

Environmental and Social Strategy (ESS)

Tupi Cement Project (PR-L1054)

Paraguay

I. PROJECT DESCRIPTION

- 1.1 The proposed Project is for the construction and operation of a new cement plant and a limestone quarry in Paraguay. The Project involves an annual initial production of approximately 300,000 tons of clinker and approximately 400,000 tons of cement.

A. Project sponsors

- 1.2 The Project sponsors are: Camargo Correa Cimentos S.A. (35%), Votorantim Cimentos Ltda. (35%) and Concret Mix S.A. (30%), (together, the “Sponsors”). The Sponsors are already present in the Paraguayan market through Yguazú Cimentos S.A. (the “Borrower,” or the “Company”), a cement import company that supplied Paraguay with 11% of its cement needs in 2009. The Company will make use of its market knowledge and already existing distribution network to place its production.

B. Site location

- 1.3 The cement plant will be located in Villa Hayes, Paraguay, approximately 30 km north of Asunción on the Paraguay River. The project includes quarrying infrastructure for extracting and crushing limestone at Itapucumi, 400 Km north of Asunción on the Paraguay River, a port enabling transportation of the raw materials by barge, and clay and pozzolana quarries in sites to be chosen at a later stage. The clinker kiln, grinding mill, and bagging facility will be located in Villa Hayes. See Figures 1 & 2.

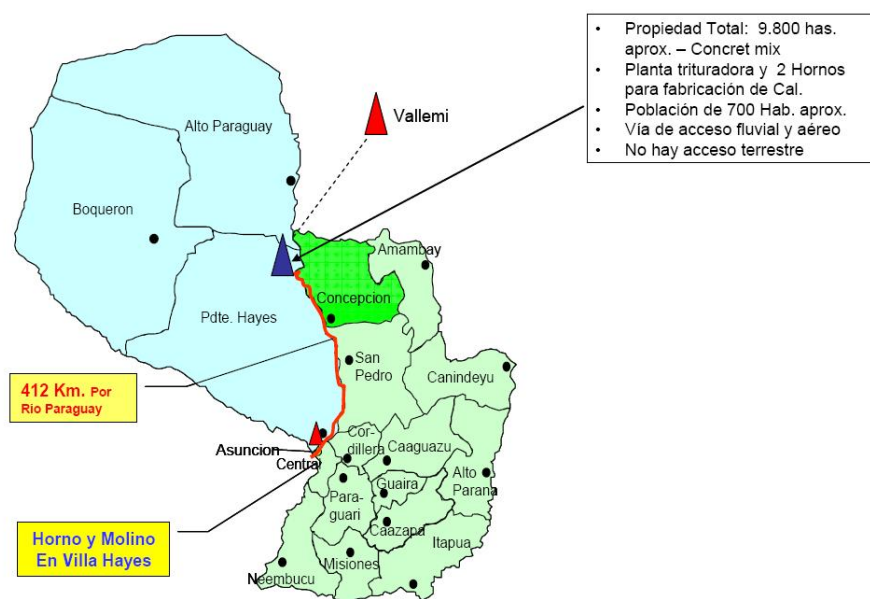


Fig. 1: Plant and quarry locations

C. Cement production

- 1.4 Portland cement is made from the mixture and calcination of limestone and clay materials in a proper proportion. Thus, in addition to limestone, cement production requires the use of clay, gypsum to regulate the setting time of cement, and iron ore to adjust the composition of the mixture. To make pozzolanic cement, pozzolana must also be added to the mixture. Table 1 summarizes consumption and source of raw materials and other inputs (such as energy and water).

Table 1: Consumption and source of raw materials and other inputs

| INPUT | CONSUMPTION | SOURCE |
|---|---------------------------|---|
| Limestone | 460,000 t/year | Limestone quarry in Itapucumi |
| Fine limestone | 12,000 t/year | |
| Clay | 76,000 t/year | Clay quarry (site not yet defined, probably Asuncion) |
| Gypsum | 20,000 t/year | Brazil or Argentina |
| Pozzolana | 56,000 t/year | Pozzolana quarry (site not yet defined, probably Paraguari, 80 Km SE of Asuncion) |
| Iron ore | 11,000 t/year | Brazil or Argentina |
| Petcoke | 22,400 t/year | Brazil or Argentina |
| Coal | 22,400 t/year | Brazil or Argentina |
| Electricity | 0,12 GWh | 220 kV transmission line, which supplies Asunción |
| Water (for the cement production) | 602,4 m ³ /day | Paraguay River |
| Water (for use in offices, laboratory and irrigation) | 211,2 m ³ /day | Villa Hayes water distribution system |

D. The project facilities

Cement plant

- 1.5 The plant will be located about 30 km from Asunción, accessible by Route Nr. 9, paved, about 11 km after the bridge on the Paraguay River. An existing 0,8 km access road will be enhanced to connect the plant site to the existing road network. The cement plant, port and power substation will be located in an area of 50 ha owned by Iguazú Cementos SA, although the facilities will occupy only 19 hectares of the total area.
- 1.6 Due to the proximity to Paraguay and Confuso rivers, the project was developed taking into account that all facilities, except the storage area of limestone, will be held on filled ground, with a height greater than the level of maximum flood in the area.
- 1.7 The plant, which will use a dry process and pre-heating for the production of cement, will have following facilities: 1,000 tons/day clinker kiln (to produce 400,000 tons of cement annually); packing station with a capacity of 1,800 bags/day (50 kg bags); port on the Paraguay River; 15,000 tons clinker storage facility; 60,000 tons storage facility for other raw materials; 5,000 tons storage facility for the end product; 100 tons/hour bulk loading system; 2 silos with a total capacity of 8,000 tons of cement.

