory as soon as possible. The representative of the JCC is to submit the completion report to the JICA Bolivia Office by March 31, 2007.

- 3) Submission of the first version of the revised draft of the Institutional Development Plan (by March 31, 2007)

The CIMA Establishment Agreement^{xv} covering the period after the project until the end of 2009 had been concluded, and the first draft of the Institutional Development Plan was elaborated. In order to make the plan more feasible, (i) the definition/legal status of the organization, (ii) the financial plan, (iii) measures to secure human resources, and (iv) the method for maintaining technical capabilities should be discussed in further detail. The Bolivian representative of the JCC is to submit a draft incorporating these points, bearing in mind the

budgetary conditions of both Japan and Bolivia, to JICA Bolivia Office by March 31, 2007^{xvi} at the latest.

4) Initiation of conducting the Institutional Development Plan (by June 30, 2007)

The relevant parties on the Bolivian side should immediately start a new CIMA organizational system based on the new Institutional Development Plan mentioned above with proper assistance by the Japanese Experts. To this end, they should gradually improve the plan if necessary.

5) Maintenance of the CIMA framework.

Relevant parties on the Bolivian side should continuously ensure good condition of the equipment and machinery, human resources on counterparts and activities in all CIMA fields.

(2) Items to be realized by the Japanese side

1) Reconsideration of a system to assist the elaboration of the Institutional Development Plan (by March 31, 2007)

Under the current provisions of the Japanese expert team, it is difficult to (i) support the adjustment of requests to JICA and (ii) give advices to start CIMA's Institutional Development Plan. Thus, the addition of a short-term expert in charge of providing such support to the team of Japanese experts in Bolivia should be considered. The chief advisor expert should report the results of considerations to the JICA Bolivia Office by March 31, 2007.

2) Consideration of a plan to dispatch experts in order to complete remaining technical transfer (by June 30, 2007)

Regarding the recruitment of experts to implement unaccomplished technical transfer, the chief advisor, the staff in charge at the JICA Bolivia Office and the JICA Headquarters should consider periods and timing, and investigate and consider the possibility of the plan to dispatch Japanese experts or experts from a third Latin American country.

B. Mid- and long-term recommendations

(to be achieved by the end of December, 2009)

After the elaboration of the abovementioned Institutional Development Plan, CIMA should establish its operational principles regarding the following recommendations. These are necessary in order to ensure the persistency of the effects of the project's technical transfer outcomes, and to reinforce the future organizational sustainability of CIMA. These recommendations include the recommendations provided by the expert team of the project through the actual project management.

(1) Enhancement of partnership with mining sector

Ministry of the Mining and Metallurgy (MMH) requires that the mining sector consider environmental assessments of development in order to obtain governmental permission on any new mining development activities. CIMA should seek for enhancing the partnership with the environmental division of the Bolivian mining authority, such as the Bolivian Mineral Cooperation (COMIBOL), which had been restructured and enlarged under the current Evo Morales administration.

(2) Analysis and evaluation of the market value of CIMA's business

CIMA should analyze and evaluate its conformity with local and social market needs in Potosi

Prefecture and in Bolivia, sustainability and market value for the three fields of cooperation implemented in this project (chemical analysis, environmental research and wastewater treatment). Upon the evaluation of the market value of the project, economic benefits (financial analysis), and social benefits (from the perspective of national and regional economy analysis) should be taken into consideration and cost-benefit effects should be clarified in the numerical value.

(3) Study on securing budgets for CIMA project

In order to secure funding for projects, CIMA should study and negotiate all the possible financial resources such as national ministries and agencies, COMIBOL, Potosi Prefecture, UATF and operating revenue, and reflect said prospect in its cost-benefit analysis.

(4) Efforts to develop the organizational capacity and reinforce the foundation of CIMA

1) Aim to improve and establish its status as a chemical analysis laboratory

CIMA should reinforce its organizational capacity under a clear strategy and motivation such as reinforcing its status as a standard analysis institution in stages, for example by firstly earning certification from Potosi Prefecture, then from the government of Bolivia, and finally from international organizations. Since CIMA aims to become a reference laboratory in Bolivia, it must obtain ISO17025 certification in the future. To this end, it must prepare an individual plan for the preparatory work involved in obtaining the certification.

