

Bangladesh

Ex-post Monitoring of Completed ODA Loan Project
“Energy Saving, Environmental Protection and Improvement of On-stream Factor
of Ghorasal Urea Fertilizer Factory”

External Evaluator: Kenichi Inazawa

(Office Mikage, LLC)

Field Survey: Sep-Oct 2009

1. Project Description



Map of the Project Area



Ghorasal Urea Fertilizer Factory

1.1 Project Objective

The objectives of the project were to improve the energy efficiency and prevent ammonia leakage of Ghorasal Urea Fertilizer Factory located in the suburb of Dhaka, by upgrading obsolete equipment that had not been upgraded before; thereby contributing to the stable supply of the urea fertilizer and improvement of environment.

1.2 Outline of Loan Agreement

Loan Amount / Loan Disbursed Amount	5,443 million yen/ 5,443 million yen
Loan Agreement / Final Disbursement Date	July, 1999 / November, 2001
Ex-post Evaluation	FY2003
Executing Agency	Bangladesh Chemical Industries Corporation (BCIC) (The Ghorasal Urea Fertilizer Factory is in charge of the management and maintenance works of the project facilities.
Main Contractor (Over 1 billion yen)	Toyo Engineering Corporation

Main Consultant (Over 100 million yen)	N/A
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1.3 Background of Ex-Post Monitoring

At the time of ex-post evaluation (implemented in FY2003), there were problems related to the development of facilities which were not covered by the project (problems with the production process). As a result, the overall capacity utilization ratio of the Ghorasal Urea Fertilizer Factory had not increased. The actual urea fertilizer production was slightly lower than initially planned (approximately 80% of the planned level), giving slight concerns about the effectiveness of the project. Furthermore, concerning management and maintenance, the fertilizer factory was employing an inadequate maintenance plan and stopgap approach to handling problems with equipment and machinery. Financially, the retail price of urea fertilizer was being kept at a low, government-controlled price that did not reflect the production cost of the fertilizer, causing the project to be in debt, and raising concerns about the financial sustainability of the project. Plant facilities and equipment were becoming increasingly obsolete and it was thought that a thorough maintenance and inspection system was needed. Furthermore, it was recommended that a cost analysis of fertilizer production and a revision of the retail price system were necessary.

Given the above stated issues, this project was selected for ex-post monitoring, with the objective of confirming the operational performance, future outlook and financial improvement of plant facilities and equipment in the time following ex-post evaluation. The project was reviewed based on each evaluation item through a new field survey, with the goal of developing conclusions.

2. Monitoring Results

2.1 Effectiveness (Impact)

2.1.1 Quantitative Effects

(1) Improvement of Energy Efficiency

As shown in Table 1 below, power generation per 1 Nm³ of natural gas has been in line with initially planned levels (2.39kWh/Nm³ of natural gas) since the time of ex-post evaluation. Furthermore, the thermal efficiency of generators has also been improving. This may be due to the stable power supply provided by the project continuing to produce effects even after ex-post evaluation¹. On the other hand, both natural gas consumption

¹ However, as of October 2009 the 18MW gas turbine power generator installed by the project was undergoing repairs due to a mechanical breakdown. Currently the Ghorasal Urea Fertilizer Factory is operating its plants using power supplied by the nearby Polash Urea Fertilizer Factory (just like the Ghorasal Urea Fertilizer Factory, it is a urea fertilizer factory under the umbrella of the Bangladesh Chemical

(Nm³) and cooling water consumption per 1 ton of urea produced are a little higher than they were at the time of ex-post evaluation. According to the Ghorasal Urea Fertilizer Factory, this is because the number of shutdowns has increased since the time of ex-post evaluation, and large amounts of natural gas and cooling water are necessary when restarting plants and for restoration work. The main reason for the increase in the number of shutdowns, as was pointed out in the Ex-Post Evaluation Report, is that approximately 40 years have passed since the fertilizer factory commenced operations, meaning that all of the equipment and machinery in the factory is becoming obsolete. Then, it has resulted in the occurrence of an increasing number of malfunctions.

Table 1: Actual Value of Improvement of Energy Efficiency

At time of Ex-post Evaluation					
Item		1999/00	2000/01	2001/02	2002/03
1. Power Generation (kWh/1 N m ³ of Natural Gas)	Plan	-	-	2.39	2.39
	Actual	1.73	1.73	2.67 (111.7%)	2.62 (109.6%)
2. Thermal Efficiency at the Generating End (%)	Plan	(not specified)			
	Actual	17.0	17.0	26.1	25.7
3. Natural Gas Consumption per 1 ton of Urea Produced (N m ³)	Plan	-	-	868	868
	Actual	1,083	1,108	1,116 (77.8%)	1,041 (83.4%)
4. Cooling Water Consumption per 1 ton of Urea Produced (ton)	Plan	-	-	9.70	9.70
	Actual	13.40	13.94	14.40 (67.4%)	13.01 (74.6%)
At time of Ex-post Monitoring					
Item		2003/04	2004/05	2005/06	2006/07
1. Power Generation (kWh/1 N m ³ of Natural Gas)	Plan	2.39	2.39	2.39	2.39
	Actual	2.57 (107.5%)	2.88 (120.5%)	2.85 (119.2%)	2.90 (121.3%)
2. Thermal Efficiency at the Generating End (%)	Plan	(not specified)			
	Actual	25.27	28.34	27.97	28.53
3. Natural Gas Consumption per 1 ton of Urea Produced (N m ³)	Plan	868	868	868	868
	Actual	1,217 (71.3%)	1,183 (73.4%)	1,366 (63.5%)	1,264 (68.7%)
4. Cooling Water Consumption per 1 ton of Urea Produced (ton)	Plan	9.70	9.70	9.70	9.70
	Actual	15.18 (63.9%)	15.17 (64.0%)	17.16 (56.5%)	14.92 (65.0%)

Source: Ex-post Evaluation Report (at time of Ex-post Evaluation: Upper), Answers on Questionnaire (at time of Ex-post Monitoring: Lower)

(2) Control of Ammonia Leakage

Industries Corporation, the executing agency for the project).

