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# ENVIRONMENTAL ASSESSMENT REPORT

**Zambia Concrete Limited Facility**  
**Kafue Industrial Area**  
**Kafue**  
Date Assessed : May 8, 1995

Prepared for the  
**ZAMBIA PRIVATISATION AGENCY**

Prepared by  
**P H ASSOCIATES, INC.**

July 18, 1995

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## CONFIDENTIALITY STATEMENT

This is an internal document, prepared for the Zambia Privatisation Agency (ZPA) and the United States Agency for International Development (USAID), by PH Associates, Inc. for their use.

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# TABLE OF CONTENTS

4

<b>1. INTRODUCTION .....</b>	<b>1</b>
1.1 Background .....	1
<b>2. SCOPE OF WORK .....</b>	<b>3</b>
<b>3. METHODOLOGY .....</b>	<b>4</b>
3.1 Ministry Records Reviews and Interviews .....	4
3.2 Environmental Regulations.....	4
3.3 Aerial Photographs.....	5
3.4 Facility Site Reviews .....	5
3.4.1 Site Visits .....	6
3.4.2 Facility Records.....	6
3.4.3 Interviews .....	6
<b>4. RESULTS OF ENVIRONMENTAL ASSESSMENT.....</b>	<b>7</b>
4.1 Facility Ministry Records.....	7
4.2 Aerial Photographs.....	7
4.3 Facility History and Records.....	7
4.4 Site Activities and Processes.....	7
4.5 Environmental Setting.....	8
4.5.1 Topography.....	8
4.5.2 Geology .....	9
4.5.3 Hydrogeology .....	9
4.6 Field Reconnaissance Results .....	9
4.6.1 Utilities .....	9
4.6.1.1 Electricity .....	9
4.6.1.2 Water Supply.....	10
4.6.1.3 Sanitary Sewer .....	10
4.6.1.4 Stormwater Control.....	10
4.6.2 Structures.....	10
4.6.3 Environmental Effects and Observations .....	11
4.6.3.1 Chemicals, Petroleum, and Process Materials .....	11
4.6.3.2 Process Waste Streams.....	11
4.6.3.3 Air Emissions.....	12
4.6.3.4 Pesticide/Herbicide Use .....	12
4.6.3.5 Underground/Aboveground Storage Tanks .....	12

4.6.3.6 Releases/Spill Controls .....	12
4.6.3.7 Potentially Hazardous Materials .....	13
4.6.3.8 Waste Disposal.....	13
4.7 Applicable Environmental Regulations .....	14
<b>5. CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>15</b>
<b>6. REFERENCES .....</b>	<b>17</b>
<b>7. FIGURES</b>	
<b>8. PHOTOGRAPHS</b>	
<b>9. APPENDICES</b>	
APPENDIX A	ZPA QUESTIONNAIRE
APPENDIX B	PH ASSOCIATES QUESTIONNAIRE
APPENDIX C	MINISTRY RECORDS, REVIEW AND INTERVIEWS
APPENDIX D	ENVIRONMENTAL REGULATIONS OF ZAMBIA
APPENDIX E	ENVIRONMENTAL ASSESSMENT CHECKLIST
APPENDIX F	FACILITY RECORDS
APPENDIX G	PROCESS FLOW DIAGRAMS

## 1. INTRODUCTION

An environmental assessment was conducted by PH Associates, Inc. of the Zambia Concrete Limited (ZCL) Facility, Kafue, Zambia. The purpose of the assessment was to determine whether air, soil, surface water, or groundwater has been potentially affected at the facility site by current or past site activities or processes, and to provide information concerning potential environmental liabilities. This assessment was based on Ministry reviews and interviews, review of applicable environmental regulations, aerial photographs, facility records, interview of site personnel, and an onsite/offsite reconnaissance of the property.

This report has been prepared for the Zambia Privatisation Agency (ZPA) pursuant to a contractual agreement between the U S Agency for International Development (USAID) and PH Associates, dated March 16, 1995. The report is based on limited documented information and interviews with available facility personnel, is accurate to the best of PH Associates knowledge and belief, and has been prepared for the exclusive use of ZPA for specific application to the above-referenced facility. No warranty, expressed or implied, is made. In the event of any changes in the nature, design or locations of the facility site or structures, the conclusions and recommendations in this report should not be considered valid unless the changes are reviewed and the conclusions are verified in writing by PH Associates. This report should not be construed to be a legal representation or interpretation of environmental laws, rules, or regulations.

### 1.1 Background

As part of a preliminary information gathering activity in 1992, the ZPA distributed a questionnaire requesting disclosure of specific company and site information that would be relevant to completing the environmental assessment. A questionnaire for Zambia Concrete Limited (ZCL), Kafue facility was returned to ZPA and is attached in Appendix A.

Additional environmental data was requested by PH Associates in the form of a questionnaire submitted to the facility during June and July 1994. The purpose of the PH Associates questionnaire was to obtain information that was either not available at the time, or to supplement information not fully detailed in the returned ZPA questionnaire. The additional data was obtained by distributing an extensive environmental survey questionnaire to facility management, and requesting their cooperation in completing and returning the survey form. The PH Associates questionnaire was returned for the ZCL facility and is attached in Appendix B.

ZCL manufactures concrete products such as pre-stressed concrete sleepers (beams used in railroad construction), bridge beams, building blocks, fence poles, and concrete curbing and slabs. According to management, ZCL is currently operating at approximately 20% production capacity because of their poor financial situation. The 41,000 square meter manufacturing facility, located at Plot 163A in the Kafue Industrial Area, (Section 7, Figure 1), commenced operations in 1981 from this location. ZCL own a 72,000 square meter residential area approximately 750 meters to the south and southwest of the facility that is used by their 160 full-time workers and their families. This area was not visited by PH Associates and is not part of this assessment.

Many other industries are located within a 1 kilometer radius of the ZCL facility. Those industries immediately neighboring ZCL include rail spurs and storage yards belonging to Zambia Railways Limited (southern border) and Nitrogen Chemicals of Zambia Limited

manufacturing facility towards the west. Undeveloped areas border ZCL on their eastern and northern perimeter. Other industrial facilities in the area include Bata Tanneries Limited, a ZESCO substation, Kafue Textiles of Zambia Limited, and the Kafue Urban District Council sewage treatment facility all located to the west of ZCL. The town of Kafue is approximately 1.5 kilometers to the southeast of the ZCL facility

## 2. SCOPE OF WORK

PH Associates performed an environmental assessment to assess and document potential adverse environmental effects on air, soil, surface water, and groundwater that might have resulted from either current or past activities on the site. This assessment was qualitative, based on readily available existing information, interviews and field observations. It did not involve environmental field testing or sampling, laboratory analyses, or an asbestos survey.

In general, PH Associates staff endeavored to:

- Conduct interviews with Ministry personnel and other pertinent organizations to assess the current state of environmental affairs and regulations.
- Review available Ministry reports on past facility inspections and geologic and hydrogeologic data.
- Evaluate existing environmental regulations that are applicable to assessing potentially adverse effects on air, soil, surface water and groundwater.
- Review available facility files to investigate past or current activities on the site with respect to environmental permits and compliance, wastewater, site drainage, and air emissions; and handling, storage, treatment, and disposal or spills of potentially hazardous materials and wastes.
- Review readily available aerial photographs of the site and adjacent properties. In addition, PH Associates reviewed available drawings of the site showing facility layout, underground piping, buried tanks, utilities and site drainage systems.
- With the consent of the site management, perform an onsite field reconnaissance of the facility. During the field reconnaissance, PH Associates looked for evidence of releases of potentially hazardous chemicals, petroleum products, or process wastes to the soil, surface water, and groundwater by spilling, dumping, burning or burial of materials.
- Perform a field reconnaissance of the area, within approximately 1 kilometer radius of the facility, that was feasible within the level of effort identified for this contract. During the field reconnaissance, PH Associates attempted to identify neighboring commercial and industrial sites that may potentially adversely affect the environmental conditions at the facility.
- Interview available staff who were knowledgeable of current and past site activities and processes at the facility and of surrounding properties.
- Document the findings and observations of the visited site with photographs. Copies of these photographs are included in Section 8 of this report.
- Prepare an Environmental Assessment Report presenting the areas of environmental concerns, results of the Ministry records, applicable environmental regulations, aerial photograph reviews, site visits and personnel interviews, and provide conclusions and recommendations for submission to USAID and ZPA.

### 3. METHODOLOGY

This section presents the methodology used to complete the scope of work for the environmental assessment project. Methods used include a review of the ministry records, environmental regulations, aerial photographs, facility records, ministry and facility personnel interviews, and site visits. Results of the assessment are presented in Section 4.0, and the conclusions and recommendations are presented in Section 5.0.

#### 3.1 Ministry Records Reviews and Interviews

PH Associates interviewed Ministry personnel and other pertinent organizations to discuss the current state of environmental affairs and regulations in Zambia. Ministry records, such as factory inspections, geologic and hydrogeologic reports, were also obtained and reviewed for the sites to be assessed.

The following Ministries personnel and other pertinent organizations were interviewed and the results of these discussions are included in Appendix C.