2) Reinforce the field of general environmental chemical analysis

CIMA is equipped with state-of-the-art environmental analysis equipment for Bolivia, and has great potential for business expansion, including environmental chemical analysis not only examining mining pollutants, but also pollutants affecting people's living conditions. Due to the improvement in local residents' environmental awareness, the environmental authorities in Potosi Prefecture are now required to reinforce their environmental management capacity as part of the social services offered in the field of living environment.^{xvii} Thus, the authorities should proactively diversify their activities mainly in the water quality analysis field and to try to improve their capacity.

3) Strive to accomplish differentiation as a comprehensive chemical analysis organization

CIMA's chemical analysis has served to provide basic data for environmental surveys and wastewater treatment. Accordingly, it has experiences and a proven record in comprehensive chemical analysis, such as sampling, analysis, compiling data and evaluating pollution, in addition to the chemical analysis technology for test specimens on consignment. As a result, CIMA should consider a strategy that aims to differentiate itself from laboratories that focus exclusively on chemical analysis.

4) Consider business strategies in the environmental consultant field

a) Environmental survey field

Growing demand is expected for environmental surveys of basins and nearby regions, following the new demand for mining development, thanks to the improved economic environment for resource development. The results of technology transfers in the field of environmental surveying should be preserved so that CIMA can accept more business commission orders in the new environmental survey field. In order to keep up its activities as

an independent analysis center, CIMA should make efforts to improve its management and cost accounting, including the preparation of estimates and external public relations.

b) Wastewater treatment field

Basic neutralization technology for wastewater treatment, biochemical wastewater treatment technology and productivity enhancing technology through the application of mineral processing technology have been transferred. These technologies cover a broad range including the conceptual, basic and detailed designs and the construction of wastewater treatment plants. CIMA should consider differentiating itself from the private wastewater treatment industry by offering wastewater treatment consulting services to small and medium-sized mines in collaboration with chemical analysis field, and developing an environmental conservation business through the utilization of productivity enhancement technology. It could also differentiate itself by offering training in wastewater treatment technology.

5) Establishment as a focal point of environmental education field

Because CIMA's equipment is kept at UATF's mining department, it is possible to utilize it as an educational facility for university and corporate personnel in the environmental field. The administrative foundation for CIMA's business should be reinforced, including the effective mutual use of university funding and infrastructure.

6) Reinforcement of CIMA's PR and extension activities

In the agreement to establish CBIMA (Center for Mining and Environmental Research in Bolivia) concluded in September 2006, the Center's role as a mining and environmental center for all of Bolivia was clearly stipulated. Therefore, activities should be expanded from Potosi Prefecture to other mining prefectures. To this end, it is important to publicize CIMA's potential in regards to waste water disposal technology, environmental monitoring and chemical analysis, and CIMA should continue to publicize its activities on its website and issue reports on the center's activities.

It is essential that a long-term policy be devised for CIMA's development in all fields, covering financial, technical and personnel aspects.

3-7 Lessons learned

(1) Impacts of the change of administration and relations between the central and local governments

South American countries, including Bolivia, have recently been tilting to the left, which is influencing the high degree of cohesion between the central and local governments. This has also influence the allocation of the counterparts for the project. Under the Evo Morales administration, inaugurated in January 2006, the MAS Party (the Movement for Socialism) has been obtaining overwhelming power, resulting in frequent reforms of central government ministries in accordance with the party policy, and has caused some stagnation in personnel affairs and budget implementation. Although the project had been engaging talks with governmental officials responsible of implementation, and depending on the situation of confirmation regarding the implementation framework and renewed progress, it can be pointed out that it has had a significant comprehensive impact on the smooth operation of the project.

Although the political condition has been unstable, with four changes of central government during the implementation period of the project, the strong commitment of the university

contributed in large part to ensuring the stability in technical transfer aspects.

(2) Addressing the administrative aspects of the project

This project requires technical transfer aspects, primarily the dispatching of experts responsible for providing and using the equipment, as well as administrative aspects to ensure that Bolivian citizens are at the receiving end of the transfer benefits. In meeting the first requirement, a group of technical experts including a chief adviser formed a team in an efficient and rational manner, but there is a strong chance that weaknesses were present in addressing the administrative aspects. Delays in preparing a sustainable development plan, which was requested by JICA, were actually concluded as having had a major impact on the achievement of the project goals and installation of the infrastructure for the overall purpose. In general, when it is judged that the administrative implementation capability of the counterpart government and institution is not high, the team or Japanese experts should have added members with not only knowledge of the technical aspects but also with an administrative perspective.