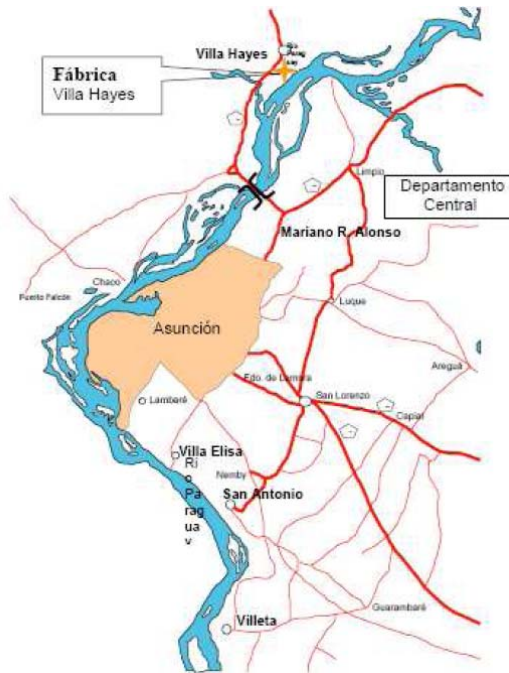


Fig. 2: Site location in Villa Hayes

- 1.8 The fuel used in both the preheater and precalciner as in the kiln will be petcoke, although coal can be used interchangeably, depending on availability and chemical properties of petcoke. Petcoke and coal will be obtained from Brazil or Argentina, and will be transported to the port of the factory by barges along the Paraguay River.
- 1.9 The water supply for the industrial process will be supplied from an intake located in the Paraguay River, being pumped to the water treatment plant, with a nominal capacity of 185 m³/h. The water to supply the administrative buildings and the laboratory, and for use in irrigation of green areas and roads, will come from the public water supply system of Villa Hayes, already treated.
- 1.10 The fire fighting system with fire hydrants will be independent of the water supply network. The system will operate entirely by gravity, and there will always be a permanent reserve for emergencies via a 108 m³ elevated tank.
- 1.11 All wastewater generated in the administrative facilities and laboratories will be collected and treated in a wastewater treatment plant of activated sludge type, with a capacity of 9 m³/h. The plant will be composed of an aeration tank, secondary sedimentation, a chlorination chamber and an aerobic sludge digester. The treated wastewater will be discharged into the Paraguay River, in full compliance with national and international discharge standards (SEAM Resolution No 222/02 and IFC standards). After digested in the aerobic digester, the sludge will be sent to a drying bed.
- 1.12 Solid waste generation is not anticipated in the industrial process of cement manufacture. With regard to domestic solid waste, it will be collected twice a week by a contractor and sent to the treatment plant in Villa Hayes, where it will be sorted and separated, recyclable fraction will be made available for any properly licensed recycling companies and non-recyclable fraction will be sent to municipal landfill.

filters, fans, water spraying and cyclone dust collectors.

Port

- 1.14 A port will be built close to the cement plant, which will receive the limestone transported by barge from Itapucumi. The port will also receive barges with loads of iron ore, coal and gypsum from Brazil or Argentina. The port was already licensed by the national port authority (Marina Mercante del Estado).
- 1.15 This port will consist of a reinforced concrete pier, which will serve as a berthing area for barges. It will house the discharge system (mobile or fixed) that will allow barges to be downloaded one after the other with a continuous flow of discharge. It will also have a 50 m reinforced concrete bridge, which will connect the port with the facility.
- 1.16 The excavation of the approximation basin, providing access to the dock by the Paraguay River, was already done using suction dredges, to a depth of 6 meters, withdrawing a total of 150,000 m³ of material.

Limestone quarry

- 1.17 Limestone, the main raw material in the cement manufacturing process, will be obtained from a quarry located at Puerto Itapucumi. Access to the limestone quarry is done by plane using a landing strip for small-scale aircraft, or by water, using the river Paraguay. There is no access by land.
- 1.18 The estimated monthly production of the quarry is 40,000 tons of limestone, with an average production of 1,688 m³/month of sterile material (soil and rock). It is estimated that the life span of the quarry will be 330 years.
- 1.19 The use of explosives will be subject to a stringent control and supervision. There will be one explosion per week. Security standards for the use, transport and storage of explosives will follow the national regulations (Decreto N° 23.459/76) and the IFC *Environmental, Health and Safety Guidelines for Mining*. All staff involved in explosive management will receive a special training. Explosions will be held always at the same time (12:00 pm) in order to minimize impact on fauna.
- 1.20 The energy required to operate the mill and other facilities will come from a transmission line of 23 kV, which feeds two transformers that lower the voltage to 6.6 kV and 400 V in a substation at the quarry.
- 1.21 The support facilities consist of two administrative buildings, clothing room, dining, warehouse, storage building, maintenance garage with an effective surface area of 400 m², a fuel depot and waste yard. Facilities also include a port, in which limestone will be loaded into barges and transported to Villa Hayes through the Paraguay River.

E. Transport of raw material

- 1.22 Both limestone from Itapucumi and other raw materials imported from Brazil and Argentina will be transported to the cement plant in Villa Hayes by barges through the Paraguay River. Transportation will be contracted with third parties and barges will be open, uncovered the shipped limestone.

- 1.23 In the Paraguay River, different types of barges are being used, depending on their function, capacity and shipping owner. Most common are the Mississippi type, which are classified in 1,000, 1,500 and 2,000 tonnes. The approximate dimensions of these barges are 46.0 m long, 11.0 m wide, 5.1 m height and 2.7 to 3.0 m draft. In this case, barges with a capacity of 2,000 tons will be used, in convoys of 10 barges, totaling 20,000 tons per convoy. According to the experience of different shipping companies, the worst time of transport could be 4 days between Itapucumi and Villa Hayes (downstream) and 5 days from Villa Hayes to Itapucumi (upstream).
- 1.24 The Paraguay River has an average of four-month low level by year, in which navigation is restricted depending on the depth of the vessels. During this period, barges will be charged under their capacity, thus allowing navigability.

F. Other raw materials and fuels

- 1.25 Other materials that will be used in the cement manufacturing process are: clay (76,000 t/year), pozzolana (56,000 t/year), iron ore (11,000 t/year), gypsum (20,000 t/year), coal (22,400 t/year) and petcoke (22 400 t/year).
- 1.26 The clay and the pozzolana to be used as raw materials for cement manufacture will be obtained exploiting quarries sites to be defined later and they will be subject to specific environmental and social assessments.

