China

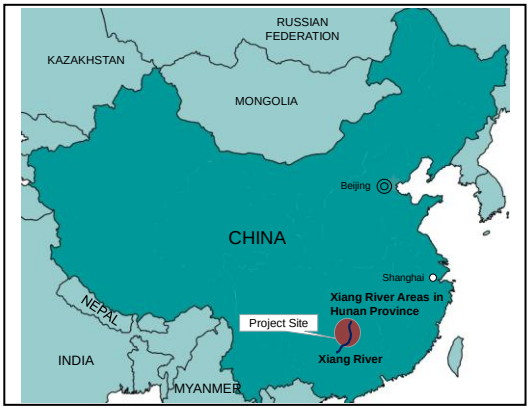
Ex-Post Evaluation of Japanese ODA Loan Project

Xiang River Basin Hunan Environmental Improvement Project

Xiang River Basin Hunan Environmental Improvement Project (II)

External Evaluator: Kaori Honda, IC Net Limited

1. Project Description



Project Site

Expansion Project of Changsha No.1 Sewage Treatment Plant: Final Settling Tank

1.1 Background

The basin of Xiang River (length: 865 kilometers) that runs into Chang River, the longest river in China, is home to China's major non-ferrous, construction materials and other industries. Because of its rapid economic growth in the last ten-strong years, Xiang River Basin has been designated as one of the highest priority development areas of Hunan Province. The economic growth brought with it increases in the amounts of industrial and household waste water in the area, resulting in a serious problem of water quality deterioration in the basin. Being the source of potable water for the urban population in the basin, the Xiang river system was required to meet Grade II or III under China's national water quality standard.[1]

At the time of project appraisal (1997), pollution of water and air was a serious problem in Xiang River Basin; the quality of Xiang River water was below the standard at nearly all of the monitoring sections.[2] The pollutants identified included not only organics but also lead, cadmium, mercury and other heavy metals, giving rise to concerns about human health risks. Additionally, the increased standards of living and rapid rise of urban population resulting from economic growth generated increasingly greater amounts of household and other solid waste,

[1] The surface water quality standard was promulgated by the Ministry of Environmental Protection on April 5, 1998, going into effect on June 1 that year. The standard sets out COD and 29 other water quality parameters with classification into Grades 1 through IV. Potable water sources must satisfy Grade II or III standard. Source: JICA literature

[2] Monitoring sections refer to the monitoring stations that are set up to monitor river water quality on a periodical basis. For the project appraisal, the figures quoted in the Hunan Province Environmental Protection Master Plan were referenced.

making it difficult for capacities of waste treatment facilities to cope with. Some of such collected waste was left open-air on the banks of River Xiang in heaps, causing contamination of soil, groundwater and the river. The problem of air pollution in the region was also grave: acid rain fell on major cities frequently, suggesting the need for conversion from coal to city gas, regulations on industrial emissions, introduction of cleaner production[3] technologies and other measures.

Against this background, the project in question was implemented for the purpose of improving the environment of Xiang River Basin through improved sewage and waste water treatment, air pollution measures and solid waste management.

1.2 Project Outline

The objective of this project is to prevent aggravation of water quality deterioration, acid rain and other environmental pollutions by implementing projects relating to sewage and waste water treatment, air pollution abatements and solid waste treatment along Xiang River in Hunan Province, a region faced with serious water, air pollution, and unsound solid waste management problems as a result of rapid economic growth, thereby contributing to an improved natural environment in the basin as well as an improved standard of living for the local residents.

Approved Amount/ Disbursed Amount	(I) 5,678million yen, (II) 6,175million yen; Total 11,853million yen / (I) 5,675 million yen, (II) 6,174 million yen; Total 11,849 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	(I) September 1997, (II) December 1998 / (I) September 1997, (II) December 1998
Terms and Conditions	(I) Interest Rate: 2.1％ Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: General untied (II) Interest Rate: 0.75％ Repayment Period: 40 years (Grace Period: 10 years) Conditions for Procurement: Partial untied
Borrower / Executing Agency(ies)	Government of People's Republic of China / Hunan Provincial People's Government (Hunan Province Management Office of Japanese Loan for

[3] Methods of production and processing that are designed to minimize generation of hazardous substances and waste and incorporate reaction processes for removal of hazardous substances. See http://dictionary.goo.ne.jp/leaf/jn/217673/m0u/%E3%81%8F%E3%82%8A/

	Environmental Protection Project)
Final Disbursement Date	(I) April 2003 / (II) July 2004
Main Contractor (Over 1 billion yen)	Not applicable
Main Consultant (Over 100 million yen)	Not applicable
Feasibility Studies, etc.	OECF SAPROF (Special Assistance for Project Formation) " Xiang River Basin Hunan Environmental Improvement Project" OECF, 1998
Related Projects (if any)	Not applicable

The project is divided into 22 sub-projects, which can be grouped into five categories: Category 1 – City sewage treatment projects for sewage of the entire city with a focus on household sewage, Category 2 – Industrial waste water treatment projects for industrial plants and other facilities that discharge large quantities of waste water, Category 3 – Air pollution abatement projects through provision of coal-substituting energies, Category 4 – Waste treatment projects for solid waste management, and Category 5 – Project for improved environmental monitoring capacity of the Bureau of Environmental Protection of Hunan Province. In fiscal 1997, 13 of these sub-projects were taken up as the Japanese ODA loan project under the title of "Xiang River Basin Hunan Environmental Improvement Project," and in fiscal 1998 nine other sub-projects were taken up as Phase II project under the title of "Xiang River Basin Hunan Environmental Improvement Project (II)." For the purpose of distinction of the two phases of the project, terms "Project (I)" and "Project (II)" are used herein, as required. The following is a list of the sub-projects that were planned for implementation at the project planning stage:

Category 1 City sewage treatment projects

1-1) Sewage Treatment System Construction Project in Yongzhou City
1-2) Sewage Treatment System Construction Project in Yueyang City
1-3) Sewage Treatment System Construction Project in Changde City
1-4) Sewage Treatment Project in Zhuzhou City
1-5) Sewage Treatment Project in Linxiang City
1-6) Sewage Treatment Project in Xingsha Development Area of Changsha
1-7) Environmental Countermeasures in Wulingyuan Scenic Zone, one of the World Natural Heritage, in Zhangjiajie City

Category 2 Industrial waste water treatment projects

2-1) Expansion Project of Wastewater Treatment Plant for Zhuzhou Heavy Metal Factory
2-2) Wastewater Treatment Project for Zhuzhou Chemical Factory
2-3) Chrome Slag Treatment Plant in Hunan Ferroalloy Factory
2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project
2-5) Wastewater Treatment Project for Xiangtan Paper Mill Factory
2-6) Mining Water Pollution Control Project in Shuikoushan
2-7) Industrial Pollution Control Project by Xiangtan Iron & Steel Co.
2-8) Water Pollution Control Project by Liuyang Paper Plant
2-9) Gas Supply and Water Pollution Control Project by Liuyang Nitrogenous Fertilizer Factory

Category 3 Air pollution abatement projects

3-1) Expansion Project of Gas Supply Network in Shaoyang City
3-2) Expansion Project of Gas Production Plant in Zhuzhou City
3-3) LPG Supply Project in Changsha City

Category 4 Waste treatment projects

4-1) Garbage Filling Yard Construction Project in Hengyang City
4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City

Category 5 Other project

5-1) The Environmental Monitoring and Management Center of Hunan Province

The map below illustrates the water system of Xiang River and the locations of sub-projects.

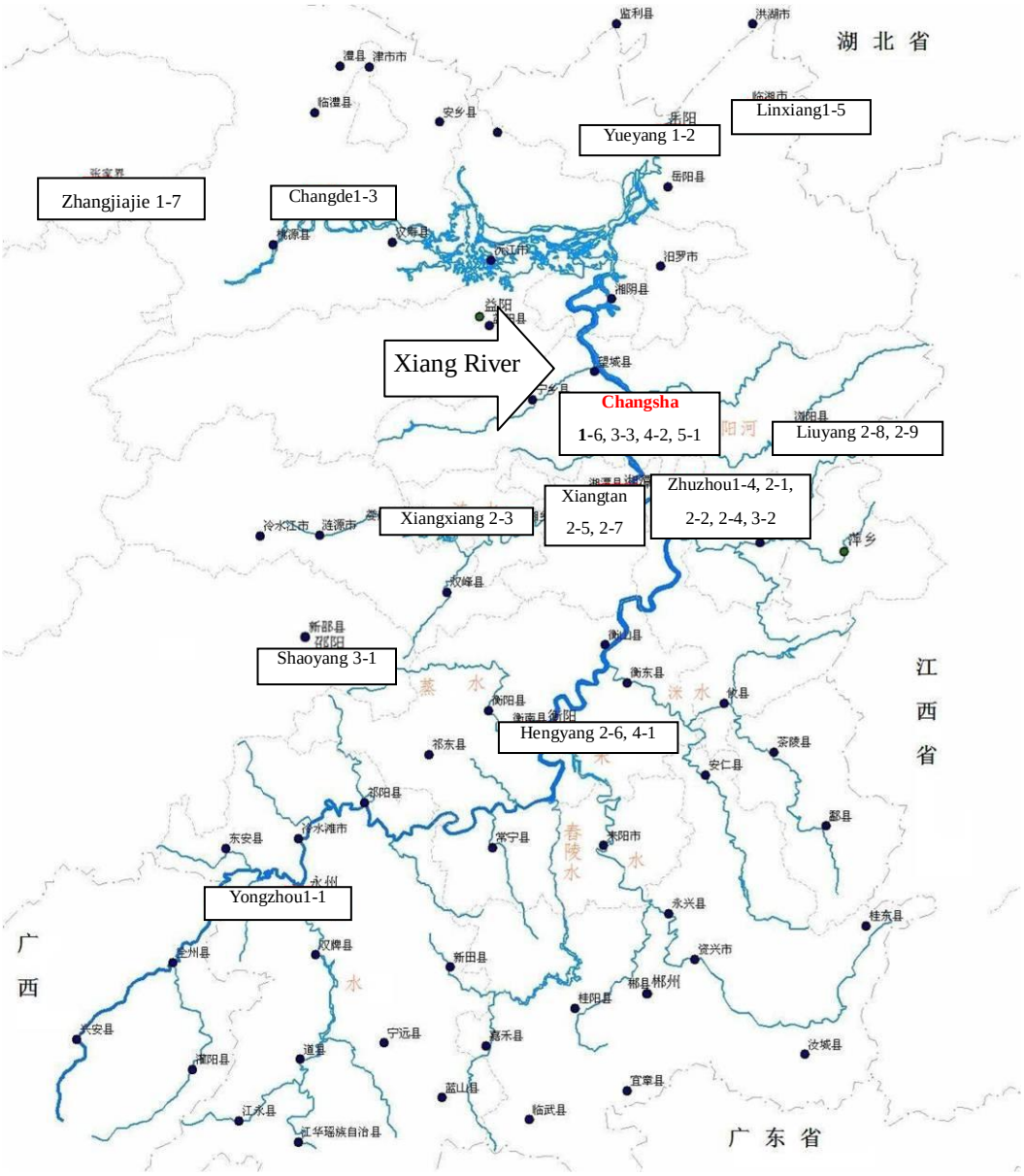


Figure 1 Location of Sub-projects

Source: Prepared from various reference materials

Note: Changsha is the capital of Hunan Province.