At the time of ex-post evaluation, the observed value for the concentration of ammonia in water subject to DOE standards² was 0.15-5.0 ppm in FY2002/2003.³ The concentration of ammonia in the atmosphere over the same time period ranged between 5.0-60.0 ppm, falling below the target of 45 ppm most of the time. At the time of ex-post monitoring, the observed values for the concentration of ammonia in water and atmosphere subject to DOE standards have met the standards, as is shown in Table 2 below.

On the other hand, the values for the concentration of ammonia in water not subject to DOE standards are observed to be high compared to the time of ex-post evaluation,⁴ ranging toward the maximum values. The increase in the number of shutdowns resulted in large amounts of ammonia collecting in drain pipes, and these values were recorded temporarily when those pipes were cleaned, flushing their contents into the facility's artificial lagoon. According to the explanation given by the fertilizer factory, normally the concentration ranges between 200 ppm and 300 ppm, so this is not a big issue. Furthermore, just as at the time of ex-post evaluation, environmental monitoring of the artificial lagoon is not subject to DOE standards and is considered to be one of the processes necessary in carrying out waste water treatment for the Sitalakhya River adjacent to the factory. For this reason, no measures have been taken to reduce the ammonia concentration in the artificial lagoon to a level acceptable to DOE standards. But before discharging to Sitalakhya river, the water (lagoon outlet) is being diluted with fresh water to DOE standards.

Table 2: Environmental Monitoring Data (unit: ppm)

Item Year	Subject to DOE Standards		Not Subject to DOE Standards
	Ammonia Concentration in Water (Monitoring point: 50m downstream from the drain outlet from the artificial lagoon to the river)	Ammonia Concentration in Atmosphere (Monitoring point: urea plant)	Ammonia Concentration in Water (Monitoring point: drain outlet to the artificial lagoon)
1999/00	N/A	N/A	100-400
2000/01	N/A	N/A	80-300
2001/02	0.25-5.0	10.0-80.0	50-275
2002/03	0.15-5.0	5.0-60.0	50-250
2003/04	0.03-5.0	N/A	72-1,820
2004/05	0.07-4.8	N/A	110-1,860
2005/06	0.07-5.0	2.0-75.0 *Note	152-1,902

² The limits for the concentration of ammonia stipulated by the DOE (Department of Environment of Bangladesh): 5 ppm or below for water and 50 ppm or below for the atmosphere.

³ The data indicate the range between the minimum and maximum values recorded each year.

⁴ The monitoring result in FY2002/03 was 50-250 ppm.

2006/07	0.08-5.0	2.0-12.0	159-2,171
2007/08	0.18-5.0	2.0-8.0	142-1,802

Source: Executing Agency documents

Note) A maximum value of 75.0ppm was observed but according to the fertilizer factory this was caused by an emergency shutdown of the urea plant (on the day of the observation the remaining ammonia was discharged, so the observed amount of ammonia increased temporarily), and therefore this was an exceptional case.



Figure1: Artificial Lagoon
(adjacent to the fertilizer factory)



Figure 2: Ammonia Plant in the Fertilizer
Factory

Furthermore, there are not any particularly big problems regarding environmental measures for the artificial lagoon, which was pointed out at the time of ex-post evaluation.⁵ In this survey, it was confirmed that the Ghorasal Urea Fertilizer Factory was handling the issue appropriately. For example, in the dry season when the amount of water in the lagoon decreases due to evaporation, the factory adds water to the lagoon to prevent it from giving off the odor of ammonia, and in the rainy season when the amount of water in the lagoon increases, the factory uses a drainage pump to discharge water appropriately into the adjoining Sitalakhya River (adjusting the amount of water in the artificial lagoon). The factory also implements regular water quality monitoring for the lagoon (implemented once a week).

2.1.2 Impact

(1) Improvements of Living, Social, and Living Environment in the Region (Beneficiary Survey)

Table 3 below shows the results of a beneficiary survey of residents living within 2-3 km of the Ghorasal Urea Fertilizer Factory.⁶ In general, no major changes are seen compared to the beneficiary survey results at the time of ex-post evaluation, but a

⁵ The Ex-Post Evaluation Report stated, “in the dry season when the water level declines, the ammonia concentration in water may increase and the evaporated ammonia may give off an odor. In the rainy season, on the other hand, the excess water in the lagoon may flood adjacent areas, as has happened in the past.” Environmental measures were proposed to reduce the impact on local residents.

⁶ The survey was conducted on the issue of “change compared to five years ago (= the change from the time of ex-post evaluation).” 100 people were randomly selected. (=the sample size is 100.)

significant number of residents has reported that they still notice an ammonia odor, indicating that concerns about health continue to exist.

