SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT

LAFARGE ISLAM CEMENT LIMITED

IN THE

PEOPLE'S REPUBLIC OF BANGLADESH

August 1997

CURRENCY EQUIVALENTS

(as of 31 July 1997)

Currency Unit	-	Taka (Tk)
Tk1.00	-	$0.023
$1.00	-	Tk44.00

For the purpose of calculations in this Report, an exchange rate of Tk44.00 to $1.00 has been used.

ABBREVIATIONS

BOD	-	Biochemical Oxygen Demand
DOE	-	Department of Environment
EIA	-	Environmental Impact Assessment
JGTDS	-	Jalabad Gas Transmission and Distribution System Limited
LIC	-	Lafarge Islam Cement Limited
SEIA	-	Summary Environmental Impact Assessment
TSP	-	Total Suspended Particulate

WEIGHTS AND MEASURES

dBA	-	decibels-acoustic
km	-	kilometer
m	-	meter
mg	-	milligram
mm	-	millimeter
ug	-	microgram
scum	-	standard cubic meter

NOTES

(i) The fiscal year (FY) of the Government and its agencies ends on 31 December.
(ii) In this Report, "$" refers to US dollars.

CONTENTS

I. INTRODUCTION

1. At the present, Bangladesh imports 2.3 million tons per year of portland cement out of a total consumption of 3.0 million tons per year. This reflects an increase in importation and consumption by 40 percent and 20 percent respectively during the last two years. The widening gap between demand and consumption is the result of higher consumer confidence and construction activities, and a deteriorating productivity by existing cement plants. Although there are five cement plants operating in the country, only the Chatak Cement Plant is producing cement from basic raw materials with a capacity of 270,000 tons per annum. The other four cement plants are primarily grinding and bagging imported cement clinker from India and the neighboring countries. In essence, Bangladesh is dependent on imports for 87 percent of its cement needs. The price of cement is highly dependent on the transport and handling costs, such that the cost of cement in Bangladesh is 60 to 70 percent higher than the world market price. Cement availability is a serious constraint in the development of basic infrastructure in Bangladesh. To attract more investment in the cement sector, the Government has opened the sector to private investors.

2. The Islam Group of Companies, which has extensive investment in real estate and construction in Bangladesh previously applied for a Bank loan to establish a dry process cement factory near Chatak, Sunamgonj to produce 0.6 million tons per year of grey portland cement.[1] With the increasing demand for cement and the need for higher productivity and efficiency, the Islam Group of Companies decided to team up with Lafarge of France to construct a 1.2 million tons/year cement plant (the Project) in the same site. Lafarge is a specialized company in the cement industry and is ranked second worldwide in capacity and number of cement plants owned and operated. The joint venture company, Lafarge Islam Cement (LIC), is the Borrower. The environmental impact of the cement manufacturing plan is classified by the Bank as category A, as the plant has the potential to cause serious environmental problems if proper mitigation measures are not in place. The original Environmental Impact Assessment (EIA) was prepared by Envirocare (Pvt) Ltd. for the Islam Group of Companies and was circulated to the Board of Directors of the Bank on 25 July 1995, 120 days before its approval on 19 December 1997. The Bank's environment specialist visited the Project site on 4-6 May 1995 to verify critical aspects of the EIA report. The original EIA report has been submitted to the Department of Environment (DOE) of Bangladesh on 2 June 1995 and approved on 20 November 1995.

3. The LIC has retained Envirocare (Pvt) Ltd. to update the EIA and the summary EIA (SEIA). Pursuant to the Bank's guidelines, this updated SEIA is circulated to the Bank's Board of Directors 120 days prior to loan approval. The revised EIA report has been submitted to DOE and approval is expected in October 1997. The previous and updated EIA report is available at the Project office on request. This SEIA is prepared by the Borrower and has not been evaluated and assessed by the Bank. The Bank's assessment of the report and evaluation of the environmental impacts related to the Project will be included in the documentation presented to the Board at the time the Project is considered for approval.

[1] Loan No. 1418-BAN: Islam Cement Limited, approved on 19 December 1995.