2. Outline of the Evaluation Study

2.1 External Evaluator

Kaori Honda, IC Net Limited

2.2 Duration of Evaluation Study

For the purpose of the ex-post evaluation, a study was conducted over the following period of

time:

Duration of the Study: October 2009 –October 2010

Duration of the Field Study: January 7 – 29, 2010 and April 13 – 21, 2010.

2.3 Constraints during the Evaluation Study

At the time of project planning, improvement of Xiang River water quality was cited as one of the goals of the project. Realization of such a broadly-defined goal, however, was unrealistic, given the size and scope of the project. Xiang River is a very long river that extends 865 kilometers in total. Added to this was the presence of a number of external factors[4] that affect the water quality of Xiang River. It was not possible to substantiate any correlations between the effective reduction of pollutants through the sub-projects and the water quality of Xiang River.

For the purpose of this ex-post evaluation, accordingly, the objective of the project was re-interpreted as "the improvement of rivers and water systems of Xiang River adjacent to the sub-project sites" and data and information on the water quality at monitoring sections closest to the sub-project sites were collected. Some of such monitoring sections, it should be added, are at some distance (3 – 28 kilometers) from the sub-project sites concerned and are undeniably affected, both positively and negatively, by the numerous external factors of such a long and wide river. Because of this difficulty of establishing definitive correlations between the water quality at monitoring sections and project impact, certain assumptions were added in the evaluation.

In some sub-projects, the operation had been discontinued or the operating enterprise had gone bankrupt. Verifiable information is extremely limited for these sub-projects, though a survey visit was accepted in some cases.

3. Results of the Evaluation (Overall Rating: B)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plan of People's Republic of China

(1) Development policy at the time of project appraisal

Addressing environmental problems that have been aggravated in conjunction with rapid economic growth is a major challenge in China. The Ninth 5-year Plan (1996 – 2000) cites measures against water and air polluting sources and improvement of urban environment as top priority issues. Xiang River, being one of the tributaries of Chang River, has been designated as a priority region as a part of the Seven Major River Basin Program that flows into Chang River. The impending challenge at the time was to implement environmental improvement plans that would serve the dual purposes of restructuring ailing state companies and combating environmental pollution.

[4]Examples of such external factors include: decreased number of polluting sources resulting from closure of small- and medium-sized factories through the government's industrial structure adjustment policy, increased emission/discharge of pollutants and contaminants resulting from industrialization and urbanization.

In line with this national government policy, the Basic Policy on Xiang River Basin Comprehensive Environmental Improvement Plans (1998) calls for conformance of all industrial effluents in the Province with all applicable discharge standards, both national and provincial. The Report on Overall Environmental Impact of the Japanese ODA Loan Project for Xiang River Basin Hunan Environmental Improvement, which served as the environmental impact assessment report of Hunan Province Environmental Protection Master Plan, recommended that emission/discharge standards of industrial waste water, industrial gases and solid waste to be set in accordance with the national requirements of "containing total emissions/discharge of major pollutants in the year 2000 not higher than the levels of year 1995." The project was implemented based on this policy.

(2) Development policy at the time of ex-post evaluation

Increase of environmental pollution abatement capacities and protection of ecology and environment are given major challenge status in China's National Development Plans, in both the Tenth 5-year (2001 - 2005) and the Eleventh 5-year (2006 - 2010) Plans. More specifically, the Plans call for sound management of environmental problems that would otherwise adversely affect sustainable development of the society, by prioritizing prevention and abatement of pollution and by improving the quality of potable water in both urban and rural areas. The stated goals include: improvement of water environment through reduction of COD[5] in the effluent, mitigation of air pollution through reduction of sulfur dioxide emissions, and promotion of recycling and safe treatment of solid waste. In both The Tenth and Eleventh 5-year National Environmental Protection Plans, standards for the levels of pollutants that must not be exceeded are set out.

The Eleventh 5-year Plan for Prevention of Xiang River Basin Water Quality Pollution (2006 – 2010) states that Xiang River is one of the seven major rivers that runs into Chang River, and that Xiang River basin requires intensive efforts such as improved city sewage treatment, heavy metal effluent treatment and sound management of municipal solid waste.

The project has as its objectives reduction of water pollution, air pollution and solid waste, which have been identified as focus areas in both the national and provincial development plans. Thus, its relevance to development policies is high, at the time of project appraisal as well as of ex-post evaluation.

3.1.2 Relevance with the Development Needs

3.1.2.1 The need to improve water and air in Xiang River basin

Water pollution of Xiang River at the time of project planning was serious; the standards were exceeded at several monitoring stations in terms of not only COD and BOD[6] but also of

[5] COD, standing for Chemical Oxygen Demand, is an indicator of the degree of water contamination. It is the amount of oxygen that is consumed for oxidization of organics in the water by an oxidizing agent.

[6] BOD stands for Biochemical Oxygen Demand. It is an indicator of the degree of water contamination. It is especially important as a regulatory parameter for industrial effluent. It is expressed in terms of oxygen consumed by microorganisms for decomposition of organic components in the water. The higher is the BOD value, the higher is the degree of water

lead, cadmium and other heavy metal concentrations. BOD was 6 – 34% in excess of the standard at six major water quality monitoring sections, and mercury concentration in Xiangtan, an industrial city near Changsha, was approximately 60% above the standards. Air pollution in the region was no less serious; Frequencies of acid rain were 100% in Changsha, 99% in Xiangtan and 57% in Zhuzhou. Additionally, the generation of household waste and other solid waste was on the increase. Lack of waste treatment facilities was causing serious problems of foul odor and contamination of soil and nearby water streams.

The project was intended to address the serious environmental pollution in the region as described above, and its objective of pursuing improvement of water pollution, air pollution and solid waste management was relevant to the development needs of the region. The holistic approach of addressing multiple development needs by a single project was quite appropriate because the sources of pollution in Xiang River basin were diversified and geographically dispersed.

3.1.2.2 Relevance of project objectives definition and sub-projects selection

Meanwhile, there was room for improvement in terms of (1) relevance in the definition of project objectives, and (2) relevance in the selection of sub-projects.

(1) Relevance of project objectives definition

The project had a stated objective of "preventing aggravation of environmental pollutions by implementing projects relating to sewage and waste water treatment, air pollution abatement, and solid waste treatment, thereby contributing to an improved natural environment in the basin as well as improved standard of living for the local residents." Strictly interpreted, these wordings mean "quality improvement of the water in Xiang River as a whole."

This interpretation, however, is unrealistic, given the vastness of Xiang River and the input that was to be made by the project. Major rivers such as Xiang are exposed to numerous external factors, and it is next to impossible to make a rational assessment of the project impact on the overall water quality improvement of Xiang River.[7] For this reason, the objective of the project was restated as "the improvement of rivers and water systems of Xiang River adjacent to the sub-project sites" and the water quality at monitoring sections closest to the sub-project sites was chosen as indicator of effectiveness evaluation. The improvement of living standard of the local residents was chosen as the measuring stick for evaluation of project impact, the overall goal.

Also included in the project objectives was alleviation of air pollution and acid rain damages through introduction of a city gas service to reduce emissions of sulfur dioxide and other

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contamination.

[7] If all the sub-projects of the project were to demonstrate their designed performances in full, 75,821 tons of COD were to be reduced each year. The COD discharge in 1997 of eight cities in the Xiang River basin was 438,108 tons in total, which means the project impact would have accounted for 17%. It should be noted, however, that the actual benefit would be smaller because COD from sources other than the eight cities is not accounted for.

polluting substances. Even though reduction of sulfur dioxide gas emissions at the sub-project level is possible ("output"), it is not clear how such reduction would contribute to "improvement of life environment through waste gas reduction" that is stated as a qualitative effect ("outcome") of the project. For the purpose of the present ex-post evaluation, effectiveness is rated on the basis of sulfur dioxide emissions reduction that is set out as a quantitative effect of the project, and the "improvement of life environment through waste gas reduction" is used as a basis for rating of project impact. Since the input of only one project in one city is unlike to produce any noticeable results on the entire population and there are numerous external factors, the effect of waste gas reduction on the life of local residents was not measurable. Accordingly, evolution of acid rain frequency was reviewed only as data for reference.

(2) Relevance of sub-projects selection

There were substitutions in the sub-projects prior to the project implementation; three of the initially-contemplated nine industrial waste water treatment projects of Category 2 were replaced by different sub-projects. The reasons for the changes are as follows:

- 2-4) Wastewater Treatment Project for Xiangtan Paper Mill Factory: The company had financial problems and went bankrupt in 1999.
- 2-8) Water Pollution Control Project by Liuyang Paper Plant: The plant operation was discontinued as a result of government industrial structure adjustment policy, because of its small production capacity and heavy environmental load.
- 2-9) Gas Supply and Water Pollution Control Project by Liuyang Nitrogenous Fertilizer Factory: The production process was streamlined and the financing was made from domestic sources, thus avoiding the need for a Japanese ODA loan.

In exchange, the following three sub-projects were implemented:

- 2-10) Organophosphorus Pesticide Tech-transformation and Wastewater Treatment Project
- 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant
- 1-9) Sewage Treatment System Construction Project in Liuyang City

The project has built up flexible management system among the Borrower, the Executing Agency and JICA, by adequately replacing the suspended sub-projects with difficulties before implementation. These new substitute sub-projects are highly relevant with the project objective and match the needs and beneficial effects. The replacement itself has no influence over the entire project; however, it should be remembered that closer examination of the financial conditions and project implementation organization at the appraisal stage might have avoided such substitution. All of the replaced sub-projects related to private enterprises and the substitution became necessary due to financial difficulties, insufficient business scale and other reasons. It was found, for instance, financial conditions were not reviewed sufficiently at the

time of appraisal for Sub-projects 2-4) Wastewater Treatment Project for Xiangtan Paper Mill Factory and 2-9) Gas Supply and Water Pollution Control Project by Liuyang Nitrogenous Fertilizer Factory.

Meanwhile, it should be recognized that ex-ante evaluation was not commonly performed as strictly at the time of appraisal of this project (1997 – 1998) as it is today, and clear rules or procedures had not been established for selection of sub-projects. The appraisal was carried out in a more simplified way in comparison with that of other ODA Loan projects, and the brevity of the appraisal was understandable in view of the large number of sub-projects involved. These shortcomings in the relevance of project objective definition and of sub-projects selection are not reflected in the rating because of the absence of stringent ex-ante evaluation at the time, the practical inability of performing detailed appraisal of individual sub-projects, and counterpart's major lead in selection process.