G. Alternatives Analysis

- 1.27 **Project Site Options:** The availability of limestone is the primary criterion for determining potential sites for a new cement plant. An alternatives analysis was conducted for the Project that included two possible locations for the cement plant: in Puerto Itapucumi, close to the limestone quarry, or in Villa Hayes, next to the largest consumer of cement of the country, Asunción.
- 1.28 The alternative near Asunción, despite being distant approximately 412 km of the quarry, had the following advantages: proximity to the main market; located in an industrial area; availability of electrical power; favorable port conditions; accessibility, and, more importantly, human resources availability. In addition, most of the other raw materials and fuel for the process, as slag, gypsum and petcoke, could be imported from Argentina, and were therefore closer to Villa Hayes than to Itapucumi. The only exception would be iron ore, which will be transported from Corumbá, Brazil.
- 1.29 From an environmental standpoint, Itapucumi presented a much more preserved environment than Villa Hayes. Therefore, with the factory in Itapucumi, the environmental footprint would be much more significant regarding natural environment than in Villa Hayes.
- 1.30 The most sensitive issue of the alternative of locating the plant in Itapucumí was social: the town does not have enough population to provide the workforce needed to carry out the project (about 900 workers). Itapucumi has only about 700 inhabitants, and 90% of the economically active population works already in an existing lime factory. Installing the factory in Itapucumi would bring an influx of population and the need to implement

housing and urban infrastructure to meet the requirements of the migrant population creating therefore significant environmental and social impacts.

- 1.31 **Technology and Process Options:** The study of alternative technology was developed for the clinker kiln in the cement plant. The dry process with preheating, chosen for the cement factory in Villa Hayes (with 5 stages), is the most efficient technology, with increased production capacity associated with fuel economy and low heat.
- 1.32 In addition, the technology used in the process was reviewed to optimize the plant in terms of energy efficiency and the resulting CO₂ emissions. The small size of the plant (1000 tons per day of clinker) originally meant that the efficiency was below the requirement set by the IDB guidelines (See Section 3.7). A revision of the design was undertaken, and the resulting changes are within the guideline parameters (See Section 5.21).

H. Work force

During construction

- 1.33 An estimated workforce of 422 workers will be needed in average, and 915 during peak construction of the plant and limestone quarry facilities. Approximately 40 workers will be needed to build the facilities and install the equipment at the limestone quarry. In addition to direct labor, it is estimated that the indirect labor will be needed during the construction in the implementation of the cement factory in Villa Hayes (180 persons).

During operation

- 1.34 For operation, the cement plant will require 122 workers, in 8 hour shifts. In addition to direct labor, is also estimated that the plant operation will create another 180 indirect jobs, corresponding to workers for subcontractors. The operation of the limestone quarry in Itapucumi will require 8 workers.

I. Schedule and budget

- 1.35 Implementation works of the project will last 28 months. Work on the cement plant has been running since the beginning of 2011; some fillings, access roads and internal roads have already been made, and the works at the port started in March 2011.
- 1.36 The total investment for the project, including the cement plant in Villa Hayes and limestone quarry in Itapucumi, is US\$ 105 Mill.

II. ENVIRONMENTAL AND SOCIAL COMPLIANCE STATUS

A. National Requirements

- 2.1 Key applicable national legislative requirements include Law Nr. 294/93 *Environmental Impact Assessment* and Resolution Nr. 1133/04 that regulates this law, whose enforcement authority is the Ministry of Environment (Secretaría del Ambiente, SEAM). Those regulations require an EIA for industrial plants of any kind; extraction and processing of surface and in depth solid minerals; construction, clearing and excavation

works. The environmental license issued by SEAM authorizes the requesters to initiate or continue the work or activity and obliges them to comply with the mitigation measures proposed for the project. The license should be renewed every two years. Environmental licenses were already issued by SEAM for some parts of the project; this issue will be further assessed during the due diligence process.

- 2.2 Other applicable regulations are: Law Nr. 352/94 that regulates the management of the National System of Protected Areas; Law Nr. 350/94 approving the RAMSAR Convention on Wetlands of International Importance; the Statute of Indigenous Communities (Laws Nr. 904/81 and 919/96); Law Nr. 422/73 of Forestry; Law Nr. 3239/07 of Water Resources; SEAM Resolution Nr. 222 /02 setting water quality standards; Law Nr. 836/80 Health Code; Law Nr. 3956/09, which provides for integrated management of solid waste; Law No 1100/97 to prevent noise pollution; Law Nr. 1910/02 dealing with firearms, ammunition and explosives; Law Nr. 213/93 establishing the Labor Code and regulating hygiene, health and safety at work; Law Nr. 946/82, for the protection of cultural heritage; Law Nr. 3180/07 which regulates mining activities; Law Nr. 269/93, approving the Agreement for Water Transport through the Paraguay–Parana Waterway. Paraguay has no regulations establishing air quality standards.
- 2.3 The SEAM, as a part of its permitting process requires that projects of this nature conduct an EIA of the proposed development. JGP Consultoria e Participações Ltda., a Brazilian consulting firm, was contracted by Yguazu Cementos S.A. to conduct the study in accordance with the terms of reference approved by SEAM. In addition, the IDB supplied comments on the TOR to enhance the scope to cover IDB as well as other international EIA requirements. A preliminary EIA has been prepared, which is still under revision and will be disclosed at the Bank’s website prior to due diligence.
- 2.4 An initial public consultation phase was conducted simultaneously with the EIA in the first quarter of 2011, including disclosure and consultation events with the communities of Villa Hayes and Itapucumi, and other stakeholders, on February 8th and 10th, 2011.