Just as at the time of ex-post evaluation, the residents living on the north and northeast side of the Ghorasal Urea Fertilizer Factory and artificial lagoon notice the ammonia odor more and were more likely to be concerned about the environment impact of the factory than residents in other areas. One reason for this is that these areas are adjacent to the artificial lagoon, but another reason is that monsoons from the south (in winter) and southwest (in summer) blow the odor of the fertilizer factory to the north and northeast, so the residents in these areas notice the ammonia odor relatively more, and as a result tended to have more concerns about the environment.

Table 3: Results of the Beneficiary Survey

A. Impact on the Environment						
Question	Before Project Completion	%	At time of Ex-post Evaluation	%	At time of Ex-post Monitoring	%
1.Degree of Environmental Pollution (Degree of environmental pollution from Ghorasal Urea Fertilizer Factory)	Serious /Considerable	62	Improved Significantly	39	Improved Significantly	2
	Some/A little	34	Improved to Some Extent	59	Improved to Some Extent	48
	None	4	Deteriorated to Some Extent	0	Deteriorated to Some Extent	8
	-	-	No Change	2	No Change	42
2.Damage to Livestock (animals and fish) (multiple answers)	Cattle	20	Cattle	3	Cattle	13
	Poultry	66	Poultry	22	Poultry	22
	Fish	95	Fish	20	Fish	18
3.Damage to Fish in the Sitalakhya River and the Surrounding Areas	Serious /Considerable	65	Serious /Considerable	9	Serious /Considerable	17
	Some/A little	19	Some/A little	39	Some/A Little	52
	None	16	None	52	None	31
4.Water Pollution in the Sitalakhya River and the Surrounding Areas	Serious /Considerable	69	Serious /Considerable	45	Serious /Considerable	14
	Some/A Little	11	Some/A Little	47	Some /A Little	41
	None	20	None	8	None	45
5.Damage to Vegetation	Serious /Considerable	70	Improved Significantly	42	Improved Significantly	17
	Some/A Little	17	Improved to Some Extent	39	Improved to Some Extent	49
	None	13	None	19	None	34
B. Impact on Human Health						

Question	Before Project Completion	%	At time of Ex-post Evaluation	%	At time of Ex-post Monitoring	%
1.Degree of the Ammonia Odor	Serious	57	Serious	3	Serious	26
	Some/A little	41	Some/A little	67	Some/A little	55
	None	2	None	30	None	19
2.Damage Condition to Health due to the Ammonia Odor	Serious	35	Serious	4	Serious	6
	To some extent/A little	65	To some extent/A little	43	To some extent/A little	49
	None	0	Little	51	Little	45
	-	-	None	2	None	0

Source: Results of Beneficiary Survey

Note: The left and center column shows results of the beneficiary survey implemented at the time of ex-post evaluation. The right column shows the result of the beneficiary survey at this time.

(2) Improvement of Urea Fertilizer Production Capacity

Regarding actual urea fertilizer production and the capacity utilization ratio, as shown in Table 4, production is slightly lower than at the time of ex-post evaluation (average of 70%-80%). The number of annual operating days has been maintained at almost the same level as it was at the time of ex-post evaluation. As previously stated, the main reason for actual urea fertilizer production being 70-80% of the planned value is the obsolescence of factory equipment and machinery, which leads to a large number of shutdowns, affecting the ability of the production line to operate according to plan. According to a management officer at the fertilizer factory, there have been a large number of shutdowns since the time of ex-post evaluation⁷ and large-scale replacement and comprehensive renovation of equipment and machinery are necessary for the factory.

In August 2007 a gas compressor, a key piece of equipment in the urea fertilizer production process, was damaged in a fire.⁸ Repair work on the gas compressor took approximately two years and ended in August 2009,⁹ but in the meantime the production line was completely shut down. As a result, annual production in FY2007/2008 was 21.87 thousand tons, much lower than the previous year. Moreover, there was no urea fertilizer production at all in FY2008/2009.¹⁰ At the time of this survey it was confirmed that the repairs had been completed and the gas compressor and the production line were operating normally, causing the level of production of urea fertilizer to return to the level

⁷ There were 17 shutdowns in FY2005/06 and 20 shutdowns in FY2006/07. There were also two shutdowns in FY2007/08. (A gas compressor was damaged in August 2007, resulting in the production line operating only about 20 days. In other words, the number of shutdowns was "2 times/about 20 days.") The fiscal year in Bangladesh is from July to June the following year.

⁸ Regarding the cause of the fire, according to Ghorasal Urea Fertilizer Factory, "the precise cause is unknown, but some oil leaked out of the gas compressor and was somehow ignited (the cause of ignition is unknown)."

⁹ It took a long time to complete repairs because the damaged gas compressor had to be dismantled and its parts shipped overseas (to Malaysia, the United States, etc.).

¹⁰ During the production line shutdown, maintenance and inspections of the facilities and equipment were carried out as usual.

before 2007.