3.1.3 Relevance with Japan's ODA Policy

The Economic Cooperation Plan for China, a country assistance program policy statement formulated in 2001, cites responses to environmental pollution associated with economic growth as one of the long-term challenges in China's development strategy. The policy statement list "cooperation in the effort to address the environment and other global challenges" as the number one issue among priority areas for Japan's assistance; hence, the project under evaluation is highly relevant with Japan's ODA policy.

In conclusion, this project has been highly relevant with China's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

The sub-projects, which are grouped into categories described below, were generally implemented as planned. Category 1 "City sewage treatment projects" were implemented as planned in general. Category 2 "Industrial waste water treatment projects" were implemented as planned in general, except for the two sub-projects that were replaced. Category 3 "Air pollution abatement projects" were implemented as planned in general, but two of the three sub-projects are not in operation and limited information was available. Category 4 "Waste treatment projects" and Category 5 "Other project" were also implemented as planned in general. (See Attachment 1)

(1) Category 1: City sewage treatment projects

Category 1 "City sewage treatment projects" were generally implemented as planned. For the purpose of sub-project substitution, sub-projects 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant and 1-9) Sewage Treatment System Construction Project in Liuyang

City were newly included. City sewage treatment projects form a part of the urban basic infrastructure and are mostly implemented and operated by local governments. It is believed that these sub-projects were less resilient to market economy influences, suffering little occasions of work interruptions or design alterations. The design treatment capacity of Sub-project 1-7) "Environmental Countermeasures in Wulingyuan Scenic Zone, one of the World Natural Heritage, in Zhangjiajie City" was lowered. This was due to the cancellation of a tourist facilities construction that had been initially planned outside the scope of the project, as well as a reduced discharged water that reflected the designation of Shuirao Si Gate, a zone initially considered to be served by the project, as a natural reserve.

(2) Category 2: Industrial waste water treatment projects

Category 2 "Industrial waste water treatment projects" were implemented as planned in general, except for the two sub-projects that were replaced. Sub-project 2-10) Organophosphorus Pesticide Tech-transformation and Wastewater Treatment Project, as hereinafter described in detail, encountered financial difficulties and went bankrupt, partly influenced by the industrial structure adjustment policy of the government.

(3) Category 3: Air pollution abatement projects

Category 3 "Air pollution abatement projects" were implemented as planned in general, but two of the three sub-projects are not in operation and little information was available. The facilities under sub-project 3-2) Expansion Project of Gas Production Plant in Zhuzhou City were constructed as planned and were in operation until 2008. However, the change of government policy on city gas services from coke-based to natural gas-based forced the facilities to discontinue operation, except the distribution pipeline. Similarly, the facilities under sub-project 3-3) LPG Supply Project in Changsha City were constructed as planned and were in operation for about two years, but the change of government policy on city gas services (from LPG-based to natural gas-based)[8] forced the facilities to discontinue operation. As of this writing, the pipeline facilities have been transferred to Changsha XinAo Gas Company and are in service.

(4) Category 4: Waste treatment projects

Category 4 "Waste treatment projects" were implemented as planned in general.

(5) Category 5: Other project

Category 5 "Other project" was implemented as planned in general.

[8] The West-East Gas Pipeline Project advocated in the Tenth 5-year Plan was motivated by the government policy to diversify energy sources and reduce coal consumption by increased use of natural gas.

3.2.2 Project Inputs

3.2.2.1 Project Period

Though the planned project period at the time of appraisal was 36 months from September 1997 through August 2000 for Project (1), the actual implementation took 96 months (267% of the planned period) from January 1998[9] through December 2005. The implementation of Project (II) was planned for the 49 months from December 1998 through December 2002, but in practice it took 81 months (165% of the planned period) from April 1998 through December 2004.

There were considerable differences among the sub-projects in terms of project period divergence. The individual divergences of sub-projects were rated, and the rating average was used for the overall rating. (See Attachment 2). Based on this calculation, the average rating point is 1.55 (average of subprojects' period exceeded 50% or higher and less than 80%) or slightly longer than planed.

Overall, the actual project period was longer than planned, but the length of delay varies from one sub-project to another. In 7 of the 22 sub-projects, the construction was completed and completion inspection was conducted within 150% of the planned period. Thirteen others suffered project delays between 150% and 250%. Project delays of over 250% were observed for 1-3) Sewage Treatment System Construction Project in Changde City and 2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project. Sub-project 1-3) Sewage Treatment System Construction Project in Changde City took as long as two years for the completion inspection following the construction completion. Sub-project 2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project experienced suspension of the entire business activities of the implementing agency because of financial difficulty. The implementing agency was initially a state company but a difficulty in financing forced it to be merged with a private entity. The operation was thus suspended for about two years. Sub-project 2-10) Organophosphorus Pesticide Tech-transformation and Wastewater Treatment Project and 3-2) Expansion Project of Gas Production Plant in Zhuzhou City are not counted for the purpose of rating, owing to unavailability of required information because the former sub-project has been cancelled after implementation and the latter underwent operation discontinuation.

3.2.2.2 Project Cost

The total project cost of Projects (I) and (II) combined was 26,593 million yen against the plan of 25,008 million yen (106%), thus resulting in a minor overrun. The foreign currency was expended almost as planned, while the domestic currency expenditures exceeded the planned sum slightly. The major reason was the additional input for roads and pipelines that became necessary as a result of location change of some sewage treatment plants. Sub-project 1-1)

[9] The month in which the pertinent executing agency or corporation actually started the project implementation is deemed as the project initiation month.

Sewage Treatment System Construction Project in Yongzhou City, in particular, was over 150% in excess of the planned project cost; domestic funds had to be included additionally for the improvement of pipeline networks and other purposes.

In summary, both project period and project cost were slightly higher than planned, therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: b)

For the purpose of this ex-post evaluation, effects on water pollution, air pollution and solid waste management will be evaluated in a comprehensive manner. However, central themes of the description and the weight in rating will relate to water quality improvement because it is the focus of project inputs. The indicators for project effectiveness and impact for the evaluation are defined as follows:

- Level 1: Operation and effect indicators of sub-projects
  Quantitative effects: reductions in COD, mercury, arsenic, cadmium, lead, sulfur dioxide, household waste and chrome slag [Effectiveness]
- Level 2: Water quality of rivers and water systems adjacent to the sub-project sites
  Water quality of rivers and water systems adjacent to the sub-project sites along Xiang River at the monitoring sections [Effectiveness]
- Level 3: Improvement of health conditions of local residents
  Qualitative effects: (a) improvement in the living standard of local residents and preservation of water resources through improved quality of rivers and water systems in the Xiang River basin, and (b) improvement in the living standard of local residents through reduction of gas emissions and solid waste [Impact]

As was mentioned in 3.1.2.2 (1) "Relevance of project objectives definition," the objective of the project was restated as "the improvement of rivers and water systems of Xiang River adjacent to the sub-project sites." As indicators of effectiveness evaluation for water pollution improvement, the operation and effect indicators (Level 1) and the water quality at monitoring sections closest to the sub-project sites (Level 2) were chosen.

No detailed data or information was available with regard to air pollution abatement projects because two of the three sub-projects were no longer operational. Accordingly, effectiveness was evaluated in terms of achieved reductions of pollutants by the sub-projects (Level 1) and the frequency and pH value of acid rain (Level 3) were used only as reference data in the project impact evaluation.

The effectiveness of solid waste treatment project was evaluated in terms of the amount of household waste treated (Level 1). Because no water quality data (Level 2) was available with respect to the rivers and water systems adjacent to the sub-project sites, this portion is not reflected in the rating.

3.3.1 Quantitative Effects

Effectiveness measuring the degree of achievement of project objectives is evaluated on the basis of: (1) operation and effect indicators of the sub-projects, (2) evolution of water quality of the rivers and water systems at monitoring sections closest to the sub-project sites, and (3) results of calculations of internal rates of return (IRR).

3.3.1.1 Results from Operation and Effect Indicators

Annual reductions in COD, mercury, arsenic, cadmium, lead, sulfur dioxide, chrome slag and household waste were to be used as effect indicators of the project. Please refer to Attachment 3, "A Summary of Operation and Effect Indicators for Sub-Projects," for a comparison of target and actual values. For a quick review of project effectiveness, the status of operation and effect are summarized by sub-project category as follows:

Table 1 Status of Operation and Effect by Sub-project Category

Category	Status of operation	Effect
Category 1: City sewage treatment projects	Nine out of nine are operational.	Objectives generally achieved
Category 2: Industrial waste water treatment projects	Six out of seven are operational; one has been discontinued.	Objectives generally achieved
Category 3: Air pollution abatement projects	One out of three is operational; two have been discontinued.	Substantially below the plan
Category 4: Waste treatment projects	Two out of two are operational.	Plan exceeded
Category 5: Other project	One out of one is operational.	Objectives generally achieved

The effectiveness of sub-project in operation is generally good. With respect to Category 1 "City sewage treatment projects," the COD reduction and other indicators are below the target values that were set at the time of project planning. This, however, is due to reduced emissions of pollutants itself, reflecting the withdrawal from the market of small- and medium-sized companies through industrial structure adjustment. In most of the sub-projects, the quality of post-treatment discharged water is superior to what was envisioned in the project plan. With respect to Category 2 "Industrial waste water treatment projects," the target reduction values of hazardous substances in the plant effluents have been met in most of the sub-projects. Operation of one sub-project has been discontinued because of the company's financial difficulties. The effectiveness of Category 3 "Air pollution abatement projects" has been limited, because the operation of two of the three sub-projects has been discontinued. With respect to Category 4 "Waste treatment projects," the covered population became larger than planned, and the amount of solid waste treated far exceeds the target value. The water quality, however, has not met the target values. Specific amounts of annual reduction are reviewed for each category as below.

(1) Water pollution improvement projects

Category 1: City sewage treatment projects (9 sub-projects implemented)

Reduction item	Target value	Actual reduction	Achievement ratio (%)
COD	75,821 t/yr	42,439t/yr	56
BOD	37,782 t/yr	16,447t/yr	44
SS[10]	177,185 t/yr	142,662t/yr	81
Sewage treated	850,000 t/day	630,000 t/day	74

Note: The reductions in this table include those from sub-projects of other categories for the purpose of reviewing the overall effectiveness of the entire loan project.

The effect indicators chosen for city sewage treatment projects were reductions in COD, BOD and SS as well as the amount of sewage treated. Reduction in COD, BOD and SS varied between 44% and 81% of the plan. This was affected by the less than anticipated generation of pollutants, reflecting the withdrawal from the market of small- and medium-sized enterprises through industrial structure adjustment. It is worth noting that the water quality achieved by most of the sub-projects is better than the planned quality. Altogether, the effectiveness of pollutants reductions can be considered good.