B. IDB and other International requirements

- 2.5 IDB policies and directives expected to be triggered in this Project include B.04 (other risks), B.05 (environmental assessment requirements), B.06 (consultation), B.10 (hazardous materials), B.11 (pollution prevention and abatement) and B.12 (project under construction) of the Environmental Safeguards Policy (OP-703).
- 2.6 Compliance with the Policy on Indigenous Peoples (OP-765) will be further evaluated during due diligence. Directive B.06 of OP-703, as well as the disclosure of Information Policy (OP-102), is particularly relevant in regard to consultation with local communities. The cement plant site is prone to flooding, therefore OP-704, the Natural Disaster Risk Management Policy applies to this Project.
- 2.7 The IDB Cement Manufacturing Plan Guidelines¹ apply to this project, and based on the information provided by the Company, the Project can meet the threshold requirement with some adjustments. Other international standards that will apply to this Project

¹ Cement Manufacturing Plant Guidelines; An Approach to Reconciling the Financing of Cement; Manufacturing Plants with Climate Change Objectives, August 2010: www.iadb.org/document.cfm?id=3560176

include the cement industry guidelines of the IFC, as well as the World Bank's extractive industry guidance for the quarries. The Company has committed within the EIA to meet the relevant IDB and IFC/World Bank standards.

- 2.8 Based on current limited information there is a potential for significant impacts, some of which will be of considerable magnitude and irreversible mainly due to total greenhouse gas emissions. Other potentially significant impacts such as dust emissions, noise production and other industrial plant construction impacts can be mitigated and managed with good management systems and procedures. Based on these initial conclusions, the team proposes an environmental classification of "A" for the Project under OP-703.

III. ENVIRONMENTAL AND SOCIAL SETTING

- 3.1 The environmental and social setting described below is based primarily on the EIA received from the Project Company.

A. Environmental aspects

- 3.2 **Land use.** The cement plant in Villa Hayes (aprox. 70,000 inhabitants) is located in an industrial district, being the most important the steel industry ACEPAR (Aceros del Paraguay S.A.), located about 8 km north from the cement plant, on the Paraguay River, with a production capacity of 150,000 tons of steel per year, and operating since 1986. The project area in Itapucumi is located in a rural village of 700 inhabitants, devoted almost entirely to the production of lime in the existing quarry; although not pristine, 43% of the land is covered by native vegetation.
- 3.3 **Air quality.** In Villa Hayes, air quality is mainly affected by the emission from ACEPAR. However, no monitoring of its emissions or current air quality in Villa Hayes is performed by this industry. The Itapucumi air quality is relatively good, the current lime quarry being the largest emitter.
- 3.4 To establish a baseline for assessing the noise impacts arising from the project, 10 points were selected and monitored during the preparation of the EIA (five in Villa Hayes and five in Itapucumi). All measurements carried out in Villa Hayes (except one) were above both national and IFC regulations (both daytime and nighttime measurements). This indicates that the area is currently acoustically degraded. In Itapucumi only daytime measurements were made, since the site will not operate during the night. Of the five points measured, three showed values below the provisions of the national legislation and of these, only two were below those recommended by the IFC, which indicates that the area is also moderately degraded acoustically, due to the operation of the lime quarry.
- 3.5 **Habitats.** Baseline survey work was conducted on the plant site and quarry and reported in the EIA. The EIA reports that the cement plant site, located in the periurban area of the city of Villa Hayes, is highly disturbed and does not exhibit a great deal of biodiversity. The area is close to the Paraguay and Confuso Rivers and subject to periodic flooding. In addition, the entire area has been deforested in the past and vegetation completely removed. In this site, there is a predominance of palm trees and floodplains, forest formations (8% of direct area of influence). In the Itapucumi direct area of influence there is a predominance of native forest formations (43%), although the area on which the

- quarry will operate is already under operation as part of a lime factory. There are no protected areas in the surroundings of any of the project facilities that could be impacted.
- 3.6 Samples taken in Villa Hayes pointed to the presence of 88 species of birds, none of them recorded in the international list of threatened species (IUCN 2010) and only one (*Bartramia longicauda*) is near threatened with extinction in the national list of Paraguay. The samples at Itapucumi noted the presence of 111 species of birds, none of them present in the international list of threatened species (IUCN, 2010). However, in the national list can be found the following species considered almost threatened in the country: *Cairina moschata*, *Amazona aestiva*, *Philydor rufum* and *Xolmis velatus*.
 - 3.7 The samples in Villa Hayes have pointed out the local presence of 13 species of large mammals of which six are wild, the rest are domestic or farmed species. In Itapucumi a total of 20 species of large mammals were recorded, of which 16 are wild and four domestic. At this location, two species of mammals listed in the IUCN Red List as Vulnerable were recorded: *Tapirus terrestres* and *Myrmecophaga tridactyla*.
 - 3.8 As a result of interviews with fishermen in Itapucumí and Villa Hayes, 15 species of fish were listed, which are not endemic to the watershed, endangered or near extinction species, except *Salminus maxillosus*, which is protected by national law.
 - 3.9 **Water resources.** In Villa Hayes, the cement plant is located at the confluence of the Paraguay River and the Confuso River, a medium sized river that flows into the right bank of the Paraguay River. In Itapucumi, the limestone quarry is located in the left bank of the Paraguay River. During preparation of the EIA the water quality both in Villa Hayes as Itapucumi was monitored. The results of the analysis of samples taken in Villa Hayes showed high values of turbidity and fecal coliforms, although low in BOD₅, probably due to poor wastewater treatment and indicating that the water quality is currently degraded. In Itapucumi, the results showed that water quality is relatively good, except for high values of fecal coliforms, due to the absence of wastewater treatment.
 - 3.10 **Cultural resources.** According to the analysis of previous reports and fieldwork, the archaeological and cultural resources potential in Villa Hayes and Itapucumi is negative. However, the EIA provides some preventive measures in case of archeological chance finds.
 - 3.11 **Natural disasters and climate change.** One of the highest impact of climate events in Paraguay is El Niño, which brings changes in the pattern of the general circulation of the atmosphere in southeastern South America, covering the central and northern Argentina, southern Brazil, Uruguay and Paraguay, where primarily impacts the Eastern Region of the country and the Paraguay River. During its occurrence, El Niño causes heavy rain and flooding in the Paraguay River basin, affecting in this case mainly the cement plant in Villa Hayes, which is located in a flood prone area.
 - 3.12 The EIA has not evaluated the potential for natural hazards to be exacerbated by the effects of climate change, but given the location of the project in an area that is known to be vulnerable to the effects of climate change; this will be further evaluated during the due diligence.