Table 4: Data related to Urea Fertilizer Production

At time of Ex-Post Evaluation						
Item		1999/00	2000/01	2001/02	2002/03	
1. Urea Production (ton/day)	Plan	-	-	1,422	1,422	
	Actual	1,146	1,107	1,132	1,168	
2. Capacity Utilization Ratio* (%)	Plan	-	-	100	100	
	Actual	80.59	77.85	79.61	82.14	
3. Annual Operating Days (operating days/year)	Plan	-	-	330	330	
	Actual	280.88	276.70	286.91 (86.9%)	322.82 (97.8%)	
4. Annual Production (thousand tons)	Plan	-	-	470	470	
	Actual	321	306	324 (68.9%)	377 (80.2%)	
At time of Ex-Post Monitoring						
Item		2003/04	2004/05	2005/06	2006/07	2007/08
1. Urea Production (ton/day)	Plan	1,422	1,422	1,422	1,422	1,422
	Actual	1,113	1,134	1,024	1,038	936
2. Capacity Utilization Ratio* (%)	Plan	100	100	100	100	100
	Actual	78.27	79.75	72.01	73.00	65.82
3. Annual Operating Days (operating days/year)	Plan	330	330	330	330	330
	Actual	295.21 (89.5%)	308.31 (93.6%)	264.68 (80.2%)	320.48 (97.1%)	23.37 (7.1%)
4. Annual Production (thousand tons)	Plan	470	470	470	470	470
	Actual	329 (69.9%)	350 (74.5%)	271 (57.7%)	333 (70.8%)	22 (4.7%)

Source: Ex-post Evaluation Report (at time of Ex-post Evaluation: Upper), Answers on Questionnaire (at time of Ex-post Monitoring: Lower)

*The value with parentheses under the “Actual” value indicates achievement degree against the “Plan”.

*Note) The definition and calculation method of Capacity Utilization Ratio (%) in this table are “(Actual value of the urea production (ton/day) / Plan value of the urea production (ton/day)) × 100”.



Figure 3: Work for Delivery of the Urea Fertilizer (before being packed in bags)

Figure 4: Shipment of the Urea Fertilizer

(3) Actual Condition of Domestic Production and Supply of Urea Fertilizer

As shown in Table 5, the total domestic urea fertilizer supply in Bangladesh since the time of ex-post evaluation is approximately 2.3 to 2.7 million tons per year. The domestic production (total production for the six domestic fertilizer factories) is approximately 1.4 to 1.9 million tons per year. As shown in Table 5, domestic supply has been increasing a little. This has been achieved by supplementing domestic production, which tends to be insufficient, with imports. The fall in the FY2007/2008 production of the Ghorasal Urea Fertilizer Factory, as stated above, was due to the influence of a production line stoppage caused by damage to the gas compressor. As a result, there was a fall in domestic production that year.

Table 5: Domestic Supply of Urea Fertilizer and Production
at Ghorasal Urea Fertilizer Factory (unit: 1,000 tons)

Item	At time of Ex-post Evaluation		At time of Ex-post Monitoring				
	2001/0 2	2002/0 3	2003/0 4	2004/0 5	2005/0 6	2006/0 7	2007/0 8
Domestic Production	1,546	2,057	1,982	1,878	1,730	1,817	1,477
Domestic Supply	2,066	2,239	2,324	2,523	2,451	2,528	2,763
Production at Ghorasal Urea Fertilizer Factory	324	377	329	350	271	333	22
Import ¹¹ (incl. KAFCO ¹²)	520	182	342	645	721	711	1286

Source: Ex-post Evaluation Report and Executing Agency documents

The urea fertilizer import price ranges from Tk 21,000 to Tk 26,000/ton (and averages Tk 25,000/ton). According to the management officers of the Executing Agency (the Bangladesh Chemical Industries Corporation) and the fertilizer wholesalers, the higher the volume of imports of urea fertilizer the more difficult the financial position of the producers becomes (it is by purchasing the fertilizer at a higher price than the domestic

¹¹ "Import" includes a small amount of stocks from the previous year.

¹² KAFCO (Karnaphuli Fertilizer Company) is an export-oriented joint venture corporation of foreign capital located in Chittagong, Bangladesh's second-largest city. The firm is an affiliated company of the Bangladesh Chemical Industries Corporation, just over 40% owned by the Bangladesh Chemical Industries Corporation and just over 30% owned by KAFCO Japan which was established with investments from Japan (JBIC, Marubeni Corporation and Chiyoda Corporation). KAFCO is required to sell fertilizer at the export price even in Bangladesh because under a condition of the loan agreement it is required to export all of its products.

sales price¹³). Furthermore, domestically produced urea fertilizer has a good reputation for its quality, so the demand is high in the fertilizer market of Bangladesh. It is expected in the future that the market will be activated if production of urea fertilizer increases.

(4) Interview with Fertilizer Distributors

Table 6 below shows the results of the interview survey with the distributors (wholesalers) that handle urea fertilizer produced by the Ghorasal Urea Fertilizer Factory.¹⁴ The results show that, just as at the time of ex-post evaluation, the urea fertilizer produced by the fertilizer factory scored highly in meeting the demands of the market, in quality, and in other categories.