Fig. 2 Sub-project 1-6) Sewage Treatment Project in Xingsha Development Area of Changsha: wide-mesh screen

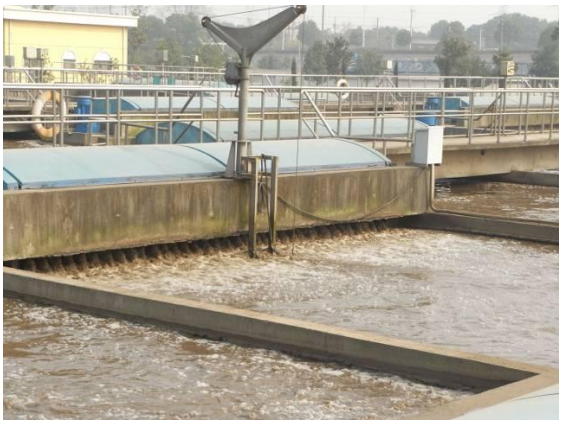

Fig. 3 Sub-project 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant: oxidation ditch process-based treatment facility

Category 2: Industrial waste water treatment projects (7 sub-projects implemented, of which 1 has been closed)

Reduction item	Target value	Actual reduction	Achievement ratio (%)
Mercury	2 t/yr	3 t/yr	150
Arsenic	127 t/yr	117 t/yr	92
Cadmium	22 t/yr	22 t/yr	100
Lead	99 t/yr	130 t/yr	131
Chrome slag treated	2.1 t/yr	1.2 t/yr	57

The effect indicators chosen for industrial waste water treatment projects were mercury,

[10] SS, standing for "Suspended Solid", refers to insoluble particle matters that are suspended in water. It includes: micro particles of clay minerals, zoo- and phyto-planktons and their shells, organic matters and metal sediments from sewage or industrial effluents, etc.

arsenic, cadmium, lead and chrome slag treatment. The achievement ratio varied between 57% and 150%; those for mercury, cadmium and lead exceeded 100%. Approximately 95% of the chrome slag has been treated already and within one year there will be no more slag to be treated. Reductions of hazardous substances in industrial waste water have met the target values in most of the sub-projects in operation.

It should be noted, however, that sub-project 2-10) Organophosphorus Pesticide Tech-transformation and Wastewater Treatment Project suffered closure after project implementation. After the facilities were completed, the plant had an accident and the operation was discontinued entirely. Subsequently, the company faced financial difficulties and eventually went bankrupt, adversely affected also by the government's industrial structure adjustment policy.

Sub-project 2-3) Chrome Slag Treatment Plant in Hunan Ferroalloy Factory is no longer producing chrome product.

Fig. 4 Sub-project 2-2) Wastewater Treatment Project for Zhuzhou Chemical Factory: Compressed air is injected for sulfuric acid washing.

Fig. 5 Sub-project 2-2) Wastewater Treatment Project for Zhuzhou Chemical Factory: Treated water is of quality fit for direct discharge to Xiang River.

(2) Air pollution abatement projects

Category 3: Air pollution abatement projects (3 Sub-projects implemented, of which 2 have been closed)

Reduction item	Target value	Actual reduction	Achievement ratio (%)
Sulfur dioxide	10,692 t/yr	1,184 t/yr	11
Coal	25,713 t/yr	1.46t/yr	0
TSP[11]	5,521 t/yr	712t/yr	13

In Category 3 "Air pollution abatement projects," two out of the three sub-projects, namely, 3-2) Expansion Project of Gas Production Plant in Zhuzhou City and 3-3) LPG Supply Project in Changsha City, had to discontinue operation after implementation. The change in national policy that took place after the project implementation promoted use of natural gas and reduced

[11] Total Suspended Particulate; represents the total amount of suspended particulates in the air

the demand for coke gas and LPG that these sub-projects were producing, substantially diminishing their business base.[12] Thus, the operation discontinuation was a consequence of change in national policy on industrial structure adjustment and gas supply, which was unforeseeable at the time of project appraisal.[13] Accordingly, relevance of the sub-projects selection remains valid.

The effect indicators chosen for air pollution abatement projects were reductions of sulfur dioxide, coal and TSP. Sub-project 3-3) LPG Supply Project in Changsha City supplied 6.87 million cubic meters of LPG to 30,000 households with a total population of 100,000 in the third year of its operation (2003). Subsequently, however, the operation had to be discontinued as a result of change in national policy; there is little prospect that any further effect would be demonstrated. As for the two sub-projects that suffered operation discontinuation, no relevant data was provided by the implementing agencies of the sub-projects on any project effect while they were in operation. Despite the lack of substantiating data, that fact of operation discontinuation of two of the three sub-projects by itself leads to the view that the effect of air pollution abatement projects was limited.

Fig. 6 Sub-project 3-2) Expansion Project of Gas Production Plant in Zhuzhou City: Added coke furnace (no longer in operation)

Fig. 7 Sub-project 3-2) Expansion Project of Gas Production Plant in Zhuzhou City: Added coal gas purification equipment (no longer in operation)

(3) Solid waste treatment projects

Category 4: Waste treatment projects (2 sub-projects implemented)

Reduction item	Target value	Actual reduction	Achievement ratio (%)
Household waste treated	116 t/yr	131t/yr	113

The quantity of household waste treated is chosen for effect indicator of solid waste treatment

[12] Sub-project 3-1) Expansion Project of Gas Supply Network in Shaoyang City is in operation because the city is not served by natural gas.

[13] The project had a strong characteristic of "sector assistance"; as such it does not seem to have required stringent perusal processes for sub-projects selection. The project preparation study that was made at the time of project preparation makes no references as to sub-projects selection processes or aptitude of individual executing entities.

projects. The indicator very well exceeded the target value because the served population became larger than initially contemplated. It should be remembered however that the discharged water from the treatment facilities is of quality not meeting the target value, and it is running into the river close to the sub-project locations. Possible future adverse effects should be watched with caution.

Sub-project 4-1) Garbage Filling Yard Construction Project in Hengyang City is overloaded already and its closure is scheduled by the end of 2010. In the case of this sub-project, the annual treatment quantity is about 1.8 times the planned quantity because of the 1.7 times increase in the covered population from 600,000 to one million. Since the facility was commissioned in 1999, the project life will be eleven years. Initially, a project life of 14 years was envisioned, but it will have been shortened because of the higher-than-expected capacity utilization.

Fig. 8 Sub-project 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City: Equipment (a backhoe excavator)

Fig. 9 Sub-project 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City: Filling yard side ditch

(4) Other project

Category 5: Other project (1 sub-project implemented)

Sub-project	Target	Actual
5-1) The Environmental Monitoring and Management Center of Hunan Province	Improvement of environmental monitoring, upgrading of data management and capacity building of technicians	Some 20 items were added to the 29 environmental monitoring items. Accuracy of mercury, arsenic and other heavy metal analysis has improved.

Under sub-project 5-1) The Environmental Monitoring and Management Center of Hunan Province, equipment and apparatus required for environmental monitoring were supplied. While no effect indicators had been set, interviews with the concerned parties revealed that 25 pieces of equipment and apparatus are properly managed and put into use, and the project is producing generally good effect. Utilization of these equipment and apparatus has raised the accuracy of

pollutants analysis, helping prevent serious environmental contamination incidents. Measuring equipment and instruments have been distributed among the environmental monitoring stations of cities in the Xiang River basin, contributing to the improved monitoring frequency and analytical accuracy on their part.

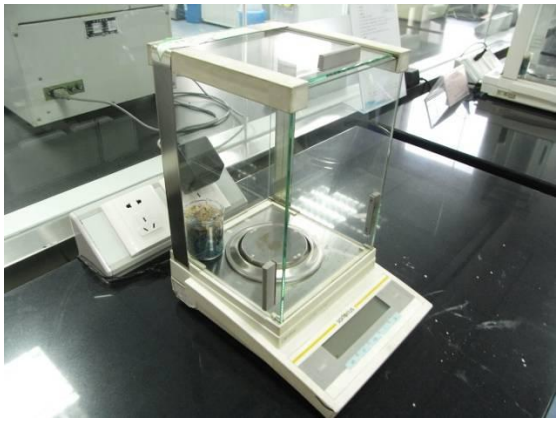

Fig. 10 Sub-project 5-1) The Environmental Monitoring and Management Center of Hunan Province: An electronic balance

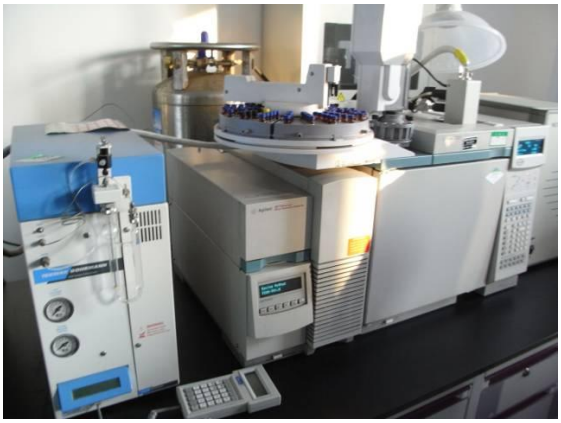

Fig. 11 Sub-project 5-1) The Environmental Monitoring and Management Center of Hunan Province: A headspace sampler (Shimadzu) [14]

3.3.1.2 Evolution of water quality of the rivers and water systems at monitoring sections closest to the sub-project sites

Table 2 shows the evolution of COD in the rivers and water systems measured at monitoring sections closest to the sub-project sites[15].

Table 2 Evolution of COD in the rivers and water systems measured at monitoring sections closest to the sub-project sites

Sub-project	Monitoring section	COD(Mg/L) as of 1997	COD(Mg/L) as of 2008
1-2) Sewage Treatment System Construction Project in Yueyang City	Chenglingji, Yueyang City: about 28 kilometer distance	3.16	2.06
2-1) Expansion Project of Wastewater Treatment Plant for Zhuzhou Heavy Metal Factory	Maijiahe, Zhuzhou City: about 6 kilometer distance	2.24	3.94
2-7) Industrial Pollution Control Project by Xiangtan Iron & Steel Co.	Zhaoshan, Xiangtan City: about 19 kilometer distance	2.44	2.48
1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant	Sanzhenzhen, Changsha City: about 3 kilometer distance	2.58 (as of 1993)	14.6 (as of 2009)

[14] It separates and analyzes volatile components of a liquid or solid sample.

[15] The review was made on the basis of available data for four major cities, because of unavailability of data for all the rivers and water systems closest to the sub-project sites.