II. DESCRIPTION OF THE PROJECT

A. Raw Material Supply

4. The main raw materials needed to manufacture cement are limestone, clay, gypsum, and fuel. To produce 1.2 million tons per year of cement, 1.5 million tons of limestone, 280,000 tons of clay, and 140,000 tons of sandstone will be needed. The Project will utilize low sulfur natural gas for fuel. When the Indian subcontinent was partitioned, Bangladesh was carved from the delta and Himalayan foothills. Bangladesh has no commercial limestone and sandstone deposits, although large deposits are available just across the Indian border. The limestone and sandstone will be purchased from Meghalaya, India, approximately 20 km away from the Project site. The Meghalaya limestone deposit is estimated at 2,166 million tons and unconfirmed reserve of another 180 million tons. Limestone and sandstone will be transported by a 17 kilometer (km) long aerial ropeway from Meghalaya-Bangladesh border to the plant site and 3 km by road from the mine site. Clay will be obtained from the nearby northern boundary of the plant site. Gypsum is a waste material in the manufacture of phosphoric acid fertilizer; at present there is an oversupply from the Chittagong Fertilizer Factory.

5. The limestone mines are ongoing operations supplying cement plants and small-scale lime producers in Bangladesh and India. While the Borrower intends to buy into one of the mines to guarantee a long-term limestone supply, the Borrower may buy limestone from other sources depending on the market prices. In selecting the limestone mines, the Borrower has required the mines to provide proof that their mining operations have complied with all safety and environmental regulations, laws, and standards required by the relevant Government authorities in India. Lam Mawshun Minerals Private Ltd. of India, one of the major mines in Meghalaya and potential limestone and sandstone supplier to the Project, has submitted a copy of the No Objection Certification of their mining operation issued by the Ministry of Environment and Forest of India on 15 January 1995.

6. The annual natural gas requirement is approximately 150 million standard cubic meter (scum).[2] The natural gas has an average heating value of 9200 Kilocalories (Kcal)/scum. The natural gas will be supplied by Jalabad Gas Transmission and Distribution System Limited (JGTDS), which has an existing gas pipeline running along the southwest border of the plant site. A new 200 millimeter (mm) diameter gas pipeline will be laid by JGTDS to be used exclusively for the Project if the present 150 mm diameter pipeline is insufficient. The new gas pipeline will use the existing right-of-way owned and maintained by JGTDS. The project site is located within the Chatak gas field with a proven gas reserve of 110 billion cubic meters (m^3). Petro-Bangla, the developer of the Chatak gas field, has confirmed the natural gas availability during the whole economic life of the Project. The natural gas from the Chatak field contains 96 percent methane; 2.5 percent ethane; and traces of iso butane, n-butane, nitrogen, carbon dioxide, and other hydrocarbons.

7. Water will be supplied from the Surma River, which flows at a distance of about 200 meters (m) from the plant site. Water will be pumped to a settling tank to remove coarse particles followed by the addition of a coagulant (primarily alum), and clarification to remove the turbidity. After removing the turbidity, the water will be disinfected with chlorine. The water

[2] A standard cubic meter is one cubic meter of gas at one atmosphere pressure and zero degree centigrade.

demand is estimated at 75 m^3/hour or 1,800 m^3/day. Although the plant capacity has been increased by 100 percent the water consumption is 50 percent lower than the previous plan because of extensive water reuse and recirculation. The water will be used to cool the bearings, power plant, will be from ground water. The minimum flow at the Surma River is 714 m^3/sec or 2.6 million m^3/hour.

B. Civil Works and Process Equipment

8. A ropeway tram-carrier type with a capacity of about 2.0 tons per bucket will be constructed to bring the limestone from the quarry in India to the Project site. The ropeway will comprise 160 pillars spaced at a distance of 100 m. The pillar base is 1.2 m by 1.2 m. The height is 15 m. The buckets will be fully closed to prevent spillage, and material loss. The ropeway route will follow the alignment of existing roads and pathways. Over the 7.5 km distance on the Bangladesh side, the route will transverse rice fields and croplands. The ropeway will be similar to the original plan except that it will be operated at a higher speed to accommodate the additional limestone requirements.