##### Environmental Council of Zambia

Mr Julius Kanyembo, Director - April 13, 1995

Mrs I Mbewe, Legal Officer - April 24, 1995

##### Ministry of Energy and Water Development, Water Affairs

Mr Stan Chisala, Senior Engineer - April 18, 1995

##### Ministry of Labor and Social Security, Chief Inspector of Factories

Mr K Mapani, Chief Inspector of Factories - April 20, 1995

Mr Kakoma Chivundu, Inspector of Factories - April 28, 1995

Mr Lukwesa, Inspector of Factories - April 23, 1995

##### Ministry of Mines and Minerals Development, Geological Survey Department

Mr O Ng'ambi, Acting Director - April 24, 1995

Mr Clement Namateba, Senior Geologist (PGR) - April 24, 1995

##### International Bank for Reconstruction and Development (World Bank)

Mr Gedion Nkojo, Resident Representative - April 24, 1995

Mr Julius Chileshe, Natural Resource Economist - April 24, 1995

#### 3.2 Environmental Regulations

Legislative Policies, Acts, and Regulations enacted by Zambia were reviewed for their applicability to completing environmental assessments of the facilities identified by the ZPA. The purpose of the review was to evaluate and summarize those guidelines pertaining to environmental issues which industries in Zambia are required to adhere. A summary of the environmental regulations for Zambia is presented in Appendix D, Table 1. Twelve regulations were selected for review based on their potential applicability to the assessed sites. Six of these regulations contained applicable environmental laws addressing air, soil and water pollution and include:

- Water Act of 1949
- Environmental Protection and Pollution Control Act of 1990
- Water Pollution Control Regulations of 1993
- Waste Management Regulations of 1993
- Mining (Dumps) Regulations of 1972
- Mines and Minerals Act of 1976

The applicable regulations or laws used to evaluate environmental compliance of the facilities assessed are summarized in Table 2 of Appendix D. Only recently have regulations addressing the protection of human health and the environment in any detail been enacted. Prior to the passing of the Environmental Protection and Pollution Control Act of 1990 and the establishment of the Environmental Council of Zambia, legislation mostly addressed issues of worker health and safety.

Currently, no guidelines have been implemented by the Environmental Council of Zambia defining specific materials or chemicals as hazardous. Application of the term "hazardous" is generally based on specific characteristics of a substance or constituent such as ignitability, corrosivity, reactivity, and toxicity. Depending on the concentration of the constituent in sludges, soil, surface water, or groundwater, the constituent may or may not be considered hazardous.

Since Zambia has not developed hazardous chemicals guidelines, PH Associates applied fourteen programs adopted by the United States Environmental Protection Agency (EPA) and State Governments that identify substances as either hazardous, extremely hazardous, toxic or carcinogenic. The California EPA May 1992 Chemical Cross-Index reference tabulates all the hazardous chemicals and compounds listed in these programs and was used by PH Associates to assess whether substances found during the assessments were potentially hazardous.

### 3.3 Aerial Photographs

On April 12, 1995 the Mapping Services Section of the Survey Department was visited by PH Associates to review any available and applicable aerial photographs of the sites to be assessed. The aerial photographs were reviewed to identify possible changes in structures, topography, site activities, processes, and waste disposal practices that could be used as additional information to the current site conditions observed during PH Associates visit.

Review of the aerial photographs from the Survey Department indicated that the photographs and any enlargements are at a scale where ground objects are much too small to provide any useful information or details of the sites. Aerial photographs were available at a scale of 1:30,000 and enlargements at a scale of 1:7,500. Based on PH Associates past experience it was determined that no applicable information would be gained from use of aerial photographs at this scale.

### 3.4 Facility Site Reviews

Site reviews were conducted by PH Associates and included site visits, analysis of facility records and facility personnel interviews.

### 3.4.1 Site Visits

PH Associates conducted a field reconnaissance of the site focusing on identifying site activities and practices that have or may have potential environmental effects in the future. An Environmental Assessment Checklist survey form was completed during the field reconnaissance and is attached in Appendix E. The Location Map and Site Plan for the facility are attached in Section 7. Photographs of the field observations taken during the site visit are included in Section 8.

A field reconnaissance of the area within approximately 1 kilometer radius of the facility was also performed to identify neighboring industries that may potentially adversely affect the environmental conditions at the facility. The offsite reconnaissance, that was feasible for the contracted level of effort, involved interviews with facility personnel and a drive-by of the surrounding area. No offsite industries were contacted or visited by PH Associates.

### 3.4.2 Facility Records

Facility records and aerial photographs applicable to completing the environmental assessment were requested from the facility. Records requested included documents containing information and details on building and structure designs, underground storage tanks, process flow diagrams, process materials and wastes, waste disposal, environmental permits, monitoring programs and controls, and documentation on storage or use of potentially hazardous materials. These records, if made available to PH Associates, are attached in Appendices F and G.

### 3.4.3 Interviews

Interviews were conducted with available facility personnel, usually site managers, who could provide information on past or current site activities and processes, potentially hazardous materials use and storage, spills, accidents, utilities, fuel storage areas, maintenance practices, waste disposal, permits, monitoring programs, and laboratory analyses.

## 4. RESULTS OF ENVIRONMENTAL ASSESSMENT

The results of the environmental assessment are presented below and include the following sections: Facility Ministry Records/Site Aerial Photographs/Facility History and Records/Site Activities and Processes/Environmental Setting/Field Reconnaissance Results and Applicable Environmental Regulations.

### 4.1 Facility Ministry Records

Environmental data for the ZCL facility was obtained from the Ministry of Labor and Social Security, Chief Inspector of Factories. The 1984 letter is attached in Appendix F, and mainly addresses worker health and safety issues, especially high noise levels and the required worker protection.

### 4.2 Aerial Photographs

No aerial photographs of the ZCL facility were available that would provide PH Associates with information applicable to completing the environmental assessment.

### 4.3 Facility History and Records

On May 8, 1995, Mr J Holloway of PH Associates interviewed Mr Emmanuel Ziko, General Manager of ZCL and Mr B Sakala, ZCL Head of Production, to obtain information on ZCL's history, processes, products, and available facility records, maps, and aerial photographs. A Site Facility Plan is shown in Section 7, Figure 2. According to Mr Sakala, the land on which the facility is situated was undeveloped prior to ZCL's building in 1981.

### 4.4 Site Activities and Processes

ZCL is a manufacturer of concrete products such as pre-stressed concrete sleepers, bridge beams, building blocks, fence poles, and concrete curbing and slabs. Pre-stressed concrete sleepers are concrete beams approximately 2 meters in length used during construction of a railway, to which the steel railroad tracks are attached. According to Mr Sakala, the facility uses the following average quantities of raw process materials annually during production:

- 2,938 metric tonnes of cement
- 3,942 metric tonnes of sand
- 6,366 metric tonnes of aggregate stone
- 252 metric tonnes of steel reinforcement (cable) and steel rail anchors
- approximately 500 metric tonnes of Comix (cement additive)
- approximately 3 million liters of water

Mr Sakala stated that the Comix additive is used to reduce the amount of water required in the process, although he could not specify the chemical composition of the additive.

A simple production process is used at ZCL to produce their concrete products. These processes are detailed in the process flow diagrams attached in Appendix G. For all of

ZCL's products, the process begins with mixing cement, sand, gravel, Comix, and water in the batching plant to the desired consistency (Section 8, Photograph 1). The mixture is then poured into a mold, depending on the product to be made, and cured (dried) for 12 to 36 hours until hard. Vibrators are used to loosen the cured concrete from the molds and the products are stacked and stored in their appropriate areas at the facility. Steel reinforcement is used in the products, with the exception of the concrete blocks, and is positioned within the molds prior to pouring the cement mixture. For production of the pre-stressed concrete sleepers, the reinforcement consists of heavy steel cables that are stretched through the mold (Section 8, Photograph 2). By stretching the cables within the mold until the concrete has hardened, the resulting tensile strength of the concrete sleepers is increased.

Steam generated from electrical boilers is used during the curing of sleepers to reduce curing time and ensure proper hardening of the concrete (Section 8, Photograph 3). The wastewater derived from the curing process in the production shed is collected in floor drains that discharge into the facility's sewer line.

ZCL also uses steel rail anchors, wood planks, and various petroleum products associated with vehicle and machinery maintenance at the facility. The steel rail anchors are used in production of the pre-stressed concrete sleepers, and extend from the top of the sleepers thus allowing the steel rails to be fastened into the railroad bed. The wooden planks are used to stack the various concrete products at the facility and are treated with motor oil in the wood treatment area prior to use.

Other activities at the ZCL facility include:

- 15 vehicles used for production, delivery, and general transportation
- Process equipment maintenance in the equipment workshop
- Vehicle maintenance in the vehicle maintenance shop
- Operation of a geotechnical laboratory for quality control testing of the products (Section 8, Photograph 4)
- Administrative offices
- A canteen for the workers
- Water production from one onsite borehole (Section 8, Photograph 5)
- Storage and dispensing of fuels from the facility filling station (Section 8, Photograph 6) and
- Storage of petroleum products and spare parts in the facility warehouse (Section 8, Photograph 7)

## 4.5 Environmental Setting

### 4.5.1 Topography

The topography of the Kafue area consists mostly of gently sloping hills bordering the Kafue River Valley. The hills are generally 100 to 300 meters elevation above the Kafue River and trend west-northwest. Regionally, these features are located on a high plateau of approximately 1,000 to 1,400 meters elevation that extends over a large area of Central Zambia. The ZCL facility is located in the Kafue Industrial Area (Section 7, Figure 1). The site is at an elevation of approximately

995 meters above sea level and the ground surface at the site slopes slightly towards the southwest (RZ, 1988 and 1993).

The Kafue River is the major surface water drainage system for the Kafue area and generally flows towards the east-southeast in this area. Expansive dambos are typical along the banks of the Kafue River with some extending up to 0.5 kilometers away from the river. The Kafue River is located approximately 1.5 kilometers south of the ZCL facility. The Kasenje River, a small tributary of the Kafue River, is located 1 kilometer to the west of the site.

The surface of the ZCL facility is mainly covered with dirt or gravel. Only the main process and office areas are paved. No stormwater drains were observed at the site. As a result, surface water runoff in the paved areas flows southwest along the street curbing to the unpaved batching plant and stone storage area where it infiltrates into the subsurface soil (Section 7, Figure 2).