B. Socioeconomics aspects

- 3.13 Villa Hayes was founded in 1786. With a population of 69,493 and an area of 47,156 km², it has a population density of 1.2 km². It is a predominantly urban district with nearly 70% of its population living in urban areas against 30% who live in rural areas. It is also an industrial district, with some heavy industries like a big steel factory. The area where the cement plant and the port are located is also a minor fishing zone, activity carried out by small commercial fishermen, gathered in two local legally recognized fishermen's associations, with a total of 200 members. The inhabitants of the districts belonging to the area directly affected by the project are mostly associated in neighborhood committees.
- 3.14 Itapucumi has a population of approximately 700 inhabitants and the village consists of 130 houses, most of them made of wood. The town is devoted almost entirely to the manufacture of lime and its inhabitants are mostly employees of Concret Mix S.A., in place since 1998. There is no labor union. The town is located on land belonging to Concret Mix S.A., and the company plans to give residents the titles of the land they occupy. The entire area is considered rural, the streets have no name and are not paved. All houses have electric power, there is no storm drain or sewer. The water comes directly from the Paraguay River without any treatment, being stored in a tank of 5,000 liters. The principal means of access to Itapucumi is by navigating the Paraguay River and by air, as previously mentioned. From Concepción (capital of the Department) to Itapucumi or vice versa the stretch that ships must travel is 136 Km by water, the frequency is once a week and the travel takes approximately 10 hours. Fishing is not the main activity in the area. Most people interviewed during the implementation of the EIA were employees in the lime factory.
- 3.15 The EIA provides a listing of existing indigenous communities in the departments of Concepción and Presidente Hayes, where the cement plant and quarry are located. During due diligence a more accurately identification of the presence of some of these communities in the area of influence of the project will be performed.

IV. ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS

A. Construction Impacts and Risks

- 4.1 The key potential environmental and social issues from the Project construction include physical impacts from land clearing, loss of habitats and labor health and safety risks. In addition, there could be impacts from the influx of construction workers (up to 900 during peak construction). The latter is particularly important in Itapucumi, where up to 40 workers will be employed for the implementation of the quarry, in a community of just 700 inhabitants. The risk of the interrelationship of these workers with indigenous communities will be evaluated during the due diligence
- 4.2 Other environmental and social impacts associated with the construction will be air pollution, traffic disruptions, vibrations, noise, waste and wastewater generation, soil erosion, problems associated with truck traffics, etc. Overall, the construction activities

are transitory and can be mitigated or managed, and are considered likely to have a minor to moderate adverse impact. Details of key potential impacts are presented below.

- 4.3 **Impacts on terrestrial habitats.** The main direct ecological impact from the construction phase will be the loss of vegetation associated with the “clearance” at the quarry in Itapucumi. Although it is an existing quarry large areas of land will be required over the life of the Project, and this will cause an irreversible impact. Similar impacts, but on a lesser scale due to the smaller required volumes, can be expected at the plant site.
- 4.4 With soil and vegetation removed, the habitat for fauna will also be destroyed along with any fauna that cannot readily move away when site clearance takes place. Vegetation loss at the quarries and cement plant sites cannot be avoided, but successful restoration, improvement and long term management of the surrounding areas for conservation and productive uses will provide significant compensation. Changes in the natural drainage patterns will also be caused by quarrying activities, which may also have long-term impacts on the surrounding habitats.
- 4.5 Another potential impact to be considered is the increased hunting of wild animals due to the presence of workers in the areas of influence, particularly the limestone quarry in Itapucumi.
- 4.6 **Soil Erosion.** Removal of preexisting vegetation on large areas and activities carried out at the quarry and the cement plant site can generate significant impacts on the soil (erosion produced by storm water, as well as contamination from runoff of traces of heavy metals contained in soil while it is removed). The Contractor will be required to minimize areas of exposed soil and to compact and resurface the disturbed areas as soon as possible. The Contractor will also have to build a drainage system during the very initial stage of the project. As an impact associated with the construction period, the alteration in water quality due to soil erosion at the cement plant is considered a temporary impact. After the end of the earth-moving activities, the potential for sediment transport to the Paraguay and Confuso Rivers will be significantly reduced. At the quarry, structures and procedures for permanent erosion control will be necessary, given its long life span.
- 4.7 **Surface water.** Among modifications in physical properties with the corresponding change in water quality are the color changes, increased turbidity and increased concentration of total solids. Potential chemical changes arise primarily from the contribution of nutrients in the sediment. Both physical and chemical alterations may represent interference with the habitat of aquatic communities. Also associated with the input of organic matter from plants carried with the soil washed away, exists the possibility of increasing variables such as pH and biochemical oxygen demand (BOD). Therefore, small water ponds and lakes formed in the fluvial plain of Paraguay and Confuso Rivers, in the area of the cement factory, have a greater potential to be altered in its chemical qualities, as they lack dilution capacity that the main channel of the Paraguay River possesses.
- 4.8 With regard to the silting of water bodies in the area of the cement factory, the small ponds located on the flood plain of the Paraguay River and a lake formed by the left arm of the Confuso River, can receive contributions of materials. In this case, the impact can be permanent and irreversible because, unlike rivers and streams, these water bodies are

not able to transport this material downstream. In the case of the main channel of the Paraguay River, due to its greater ability to transport sediments, the impact may be temporary and reversible.