Table 6: Results of the Interviews with Fertilizer Distributors

Question	Answer		
1. Does UFFL urea fertilizer meet the demands of the market (especially, in light of the fertilizer quality)?	Yes, very much: 9	Yes, to some extent: 1	No: 0
2. Have urea fertilizer sales of Ghorasal Urea Fertilizer Factory increased since the ex-post evaluation?	Yes, significantly increased: 1	Yes, to some extent: 3	No: 6
3. Has the number of employees increased since the ex-post evaluation?	Yes, significantly increased: 1	Yes, to some extent: 3	No: 6
4. What is your view of the future trend in fertilizer use in Bangladesh?	Promising: 10	Skeptical: 0	Pessimistic: 0
5. What do you think of the price level of urea fertilizer of Ghorasal Urea Fertilizer Factory?	High: 1	Reasonable: 9	Low: 0

Source: Results of the Interviews with Fertilizer Distributors (10 companies answered)

Furthermore, a simple interview survey for the farmers living in the area around the Ghorasal Urea Fertilizer Factory (sample size of 17) was also conducted. More than two-thirds of the respondents were actually using urea fertilizer from the Ghorasal Urea Fertilizer Factory. All respondents stated that the quality of the fertilizer was “extremely good.”

2.2 Sustainability

2.2.1 Operation and Maintenance Agency

¹³ For details refer to “Sustainability, (3) Financial Status for Operation and Maintenance”

¹⁴ The survey was conducted on the issue of “change compared to five years ago (= the change from the time of ex-post evaluation).”

2.2.1.1 Institutional Structure for Operation and Maintenance

Just as at the time of ex-post evaluation, the Executing Agency for the project is the Bangladesh Chemical Industries Corporation, while the Ghorasal Urea Fertilizer Factory is in charge of operating and maintaining the facilities. The Ghorasal Urea Fertilizer Factory is a state-run fertilizer factory under the umbrella of the Bangladesh Chemical Industries Corporation.¹⁵ As of September 2009, the Ghorasal Urea Fertilizer Factory has 922 employees. The factory is comprised of seven departments (the Operation Department, the Maintenance Department, the Technical Department, the Commercial Department, the Administration Department, the Finance and Accounting Department and the Civil Engineering Department) which are led by the head of the factory (the Managing Director).

One recent matter for concern is the increase in the number of employees who are quitting. According to the head of the factory, “a particularly large number of younger employees are quitting.” The main reason for this is that the salary system for state-run fertilizer factories like the Ghorasal Urea Fertilizer Factory is determined by the government. Many young employees leave because they do not feel that the salary system is attractive (the salary level is low compared to private sector companies¹⁶).

Another matter for concern is that nearly all of the members of management are to reach mandatory retirement within two years¹⁷ and there are no officers in the younger generation that can be promoted to manager in that time (for the reasons that there are not many to begin with, and that those who would have been eligible had already quit). According to management officers, “The employee distribution structure has been affected¹⁸ and there is the possibility that if this problem is not resolved within two years, the factory will have a hard time continuing on.”

Finally, the “Quality Control and Environmental Pollution Control Section” which was established with the objective of preventing ammonia leakage, is comprised of and operated by highly experienced employees, just as it was at the time of ex-post evaluation.¹⁹ This section is a lower branch of the Technical Department of the Ghorasal

¹⁵ There are six fertilizer factories, including the Ghorasal Urea Fertilizer Factory, under the umbrella of the Bangladesh Chemical Industries Corporation. All of them are state-run fertilizer factories. In addition, the BCIC has a paper-manufacturing company and a cement-manufacturing company.

¹⁶ According to the management officers of the fertilizer factory, the salary level at the Ghorasal Urea Fertilizer Factory is approximately one-fifth that of the private fertilizer company, KAFCO.

¹⁷ The mandatory retirement age is 57 years old. Personnel systems are also determined by government regulations.

¹⁸ According to the interview result, “in the 1970s and the first half of the 1980s there were large profits from fertilizer sales and the salary system was attractive, so many people came to work at the factory. However, since around the middle of the 1980s salaries have become gradually less attractive compared to private sector companies, while at the same time no major changes have been made to the salary system. As a result, imbalances have arisen between the number (work class) of employees that joined the factory in the 1970s and the first half of the 1980s and those that have joined since about the middle of the 1980s.”

¹⁹ However, the head of this organization, the Deputy Chief Chemist, quit in 2008, and his post is still

Urea Fertilizer Factory, and has 33 employees as of September 2009.

2.2.1.2 Technical Capacities for Operation and Maintenance

There are no problems related to the plant's technical capacities. The Technical Department of the Ghorasal Urea Fertilizer Factory is in charge of personnel education and training programs for employees. In FY2006/2007 a total of 19 educational and training programs were implemented (over a total of approximately 346 days; approximately 58 employees participated in these programs), and in FY2007/2008 a total of 11 education and training programs were implemented (over a total of approximately 220 days; approximately 40 employees participated in these programs). Just as at the time of ex-post evaluation, most education and training are carried out by TICI.²⁰ There is not much education oriented toward management due to budgetary constraints.

Training through OJT is also being implemented. In the case of new employees, after they receive three months of education at TICI, they also receive OJT training in three departments in the Ghorasal Urea Fertilizer Factory for a total period of nine months of OJT training. (After training they are deployed to the department which they were judged to be most suitable for during OJT.)

2.2.1.3 Financial Status

(1) Operating Income and Operating Costs

Changes in the sales volume of urea fertilizer and operating costs since the time of ex-post evaluation follow:

- Sales Volume of Urea Fertilizer: As shown in Table 7, the sales volume of urea fertilizer was 306,514 tons in FY2006/2007, almost the same level as the time when the project was completed. However, in FY2007/2008 it was much lower at 67,301 tons. The reason for this, as stated above, is the shutdown of the production line due to a gas compressor fire in August 2007, which meant that in that fiscal year the production line was actually operating for only about 20 days, resulting in a much lower production level.