#### 4.5.2 Geology

No site specific geologic reports for the Kafue area were available for review by PH Associates. The ZCL facility is situated on young alluvium, colluvium, and laterite soils of unknown lateral extent and thickness (RZ, 1981).

#### 4.5.3 Hydrogeology

No specific hydrogeologic reports for the Kafue area were available for review by PH Associates. Groundwater in the area probably follows the topography and flows southward towards the Kafue River.

According to Mr Sakala, ZCL installed a borehole to a depth of 50 meters in 1987 (Section 8, Photograph 5). The borehole is located on the western corner of the property. Groundwater was first encountered during installation of the borehole at a depth of 15 meters. ZCL uses approximately 200,000 liters of groundwater annually as a supplement to their municipal water supply. Both supplies are used in their production process and for drinking at the facility. No other information concerning borehole construction or groundwater quality was available.

### 4.6 Field Reconnaissance Results

On May 8, 1995, a tour of the ZCL facility by PH Associates was provided by Mr B Sakala, ZCL Head of Production. During the tour, ZCL's operations and products were discussed. Results of the field reconnaissance and interviews with the ZCL management are presented below.

#### 4.6.1 Utilities

The following is a summary of the utilities that service the ZCL facility as reported by Mr Sakala.

##### 4.6.1.1 Electricity

Zambia Electricity Supply Corporation LTD (ZESCO) provides electricity to the ZCL facility. Three electrical transformers, owned by ZESCO, are located inside a secured area of the main production building at the ZCL facility (Section 8, Photograph 8). ZESCO personnel maintain the transformers and change the transformer oils periodically.

PH Associates did not observe the transformers since the area was locked during the site visit. Mr Sakala stated however, that to the best of his knowledge no oil spills have occurred. He was unaware whether ZESCO tests the transformer oils for polychlorinated biphenyls (PCBs).

#### 4.6.1.2 Water Supply

The ZCL water supply is obtained from an onsite borehole and the Kafue Urban District Council (Council). According to Mr Sakala, the facility uses approximately 2.8 million liters annually from the Council and 200,000 liters from their one borehole. ZCL does not treat and has never tested either water supply prior to use in the production process or for drinking.

#### 4.6.1.3 Sanitary Sewer

According to Mr Sakala, the drains and bathroom facilities within the main process and office area are connected to a sewer line running northwest through the center of the facility (Section 7, Figure 2). This sewer line connects to the Council sewer system offsite. No septic tanks are located on the facility.

#### 4.6.1.4 Stormwater Control

Only the main process and office areas at the site are paved and no stormwater drains were observed in these areas. As a result, surface water runoff in these areas flows along the street curbing and reaches the unpaved batching plant and stone storage areas where it infiltrates into the subsurface.

### 4.6.2 Structures

Structures at ZCL are made of brick, concrete, steel, and have concrete floors and asbestos pipe insulation and roofing sheets. Structures and areas at the facility are presented on the Facility Site Plan (Section 7, Figure 2) and include:

- Production shed including an equipment workshop, spare parts storage area, geotechnical laboratory, electrical transformer and electric boiler rooms
- Administration building
- Vehicle maintenance shop and filling station with underground storage tanks (Section 8, Photographs 6 and 9)
- Workers canteen
- Security building
- Sleeper storage area
- Sleeper loading area
- Batching plant
- Block making area
- Wood treatment area
- Stone storage area

- Sand storage area
- Warehouse (Section 8, Photograph 7)
- Three cement silos (Section 8, Photograph 10).
- One water tower (Section 8, Photograph 11) and
- One onsite borehole in the sand storage area (Section 8, Photograph 5)

#### 4.6.3 Environmental Effects and Observations

Observations made during the field reconnaissance and any potential environmental effects are discussed in the following sections.

##### 4.6.3.1 Chemicals, Petroleum, and Process Materials

Details of chemicals, petroleums, process materials and the average annual quantities used at ZCL facility were provided by Mr Sakala during the site visit. These process materials include:

- 2,938 metric tonnes of cement
- 3,942 metric tonnes of sand
- 6,366 metric tonnes of aggregate stone
- 252 metric tonnes of steel reinforcement (cable) and steel rail anchors
- approximately 500 metric tonnes of Comix (cement additive)
- approximately 3 million liters of water

The stone, sand, cement, and steel reinforcement and anchors are delivered by rail to the site and stockpiled in the various open storage areas. Cement and water are stored in three cement silos and a water tower at the batching plant, respectively. Wood planks are stored in the concrete sleeper storage area.

Petroleum products including petrol, diesel, motor oil, and lubricating grease are also used and stored at the facility. These materials are stored in 210 liter drums in the equipment workshop, vehicle maintenance shop, warehouse and underground storage tanks (USTs) at the filling station. According to ZCL, approximately 2,500 liters petrol, 3,500 liters diesel, 420 liters motor oil, and 630 liters hydraulic oil are used each month. 50 kilograms bags of Comix and several acetylene tanks are also stored in the warehouse (Section 8, Photograph 12).

##### 4.6.3.2 Process Waste Streams

Waste streams from the production process include process wastewater, scrap steel, broken blocks, unusable concrete, petroleum products (used oils and fluids), and general office trash. According to Mr Sakala, the volume of wastewater from the production process is approximately 500,000 liters annually. The wastewater originates from the cement curing phase of the process where steam is used to facilitate hardening of the cement. Since the wastewater is initially in direct contact with the cement, the discharge potentially has an elevated pH. Floor drains within

the production shed collect the wastewater and discharge it to the Council sewer. No analytical testing of the process effluent has been conducted.

Another wastestream is the surface water runoff from the ZCL facility that potentially contains petroleum products spilled around the facility. The surface water runoff from the facility flows to the batching plant and stone storage area where it infiltrates into the subsurface soil.

#### 4.6.3.3 Air Emissions

Air emissions from the ZCL facility include dust generated during batch plant operations and while filling the cement silos. Mr Sakala was unaware of any offsite dust problems or complaints resulting from ZCL's operations. No emissions are associated with ZCL's electric boiler.

#### 4.6.3.4 Pesticide/Herbicide Use

According to Mr Sakala, no pesticides or herbicides are used at the facility.

#### 4.6.3.5 Underground/Aboveground Storage Tanks

ZCL operates two 3,500 liter underground storage tanks (USTs) located at the filling station (Section 8, Photograph 6). According to ZCL, the tanks are constructed of steel and were installed in 1980. Approximately 2,500 liters petrol and 3,000 liters diesel are used each month. No information concerning leaks or inventory monitoring and control procedures were available for review by PH Associates.

Three 50 metric ton capacity silos are located next to the batching plant and are used to store cement. ZCL also uses a 135,000 liter capacity water tower (Section 8, Photographs 10 and 11).

#### 4.6.3.6 Releases/Spill Controls

Spills consisting of petrol, diesel, oils and grease were observed in many areas at the ZCL facility. The areas where spills have occurred are summarized below:

- The majority of petroleum spills have occurred at the unpaved filling station (Section 8, Photograph 6).
- Oil/grease spills at the vehicle maintenance shop and outside the equipment workshop (Section 8, Photographs 6, 9, 13, and 14).
- Oil spill at the wood treatment area (Section 8, Photograph 15).
- Oil spill near the water tower (Section 8, Photograph 10).
- Motor and hydraulic oil spills inside the warehouse (Section 8, Photograph 12).
- Oil has also been discharged from a wash basin within the equipment workshop onto the pavement outside. The oil was observed in pools along the pavement curbing (Section 8, Photographs 16 and 17).

Other liquid waste streams released from the facility include the process and sanitary wastewater and surface water runoff. The volume of wastewater from the production process is approximately 500,000 liters annually, and potentially has an elevated pH. The process and sanitary wastewater is discharged to the Council sewer for treatment and disposal.

Surface water runoff from the ZCL facility potentially contains petroleum spilled on the ground around the facility. The surface water runoff from the facility flows into the batching plant and stone storage areas where it infiltrates into the subsurface.

Over the years tonnes of cement have potentially been spilled at the batching plant. According to Mr Sakala, some cement is spilled during the transfer of cement from railway cars to the storage silos (Section 8, Photographs 18 and 19).

Petroleum spilled in the unpaved areas of the facility infiltrate with rainwater into the subsurface soil and groundwater. This is particularly evident at the vehicle maintenance shop, filling station, wood treatment area, and in front of the equipment workshop (southeast side). Rainwater percolating through cement spilled at the batching plant may have an elevated pH. As a result, the surface and subsurface soil and shallow groundwater quality at the facility may potentially be adversely affected.

#### 4.6.3.7 Potentially Hazardous Materials

Currently, no guidelines have been implemented by the Environmental Council of Zambia defining specific materials or chemicals as hazardous. Application of the term "hazardous" is generally based on specific characteristics of a substance or constituent such as ignitability, corrosivity, reactivity, and toxicity. Depending on the concentration of the constituent in sludges, soil, surface water, or groundwater, the constituent may or may not be considered hazardous.

Materials onsite such as the petroleum products and stormwater runoff may potentially contain specific constituents at levels that could be identified as hazardous and regulated once guidelines are enacted. Fuels at the site contain lead, benzene, ethyl benzene, toluene, and xylenes. Applying regulations adopted by the EPA, these constituents potentially pose a threat to human health and the environment based due to ignitability, toxicity, and human carcinogenic risk (Cal EPA, 1992). Excessive levels of lead have been shown to retard the developmental growth of children while benzene is a known cancer causing compound.

Asbestos found in the sheet roofing and pipe insulation at the facility is potentially hazardous and has been known to produce lung cancer and other respiratory problems in individuals who have had prolonged exposure.