Sources: Bureau of Environmental Protection of Hunan Province, except for 1-8) which was furnished by Changsha No.1 Sewage Treatment Plant

The COD measured at the monitoring section closest to the site of Sub-project 1-2) Sewage Treatment System Construction Project in Yueyang City is on an improving trend in comparison with year 1997. The COD measured at the monitoring section closest to the site of Sub-project 2-1) Expansion Project of Wastewater Treatment Plant for Zhuzhou Heavy Metal Factory is on a deteriorating trend in comparison with year 1997. The COD after the implementation of Sub-project 2-7) Industrial Pollution Control Project by Xiangtan Iron & Steel Co. deteriorated in year 2003 against year 1997 and since then has been on a moderate improving trend. However, there was little change over the year 1997. The COD after the implementation of sub-project 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant is on a deteriorating trend in comparison with year 1993. In comparison with the initial data at the time of project appraisal, COD is on deteriorating trends in the cities of Changsha and Zhuzhou and is on an improving trend in Yueyang City.

From a broader perspective, there have been substantial increases in the amounts of discharged industrial/household waste water and their COD in Hunan Province, as shown in Table 5 below.

Table 3 Evolution of Industrial/Household waste water discharge and its COD in Hunan Province (2000 – 2008)

Year	Waste water (100 million tons)			COD (10,000 tons)		
	Total	Industrial	Household	Total	Industrial	Household
2000	21.13	10.18	9.87	67.40		
2001	20.77	10.72	10.05	71.88	31.66	39.30
2002	22.02	11.18	10.84	74.12	30.93	43.19
2003	23.57	12.41	11.16	74.69	25.16	49.53
2004	25.00	12.31	12.69	84.99	27.60	57.39
2005	25.56	12.24	13.32	89.45	29.38	60.08
2006	24.41	10.00	14.41	92.25	29.21	63.04
2007	25.21	10.01	15.20	90.36	25.72	64.64
2008	25.03	9.23	15.80	88.46	23.73	64.74

Source: Hunan Province Environmental Statistical Yearbooks (2004 through 2008 editions)

By the year 2008, the amounts of waste water and COD discharge have increased to 118% and 131% of the year 2000, respectively. In the context of such an overall increase of waste water in the basin, the project served to reduce COD by 42,439 tons a year, corresponding to 4.8% of the total COD discharge of the basin in 2008. The aggregate total of waste water treated by the sewage treatment plants of this project is 630,000 tons per day, or by simple conversion, 230 million tons a year, which accounts for 9.2% of all waste water generated in the Hunan Province. Based on these figures, COD in the order of 40,000 tons and waste water in

the order of 200 million tons would have been discharged into the environment if it were not for the project under evaluation. The project may be said to have made a certain degree of positive contribution in the sense of preventing aggravation of environmental pollution.

3.3.1.3 Results of Calculations of Internal Rates of Return (IRR)

Results of calculations of IRR: Financial Internal Rate of Return (FIRR)

The FIRR of sub-projects with financial benefits (those that charge fees in return for the service provision) was recalculated in order mainly to examine their financial sustainability. Of the four sewage treatment plants for which verifiable data were available, three produced negative results. This is due to the service fee that is artificially set at low levels because the implementing agencies are public entities and by nature are not expected to be financially self-standing. The sewage treatment service is supported by the city governments for necessary funds, and no realistic problem is in sight for sustained operation.

Sub-project	Results of FIRR calculation
1-1) Sewage Treatment System Construction Project in Yongzhou City	Negative result
1-3) Sewage Treatment System Construction Project in Changde City	3.76% (project life = 30 years)
1-5) Sewage Treatment Project in Linxiang City	Negative result
1-7) Environmental Countermeasures in Wulingyuan Scenic Zone, one of the World Natural Heritage, in Zhangjiajie City	Negative result

- Costs: operation cost, maintenance cost (labor and other costs)
- Revenue: Sewage treatment fee (project life = 30 years; for Yongzhou City 20 years)

Sub-project 1-3) Sewage Treatment System Construction Project in Changde City produced a positive result, because the city charges a relatively high fee for the sewage service in comparison to cities of the other sub-projects. One factor for the difference may be the large population served by the sub-project (2.5 – 10 times as large).

3.3.2 Qualitative Effects

The qualitative effects of this project will be discussed in the section on "Impacts to Beneficiaries."

In sum, these sub-projects have generally achieved their respective objectives and helped prevent aggravation of water pollution in the nearby rivers. From this perspective, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Impact

3.4.1 Intended Impacts (Improvement in Health, Welfare and Living Environments)

The qualitative effects of the project relate to water resource conservation, waste gas pollutants reduction and reduction of unsanitary solid waste disposal for improvement of the living environment of the residents in the basin. In order to analyze these aspects, the project impact was evaluated by the use of: (1) acid rain frequency data (to be regarded as reference only because two of the three sub-projects concerned are no longer operational), and (2) results of the beneficiaries survey.

(1) Acid rain frequency

The contribution of this project in reducing acid rain frequency and otherwise abating air pollution is rather limited, partly because two of the three sub-projects concerned suffered operation discontinuation. For reference purpose, let us take a look at the evolution of acid rain frequency and annual average pH values[16] in the cities of Shaoyang, Zhuzhou and Changsha. As of this writing, only sub-project 3-1) Expansion Project of Gas Supply Network in Shaoyang City is operational.

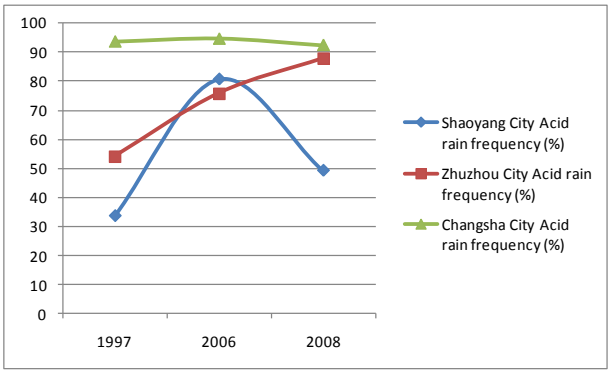

Figure 12 Acid Rain Frequency

Source: Hunan Provincial People's Government

Acid rain frequency continues to be high in Changsha City in comparison with the year 1997. In Zhuzhou City, it has increased more than 30 percentage points over the ten years. In Shaoyang City, the frequency went up in 2006 but has been on a declining trend since then. Sub-project 3-1) Expansion Project of Gas Supply Network in Shaoyang City started its operation in 2005 and has reduced between 660 and 1,184 tons of sulfur dioxide emissions every year. Even though no data or information was available that would establish definitive

[16] Acid rain refers to the phenomenon of acidic substances deriving from sulfur dioxide (SO_2), nitrogen oxides (NO_x) and other compounds emitted into atmosphere through fossil fuel incineration, metal smelting and other processes fall down back to the ground, entrenched in rain, snow, fog, etc. Hydrogen ion concentration (pH) is the indicator commonly used to express acidity/alkalinity of a substance. Lower pH values mean stronger acidities. In many parts of the world, rain with a pH value not greater than 5.6 is as an acid rain. Source: Japan Meteorological Agency website http://www.data.kishou.go.jp/obs-env/acidhp/knowledge_acid_rain.htm

relationship between the observed acid rain frequency decline and this sub-project, it appears likely that the project has indeed been making a certain degree of contribution to the turnaround that occurred in 2006.

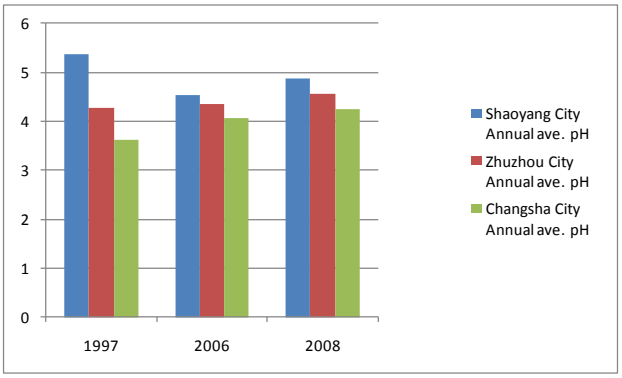

Figure 13 Annual Average pH Value

Source: Hunan Provincial People's Government

The annual average pH value of precipitation is showing an improving trend in the cities of Changsha and Zhuzhou, while it is on a deteriorating trend in Shaoyang City.

(2) Results of beneficiaries survey

A beneficiaries survey was made to local residents of Xiang River basin on the question of water pollution of the river (102 responses)[17]. While 25.5% of the respondents felt the pollution of Xiang River ten years ago was "very serious" or "relatively serious," 73.6% felt that way about today's situation. The survey revealed that many (72.2%) believed that major cause of the pollution was the industrial waste water and household waste water coming down from upstream, and a similarly large number of respondents (63%) cited above-standard discharge of urban sewage treatment plants as another major cause. Thus, the respondents were found to have a negative perception about the quality of Xiang River as a whole. This likely reflects influences of increases in the number of polluting sources, rising quantities of waste water discharge over the decade and other external factors that were brought about by the rapid economic growth and urbanization.

3.4.2 Other Impacts

3.4.2.1 Land Acquisition and Resettlement

No particular problems were observed with respect to the ODA loan project under evaluation.

[17] The beneficiaries survey was conducted by face-to-face interview, based on a structured interview format. The questions mainly related to change of Xiang River water quality over the decade, water usages with available quality, degree of satisfaction with the water quality, major sources of pollution, etc. The interviews were made to residents living close to Xiang River or the sub-project sites in five cities: Yongzhou, Hengyang, Zhuzhou, Xiangtan and Changsha.

A voice of dissatisfaction was raised by some on the question of compensation money relating to the resettlement that became necessary in connection with the facilities expansion under Sub-project 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City. There are ongoing negotiations about the compensation package between the government and the residents.

3.4.2.2 Economic benefits

On-site interviews and other information sources suggest that certain degrees of economic benefits have been realized in some sub-projects.

- Sub-project 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City: Some local residents responded that they were enjoying economic benefits by the construction of the 7 kilometer road and sale of farm products to the plant.
- Sub-project 2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project: The factory enjoys an economic benefit of RMB 35 million a year from the use of circulation water and the production of aerated concrete blocks from fly ash.

3.4.2.3 Negative impacts

Negative impact was expressed by local environmental experts and residents in the vicinity of garbage treatment sites. A follow-up is believed necessary.

- For Sub-project 4-1) Garbage Filling Yard Construction Project in Hengyang City, local experts pointed out incidents of unlawful discharge and noncompliance with the standards with respect to cover soil application and discharged water treatment.
- Some residents in the neighborhood of the site of Sub-project 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City complained about contamination of nearby rivers and streams, crop damage by the discharged water, cases of skin diseases, increased emergences of mosquito and flies, etc.
- Sludge from sewage and solid waste treatment sites was not recyclable for compost[18] and compiled by filling after treating. According to the officers at 1-6) Sewage Treatment Project in Xingsha Development Area of Changsha, the current method of dehydration and filling would affect adversely to environment, so that they requested technical and financial support for low-cost and efficient sludge treatment.