- Sales Income: Since the time of ex-post evaluation, the urea fertilizer price (the retail price) has continued to be controlled at Tk 4,800/ton, so sales income has been entirely dependent on sales volume. The reason for the fall in sales income in FY2007/2008 was the shutdown of the production line noted above. However, in June 2008 the retail price was revised to Tk 10,000/ton. As a result, it is highly likely that factory income will

vacant. The factory is currently trying to recruit a suitable person for the post who is highly experienced and has outstanding management skills.

²⁰ TICI (Training Institute of Chemical Industries) is a governmental education and training organization under BCIC. It mainly provides education and training in the chemical and industrial fields. Its educational facility is adjacent to the site of the Ghorasal Urea Fertilizer Factory.

increase going forward. It is explained under “(2) Financial Status of Ghorasal Urea Fertilizer Factory” on the next page for more details.

• Production Cost: The production cost per 1 ton has risen further since the time of ex-post evaluation as a result of rises in the cost of raw materials, natural gas, personnel expenses and packing material expenses. The production cost per 1 ton in FY2006/2007 was Tk 6,862 and the operating cost per 1 ton was Tk 7,450.²¹

Table 7: Operating Income and Operating Costs

At time of Ex-post Evaluation					
Item	1999/00	2000/01	2001/02	2002/03	
1. Sales Volume of Urea Fertilizer (ton/year)	324,634	328,678	303,334	350,809	
2. Urea Price (Wholesale Price) (Tk/ton)	4,816	4,804	4,801	4,800	
3. Sales Income (1,000Tk/year)	1,562,941	1,578,819	1,456,256	1,683,885	
4. Operation costs (1,000Tk/year)	1,943,940	2,023,062	2,087,363	2,068,773	
5. Operating Profit (1,000Tk/year)	(380,999)	(444,243)	(631,107)	(384,888)	
At time of Ex-post Monitoring					
Item	2003/04	2004/05	2005/06	2006/07	2007/08
1. Sales Volume of Urea Fertilizer (ton/year)	325,701	369,120	285,614	306,514	67,301
2. Urea Price (Wholesale Price) (Tk/ton)	4,800	4,800	4,800	4,800	4,800 (10,000) *Note 1
3. Sales Income (1,000Tk/year)	1,573,800	1,783,097	1,374,436	1,472,928	327,960
4. Operation costs (1,000Tk/year)	2,354,322	2,364,004	2,404,208	2,283,760	1,797,023
5. Operating Profit (1,000Tk/year)	(780,522)	(580,907)	(1,029,772))	(810,832)	(1,469,063))

Source: Ex-post Evaluation Report (at time of Ex-post Evaluation: Upper), Answers on Questionnaire (at time of Ex-post Monitoring: Lower)

Note 1) The urea price has been revised to 10,000 Tk/ton since June 2008.

(2) Financial Status of Ghorasal Urea Fertilizer Factory

Since the time of ex-post evaluation more deficits have been posted, the cumulative deficit has risen and the financial status of the factory has worsened further. The major reason for deficit, as stated above, is that production costs and operation costs have been

²¹ Production cost/ton = annual operation cost/annual fertilizer production; operation cost/ton = annual operation cost/annual fertilizer sales volume

higher than the retail price (Tk 4,800/ton), resulting in permanent deficits.

However, in June 2008 the retail price of urea fertilizer was revised by government policy, from Tk 4,800/ton to Tk 10,000/ton. As a result, it is expected that the financial situation will improve from FY2009/2010 onwards.²² Nonetheless, as previously stated, the Ghorasal Urea Fertilizer Factory frequently experiences shutdowns due to the obsolescence of equipment and machinery. Some aspects of the factory's financial status will depend on future production capacity.

Table 8: Profit and Loss Statement of Ghorasal Urea Fertilizer Factory (unit: million taka)

Item	2001/02	2005/06	2006/07	2007/08
1. Sales	1,529	1,374	1,473	328
2. Cost of Sales	1,731	2,293	2,135	1,676
3. Gross Profit	(202)	(918)	(662)	(1,348)
4. Selling and Administrative Expenses	119	112	148	121
5. Operating Profit	(321)	(1,030)	(811)	(1,469)
6. Non-operating Income (miscellaneous income, etc.)	127	104	102	39
7. Non-operating Expenses (interest expenses, etc.)	146	231	223	241
8. Ordinary Profit before Taxes	(340)	(1,157)	(932)	(1,671)
9. Corporate Taxes, etc.	-	6.87	3.68	-
10. Current Net Profit	(340)	(1,164)	(936)	(1,671)
11. Balance Brought Forward	(624)	(3,071)	(4,235)	(5,171)
12. Prior Period Adjustment	-	-	-	-
13. Unappropriated Income at End of Period	(964)	(4,235)	(5,171)	(6,842)
14. Transferred from Reserves	-	-	-	-
15. Balance Carried Forward	(964)	(4,235)	(5,171)	(6,842)

Source: Ex-post Evaluation (data on 2001/02), Answers on Questionnaire (data from 2005 to 2008)

During the production line stoppage between August 2007 and August 2009, approximately 1,120 million taka was allocated from the government and the executing agency to make up for the loss (approximately 970 million taka from the government and approximately 150 million taka from the executing agency).