#### 4.6.3.8 Waste Disposal

Wastes produced and disposed of by ZCL include wastewater (process and sanitary), scrap steel, broken blocks, unusable concrete, petroleum products (used oils), and general office trash. Mr Sakala estimated 35

cubic meters of waste cement and blocks are produced monthly. The cement wastes are sold to local contractors as fill material. Scrap metals are recycled. No information was available concerning the volume of scrap metal wastes.

Mr Sakala stated that the office trash is burned onsite. Waste petroleum products (used motor oils) are stored in 210 liter drums and either recycled by British Petroleum, sold to local residents, or burned along with the office trash.

Process and sanitary wastewater are disposed of to the Council sewer. Approximately 500,000 liters of process wastewater are disposed of annually.

#### 4.7 Applicable Environmental Regulations

A summary of the applicable regulations for Zambia is presented in Table 2 of Appendix D. Based on a review of these regulations, the ZCL facility is:

- illegally discharging/releasing petroleum and process materials (cement) onto the ground that may potentially pollute soil and shallow groundwater
- illegally discharging process wastewater potentially having an elevated pH into the Council sewer without a license
- illegally burning wastes onsite

The Environmental Protection and Pollution Control Act of 1990, states that no person may discharge (directly or indirectly) poisonous, toxic, obnoxious or obstructing matter, or other pollutants into surface or groundwater bodies. This Act also states that it is illegal to dispose of solid wastes anywhere but at a licensed disposal facility.

The Water Pollution Control (Effluent and Wastewater) Regulations of 1993, requires a license to discharge wastewater that may pollute the environment (this includes discharges to the Council sewer). The conditions of the license include discharge record keeping, weekly sampling and testing of the wastewater, and submission of a bi-annual report to the ECZ. The discharge must meet the standards (limits) for parameters listed in Table 3 of Appendix D.

According to Mr Sakala, no discharge licenses or permits have been obtained by ZCL.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are presented addressing areas of environmental concerns at the Zambia Concrete Limited (ZCL) facility based on the findings of the environmental assessment.

- Diesel, petrol and oils have been spilled on the unpaved areas of the vehicle maintenance shop, filling station, equipment workshop, and wood treatment area. As a result, subsurface soil and groundwater quality in the area may potentially be adversely affected.
- Cement has been spilled at the batching plant. As a result, rainwater infiltrating through this area may have an elevated pH and potentially adversely affect groundwater quality in the area.
- Pursuant to the Environmental Protection and Pollution Control Act of 1990, ZCL is illegally burning wastes onsite.
- Pursuant to the Environmental Protection and Pollution Control Act of 1990, it is illegal to spill/release/discharge any substance that may pollute the environment. Petroleum and cement spills onsite may potentially adversely impact soil and groundwater quality at the facility.
- Water Pollution Control (Effluent and Wastewater) Regulations of 1993 state that it is illegal to discharge wastewater that may pollute the environment (including discharges to the Council sewer), and that a discharge license is required. Wastewater from the process area likely has an elevated pH and is discharged to the Council sewer without a discharge license.
- The integrity of the two steel USTs at the filling station is unknown and has never been adequately monitored to protect the environment against possible leaks. Knowing the age of the USTs, it is possible that leaks have occurred and that these releases may potentially adversely affect subsurface soil and groundwater quality in the area.
- Transformer oils at the facility may potentially contain polychlorinated biphenyls (PCBs). No testing for PCBs has been performed.
- The ZCL uses an electric powered boiler to produce steam for use in the cement curing process. No adverse environmental effects are expected from air emissions at the facility.
- According to ZCL, asbestos is used at the facility in pipe insulation and roofing sheets. Asbestos is a known human carcinogenic.
- ZCL uses approximately 3 million liters of water annually at the facility, of which 200,000 liters are obtained from a borehole located onsite.
- ZCL lacks any environmental safety and procedures plan detailing storage, handling, cleanup, and disposal procedures for the facility.
- Based on the field reconnaissance of the area surrounding the facility, there are many neighboring industries (Zambia Railways Limited, Nitrogen Chemical of Zambia Limited, Bata Tanneries Limited, ZESCO substation, and Kafue Textiles of Zambia Limited) in the industrial area that potentially adversely affect the environmental conditions of the surrounding area.

### **PH Associates recommends that**

- ZCL investigate soil and groundwater quality in the area of the vehicle maintenance shop, filling station, equipment workshop, wood treatment area, and batching plant. This investigation should include collecting soil and groundwater samples to assess the level of possible adverse

effects. If soil has been impacted, then ZCL should remove the soil and dispose of it in an appropriate disposal facility.

- ZCL remove their aging USTs and install new tanks, preferably of double-walled fiberglass construction. In addition, ZCL should install an adequate monitoring and leak detection program such as secondary containment at the UST area to prevent adverse effects from possible future releases.
- ZCL pressure test their USTs annually to determine if major leakage is occurring.
- ZCL stop discharging wastewater containing petroleum from the wash basin in the equipment workshop. The wastewater is discharged onto the ground along the northeast side of the equipment workshop.
- ZCL mitigate potential adverse effects to surface soil and groundwater quality by removing petroleum-saturated soils observed onsite. The soil should then be disposed of at an appropriate disposal facility.
- ZCL obtain a license to discharge process wastewater to the Council sewer and comply with all discharge requirements.
- ZCL stop illegally burning wastes onsite and have wastes disposed of by the Council.
- ZCL request ZESCO to analyze oils from the facility transformers for polychlorinated biphenyls (PCBs). If PCBs are found, ZCL should obtain ZESCO's Environmental Safety and PCB Mitigation Plan for Transformers (PCBs), that details ZESCO's responsibilities and plan-of-action should a PCB oil spill occur.
- ZCL conduct an asbestos survey and implement an asbestos removal plan at the facility.
- ZCL develop and implement an environmental safety and procedures plan detailing storage, handling, monitoring, cleanup, and disposal procedures for the facility, especially at the production shed, equipment workshop, filling station, vehicle maintenance shop, and wood treatment area, to minimize potential adverse effects to the environment in the future.
- ZCL maintain inventory and waste disposal records specifically listing the types and quantities of chemicals, fuels, oils, and materials brought onsite and the types and quantities of materials recycled or disposed of and their disposal locations. This "cradle-to-grave" tracking of materials should be incorporated into the environmental safety and procedures program.

## 6. REFERENCES

### CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

Chemical Cross-Index, May 1992

### GOVERNMENT OF ZAMBIA

The Environmental Protection and Pollution Control Act, No 12 of 1990

### GOVERNMENT OF ZAMBIA

The Mines and Minerals Act, 1976, Chapter 329 of the Laws of Zambia

### GOVERNMENT OF ZAMBIA

The Mining (Dumps) Regulations, 1972, Chapter 329 of the Laws of Zambia, Section 132

### GOVERNMENT OF ZAMBIA

The Waste Management (Licensing of Transporters of Waste and Waste Disposal Sites) Regulations, 1993 - Statutory Instrument No 71 of 1993, The Environmental Protection and Pollution Control Act No 12 of 1990

### GOVERNMENT OF ZAMBIA

The Water Pollution Control (Effluent and Wastewater) Regulations, 1993 - Statutory Instrument No 72 of 1993, The Environmental Protection and Pollution Control Act No 12 of 1990

### NORTHERN RHODESIA GEOLOGICAL SURVEY (NRGS, 1963)

The Geology and Groundwater Resources of the Lusaka Area, Report No 16 of 1963, J G Simpson, A R Drysdall, and H H J Lambert