9. Cement production involves the grinding of the limestone, sandstone and clay to the required size and consistency. To minimize the energy requirement, the raw materials are preheated. The mixture is then fired in the kiln calciner where the limestone, clay and sandstone forms a clinker. The clinker is ground, and gypsum is added to control the hardening period of the cement. The ground clinker and gypsum mixture is now ready for marketing as portland cement. Portland cement is bagged and stored in the warehouse. The process flow diagram is shown in Appendix 1.

III. DESCRIPTION OF THE ENVIRONMENT

A. Land Use

10. The Project will occupy 35 hectares of land in Chatak Bazar, Sylhet on the northern side of the Surma River. The Chatak Bazar township is linked with the rest of the country by roads, a railway, and the Surma River. Although the Roads and Highways Authority of Bangladesh normally does not allow a truck to carry more than 8 tons on most roads and bridges in the area, a number of industries have been built due to the proximity to energy and raw material, and access to almost all the major urban centers via the Surma River. The main industries within a 10 km radius of the Project site are the Chatak Cement Plant, Sylhet Pulp and Paper, and (Korean) Cement Plant. A number of lime factories using primitive kilns, rock crushing and washing facilities, and rock pile or storage are also found in the area. Most of the urban centers in Bangladesh are located in the delta region where construction materials such as rocks and sand are scarce. Those materials are purchased from India or quarried in the nearby hills. The surrounding areas to the factories are primarily cultivated with rice and vegetables. The land uses and Project vicinity map are shown in Appendix 2.

11. The Project site and Chatak Cement are located on the other side of the Surma River from Chatak township. As there is no bridge, the Project site, Chatak Cement, and villages on this side of the Surma River are dependent on the river for transportation.

B. Physical Environment

12. The area has a subtropical climate with a maximum temperature range from 25° to 31°C, and minimum temperature range of 13° to 25°C. December to February are the cold months, while April to August are the hot and humid months. Early humidity varies from 83 percent in March to 96 to 97 percent for most of the year. The area is affected by the southwest monsoon, which normally starts in May and ends in September. June is the wettest month with average precipitation of 1,370 mm, while November and December are the driest months with average precipitation of 6 to 7 mm. Almost 80 percent of the total rainfall of 5,900 mm takes place during the monsoon season. Due to the funnel-shape formation of the land mass in the upper portion of the Bay of Bengal where Bangladesh is located, the cyclones often have disastrous effects. Because the Project site is located close to the Himalayan foothills, it is not affected by the damaging effects of the storm surges created by the cyclones.

13. The prevailing wind direction is southeasterly and easterly from January to March. From April to December, the prevailing wind direction is north easterly. The wind speed is 4 to 8 m/sec.

14. In spite of the presence of the two cement plants, one pulp and paper factory, and a number of small-scale lime producers, the air quality in the area is relative good. The Chatak Cement Plant has an electrostatic precipitator and bag filters for dust control and the other cement plant is operating intermittently because of technical problems. In 1995, the 24-hour average concentration for major air pollutants of concern included: sulfur dioxide ranging from 4.0 to 13.7 microgram (ug)/standard cubic meter (scum), total suspended particulate from 20 to 40 ug/scum, nitrogen oxides from 10 to 15 ug/scum. The air quality compares favorably with the proposed ambient air quality standard in Bangladesh that sets the 24-hour average concentration of sulfur dioxide at 120 ug/scum, nitrogen oxides at 100 ug/scum, carbon monoxide at 5000 ug/scum and total suspended particles (TSP) at 500 ug/scum. The ambient air quality as measured in the first quarter of 1997 showed little change. The TSP ranged from 26.7 to 38 ug/scum, sulfur dioxide and oxides of nitrogen were less than 4 ug/scum. The Bangladesh standard for TSP is 500 ug/scum, sulfur dioxide at 120 ug/scum, and oxides of nitrogen at 50 ug/scum.