- 4.9 In the area of the limestone quarry the foundations on the banks of the watercourse and the construction of the embankment of the port are the two actions with the greatest potential to cause silting. In the area of the cement plant would be the filling with material dredged from the Paraguay River and other excavations and foundations carried out in the bed of the river. As an impact associated with the construction phase, after the end of earth-moving activities, the supply of sediment for all water bodies and the consequent silting process will be reduced considerably.
- 4.10 **Groundwater.** It will be subject to an increased risk of contamination during the construction phase due to the possible infiltration of domestic sewage, associated to the improper performance of septic tanks and/or inadequate management of the wastewater treatment plant. In addition, any accidents involving toxic fuels or other materials during construction, due to maintenance activities and supply of machinery and equipment, may cause localized pollution problems. Additionally, there is a possibility of pollution with oil or other substances derived from the activities of washing, cleaning and lubrication of equipment and vehicles used during construction.
- 4.11 **Air Emissions.** Construction activities can generate dust that can cause a nuisance to local residents and cause a health risk to construction workers. As the nearest residential receptors are approximately 300 m from the plant site it is considered unlikely that there will be an impact on local people. The main risk is considered to be the exposure of workers on site. Dust control measures, together with the use of appropriate personal protective equipment and vehicle maintenance will be applied to mitigate this impact. The impact of emissions of vehicle exhaust gases on air quality is considered minimal.
- 4.12 **Other polluting material.** Potentially polluting materials will be carefully stored in suitable containment to reduce the risk of pollution incidents from spills and leaks.
- 4.13 **Visual impacts.** The cement plant site is located inside an industrial district that has already been cleared of most of its natural vegetation; therefore significant visual impacts are not expected. In the case of the limestone quarry, due to the semi-natural rural character of the proposed site, the transitory visual impacts of construction works are expected to be moderately adverse due to the introduction of prominent structures and construction equipment. However, the topography of the area will provide a natural level of screening and the layout of the site will be sensitively planned to use this to minimize negative visual impacts.
- 4.14 **Traffic.** At the cement plant site, the impact on traffic is not expected to be significant. At the quarry, the effects of construction traffic are likely to be moderate when considered within the context of the current relatively low volumes of traffic passing through the area.
- 4.15 **Noise.** Noise generation in this phase will be associated with the operation of machines needed for the construction of civil works. Both in the case of the cement factory and the limestone quarry, the nearest existing buildings are approximately 300 meters away from the area where construction will occur. Whereas most of the points where measurements were made, the existing noise level is already above 60 dB (A), is not expected that the

noise generated by the works cause excessive discomfort to the surrounding population. Anyways, measures to reduce construction noise levels will be included in the Environmental and Social Management Plan (ESMP).

- 4.16 **Construction Impacts on the Community.** The greatest potential construction impacts on the communities are likely to come from the disruption caused by the influx of workers, noise, and traffic discussed below.
- 4.17 **Impacts from the influx of workers.** It is expected that a maximum of 900 workers will be on site at the peak construction time. In the case of the cement plant in Villa Hayes, most of the impacts will be in the areas directly around the plant site. The population of Villa Hayes, due to its size and proximity to Asunción, is accustomed to the presence of workers from other places. But in the case of Itapucumi, due to its limited access, distance from other populated areas and for being a town almost totally linked to the mining of limestone and with little social infrastructure, exists a relative isolation, being sensitive to the presence of a large number of external workers, which has the potential to lead to conflict in the community, increased violence, and issues such as sexually transmitted disease. It is planned that they will live in a specially constructed camp. The camp will be located adjacent to the construction site and will have all the necessary facilities to make the camp self-contained, including recreational facilities. The construction camp will consist of several pre-fabricated buildings and necessary infrastructure.
- 4.18 **Labor Health & Safety.** During the construction phase of the project, moderate risks to health and safety of workers are expected, related to the construction of foundations, reinforced concrete and steel, ports, silos, industrial plants, dredging and mining. Both national regulations and IFC labor health and safety guidelines will be applied during the construction phase. If properly implemented and monitored, these risks can be reduced and managed.

B. Operation Impacts and Risks

- 4.19 **Air Emissions.** A detailed study of the potential atmospheric emissions from the proposed cement works was undertaken as part of the EIA which included air emissions during normal operation of the cement kiln, as well as minor emissions of fine particulate matter from other processes. The study assessed the emission's ground level pollutant concentrations. These changes in local air quality were then compared to the IFC guidelines, considering that the country has no air pollution regulation. Atmospheric emissions were modeled using the US Environmental Protection Agency (EPA) atmospheric dispersion model AERMOD, an internationally recognized advanced dispersion model. The assessment focused on the locations of local residential areas where individuals may be exposed for relevant time periods according to the air quality criteria. The wider surrounding area was also modeled. It was concluded that at all sensitive receptors, the maximum changes in sulphur dioxide, carbon monoxide, particulate matter, and nitrogen dioxide concentrations due to plant operation are a small fraction of the relevant air quality criteria, and future air quality will remain well within these criteria.
- 4.20 The overall conclusion from the dispersion modeling study is that when the plant is in operation future air quality will be well within the IFC guidelines specified for the

cement production and the protection of human health. These limits are set well below the levels at which there are any observable effects on human health or respiratory function in order to protect vulnerable individuals within the population. On that basis, it is concluded that there will be no adverse health effects in the local population due to the operation of the cement plant.

- 4.21 Despite the existence of equipment to control emissions of particulate materials during the operation of the cement plant and the limestone quarry, there is a moderate risk of dust generation during the operation. The deposition of particles on the leaves can cause physical blockage of photosynthesis and subsequently may affect groundwater. If properly implemented and monitored, this risk can be reduced and managed. Proper equipment will be installed to control particulate emissions, in addition to continuous wetting of the access roads and the stored material.
- 4.22 **GHG generation and energy consumption.** An assessment of the potential emissions of greenhouse gases from the Project has been undertaken. Carbon dioxide (CO₂) is the main greenhouse gas emission, and the primary source in this case is the cement production (clinker production and the burning of fuel). No other significant sources of greenhouse gas are likely to be released from the Project.
- 4.23 An independent consultant to the cement industry was contracted by the Bank to analyze the process and equipment selected by Yguazu Cementos S.A. with respect to the technology, its thermal energy consumption and its gross CO₂ emissions.
- 4.24 According to the IDB Cement Manufacturing Plant Guidelines, cement plants that have clinker production capacity equal to or less than 1,500 t/d fall under the excluded categories and will be assessed on a case-by-case basis to determine the applicable average design performance using energy efficient technologies. In no case shall the energy consumption of plants exceed 3,264 MJ/tonne clinker (2% higher than the 3,200 MJ / tonne clinker minimum performance criteria applicable for larger plants). In the case of CO₂ emissions, no size reduction on the target is set, and the project should demonstrate that it has optimized the design as much as possible to achieve the lowest possible emissions. In the case of the Tupi Plant, the final design is still being developed, but the Company has committed to achieving both limits.
- 4.25 According the consultant's report, the proposed technology, with some minor adjustments, can minimize CO₂ emissions and will be consistent with the guidelines for the best available techniques for cement manufacture and with the IDB Cement Plant guidelines. At the same time, the plant intends to use blended cements and supplementary cementitious materials, given the ability of such materials –such as pozzolana and flyash– to off-set CO₂ emissions.
- 4.26 Since the cement will be produced locally and used for infrastructure development within the country, this will reduce the current greenhouse gases produced to transport cement into the country. In order to ensure that once operational the cement production process is as energy efficient as possible, the operator will be required to conduct a detailed energy survey after the plant is fully operational. The aim of the assessment will be to ensure that the plant is operating as efficiently as possible in order to reduce CO₂ emissions from operations.