### REPUBLIC OF ZAMBIA

The Water Act, 1949, Chapter 312 of the Laws of Zambia

### REPUBLIC OF ZAMBIA

Geologic Map of the Southeast Quadrant, 1981, Scale 1:1,000,000

### REPUBLIC OF ZAMBIA

Topographic Sheet 1528 C3, 1988, Scale 1:50,000

**REPUBLIC OF ZAMBIA**

Topographic Sheet 1528 C1, 1993, Scale 1:50,000

**SAKALA B**

ZCL Kafue Facility, Head of Production, Personal Interview, May 8, 1995

**ZAMBIA GEOLOGIC SURVEY DEPARTMENT**

Topographic Sheet 1528 C3, 1986, Scale 1:50,000

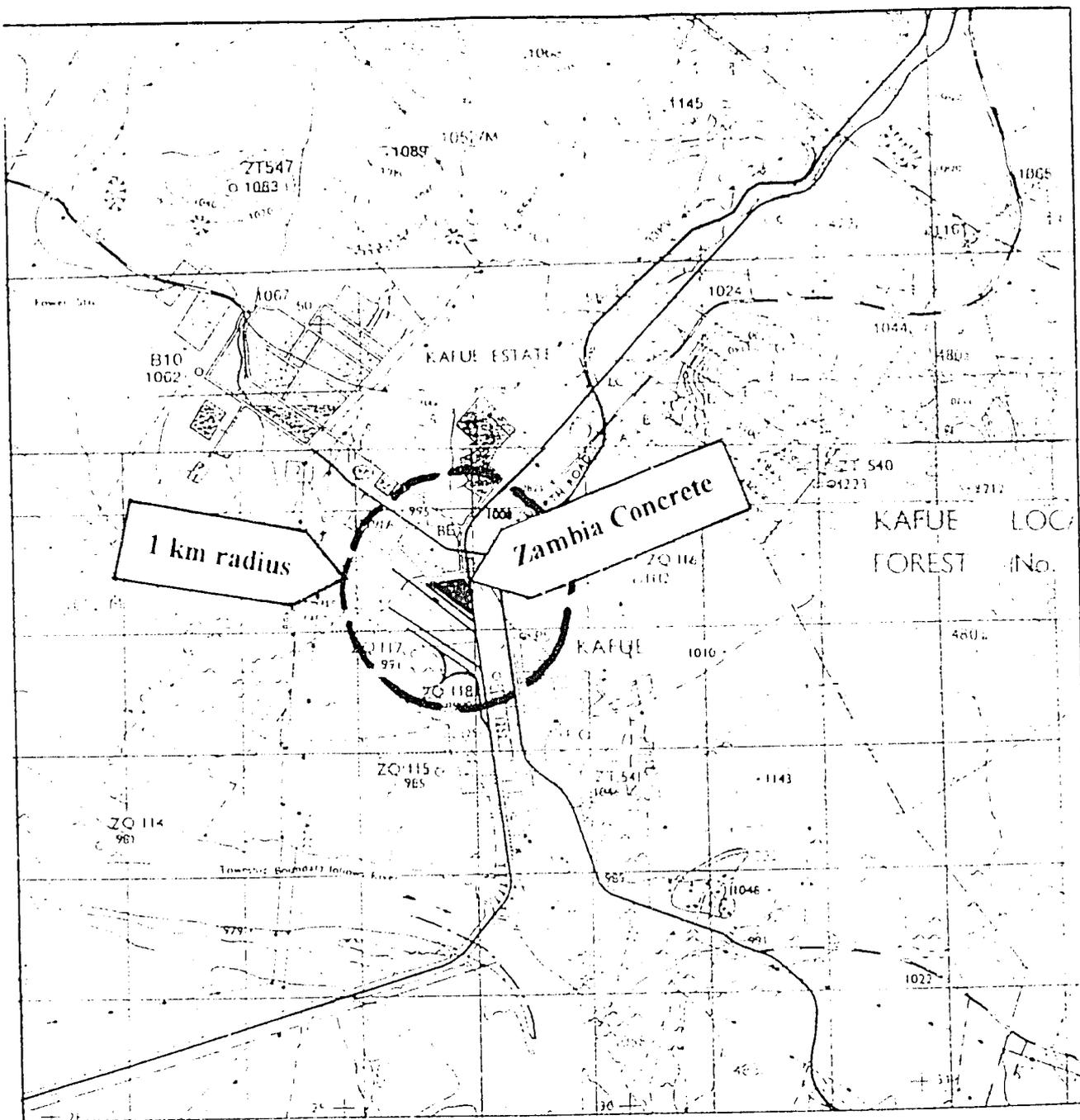
**ZAMBIA GEOLOGIC SURVEY DEPARTMENT**

Sheet No SD-35-15, Geologic Map of the Lusaka Area, 1983, Scale 1:250,000, J G Thieme

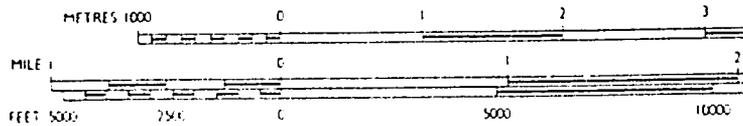
**ZIKO E**

ZCL Kafue Facility, General Manager, Personal Interview, May 8, 1995

## 7. FIGURES



SCALE



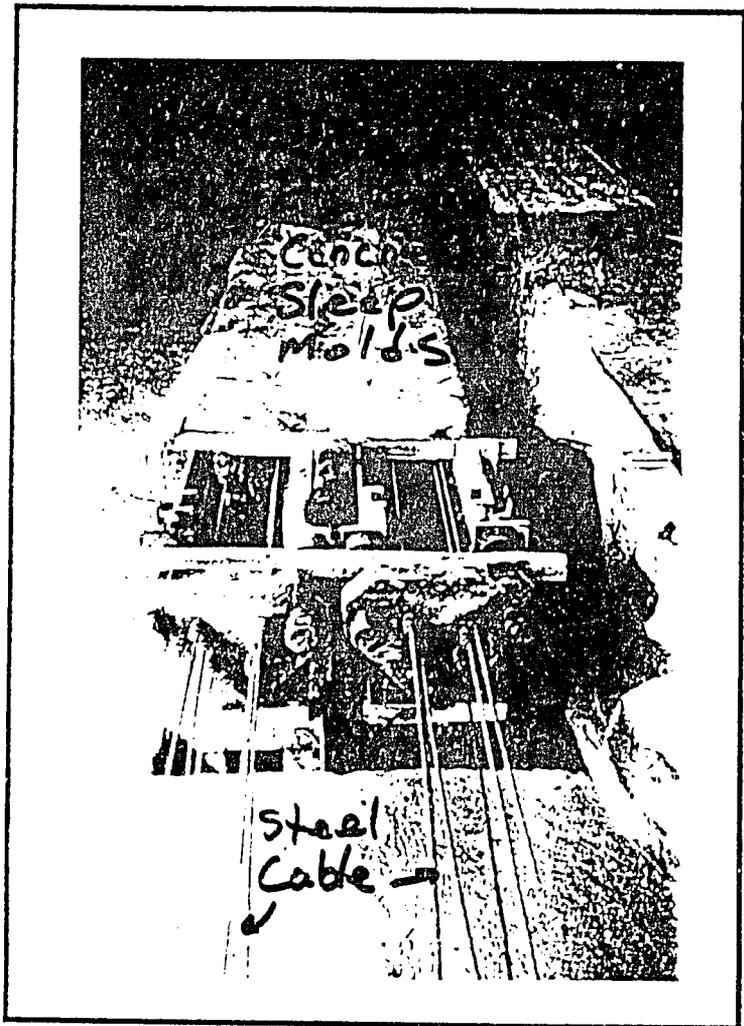
**Figure 1**  
**Site Location Map**  
**Zambia Concrete LTD**  
**Kafue Industrial Area**  
**Kafue, Zambia**