15. The Sylhet Pulp and Paper Mill uses a series of lagoon ponds to treat its industrial wastes. The effluent discharge still contains biochemical oxygen demand (BOD) of 255 milligrams (mg)/liter (l), pH of 7.4 to 8.4, and suspended solids of 341 mg/l. However, the dilution in Surma River is very high as the river is relatively unpolluted. The BOD concentration in the river is less than 10 mg/l, and the dissolved oxygen concentration is above 13 mg/l. The river water suspended solids is relatively high at 207 mg/l due to soil erosion resulting from poor land cultivation. The Chatak Cement Plant wastewater discharge, which is primarily cooling water, contains very little organic materials with a BOD of less than 5 mg/l and suspended solids concentration of less than 20 mg/l.

16. The prevailing noise level in the area varies from 45 decibels-acoustic (dBA) during daytime to 55dBA. There is no major noise source at the Project site.

17. The Project area is part of the geological formation covering the whole northeast of Bangladesh. The area is primarily composed of raw sandy and silty alluvial deposits, usually stratified either from the surface or below the cultivated topsoil. Typical of the Himalayan foothills,

the area is subject to earthquakes, although the strength and frequency of occurrence was not established due to lack of suitable equipment.

C. Biological Environment

18. There is hardly any forest in Sylhet Province. Official surveys place the forestland at 3 percent of the total land area, but it could be much smaller. Fish resources are depleted because of the increase in the population. Historical records mention the presence of tigers and jackals in the forest of Sylhet, but today they are already extinct. Domesticated animals such as goats, cow, ducks, and chickens are the main fauna in the area.

19. Various types of shrubs, herbs and other agricultural crops are grown in the winter. In the summer, most of the cultivable areas are used to grow vegetable, otherwise the land is allowed to fallow. Fish are not plentiful because of overfishing. Common fresh-water fish known in this region are cirrhinus reba, labeo bata, silonia, pangasium, and badis badis.

20. The Project site and the surrounding areas have been settled and cultivated for a long period, so there is no wildlife remaining.

D. Socioeconomic Environment

21. The Sylhet population is highly mobile and accounts for most of the Bangladeshi residing or working abroad. Almost all families have relatives working in the middle East, Malaysia, or Europe. In spite of the low productivity of the farmlands, the residents of Sylhet are able to maintain a higher standard of living than those in most urban centers of Bangladesh. The houses in Sylhet are well maintained and built.

22. The province has a literacy rate of 35 percent, which is much higher than the national average of 25 percent. The high literacy rate is encouraged by progress made by family members who have been able to find foreign employment. Although the province has a good university, technical colleges, teacher's college, and high schools, a number of Sylhet students are studying in Dhaka or outside of Bangladesh. Even graduates from the local university and colleges often work outside of Sylhet because of the very limited employment opportunities in the area. Aside from the civil service, the major employer in the area is the Chatak Cement Plant and the Sylhet Pulp and Paper Mill. Most of the residents are working in agriculture, trading, and transport.

23. The Project site is serviced by a raised unpaved road connecting Chatak Cement Factory and Dewrabazar village. The road runs along the southern boundary of the Project site parallel to the northern bank of the Surma River, which is navigable throughout the year. During the summer months, barges carrying up to 800 tons of cargo can navigate the river. As mentioned earlier, the Surma River is the main transport and communication link to the Project site from other urban centers in Bangladesh. The Project site road link to Sylhet town and Dhaka is very difficult with the absence of a bridge across the Surma River.

24. The Sylhet Pulp and Paper Mill across the Surma river from the Project site is served by a railway system. The maximum allowable capacity of a railway wagon is 19 tons. The Railway Authority has plans to expand services to industries in the future.

25. The average household size in Chatak is 6.0 persons. The nearest settlement to the Project site is the Chatak township across the Surma River and directly opposite the Chatak Cement Plant. A small settlement has also developed along the Surma River beside the Chatak Cement Plant. The main occupations in the area are agriculture, trading, and skilled and unskilled labor.

IV. ANTICIPATED ENVIRONMENTAL IMPACT AND MITIGATING MEASURES

26. The potential impacts of the Project could result from (i) construction and operation of the ropeway; (ii) on-site storage of the crushed limestone, sandstone, and gypsum; (iii) dust from grinding and mixing of raw material; (iv) dust and combustion by products from the calciner; (v) dust from clinker grinding and bagging; (vi) wastewater used for bearing cooling, and sewage discharge from staff housing and offices; (vii) disposal of solid wastes; and (viii) dislocation of the farmers tilling the 35 hectares of rice land. The original Project required 35 hectares of land because the greater amount of land required for stockpiling of raw materials and the process equipment. The revised Project process equipment is more compact and most of the limestone will be stockpiled in the quarry site rather than in the plant site.