- 4.27 **Impacts on the soil and the biodiversity at quarries.** The impacts described in Sections 5.3 to 5.5 for the quarries during construction will continue during operation. The potential impact of reduced habitat quality for fishes and benthic fauna during the operation is related to pollution of water bodies by dust, organic pollutants, metals and petroleum products due to the transport of limestone and other raw materials by barge across the Paraguay River, from Itapucumí to Villa Hayes. In the area of the cement plant there is a risk of pollution of water bodies close to the storage and handling of hazardous materials such as fuels and lubricants, due to possible leaks. Any change in water quality can cause interference in the composition and abundance of fish and benthic communities.
- 4.28 **Risk of fire.** The remaining vegetation in the vicinity of the enterprise may be more vulnerable to fire during operation. This increased risk of fire is due to the movement of workers, machines and vehicles along access roads and storage yards of raw materials, especially at the cement plant.
- 4.29 **Noise.** The EIA concluded that noise levels generated from the cement production plant are unlikely to cause disturbance in any of the nearby communities during the evening or night. There may be some disturbance during the daytime at the communities nearest to the quarrying activities. The depth of the quarry (up to 70 m) provides natural screening of noise to these communities. The company has committed to implement appropriate noise management practices in all aspects of the design and operation of the cement plant, quarry and transport.
- 4.30 A key area of potential noise and vibration emissions is the blasting associated with the limestone quarry. In order to minimize impact of blasting at the limestone quarry, the operator will use internationally recognized techniques of sequential blasting in order to minimize the blast wave and therefore reduce any impact. Also, blasting will be limited to the daytime. On the use of explosive, detonations will be carried out at most once a week, with the use of a silencing system to minimize the impact.
- 4.31 **Landscape and Visual.** The landscape and visual impacts will be: change in land cover, use and character, including an increased intensity of activity; visual impact of night time lighting, including the movement of vehicles at night and the provision of above ground utilities; visual impact of the movement of works vehicles and commuter traffic to, from and within the site. In the area of the quarry, where altitudes range between 80 and 140 m, significant alteration of relief will take place, as it is expected that the final level of the quarry reaches the height of 70 m.
- 4.32 **Impacts to surface and groundwater, and water availability.** The exploitation of the limestone quarry at Itapucumi, which will be held up to 70 m deep, can cause a localized reduction of the water table. The manufacturing of cement at the plant in Villa Hayes will be done using a dry process, and most process water (mainly cooling water) will be recycled, meaning water requirements will be minimal. The water for use in the industrial process will be supplied from the Paraguay River. All domestic sewage generated in the administrative facilities and laboratories of the cement factory will be collected and treated in a wastewater treatment plant. The water drained from the industrial area will first be sent to an oil and water separation system, and only the effluent of this system will be sent to the surface drainage network.

- 4.33 The actions that can lead to spills of pollutants in the industrial area are related to spills from vehicles and equipment involved in the internal transport of raw materials (coal, petcoke, pozzolana and clay) by trucks and the shipping and transportation of the final product. The risk of pollution of groundwater may come from leakage of effluent from the wastewater treatment plant or bad design and/or operation of the systems for collection and separation of water drained from the industrial area.
- 4.34 **Fluvial transportation of raw materials.** The movement of barges (convoy of 10 barges with 20,000 tonnes in total, for eight months a year) has the potential of destabilizing the river banks and the destruction of levees through the production of waves. Possible contacts between barges and margins can lead to compaction and alteration of river morphology, as well as to the generation of erosion and siltation processes, degradation of riparian vegetation and habitat destruction. This impact is considered moderate or high? Or is there some mitigation planned?
- 4.35 **Traffic and transportation impacts.** In the case of the cement plant in Villa Hayes, it is anticipated that construction traffic will not have significant impact on current volumes of traffic that use the main arterial highways and the local routes. In the case of the quarry in Itapucumi, the main transportation impacts will be due to the use of barges, which is discussed in 5.34.
- 4.36 **Operational impacts on local communities.** Transportation of raw materials from quarries and produced cement from the plant during operations, as well as potential noise and air pollution caused by the plant, can affect the normal activities and the quality of life of local communities.
- 4.37 Quarry activities (mainly truck traffic and blasting activities) can produce interference with existing activities (livestock, agricultural, recreational, etc.) and can affect the local quality of life. Community safety can also be impacted by blasting at the quarries. If managed properly, these community issues should not be significant, but require careful consideration.
- 4.38 **Impacts on indigenous communities.** During due diligence, a more accurate identification of the presence and the risk of impact on indigenous communities will be performed, particularly in the case of the limestone quarry in Itapucumi.
- 4.39 **Labor Health & Safety.** The dust and noise emissions resulting from the detonation, drilling, extraction and transportation activities in the area of the quarry are inevitable and can be harmful to the health of the workers, so that methods of emissions control and the use of personal protective equipment will be adopted. Local regulations establish maximum permissible daily exposure to noise and annoying sounds within industrial facilities. Cement plants generally present health risks to workers, mainly associated with exposure to dusty material throughout the production process in the loading, unloading and transportation of raw materials and packaging of the final product. Therefore, in Villa Hayes cement plant a dust extraction system with bag filters and fans is planned. Other dust collection systems to be adopted include water spray and cyclone dust collectors.