## 8. PHOTOGRAPHS



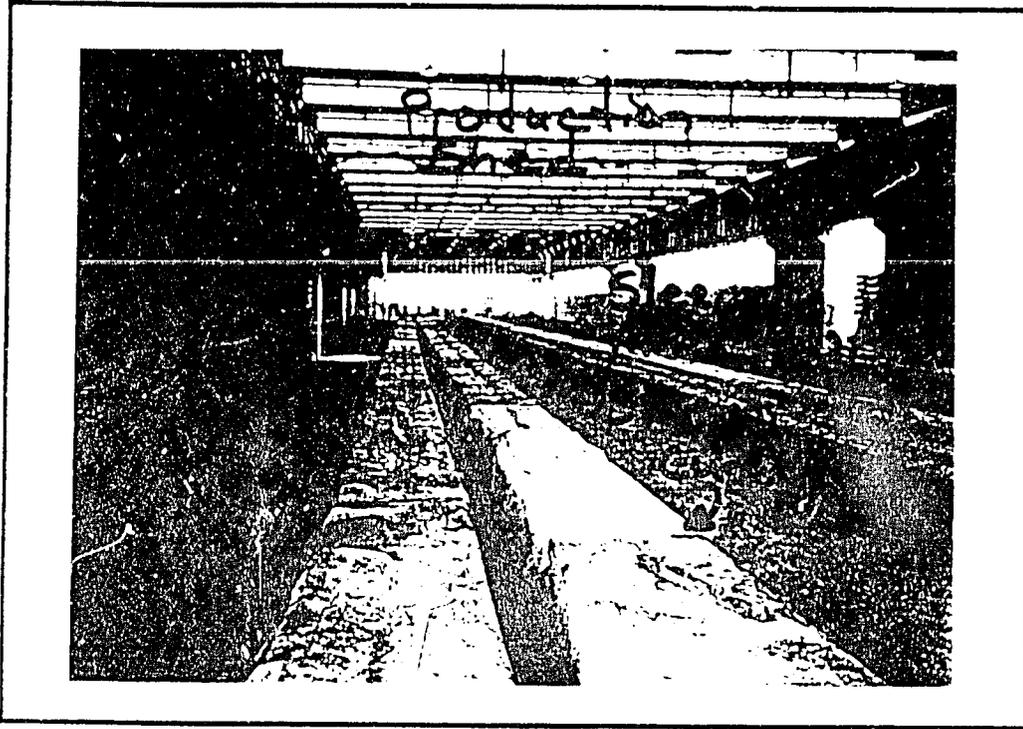
Photograph 1

BATCHING PLANT WHERE STOVE SAND, CEMENT AND WATER ARE COMBINED



Photograph 2

STEEL REINFORCEMENT IN CONCRETE SLEEPER MOLDS



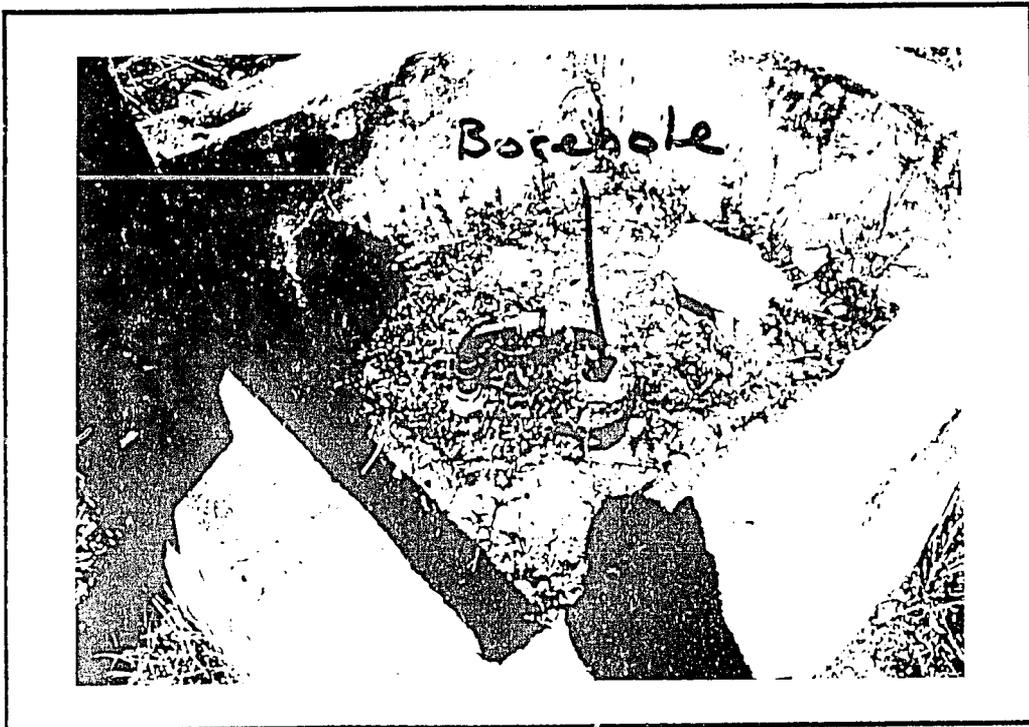
Photograph 3

STEAM CURING OF CONCRETE SLEEPERS IN PRODUCTION SHED



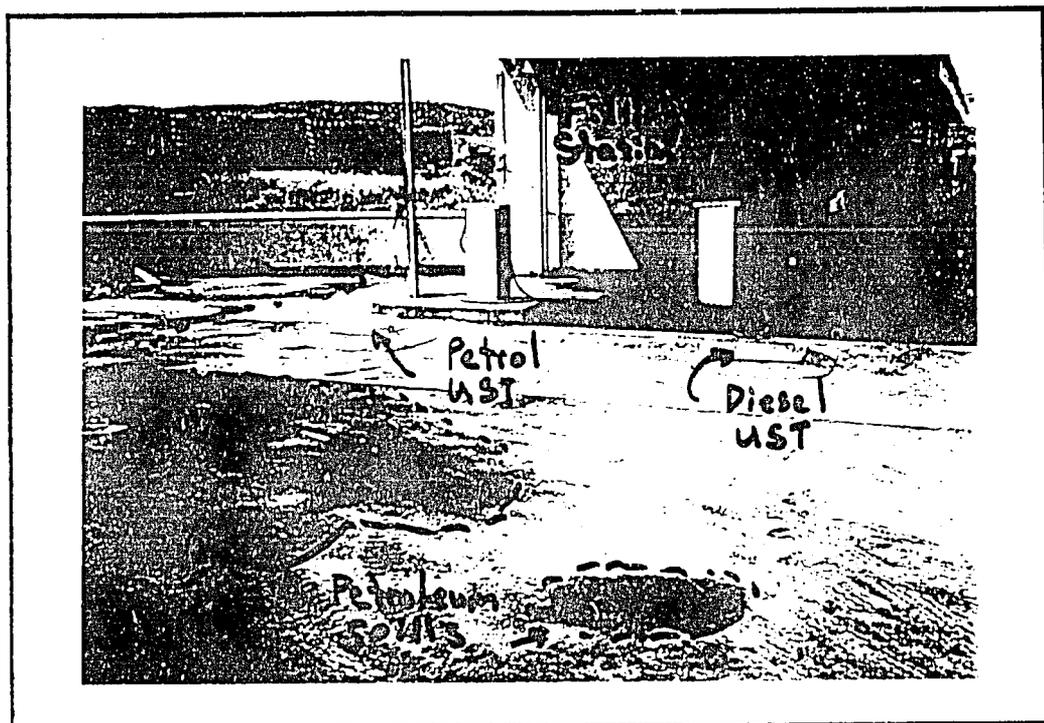
Photograph 4

GEOTECHNICAL LABORATORY



Photograph 5

FACILITY BOREHOLE



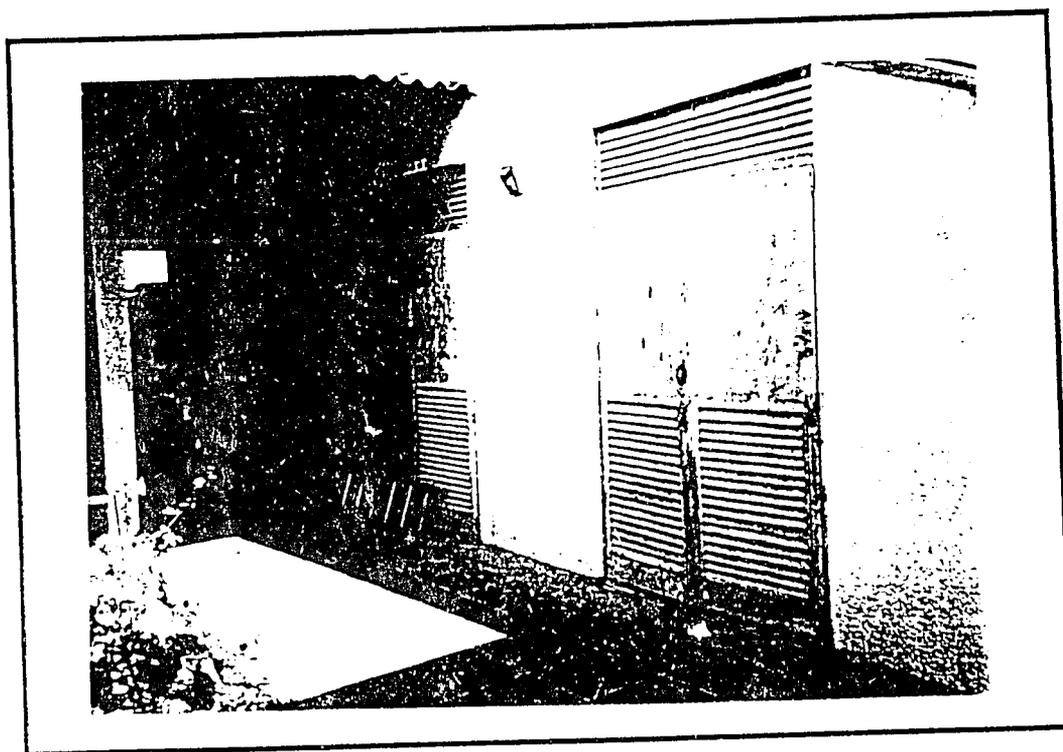
Photograph 6

FACILITY FILLING STATION W/PETROL AND DIESEL USTs AND FUEL SPILLS



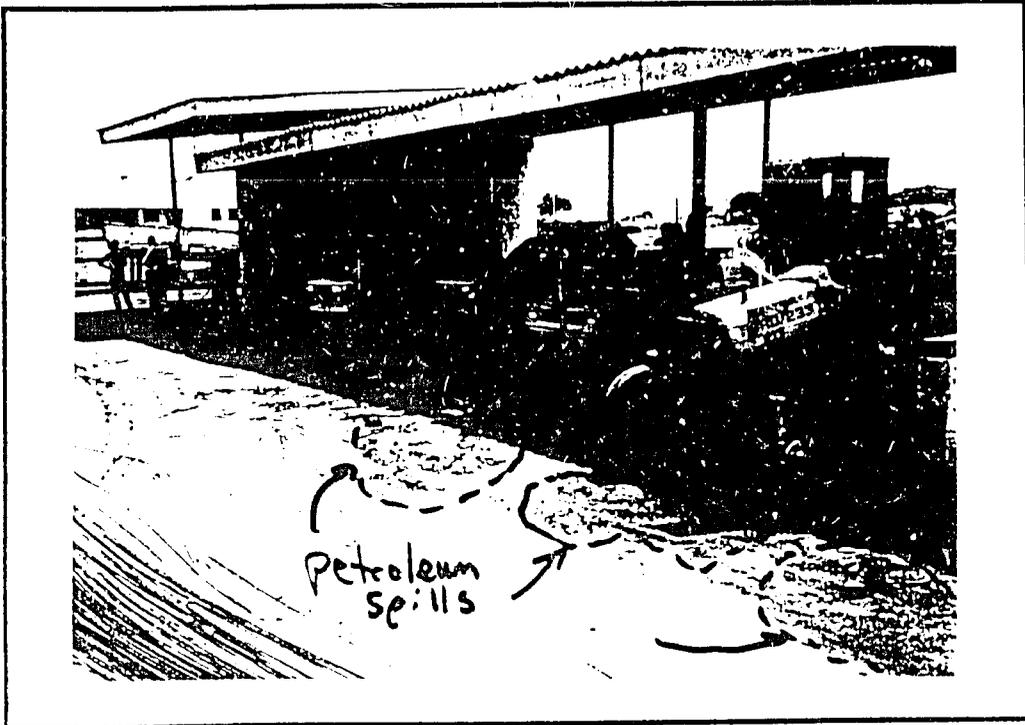
Photograph 7

FACILITY WAREHOUSE



Photograph 8

FACILITY TRANSFORMERS (3)