27. The crushed limestone and stone will be transported inside closed buckets to prevent the loss of materials, dust and spillover. Enclosure is important as crushed limestone and sandstone falling down from the ropeway could pose a hazard to persons working underneath. There are no scenic areas or areas of historical interest along the ropeway route whose value could be affected by the ropeway pillars and rope. The buckets will be sprayed with water to control fine dust particles prior to unloading of the content into the storage area. The storage area will contain sufficient crushed limestone and sandstone for at least 15 days of plant operation. The crushed limestone and sandstone stockpile will be provided with water spray to control the dust. As mentioned earlier, limestone and sandstone will be purchased from India and the price is 10 to 15 percent higher than if those materials were quarried within the plant site as with most cement plants. As LIC is paying a premium for those raw materials, the control of raw material losses is a primary consideration in controlling the fugitive dust. Trees will be planted around the stockpile area to serve as windbreaks.

28. The sandstone and clay (additives) will be crushed on site to 7.5 cm size. The limestone and additives prior to any transfer from the stockpile area to conveyor belts and crushers will be sprayed with water to prevent dust emission. The crushing operation will be carried out in an enclosed room with air pressure maintained under negative pressure by a large exhaust fan. The exhaust air will pass through a cyclone to remove the dust. The crushed limestone and additives will be weighed and the correct portion to a raw mill to reduce the particle size down to 90 to 1000 microns. The raw mill will operate on a closed cycle basis to reduce carry-over dust emission. The raw mill room will be also enclosed and the exhaust air will be treated in a cyclone in a similar manner as the crushers. As a contingency measure sufficient space is left in the cyclone area for installation of additional cyclones in series or bag filters if the emission exceeds 100 mg/scum as provided for in the interim Bangladesh emission standard for TSP. Similar mitigating measures will be implemented in the clinker grinding and bagging area to remove the TSP.

29. The homogenized mixture of fine limestone, sandstone, and clay particles will undergo preliminary drying and initial chemical reaction in the preheater using the exhaust from

the calciner. This operation cools the calciner exhaust gas to 350 C. Prior to discharge into the atmosphere the calciner exhaust gas will pass through an electrostatic precipitator to remove the particulate. The TSP in the exhaust gas stream after the electrostatic precipitator is guaranteed by the designer and equipment supplier at less than 70 mg/scum, which is less than the Bangladesh emission standard of 100 mg/scum for TSP. The flue gas sulfur dioxide will be undetectable as sulfur is very low and almost undetectable in natural gas fuel. The carbon monoxide concentration in the exhaust gas is expected to be low as natural gas undergoes almost complete combustion in the calciner. Assimilation of the exhaust emission will be further facilitated after discharge in a 60 m high stack. The original Project required a stack height of 30 m.

30. The maximum TSP concentration from the Project's emission was calculated using the Gaussian Plume model. The model predicted a maximum impact was a maximum daily average concentration of 50 ug/scum at 800 m from the plant smokestack at the worst expected conditions. When added to the existing conditions, the maximum daily concentration is expected to go up to 90 ug/scum from the present level of 40 ug/scum. While the Project will cause a 125 percent increase in the TSP level, this concentration is still within the ambient air quality standard of 500 ug/scum used in Bangladesh. Sulfur dioxide was not calculated as the natural gas fuel contains only a trace concentration of sulfur.

31. As is typical with subtropical and tropical clay subjected to monsoon rains, the oil around the Project site is acidic with the pH ranging from 4 to 5. Zinc and other essential metals are easily leached out. Farmers are adding lime and zinc oxysulphate to the soil. The residual alkaline emission from the exhaust gas is not expected to cause any serious problem on the surrounding rice fields. During the EIA study, the team visited the rice fields around the existing Chatak Cement plant and found no perceptible impact of the cement plant operation.