²² Before the revision of the retail price, the production costs were higher than the retail price, resulting in a loss of 2,000-3,000 taka per 1 ton of production. The revision of the price to Tk 10,000/ton is expected to result in a profit of Tk 2,000-3,000/ton.

(3) Influence on Fertilizer Distributors and Farmers due to the Revision of the Retail Price of Urea Fertilizer

As previously mentioned, in June 2008 the retail price of urea fertilizer was revised to Tk 10,000/ton. This change resulted in corrections to the two-tier pricing system and the elimination of brokers from the fertilizer trade (see Figure 5). It has given a significant influence on urea fertilizer sales and distribution systems. Meanwhile, it has had little effect on the retail price for farmers. It is difficult to get a detailed picture of the situation for this survey due to time issues and other constraints, but as shown in Figure 5, the retail price for farmers after the revision is not very different compared to the retail price before the revision. It seems that the revision was largely accepted. The government is strongly committed to monitoring and controlling the sales and distribution systems of fertilizer through the National Fertilizer and Seed Monitoring Committee.²³

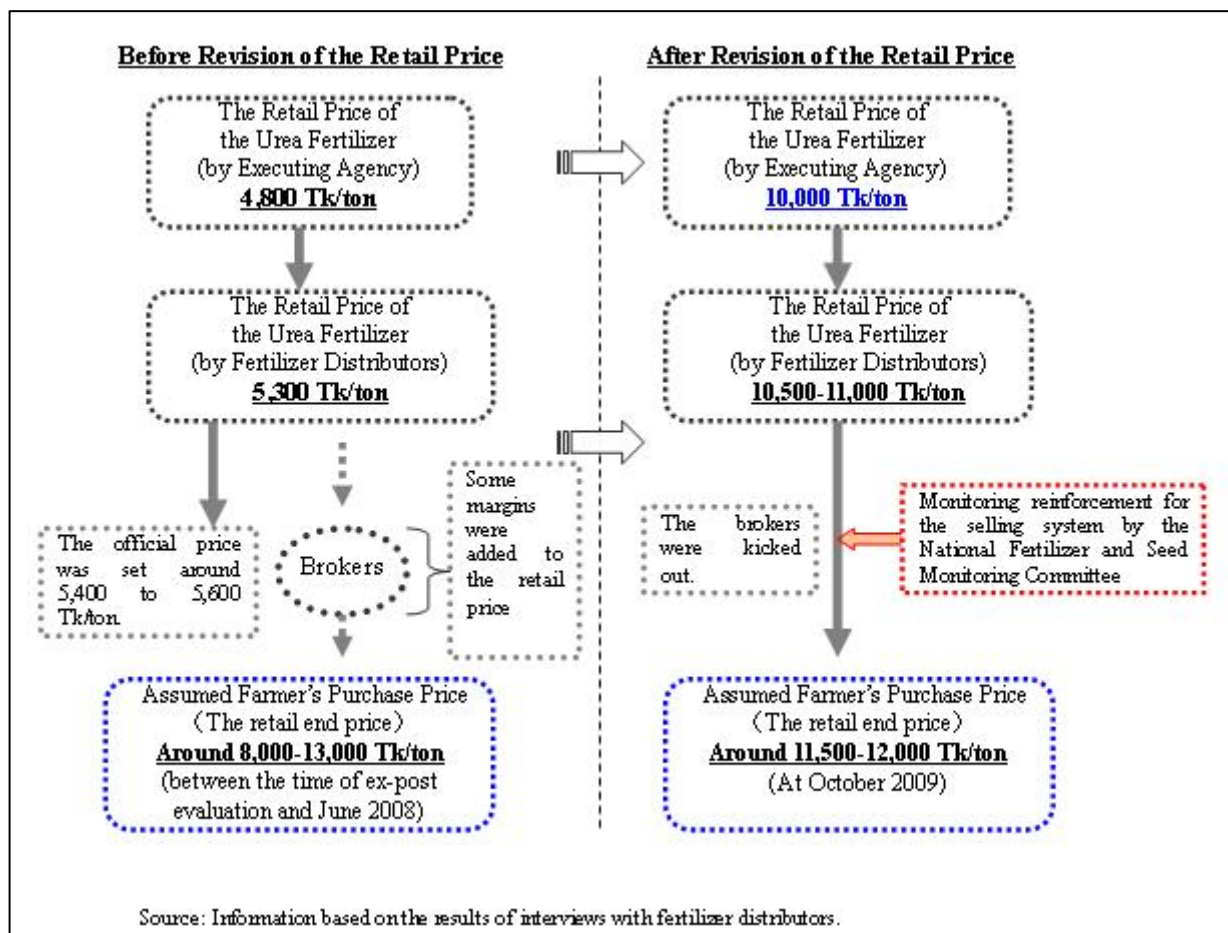


Figure 5: Change of the Selling and Distributing System due to the Revision of the Retail Price of Urea Fertilizer (Outline)

²³ The Ministry of Industries in Bangladesh cooperates with the other government ministries and agencies to run this committee.

2.2.2 Conditions of Operation and Maintenance

The conditions of operation and maintenance have not changed much since the time of ex-post evaluation. Despite having budget and staffing constraints, the Ghorasal Urea Fertilizer Factory has been implementing as much maintenance as it can. As previously stated, personnel-related problems, such as a lack of employees (the number of employees quitting their jobs is gradually increasing), are getting worse. It is inferred that this will have an influence to some extent on maintenance operations.