It is virtually impossible to analyze accurately the extent to which the project may (or may not) have contributed to the improvement of living environment of the local residents. The perception that the quality of Xiang River water has deteriorated over the decade and that the

[18] According to the officers at 1-6) Sewage Treatment Project in Xingsha Development Area of Changsha, Chinese government issued the national standard for sewage treatment called "Urban Area Sewage Treatment Sites Pollutant Discharge Standard" GB 18918-2002, and it states strict requirements for some indicators such as nitrogen, phosphorus, and Escherichia coli. The technology of currently adopted OD method cannot eliminate nitrogen or phosphorus completely, so that the advanced technology needs to be adopted to reduce the sludge with more capacity for eliminating above mentioned items.

pollution is serious is held by over 70% of the residents. While some residents stated that they were receiving economic benefits from the sub-project near them, some others point to the negative impact caused by the discharged water of solid waste facilities. With respect to air pollution abatement, the degree of contribution to acid rain frequency reduction and other concrete parameters is not clear and cannot be evaluated, partly because the sub-projects concerned suffered operation discontinuation. With all these observations put together, it seems fair to say that no project impact has surfaced onto the level of living environment of the residents. Evaluation of realized impact on the general populace appears to have its own limit in a case like this project that is characterized by the paucity of easily-visible impacts (positive, in particular) and by the difficulty of identifying the group of beneficiaries.

3.5 Sustainability (Rating: a)

This project is structured in a way that the Hunan Provincial People's Government monitors the sub-projects as the supervising organization and the respective implementation agencies/enterprises are responsible for the operation and maintenance of the individual sub-projects. Accordingly, the sustainability was rated by first evaluating the sustainability of Hunan Provincial People's Government and each of the implementation agencies individually and the computing the average value.[19] Sub-projects that are in operation at this writing are generally well operated and maintained. Sub-projects that have discontinued operation or are scheduled for closure in 2010 are evaluated to be not sustainable already at this time of ex-post evaluation.

3.5.1 Structural Aspects of Operation and Maintenance

(1) Executing agency: Hunan Provincial People's Government

The Hunan Provincial People's Government maintains an organization structure for constant supervision by continuing to keep in place the Hunan Province Management Office of Japanese Loan for Environmental Protection Project that is charged with the responsibilities of project monitoring and follow-up. The Bureau of Environmental Protection conducts an on-line monitoring of the urban sewage treatment sub-projects and some of the industrial waste water treatment sub-projects. While the project falls under the jurisdiction of four bodies --- Development and Reform Commission (5 officials), Local Finance and Securities Office (3 officials), Bureau of Environmental Protection (1 official) and Department of Construction (1 official), the Development and Reform Commission is responsible for coordination of follow-up activities. Shortcomings in project document management were pointed out in one of the self-evaluations of executing agencies, and should be corrected.

(2) Implementation Agencies of sub-projects

[19] The evaluation standards were based essentially on the sustainability standards applied to ordinary projects. Given the large number of entities involved, the simplified evaluation procedures were followed.

No problems were found with the organizational structures of those sub-projects that are in operation. The implementation agency of sub-project 2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project changed in 2003 from Xiangjian Nitrogen Fertilizer Factory, a state company, to privately-run Hunan Zhicheng Chemicals Co. Ltd. There are no management problems, either.

3.5.2 Technical Aspects of Operation and Maintenance

(1) Executing agency: Hunan Provincial People's Government (Bureau of Environmental Protection)

The Bureau of Environmental Protection performs monitoring, both scheduled and ad hoc, and is found to have the skill and competency necessary for proper supervision of the sub-projects. The Bureau of Environmental Protection makes responses to emergency situations of environmental incidents and extends routine support to city environmental monitoring stations in the Xiang River basin as well as to provincial centers through the supply of equipment, apparatus and technical assistance.

(2) Implementation Agencies of sub-projects

Generally no problems were found; most sub-projects are well-operated in terms of operation and maintenance personnel, size of technical staff and training/operation manuals. Some of the employees have participated in JICA's training programs in Japan, and the technical expertise and other knowledge acquired there are well reflected in the sub-project operation. Sub-project 1-1) Sewage Treatment System Construction Project in Yongzhou City was found to be suffering from insufficient inspection and maintenance equipment, which is a source of concern for sustained maintenance and repair activities.

3.5.3 Financial Aspects of Operation and Maintenance

(1) Executing agency: Hunan Provincial People's Government

No review was made on this particular aspect, because the Hunan Provincial People's Government is not an implementation agency of the sub-projects.

(2) Implementation Agencies of sub-projects

Most city sewage treatment enterprises are operated as public service with modest fees. Financial self-reliance is difficult or not intended at all. The government provides a constant flow of financial input and there are no financial problems that would hinder operation. With respect to sub-projects that are operated by private enterprises, no evaluation was possible because of the unavailability of financial statements.

3.5.4 Current Status of Operation and Maintenance

(1) Executing agency: Hunan Provincial People's Government

No review was made on this particular aspect, because the Hunan Provincial People's Government is not an implementation agency of the sub-projects.

(2) Implementation Agencies of sub-projects

As far as the facilities now in operation are concerned, the business environment to ensure stable operation, such as current status of operation, facilities management and spare parts replacement, was confirmed through visual inspection, examination of maintenance records and other means during the on-site evaluation study.

- With respect to sub-projects 1-2) Sewage Treatment System Construction Project in Yueyang City, 1-6) Sewage Treatment Project in Xingsha Development Area of Changsha, 1-7) Environmental Countermeasures in Wulingyuan Scenic Zone World Natural Heritage, in Zhangjiajie City, 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant, 2-6) Mining Water Pollution Control Project in Shuikoushan, 4-1) Garbage Filling Yard Construction Project in Hengyang City and 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City, expansion or revamping of the facilities have been executed or are scheduled according to the need.
- Sub-project 2-3) Chrome Slag Treatment Plant in Hunan Ferroalloy Factory was found to possess no business sustainability, because the factory is no longer producing chrome on account of weakened demand.
- Among the several treatment facilities included in Sub-project 2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project, the waste water treatment facility in the urea production line was not in service. Since the urea production is planned to be resumed by the end of this year, further follow-up is considered necessary. A "b" rating was given because the production had not yet restarted.
- The facilities of Sub-project 4-1) Garbage Filling Yard Construction Project in Hengyang City are operated at overload already and their closure is scheduled by the end of 2010, as was mentioned in the "Effectiveness" section. Construction of a separate treatment facility is planned in the framework of an existing ODA loan project.

Among the sub-projects that are privately run or are vulnerable to market fluctuations, four sub-projects have seen their business scope reduced or have suspended or discontinued operation. They were found to have no sustainability. However, all the others that are in operation have no problems and their overall status of operation is found to be good. In summary, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was planned and designed to address the grave environmental pollution of the

region. The intended approach of achieving comprehensive improvement of water quality, air quality and solid waste management was indeed relevant with the development need and the project relevance is high. With respect to the project planning process, however, there were rooms for improvement on the definition of project objectives and sub-projects selection. Under this project, three of the 22 sub-projects had to be substituted and after project implementation three had to discontinue operation. No planned effects were observed in the field of air pollution abatement. Influenced by the exiting of some small- and medium enterprises caused by the industrial structure adjustment policy, the reduction rates of COD and other water pollutants were adjudged "fair" but the quality of the treated water has indeed improved. Effects that have been realized in the fields of heavy metal concentration in industrial waste water and solid waste management exceeded initial expectation.

The evaluation study has revealed that the quality of rivers and water systems adjacent to the sub-project sites was on a deteriorating trend in the cities of Changsha and Zhuzhou and on an improving trend in Shaoyang City. Given the increases of waste water discharge and COD in recent years, the project can be said to have made a certain degree of positive contribution in preventing further deterioration of water quality.

Accordingly, a "b" rating was given to the overall effectiveness of the project. The sub-projects that are in operation are generally well operated and maintained.

In light of the above, this project is evaluated to be satisfactory (B).

4.2 Recommendations

4.2.1 Recommendations to the executing agencies

There were instances in which data required for evaluation were not available for reasons of change in personnel and others. Executing agencies should be fully advised of the importance of document management. Monitoring of pertinent data and information is very important for correct analysis of the effects and for sustained operation of the project. With respect to sub-projects at which the requested data were not available, in particular, it is hoped that the environmental monitoring center and/or the competent city environmental protection offices will make the necessary follow-up.

4.2.2 Recommendations to JICA

Nothing in particular.

4.3 Lessons Learned

(1) The project was implemented and is operated generally as planned, as far as its sewage treatment sub-projects are concerned, which are characterized by their strong public service nature. In contrast, the assistance extended to industrial waste water treatment and other sub-projects that were run by private enterprises ended up in outcomes such as project

cancellation and operation discontinuation, because of poor management or change in government policy. Particularly in extending assistance to private enterprises, it would have been desirable if the project had been designed to better respond to the dramatic changes in market conditions including rapid economic growth and policy changes. The use of a screening process that better responds to the most up-to-date situations would have been desirable by, for example, adopting the schemes that permit more flexible selection or changes of sub-projects from appraisal to implementation stages. It would then be possible for the project to adjust to immediate changes in policy, socio-economic situations, and company's financial status. It is also considered important from the viewpoint of fairness that private companies be given equal opportunities in response to the selection process led by the Government this time.

(2) As a lesson for future projects, it is felt very important to define project objectives more strictly. It is recommended that at the time of project planning the objectives be defined in such ways as: (1) the project objective should be narrowed down to reduction of pollutants at sub-project levels, (2) the target tributaries and monitoring sections should be specified, and the scope and scale of the assistance should be determined so that the water quality at such defined spots would be improved as intended, and (3) external factors (industrial structure adjustment, population trend, etc.) that have bearings on the achievement of the intended water and air quality improvement should be analyzed more fully in advance.