32. Rejected products and raw materials will be backfilled in the clay quarry area within the Project site. This will reduce the materials required in the future to rehabilitate the clay quarry. Although the clay quarry is a 50 m high hill, it is expected that the quarry operation will be carried out to a depth of 25 m below the ground. The rejected products are normally clinker, discarded insulating materials from the calciner, and impurities in the limestone and sandstone. As mentioned earlier, LIC is paying a premium for the raw materials. The dust from the crushers and grinder will be recycled into the manufacturing process stream.

33. A reversible jet bag type dust collector will be provided for venting the silo and control bin. The exhaust from the vents is expected to be less than 100 mg/scum. LIC has stipulated a supplier guarantee of 50 mg/scum or less of TSP in the emission.

34. The wastewater used for cooling the ball bearings and process equipment will be treated in an oil separator. The original volume was estimated at 1,000 m^3/day but with extensive recycling and reuse the bleed-off volume from this source is negligible. Approximately 800 m^3 of water will be used for dust control of the limestone and sandstone stock pile, dust control in the conveyor belt, and washing of the ropeway boxes. The wastewater from this source will be treated in a sedimentation tank to remove the suspended solids in the wastewater. During plant operation, LIC will study the viability of recovering the settled solids as additional raw materials. During the dry season, water after sedimentation will be used to irrigate the green areas. Domestic wastewater from the township will be mixed with the pretreated cooling water for further treatment in a facultative pond. The combined wastewater discharge from the cooling water (800 m^3/day)

and domestic sewage (500 m^3/day) is estimated at 1,300 m^3/day. The effluent after treatment in the facultative pond will contain a BOD of less than 30 mg/l and suspended solids of less than 20 mg/l after removal of the algal mass.

35. To control the impact of the noise from the process equipment, especially the crushers and grinders, the following mitigating measures will be in place (i) regulating spacing between noise sources, and between noise sources and operators (control cabins for operation); (ii) reducing structure-borne transmission by isolation of the source using resilient mountings; (iii) correcting imbalance and vibration by preventive maintenance; and (iv) providing ear defenders where necessary to operators exposed for longer duration.

A. Biological

36. The Project will displace 35 hectares of rice fields and the corresponding ecological system. Aside from cultivated rice, the rice field is host to a variety of insects, fish, freshwater crustaceans, birds, and weeds. The displacement of the flora and fauna in this area is a residual impact of the Project. As long as the pollution control equipment are properly operated and maintained, the ecological system in the surrounding rice fields will be maintained. Disruption of the biological environment is also mitigated by the development of the green areas in the Project site.

B. Socioeconomic Aspects

37. Initial site selection was based on the availability of the main raw materials such as limestone, sandstone, clay, and fuel in close proximity. The final site selection was based on the ownership pattern of the land. As mentioned earlier, a number of families in Sylhet are working in Dhaka or abroad. A number of employees in the Islam Group own land in the area and have offered their land for the Project. As the Project is considered by the Government of Bangladesh as a strategic and high priority Project, the other land will be acquired through a Government notification. The landowners will be paid according to prices to be set by the Government. LIC will provide on-the-job training for unskilled and semiskilled workers during the construction period especially to the landless farmers. The good workers will be retained during the Project operation. LIC will also initiate a training and marketing program for those tenants who could not be employed in the cement plant. There are no houses within the Project site to be relocated. The Project impact will be the loss of farmland to 43 farming families. Two years ago there were only 30 farming families farming the 45 hectares of the Project site.

38. The Project is expected to contribute positively to the economic development of the country through the provision of essential material for the construction of the nation's infrastructure.

V. ENVIRONMENTAL MONITORING AND INSTITUTIONAL DEVELOPMENT

39. The Project cost includes the procurement of analytical equipment for the analysis of stack emissions, ambient air quality, noise, and water quality. Ambient air quality and the stack emission will be monitored once every three months for TSP, carbon monoxide, sulfur dioxide and nitrogen oxide. The wastewater effluent from the facultative pond will be analyzed monthly for BOD, chemical oxygen demand, pH, suspended solids, alkalinity, hardness, and turbidity. While

LIC will maintain an analytical laboratory for analysis, it will also request the involvement of an independent third party to monitor and provide analysis. LIC has considered and contacted Bangladesh University of Engineering and Technology, Department of Environment or Envirocare Bangladesh. The DOE will also conduct surprise inspections from time to time to confirm compliance to its standards.