Photograph 9

FACILITY VEHICLE MAINTENANCE SHOP WITH PETROLEUM SPILLS



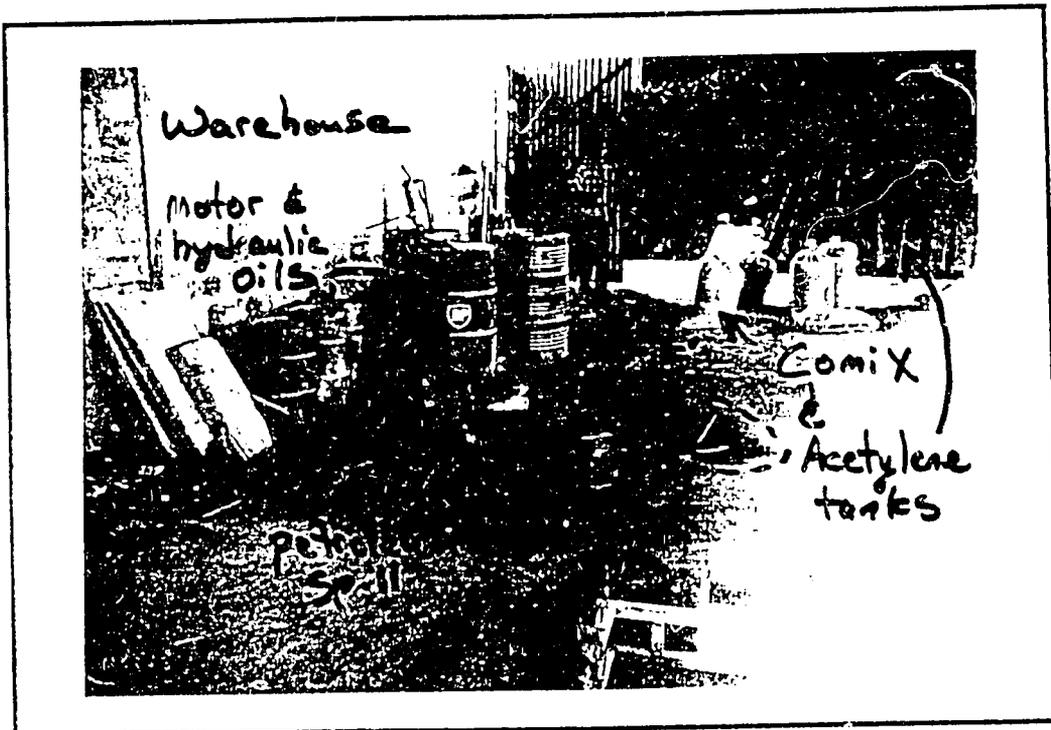
Photograph 10

CEMENT SILOS BATCHING PLANT AND PETROLEUM SPILLS



Photograph 11

FACILITY WATER TOWER



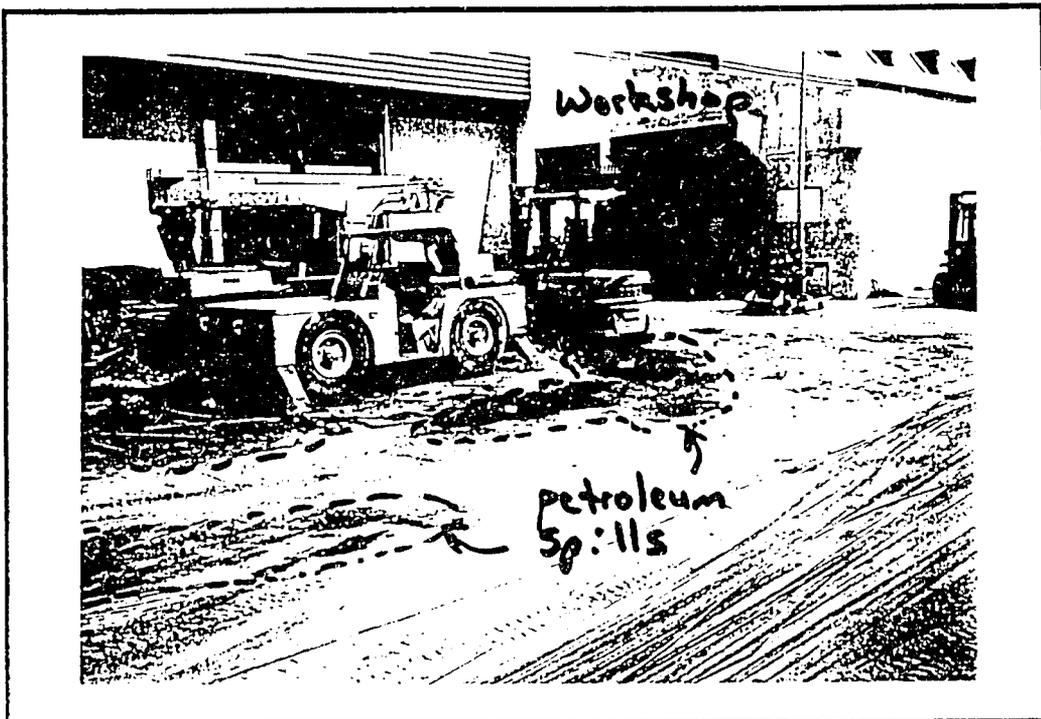
Photograph 12

STORAGE OF OILS, COMIX, AND ACETYLENE IN WAREHOUSE WITH OIL SPILLS



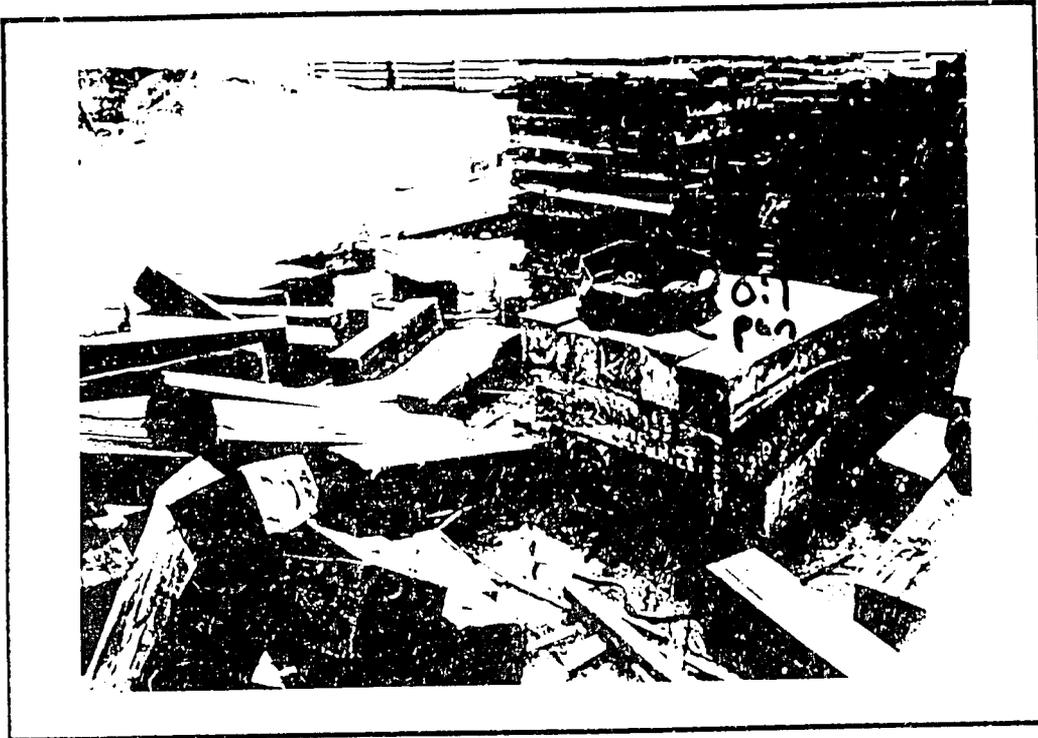
Photograph 13

PETROLEUM SPILLS AT FILLING STATION



Photograph 14

PETROLEUM SPILLS OUTSIDE EQUIPMENT WORKSHOP



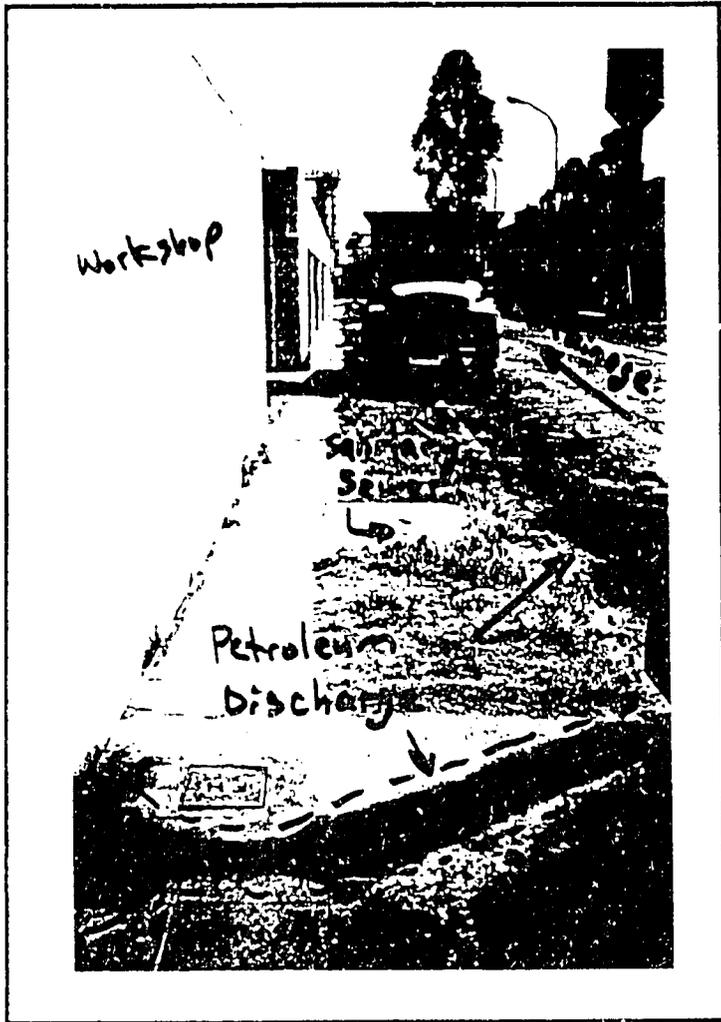
Photograph 15

OIL SPILL AT WOOD TREATMENT AREA



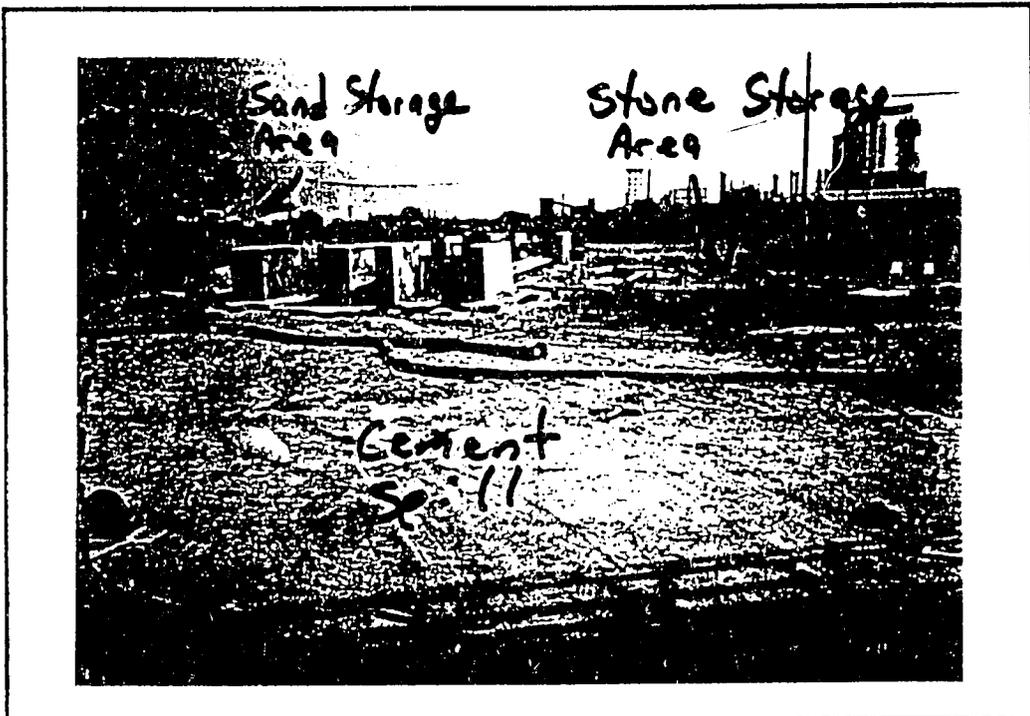
Photograph 16

PETROLEUM DISCHARGE FROM EQUIPMENT WORKSHOP



Photograph 17

PETROLEUM DISCHARGE FROM EQUIPMENT WORKSHOP. OIL POOLING ALONG CURBING.



Photograph 18

CEMENT SPILL AT BATCHING PLANT AREA



Photograph 19

CEMENT SPILL AT BATCHING PLANT AREA

## 9. APPENDICES

**Appendix A**  
**ZPA QUESTIONNAIRE**



(121)

# ZAMBIA CONCRETE LIMITED

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Our Reference:

Industrial Area  
P.O. Box 346,  
KAFUE, ZAMBIA.  
Telephone: 311381 & 311385  
Telex: ZA 70060

Your Reference:

7 January 1993

The Head of Planning & Development  
Zambia Privatisation Agency  
Findeco House  
P O Box 30819  
Lusaka

Attn. Mr S C Mwamba

Dear Sir

re: QUESTIONNAIRE ON ENVIRONMENTAL IMPACT

Please find attached a completed copy of above questionnaire  
for your further handling.

Yours faithfully  
ZAMBIA CONCRETE LIMITED

  
M M Choonga 7/1/93  
AG. GENERAL MANAGER

ZAMBIA PRIVATIZATION AGENCY  
QUESTIONNAIRE ON ENVIRONMENTAL INPUT

Name: ..... ZAMBIA CONCRETE LIMITED .....

Industry: ..... MANUFACTURER .....

Business Profile: ..... MANUFACTURER OF PRE-STRESSED CONCRETE SLEEPERS  
AND OTHER CONCRETE PRODUCTS .....

Turnover: ..... K145,637,320.00 .....

Capital Employed: ..... K40,000,000.00 .....

Employees: ..... 230 .....

1. Number and Location of offices, plants, facilities etc.:

..... ONE PLANT LOCATED AT KAFUE, FARM NO. 163 INDUSTRIAL AREA, KAFUE .....

2. Area covered by the office, plants etc., and its zoning  
(industrial, commercial etc.):

..... 9622m<sup>2</sup> .....

3. Chain of title documentation: ..... TITLE HELD BY ZAMBIA RAILWAYS .....

4. Business Start Date: ..... 03.05.79 (DATE OF INCORPORATION) .....

5. Building Type, Steel frame, brick etc.: ..... CONCRETE COLUMNS WITH  
BLOCK INFILLS. ASBESTOS SHEETS ON STEEL FRAME TRUSSES. ....

6. Products and Description processes used to produce these  
products, including waste streams employed as input/output.

..... PRE-STRESSED CONCRETE SLEEPERS, BUILDING BLOCKS, FENCING POLES..  
BRIDGE BEAMS, KERBS AND SLABS - CONCRETE IS MIXED AT THE BATCHING  
PLANT THEN Poured IN THE VARIOUS MOULDS, NO STREAMS USED. ....

7. Availability of site aerial photos, maps, drawings, layouts.

..... DRAWING AVAILABLE .....

(cont'd)

ZAMBIA PRIVATIZATION AGENCY  
QUESTIONNAIRE ON ENVIRONMENTAL INPUT

NOT APPLICABLE

8. Previous site and land use.: .....  
..... MATERIAL STORAGE
9. Surrounding land use within 1 km of the site.: .....  