C. Decommissioning

- 4.40 No detailed assessment of environmental impacts associated with decommissioning can be made at present. The plant has an expected lifespan of over 100 years and so only

general principles can be established at the present time. In broad terms, the process of decommissioning is likely to give rise to impacts similar to those experienced in the construction phase. These issues will be evaluated during due diligence to ensure proper planning is in place within the management framework for the project.

D. Cumulative Impacts

- 4.41 Projects such as this are likely to have cumulative impacts on environmental aspects such as natural habitats and natural resources. The EIA took into consideration the indirect area of influence and emissions from other industrial facilities at Villa Hayes. Air emissions were determined to have a minimal impact on ambient air conditions so are therefore unlikely to result in cumulative impacts. Increased traffic could possibly contribute to cumulative effects on the traffic on the roads, especially at the cement plant in Villa Hayes. The emissions of CO₂ will contribute to the overall contribution of greenhouse gases. The quarry in Itapucumi is going to be placed in an already existing one, which can cause some cumulative impacts. Further evaluation of these issues will be undertaken during due diligence.

E. Environmental, Social, Health & Safety and Labor Management

- 4.42 The EIA, in its *Integrated Environmental, Social, Health & Safety and Labor Management Plan*, recommended various mitigation and management measures, some of which have been mentioned previously, and these will be incorporated into management plans and procedures that will be reviewed during the ESDD.
- 4.43 The Camargo Corrêa Group, one of the project sponsors, has adopted corporate environmental and social policies and procedures that will be applied to the project, including ISO 14000 certification and integrated management systems regarding environmental quality, health and safety, and labor management.

V. ENVIRONMENTAL AND SOCIAL DUE DILIGENCE

- 5.1 The focus of the environmental and social due diligence will be on the potential impacts and risks during construction and operation of the project. The due diligence should include a carefully evaluation of the EIA study and all associated documentation, as well as all the legal requirements. The due diligence should provide the evaluation of the Company's capacity to identify, mitigate and manage the environmental and social aspects and risks during the construction and operation phases. In addition to the environmental impacts and risks, the ESDD will pay particular attention to the potential impacts on the local communities to the project, especially the indigenous communities that might be identified near the quarry site. Development and application of comprehensive health and safety procedures will also be a focus for this Project in an industry with a tradition of high risks to worker health and safety.
- 5.2 The Bank, with the assistance of an independent environmental and social consulting firm, will perform an environmental and social due-diligence (ESDD) in order to confirm

that the Project's direct and indirect impacts and risks will be properly and adequately mitigated. In particular, the ESDD will assess the following:

1. Evaluation to confirm that the Project's direct, indirect and cumulative negative environmental and social impacts have been properly identified and evaluated, in particular: (1) potential impacts on habitats; (2) potential risks and associated impacts related to flooding, erosion and land stability to the project, and/or exacerbated by the project; (3) land use impacts; (4) other potential community impacts such as traffic, dust, public safety, and pressure on services; (5) impacts related to industrial emissions (especially dust and other particulates), effluents, and waste management; (6) potential risks from accidental events, including worker accidents, accidental spills, and other unforeseen events; and (7) potential impacts on indigenous communities.
2. Assessment of compliance with applicable IDB Bank environmental and social policies, including specifically the Environmental and Safeguard Compliance Policy, Disclosure of Information Policy, Disaster Risk Management Policy and Indigenous People Policy, IDB Cement Manufacturing Plants Guidelines, IFC guidelines and other International and Regional Agreements and applicable International Conventions.
3. Assessment of compliance status with the applicable environmental, social, health and safety, and labor legal requirements in Paraguay (e.g., laws, regulations, standards, permits, authorizations, applicable international treaties/conventions, etc.), in particular the requirements in the EIA authorization and project-specific legal requirements, including consultation.
4. Evaluate the proposed environmental and social management plans, procedures, and documentation for the Project (e.g. confirm that the plans define the Project-specific proposed environmental and social control, management, and mitigation measures, monitoring programs, costs, schedule of implementation, designated responsibilities, that the ESMP has been developed based upon the assessment of the anticipated environmental and social impacts, that it is current).
5. Confirmation that adequate health and safety plans and procedures will be established and implemented both for construction and operation (including sub-contractors) to address potential worker health and safety risks associated with the Project.
6. Confirmation that adequate contingency plans and procedures will be implemented during construction and operation (including sub-contractors) to address potential Project-related accidental events (i.e., landslides, spills, explosions, fires, etc.).
7. Assessment of the Company and any contractor's capacity to mitigate and monitor environmental, social, health and safety and labor aspects properly under their respective responsibility.
8. Evaluation of Project-related information disclosure and public consultation activities that have been performed including confirmation that the participation processes of stakeholders has been adequately conducted and that the proposed future actions to provide adequate ongoing information disclosure and public consultation with the local population is in compliance with IDB policies. This will include confirmation of

- adequate stakeholder engagement, and that the communities have participated meaningfully in pertinent decisions that affect them throughout the Project lifecycle and future proposed information disclosure and public consultation activities.
9. Evaluate the identification of cumulative impacts and risks associated with the Project, including long-term socio-economic impacts and land-use issues.
 10. Evaluate the potential impacts of the Project on greenhouse gas emissions, in particular, those arising from clinker production, and energy consumption.
 11. Evaluate positive impacts of the Project and any additionality from IDB involvement.
- 5.3 As part of the Bank's environmental and social due-diligence, the Bank will prepare an Environmental and Social Management Report (ESMR) for consideration by the Bank's Environmental and Social Review (ESR) group. The ESMR will provide a synthesis of the relevant environmental and social aspects of the Project and the proposed Bank recommendations in terms of Project-specific environmental and social requirements.