40. Once a year, LIC will submit to the Bank a compilation of all the monitoring results, highlights of the activities related to plant safety and the environment of the quality control unit. If the plant has been cited for the violation of any safety and environment standards or regulations, a certification from the relevant Government authorities that the defect has been corrected or an acceptable plan of action is in place to correct the defect must be submitted to the Bank.

41. Responsibility for compliance to safety and environmental standards and regulations in the plant is vested with the manager of the Quality Control Unit. The manager reports directly to the managing director in Dhaka on all and any plant practices that are considered to affect the Project's compliance to safety and environmental regulation. Maintenance of the safety and pollution control equipment is the responsibility of the plant engineer. The quality control manager will operate independently from the plant manager. The quality control unit will be staffed with at least two licensed chemists, and one safety engineer.

VI. PUBLIC INVOLVEMENT

42. LIC, in compliance with the Government regulation, has conducted a series of public meetings on the Project especially for persons who will be affected by the land acquisition, as well as farmers and landowners of the surrounding properties. The main public meeting on May 14, 1995 was held at the LIC office in Dhaka and was presided by the Chatak township administrator. The minutes of the meeting are available at the Project office upon request. During the meeting, the Project, benefits of the Project to the community and to the nation, mitigating measures in place to protect the environment, the land acquisition process, and measures LIC is taking to provide alternative employment to displace farmers were discussed.

43. LIC conducted a series of public hearings and meetings with the people affected by the Project and the residents of villages within a 5 km radius of the Project site from February to April 1997. The minutes of the meetings and agreements made were recorded by a notary public. An English translation and the original in Bengali is available in the Project office on request.

VII. COST-BENEFIT ANALYSIS

44. The most direct and quantifiable benefit of the Project is the value of the product in comparison to imported products. The price of the inputs were all converted to international prices to eliminate distortions due to subsidies, such as in the price of the natural gas used for fuel. The cost of all the pollution control equipment, operation and maintenance of that equipment, and the procurement of the monitoring equipment are included in the Project cost. The economic rate of return of the Project was calculated at 21.4 percent. The net present value of the foreign exchange savings over the entire life of the Project is estimated at $120.2 million discounted at 10 percent per annum. In addition, the Project has nonquantifiable benefits through the supply of essential construction materials for the development of basic infrastructure; employment

opportunities in Chatak for 400 people; and another 1,000 new employment opportunities in the downstream industries, such as in the distribution, transport, additional demand for jute bags, and equipment maintenance.

VIII. ALTERNATIVES

45. The alternative to the Project is to continue the present trend of importing cement from other countries. This option will avoid the residual impact of the Project in Bangladesh. However, in global terms the emissions will be higher as additional energy will be required to transport the final product to Bangladesh from distant sources. While the dislocation of the farmers in the Project site is the main social impact of the Project, the high dependence on imported cement has caused a greater social impact on the country in restraining the development of basic social infrastructure such as roads, water supply, hospitals, schools, houses, and ports, which need large quantities of cement. The provision of this basic infrastructure in Bangladesh will continue to be more expensive without the Project.

46. In the development of the process equipment, pollution control was given a very high priority. For example, the Project opted to use a ropeway system to transport the limestone and sandstone from India rather than roads. With the ropeway system, only .084 hectare of land will be required for the pillars whereas to build the 17 km roadway will require 20 hectares of land.

IX. CONCLUSION AND RECOMMENDATION

47. The Project will provide cement at a lower price than the current price in the market today. Cement availability in the market will be also higher. The Project will assist in the development of important infrastructure in country. The main environmental impacts of the Project are the conversion of the 35 hectare rice field for the Project site and the dust emissions from the manufacturing process. As long as the pollution control equipment are properly installed, operated, and maintained, and LIC maintains a continued social responsibility for the displaced farmers, the residual impacts of the Project could be maintained at an acceptable level.

Appendix 1: Manufacturing Process Diagram
Appendix 2: Location map of Lafarge Islam Cement Plant