- Maintenance Plan: At the time of ex-post evaluation there were no long-term maintenance plans in place or benchmarks for performance. Since then, manuals for shutdowns and overhaul have been developed, as has a maintenance plan. The factory now has a plan for preventive maintenance and a maintenance plan for use when an overhaul is being carried out. Furthermore, inspections of equipment and machinery are being carried out based on standardized manuals and maintenance plans. However, as noted, the outflow of human resources is a cause for concern.

- Preventive Maintenance: Although the need for preventive maintenance was recognized at the time of ex-post evaluation, a structure to support such maintenance was not established. By the time of ex-post monitoring, a plan for preventive maintenance was developed, but the plan is found to be inadequate due to the shortage in highly experienced employees and new maintenance supplies. This is also mentioned in the “Spare Parts” section below, but the procurement of parts and machinery in particular takes time. Even though preventive maintenance is perceived to be necessary, progress has not been made on this issue due to the shortage of parts and delays in procuring them.

- Quality Control: At the time of ex-post evaluation the importance of quality control was not fully recognized. Employees prioritized annual production targets and had little awareness of cost-management. Furthermore, there were no benchmarks for quality control. On the other hand, at the time of ex-post monitoring, it was found that a strong commitment to quality control existed. Maintenance operations are being carried out under a 3-shift (24-hour) structure, and quality control inspections are being carried out during each shift. Operation manuals are in the process of being developed as well. Employees are aware of the importance of quality control. However, as the facilities are becoming more obsolete, the level of quality control is not always satisfactory.

- Spare Parts: At the time of ex-post evaluation, the executing agency’s procedure for the procurement of spare parts was judged to be inefficient and often prevented the timely procurement of necessary spare parts. At the time of ex-post monitoring, just as at the time of ex-post evaluation, necessary spare parts are being procured through procedures that in many cases still requires much time until completion of delivery. This prevents

the timely procurement of the necessary parts.

- Information Management: At the time of ex-post evaluation, documents and other materials were not managed systematically, and there was no clear maintenance history for machinery and equipment. At the time of ex-post monitoring, there is awareness that information management is still inadequate, but the factory is making efforts to improve information management, including the purchase of a batch of computer supplies in 2005 and 2006, and the establishment of LAN systems in some departments.



Figure 6: Gas Compressor after the Repair



Figure 7: Inside View of Ghorasal Urea Fertilizer Factory

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

Since the time of ex-post evaluation, the Government of Bangladesh has revised the retail price of urea fertilizer with the aim of improving the financial structure of domestic fertilizer factories, including the Ghorasal Urea Fertilizer Factory. At the same time, the Ghorasal Urea Fertilizer Factory has been strongly committed to maintenance and inspection and to quality control, and has made efforts to improve information management, including the purchase of a batch of computer supplies, which have been used to establish local area networks. However, the project faces the problem that 40 years have already passed since the fertilizer factory commenced operations. The facilities at the factory are becoming obsolete, resulting in an increasing number of shutdowns. This has made it difficult to achieve actual urea fertilizer production according to plan. The revision of the retail price of fertilizer means that financial improvement may be expected going forward if production capacity can be ensured. It is vital that the recommendations in the below paragraph should be implemented in order to ensure the necessary production capacity.

3.2 Lessons Learned

None

3.3 Recommendations

[To the Executing Agency and Ghorasal Urea Fertilizer Factory]

■The equipment and machinery in the Ghorasal Urea Fertilizer Factory is becoming more and more obsolete, and the number of shutdowns is increasing. It makes it difficult to achieve actual urea fertilizer production according to plan. The Executing Agency and the fertilizer factory should put into place an operation and maintenance structure that will ensure normal operation by reducing the problems of the facilities overall. The factory should continue its strong commitment to the maintenance and inspection of equipment and machinery and continue to replace and renovate facilities.

■The factory should implement efforts to secure human resources and retain its current employees as soon as possible.

■A system should be constructed to support the procurement of necessary spare parts without delay. Furthermore, steps should be taken to bolster the implementation system for preventive maintenance and the maintenance plan.

Comparison of Original and Actual Scope

Item	Plan	Actual
1) Output	(1) Upgrading of the Ammonia Plant	=>Almost as planned (Changes) - Repair and cleaning of the spare boiler in the reforming section were cancelled. - Replacement of the air intake tower in the air compression section was cancelled. - Installation of process compression equipment in the compound section was cancelled.
	(2) Upgrading of the Urea Plant	=>Almost as planned (Changes) - Replacement of the wooden chamber in the urea granulation section was cancelled.
	(3) Installation of a 16MW Gas Turbine Power Generator	=>Almost as planned (Changes) - The power generation capacity was increased to 18MW
	(4) Upgrading of Ancillary Facilities	=>Almost as planned (Changes) - Installation of a conveyer belt in the fertilizer storage area was cancelled.
2) Project Period	July 1999 to May 2001 (23 months)	July 1999 to September 2001 (27 months)
3) Project Cost		
Foreign Currency	5,443 million yen	5,443 million yen
Local Currency	1,018 million yen (393 million Tk)	1,000 million yen (497 million Tk)
Total	6,461 million yen	6,443 million yen
ODA Loan Portion	5,443 million yen	5,443 million yen
Exchange Rate	1 taka = 2.59 yen (December 1998)	1 taka = 2.01 yen (2000)