Concluded

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs	Refer to Attachment 1 "Outputs by Sub-project Category"	
2.Project Period	(I) Overall: September 1997 – August 2000 (36 months) (II) Overall: December 1998 – December 2002 (49 months)	(I) Overall: January 1998 – December 2005 (96 months) (II) Overall: April 1998 – December 2004 (81 months)
3.Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion	(I) Total project cost: 12,097 million yen of which Japanese ODA loan portion: 5,678 million yen (of which foreign currency: 5,678 million yen and local currency: 472 million RMB) (II) Total project cost: 12,911million yen of which Japanese ODA loan portion: 6,175million yen (of which foreign currency: 6,175million yen and local currency: 421 million RMB) Grand total project cost ((I)+(II)): 25,008 million yen	(I) Total project cost: 13,513 million yen of which Japanese ODA loan portion: 5,648 million yen (of which foreign currency: 5,648 million yen and local currency: 557 million RMB) (II) Total project cost: 13,080million yen of which Japanese ODA loan portion: 6,175million yen (of which foreign currency: 6,175million yen and local currency: 489 million RMB) Grand total project cost ((I)+(II)): 26,593 million yen
Exchange rate	(I)RMB1 = 13.60 yen (as of September 1997) (II) RMB1 = 16.00 yen (as of December 1998)	RMB1 = 14.12 yen (average of 1998 - 2005)

Attachment 1. Outputs by Sub-project Category

Plan	Actual
Category 1 City sewage treatment projects 1-1) Sewage Treatment System Construction Project in Yongzhou City ・ Influx: 100,000 m3/day 1-2) Sewage Treatment System Construction Project in Yueyang City ・ Influx: 150,000 m3/day 1-3) Sewage Treatment System Construction Project in Changde City ・ Influx: 150,000 m3/day 1-4) Sewage Treatment Project in Zhuzhou City ・ Construction of a sewage treatment plant with 100,000 m3/day capacity ・ Installation of sewer culvert (18km) ・ Construction of a pump station 1-5) Sewage Treatment Project in Linxiang City ・ Construction of a sewage treatment plant with 60,000 m3/day capacity ・ Installation of sewer culvert (2km) 1-6) Sewage Treatment Project in Xingsha Development Area of Changsha ・ Construction of a sewage treatment plant with 80,000 m3/day capacity ・ Installation of sewer culvert (12km) 1-7) Environmental Countermeasures in Wulingyuan Scenic Zone, one of the World Natural Heritage, in Zhangjiajie City ・ Construction of three sewage treatment plants (6,000 m3, 16,000 m3, 2,000 m3) ・ Procurement of environmental monitoring equipment	**Category 1 City sewage treatment projects → generally as planned** 1-1) Sewage Treatment System Construction Project in Yongzhou City ・ As planned 1-2) Sewage Treatment System Construction Project in Yueyang City ・ As planned 1-3) Sewage Treatment System Construction Project in Changde City ・ As planned 1-4) Sewage Treatment Project in Zhuzhou City ・ As planned 1-5) Sewage Treatment Project in Linxiang City ・ As planned 1-6) Sewage Treatment Project in Xingsha Development Area of Changsha As planned, but sewer culvert length (ODA portion) was reduced to 1.3km because Chinese Government implemented sewer culvert installation 1-7) Environmental Countermeasures in Wulingyuan Scenic Zone, one of the World Natural Heritage, in Zhangjiajie City Generally as planned, but sewage treatment plants were reduced from three to two. (1) Luoguta Plant with design treatment capacity of 3,000 m3/day, (2) Suoxiyu Plant with design treatment capacity of 4,000 m3/day, and (3) Pipeline connecting to Zhangjiajie City Plant of 20,000 m3/day capacity (1.6 m dia. x 9 km length). Machinery and equipment were procured generally as planned: screen, sand separator, surface aerator, etc. for Plant (1), and screen, sand separator, blower, etc. for Plant (2).
Sub-projects that were added as a result of substitution: 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant This sub-project replaced Sub-projects 2-8)	 1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant Generally as planned, but the sewer line

and 2-9) that were cancelled. ・ Sewage treatment plant upgrade (standard activated sludge process → AO process, 30,000 m3/day) ・ Construction of a new sewage treatment plant (OD process, 150,000 m3/day) ・ Sewer line (total length 24.4 km)	length (ODA portion) was reduced to 7.8 km, because the city government installed a portion of the sewer line.
1-9) Sewage Treatment System Construction Project in Liuyang City Surpluses from Sub-projects 1-4), 1-5), 1-6), 2-7) and 3-3) were directed to a new sub-project 1-9) Sewage Treatment System Construction Project in Liuyang City. ・ Construction of a new sewage treatment plant (A2O process, 80,000 m3/day) ・ Sewer line (12.1 km)	1-9) Sewage Treatment System Construction Project in Liuyang City As planned, but the construction is divided into two phases. Under Phase I, a 40,000-ton plant has been constructed. A 80,000-ton sewage treatment plant will be constructed under Phase II.
Category 2 Industrial waste water treatment projects	**Category 2 Industrial waste water treatment projects → Generally as planned, except for two cancelled subprojects and one that discontinued operation after implementation**
2-1) Expansion Project of Wastewater Treatment Plant for Zhuzhou Heavy Metal Factory ・ Treated wastewater: 1,200 t/hr (increment of 400 t/hr) ・ Treats wastewater from sulfuric acid washing, etc. ・ Recycled use of treated water	2-1) Expansion Project of Wastewater Treatment Plant for Zhuzhou Heavy Metal Factory As planned
2-2) Wastewater Treatment Project for Zhuzhou Chemical Factory ・ Closed circuit washing of sulfuric acid ・ Mercury removal ・ Spent acid recovery ・ Treatment of wastewater from chemical fertilizer production process ・ Treatment of wastewater from vinyl chloride and other chemical processes ・ Treatment of high concentration organic wastewater ・ Recycled use of cooling water ・ Sludge treatment, etc.	2-2) Wastewater Treatment Project for Zhuzhou Chemical Factory As planned
2-3) Chrome Slag Treatment Plant in Hunan Ferroalloy Factory ・ Production of chrome steel (6,000 t/y) from 21,000 t/y chrome slag	2-3) Chrome Slag Treatment Plant in Hunan Ferroalloy Factory As planned
2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project ・ Construction of new treatment facilities	2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project Generally as planned, but the urea production wastewater treatment facility

for wastewater from various processes ・ Recycled use of effluent ・ Construction a new facility for comprehensive utilization of fly-ash (200,000 t/y), etc. 2-5) Wastewater Treatment Project for Xiangtan Paper Mill Factory ・ Installation of paper mill wastewater treatment facility ・ Renovation of paper mill machinery ・ Installation of pulp dissolution equipment, etc.	has not been in service for one year because of weak urea demand. Restart is planned for February 2010. 2-5) Wastewater Treatment Project for Xiangtan Paper Mill Factory Cancelled because of financial difficulty and eventual bankruptcy. Substituted by Organophosphorus Pesticide Tech-transformation and Wastewater Treatment Project, but its executing agency, Hunan Lantian Enterprise Co., suffered a plant explosion and suspended its operation entirely. Because of financial difficulty, it went bankrupt, also affected by the government policy of industrial structure adjustment. The subproject was terminated.
2-6) Mining Water Pollution Control Project in Shuikoushan ・ Installation of wastewater facilities capable of reducing the lead, cadmium, arsenic, mercury and other substances contained in the wastewater to below the emission standards ・ Installation of recycling system for cooling water and treated effluent ・ Metals recovery from slag ・ Upgrading of sulfuric acid production unit, etc.	2-6) Mining Water Pollution Control Project in Shuikoushan Generally as planned
2-7) Industrial Pollution Control Project by Xiangtan Iron & Steel Co. ・ Recycled use (95%) of wash water through installation of blast furnace gas washing water treatment facilities ・ Utilization of coal ash generated at the in-house power station through installation of brick production facilities ・ Installation of iron recovery facilities from blast furnace slag and converter furnace dust ・ Installation of wastewater treatment facilities in the rolling mill for the treatment of organic wastewater and recovery of oil components	2-7) Industrial Pollution Control Project by Xiangtan Iron & Steel Co. Generally as planned
2-8) Water Pollution Control Project by Liuyang Paper Plant ・ Shutdown of small size pulp mills (6 mills) ・ Construction of a 17,000 t/y wood pulp mill with biochemical wastewater treatment facilities (capacity 6,000	2-8) Water Pollution Control Project by Liuyang Paper Plant The plant was closed and the sub-project was cancelled before implementation to be substituted by another sub-project.

t/day) 2-9) Gas Supply and Water Pollution Control Project by Liuyang Nitrogenous Fertilizer Factor ・ Revamp of water gas methanation unit (40,000 m3/day) to supply water gas as city gas (20,000 households) ・ Introduce gas purification wash water to water treatment facility ・	2-9) Gas Supply and Water Pollution Control Project by Liuyang Nitrogenous Fertilizer Factor Cancelled before implementation because the project was completed by local currency. Was substituted by another sub-project.
Category 3 Air pollution abatement projects	**Category 3 Air pollution abatement projects → Generally as planned, but two of the three sub-projects have ceased operation and little information was available.**
3-1) Expansion Project of Gas Supply Network in Shaoyang City • Increased gas supply to citizens of Shaoyang City: 60,000 m3/day → 110,000 m3/day • Installation of a coal gas purification unit • Expansion of gas holder: 50,000 m3 • Extension of gas pipeline (medium pressure 20.58 km, low pressure 23.51 km) • Addition of regulator stations, etc.	3-1) Expansion Project of Gas Supply Network in Shaoyang City As planned, but the regulator station has been transferred to the Technical Supervision Office, because the executing agency was not qualified to perform inspection measurements.
3-2) Expansion Project of Gas Production Plant in Zhuzhou City • Increased gas supply to citizens of Zhuzhou City: 60,000 m3/day → 120,000 m3/day • Expansion of coke gas furnace and purification unit: 60,000 m3/day • Expansion of gas holder: 54,000 m3 • Extension of gas pipeline (medium pressure 1.84 km, low pressure 8.09 km) • Addition of regulator stations, maintenance center, etc.	3-2) Expansion Project of Gas Production Plant in Zhuzhou City All the facilities were constructed and were put into use until 2008. But the government policy on city gas changed from coke gas to natural gas. Consequently, the project facilities are unused today, except for the pipeline for distribution.
3-3) LPG Supply Project in Changsha City • Reduction of SO_2 and TSP through construction of LPG gas supply facilities and network: 100,000 households to be newly served	3-3) LPG Supply Project in Changsha City All the facilities were constructed and were put into use for about two years. but the government policy on city gas changed from LPG to natural gas. The pipeline has been transferred to Changsha XinAo Gas Company and is in use.
Category 4 Waste treatment projects	**Category 4 Waste treatment projects → As planned**
4-1) Garbage Filling Yard Construction	4-1) Garbage Filling Yard Construction

Project in Hengyang City ・ Construction of filling yard for sanitary treatment of 250,000 t/y household solid waster ・ Leaching prevention measures and leachate collection system ・ Monitoring equipment for groundwater and air, etc. 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City ・ Construction of household solid waste filling yard (capacity 45 million m3) ・ Leachate treatment	Project in Hengyang City As planned 4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City As planned
Category 5 Other project 5-1) The Environmental Monitoring and Management Center of Hunan Province ・ Installation of equipment and apparatus for water quality analysis, measurements and experiments ・ Introduction of equipment for construction of monitoring data and information network, etc.	**Category 5 Other project** 5-1) The Environmental Monitoring and Management Center of Hunan Province Generally as planned, but some pieces of equipment have become obsolete and not fit for use.