On the other hand, as a result of the establishment of the Potosi Prefecture Environmental Agency as a counterparts, the organization was able to develop a strong political ties with the Governor of Potosi Prefecture (the new governor is a former president of UATF) and UATF, showing promising signs on the administrative side such as the allocation of funds to the preparation of a sustainable development plan. Recently, there have been increasing numbers of cases wherein JICA's counterparts institutions, which were initially being operated almost exclusively by funds from administrative bodies, are being requested to become financially independent after the completion of technical transfer projects, with the aim of reducing the financial burden on the government in the form of "small government" and "decentralization." If such cases are foreseen, it may be necessary for JICA's technical transfer plan to include technical assistance that also considers management aspects, including profitability, in order to ensure the sustainability of the organization.

(3) Selection of the project site and the recruitment of experts

The project site is located 4,070m above sea level, 550km from La Paz and 160km from Sucre. This means that road blocks due to political disturbances will make access to the site almost impossible. For instance, liaison committee meetings between the JCC and four supervising ministries were frequently cancelled due to road blockages. Also, working in the highland at an altitude of 4,070m is quite demanding, and some of the experts and evaluation team members required urgent treatment at lower altitudes during their terms of office due to altitude sickness and heart ailments.

Chain-reaction influences such as the continuous difficulties in recruiting a long-term expert to fulfill the requirements and the necessary earlier return to Japan of (two) experts on caused a delay in listing the equipment to be procured, and resulted in a delay in the transfer of technologies, causing difficulties in the smooth implementation of the project.

As for general lessons learned for the starting stage of the project, it is necessary to duly consider living conditions at the project site and political/financial state of the country and regions in question. It is also important to review and alter the plan in a flexible manner where necessary even during the implementation period of the project.

ⁱ Based on PDM 2.0 revised as of the Mid-Term evaluation in February 2005.

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- ii All CIMA staff members employed by the Bolivian side, including the Project Manager (Director of CIMA), clerical personnel and driver
- iii Each administration in Bolivia is required by the law to formulate the PGDES.
- iv Law No. 1333.
- v (1) Strengthening of environmental monitoring of pollution, (2) strengthening of environmental chemical analysis technology, (3) development of appropriate wastewater treatment technology development for Potosi, (4) technical recommendation for the improvement of mining concentration efficiency, (5) strengthening of dissemination activities to the related parties, (6) proposal of administrative guideline in mining and environment in Potosi, etc.
- vi On January 23, 2005, the study team, after interviewing eight representatives from the community of Quila Quila Suyu (a member of this committee) in the community office in Sucre, conducted the field study. The Terminal Evaluation also interviewed the same group of representatives on January 20, 2007.
- vii It is located approximately 20km downstream of Pilcomayo River from Potosi City.
- viii Figure as of January 2006, according to the Concentrators' Association.
- ix Two concentration plants, Lambol and Cozmic, requested supervision from the project, whereat the project conducted technical supervision and confirmed the effect of improvement.
- x (1) Personal security, (2) Higher productivity, (3) Support for systems and governance.
- xi In Argentina in 2005; a seminar to exchange information with a JICA project in Chile; the Japan-Chile Partnership Programme (JCPP) Seminar from 2002 to 2004, the "International Seminar on Mining Environment" co-sponsored with the Bolivian Geological Society in October 2006; the "Environmental Administration Seminar" co-sponsored with Chile AGI: the International Cooperation Agency of the Republic of Chile, CENMA: the National Environmental Center, and JICA) in November 2006, etc.
- xii While the Project Purpose stated in PDM 2.0 does not include these indicators, it can be judged that the establishment of organization is incomplete from the fact that the output indicator 1.5 has not been achieved.
- xiii Refer to [Indicator 2] of "Effectiveness."
- xiv Governor of Potosi Prefecture.
- xv Concluded between Potosi Prefecture and UATF on September 20, 2006.
- xvi This is a necessary deadline for determining JICA policies, by taking into consideration the deadline for Bolivian side to apply for continuation of the project budget in Potosi Prefecture.
- xvii In the field of water pollution prevention field, for example (1) accumulation of the record of analysis tests, (2) contribution in the establishment of standard analysis methods for water in Bolivia, (3) planning for the preparation of standard water samples for analysis (domestic wastewater, industrial wastewater, lake water, river water, groundwater, etc.), (4) planning for inter-laboratory water analysis tests, (5) devising of a plan for environmental monitoring (covering water, soil and the atmosphere), (6) participation in plans to carry out round robin tests within countries in South America, and (7) provision of training in water analysis testing methods and other matters in coordination with organizations in Argentina, Chile and other countries.