Attachment 2 Computation Method of Project Period Rating for Sub-projects

	Unit: months											
Sub-project code	Plan	Actual	Plan	Actual	Variance	Rating	Points		Rating	Sub-projects	Points earned	Total points
1-1)	36	82	1997.9-2000.8	1998.1-2004.10	228%	c	1		a	4	3	12
1-2)	36	53	1997.9-2000.8	1998.6-2002.10	147%	b	2		b	3	2	6
1-3)	36	94	1997.9-2000.8	1998.1-2003.12	261%	c	1		c	13	1	13
1-4)	33	36	1998.10-2001.6	1998.10-2001.9	109%	b	2			20		31
1-5)	27	55	1998.10-2000.12	2000.4-2003.6	204%	c	1		**Rating**	**b**	**Average point**	**1.55**
1-6)	30	55	1998.10-2001.3	1998.4-2002.9	183%	c	1		Excludes two sub-projects that were cancelled or not verifiable			
1-7)	51	46	1998.10-2002.12	2001.10-2004.12	90%	a	3					
1-8)	28	45	2002.4-2004.7	1999.10-2003.6	161%	c	1					
1-9)	24	59	2002.4-2004.3	2001.10-2004.12	246%	c	1					
2-1)	36	18	1997.9-2000.8	1998.1-1999.6	50%	a	3					
2-2)	36	60	1997.9-2000.8	1998.1-2002.12	167%	c	1					
2-3)	36	69	1997.9-2000.8	1999.1-2004.9	192%	c	1					
2-4)	36	93	1997.9-2000.8	1998.4-2005.12	258%	c	1					
2-5)	36		1997.9-2000.8	Cancelled	0%	d						
2-6)	36	44	1997.9-2000.8	1998.1-2001.8	122%	b	2					
2-7)	27	51	1998.10-2000.12	2000.7-2004.9	189%	c	1					
3-1)	36	87	1997.9-2000.8	1998.10-2005.9	242%	c	1					
3-2)	36		1997.9-2000.8	Not verifiable	0%	d						
3-3)	39	39	1998.10-2001.12	1999.1-2001.9	100%	a	3					
4-1)	36	78	1997.9-2000.8	1998.1-2001.9	217%	c	1					
4-2)	30	49	1998.10-2001.3	1999.1-2002.9	163%	c	1					
5-1)	36	30	1997.9-2000.8	1998.1-2000.6	83%	a	3					
					Average point		**1.55**					

Note: The overall project period rating was obtained by rating the actual project periods of individual sub-projects and computing their average. The average value ratings were “a”: no less than 80% (2.4), “b”: no less than 50% and less than 80% (no less than1.5 and less than 2.4), and “c”: less than 50% (1.5).

Attachment 3 Operational Effect Indicators of Sub-projects

Category 1 City sewage treatment projects	Pollutants (unit)	Plan (P)	Actual (A)	A/P (%)
1-1) Sewage Treatment System Construction Project in Yongzhou City	Average influx (10,000 m3/d)	10	5.1	51
	COD reduciton (t/y)	7,655	3,489	46
	BOD reduction (t/y)	3,650	1,155	32
	SS reduction (t/y)	1,500	2,710	181
1-2) Sewage Treatment System Construction Project in Yueyang City	Average influx (10,000 m3/d)	10	9.5	95
	COD reduciton (t/y)	7,300	6,472	89
	BOD reduction (t/y)	4,380	3,390	77
	SS reduction (t/y)	6,205	--	
1-3) Sewage Treatment System Construction Project in Changde City	Average influx (10,000 m3/d)	15	7.7	51
	COD reduciton (t/y)	3,285	1,670	51
	BOD reduction (t/y)	3,285	693	21
	SS reduction (t/y)	9,200	648	7
1-4) Sewage Treatment Project in Zhuzhou City	Average influx (10,000 m3/d)	10	7	73
	COD reduciton (t/y)	6,935	3,478	50
	BOD reduction (t/y)	4,015	1,459	36
	SS reduction (t/y)	5,475	3,716	68
1-5) Sewage Treatment Project in Linxiang City	Average influx (10,000 m3/d)	6	3.6	60
	COD reduciton (t/y)	5,256	920	18
	BOD reduction (t/y)	2,847	650	23
	SS reduction (t/y)	2,847	650	23
1-6) Sewage Treatment Project in Xingsha Development Area of Changsha	Average influx (10,000 m3/d)	8	8	100
	COD reduciton (t/y)	7,008	4,902	70
	BOD reduction (t/y)	3,796	1,909	50
	SS reduction (t/y)	6,716	2,399	36
1-7) Environmental Countermeasures in Wulingyuan Scenic Zone, one of the World Natural Heritage, in Zhangjiajie City	Average influx (m3/d)	24,000	8,080	34
	BOD reduction (t/y)	1,620	3	0
	SS reduction (t/y)	1,780	24	1
1-8) Expansion Project of Changsha No.1 Sewage Treatment Plant	Average influx (10,000 m3/d)	18	13.2	73
	COD reduciton (t/y)	16,425	8,266	50
	BOD reduction (t/y)	8,760	3,025	35
	SS reduction (t/y)	12,593	6,825	54
1-9) Sewage Treatment System Construction Project in Liuyang City	Average influx (10,000 m3/d)	7.6	8	105
	COD reduciton (t/y)	8,760	2,155	25
	BOD reduction (t/y)	4,672	997	21
	SS reduction (t/y)	6,716	1,538	23

Category 2 Industrial waste water treatment projects	Pollutants (unit)	Plan (P)	Actual (A)	A/P (%)
2-1) Expansion Project of Wastewater Treatment Plant for Zhuzhou Heavy Metal Factory	Wastewater treated (t/hr)	1,200	1,200	100
	Arsenic reduction (t/y)	117	117	100
	Cadmium reduction (t/y)	14	14	100
	Lead reduction (t/y)	32	32	100
2-2) Wastewater Treatment Project for Zhuzhou Chemical Factory	COD reduciton (t/y)	2,603	2,834	109
	Mercury reduction (t/y)	2	3	142
	Arsenic reduction (t/y)	46	47	103
	Fluorine reduction (t/y)	406	622	153
2-3) Chrome Slag Treatment Plant in Hunan Ferroalloy Factory	Comparable data unavailable			
2-4) Xiangjiang Nitrogen Fertilizer Factory Fly-ash and Wastewater Treatment Project	SS reduction (t/y)	12	12	100
2-5) Wastewater Treatment Project for Xiangtan Paper Mill	Cancelled			
2-6) Mining Water Pollution Control Project in Shuikoushan	Effluent reduction (million m3/y)	5.5	8.5	155
	Arsenic reduction (t/y)	9	13	138
	Cadmium reduction (t/y)	8	8	109
	Lead reduction (t/y)	67	96	143
	Mercury reduction (t/y)	67	0	0
2-7) Industrial Pollution Control Project by Xiangtan Iron & Steel Co.	COD reduciton (t/y)	1,434	1,550	108
	SS reduction (t/y)	4,742	4,838	102
	Cyanides reduction (t/y)	9	10	111
2-8) Water Pollution Control Project by Liuyang Paper Plant	Cancelled			
2-9) Gas Supply and Water Pollution Control Project by Liuyang Nitrogenous Fertilizer Factory	Cancelled			
2-10) Organophosphorus Pesticide Tech-transformation and Wastewater Treatment Project	Operation discontinued			

Category 3 Air pollution abatement projects	Pollutants (unit)	Plan (P)	Actual (A)	A/P (%)
3-1) Expansion Project of Gas Supply Network in Shaoyang City	Gas supply (10,000 m3/d)	11	8	73
	SO2 reduction (t/y)	1,324	1,184	89
3-2) Expansion Project of Gas Production Plant in Zhuzhou City	Operation discontinued			
3-3) LPG Supply Project in Changsha City	Operation discontinued			

Category 4 Waste treatment projects	Pollutants (unit)	Plan (P)	Actual (A)	A/P (%)
4-1) Garbage Filling Yard Construction Project in Hengyang City	Solid waste treated (10,000 t/y)	18	33	183
4-2) Garbage Sanitary Filling Yard Construction Project in Changsha City	Comparable data unavailable			

Category 5 Other project	Pollutants (unit)	Plan (P)	Actual (A)	A/P (%)
5-1) The Environmental Monitoring and Management Center of Hunan Province	Comparable data unavailable			

Attachment 4 Computation Method of Sustainability Rating for Sub-projects

(1) Criteria for Rating

Supervisory Organization	Criteria
Regime	- Is the regime well-organized and are the personnel well-placed for supervising the subprojects? - Is the supervisory organization in good relationship with the subproject executing organizations for incessant close communication? - Is the monitoring system well-established on the basis of environmental regulations?
Skill	- Are the personnel of Environment Protection Department well-placed and is their skill upgraded to the level to properly supervise the subprojects?
Finance	- Are the above activities financially backed up to a sufficient extent?
Subprojects	Criteria
Regime	- Is the regime well-organized for operation and administration (for decision-making)? - Is there a possibility of being privatized? If so, is there a possibility that the sustainability of the subprojects is affected?
Skill	- Are the personnel kept at an appropriate level for maintenance and operation? - Are the competent personnel having the technical skill for operating equipment well-placed? - Is a technical training system fulfilled for operation and administration? Is any training actually put in practice? - Is the operation manual available? And is it actually utilized? - Are the results of the inspections properly recorded and kept in good conditions?
Finance	- Are the profit and loss well-balanced? - Is the system to collect charges established in the manner to recover the cost? -In case the project is in deficit operation, is any governmental subsidy given, and is there no problem in carrying on operation from financial aspects?
Maintenance & administration	- Is the equipment ready to display its performance? - Is there no problem in maintenance activities, for instance, on the procurement of spare parts? -Is there no problem in having maintenance at regular intervals? - Has there been no problem in troubleshooting?

(2) Rating Result

	Evaluation		Structure	Technique	Finance	O&M
Supervised by Hunan Provincial People's Government	a		a	a		
1-1)	b	2	a	b	a	a
1-2)	a	3	a	a	a	a
1-3)	a	3	a	a	a	a
1-4)	a	3	a	a	a	a
1-5)	a	3	a	a	a	a
1-6)	a	3	a	a	a	a
1-7)	a	3	a	a	a	a
1-8)	a	3	a	a	a	a
1-9)	a	3	a	a	a	a
2-1)	a	3	a	a	a	a
2-2)	a	3	a	a	a	a
2-3)	c	1				c
2-4)	b	2	a	a	a	b
2-5)	a	3	a	a	a	a
2-6)	a	3	a	a	a	a
2-7)	a	3	a	a	a	a
3-1)	b	2	a	a	b	b
3-2)	c	1				c
3-3)	c	1				c
4-1)	c	1				c
4-2)	a	3	a	a	a	a
5-1)	a	3	a	a	a	a
Total	**a**	2.50				

	Rating	Number	Points	Total
	a	15	3	45
	b	3	2	6
	c	4	1	4
		22		55
	Rating	**a**	**Average**	**2.50**

<Method of Rating>

1. A comparison is made between the plan and achievements in each subproject to figure out a sub-rating (the subprojects cancelled or not ascertained are excluded).
2. The average of the total sub-ratings thus obtained is made as an overall rating.
3. Scores below a decimal point are taken up on the following basis:
   a: Not less than 80% (not less than 2.4)
   b: Not less than 50% to less than 80% (not less than 1.5 to less than 2.4)
   c: Less than 50% (less than 1.5)