YARD FOR ZAMBIA RAILWAYS ON THE SOUTH, NCZ ON THE WEST AND COUNCIL AND  
ZAMBIA RAILWAYS LIMITED AREA NORTH AND EAST.
10. Does the site have any permits, operational etc.?  
.....
11. Is the site within a flood plain?  
NO
12. Source of Water supply at the site (city water, water well  
etc.): COUNCIL WATER SUPPLY PLUS BOREHOLE ON SITE  
.....
13. Site drainage by open drains, covered drains, into a sewer  
etc.  
COVERED DRAINS
14. Type of discharges metal, organic, inorganic, liquids,  
solids.  
SOLIDS - CONCRETE WASTE
15. Any known Air quality odor problems. ....  
NIL
16. Occurrence of any fires at th facility: .....  
NIL
17. Are there any drums/containers having oil, grease, benzene,  
diesel stored at the site. If so, how many drums and what type?  
UNDERGROUND STORAGE TANKS. 7000 LITRE CAPACITY. <sup>total</sup> EACH FOR DIESEL AND  
PETROL. 3 DRUMS OIL AND 1 DRUM GREASE... ON AVERAGE .....  
(cont'd)



**Appendix B**  
**PH ASSOCIATES QUESTIONNAIRE**



# ZAMBIA CONCRETE LIMITED

(SUBSIDIARY OF ZAMBIA RAILWAYS LIMITED)

Reference:

Date: 28 June 1994

OFFICE OF THE GENERAL MANAGER

The Director  
Zambia Privatisation Agency  
P O Box 30819  
LUSAKA

For the attention of PH Associates (Room 212)

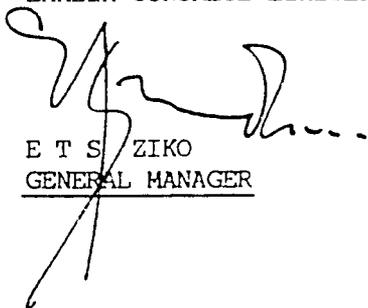
Dear Sir

I refer to your letter and questionnaire which were faxed to us on 24th June, 1994.

We are pleased to enclose a duly completed questionnaire on environmental issues at our premises for your further handling. We do hope that the data given in the questionnaire will assist you greatly in assessing environmental issues relating to our factory.

Should you require further information on this matter; please do not hesitate to get in touch with us.

Yours faithfully  
ZAMBIA CONCRETE LIMITED



E T S ZIKO  
GENERAL MANAGER

Plot No. 163A  
Industrial Area  
Off Great North Road  
P O Box 360346  
KAFUE  
ZAMBIA

TEL: +260.1.311381

FAX: +260.1.311288

TLX: ZA 70060

44

## ZPA ENVIRONMENTAL QUESTIONNAIRE 2 (REQUEST FOR ADDITIONAL ENVIRONMENTAL INFORMATION)

Please list all facilities owned by your Company, their physical addresses (location), and the name and telephone number(s) of the contact person(s) to whom all questions concerning operations and environmental issues should be addressed:

ZAMBIA CONCRETE LIMITED  
PLOT 163A OFF GREAT NORTH ROAD  
KAFUE

GENERAL MANAGER  
TEL. 311381/311020  
FAX 311288  
TLX ZA70060

Please complete the following for each facility listed above:

Facility Name: ZAMBIA CONCRETE LIMITED

1) Describe your Company's products, process method(s), and raw materials used in each individual process both past and present:

1. PRECAST CONCRETE PRODUCTS - SAND, CEMENT, STONE, WATER, REINFORCEMENT
2. PRESTRESSED CONCRETE PRODUCTS - SAND, CEMENT, STONE, WATER, REINFORCEMENT
3. BUILDING BLOCKS - SAND AND CEMENT

2) What is the approximate size of your facility, and process areas (acres)?

FACTORY	41,000m <sup>2</sup>
RESIDENTIAL	72,000m <sup>2</sup>
	<u>113,000m<sup>2</sup></u>

3) Please list the facilities and/ or structures onsite (i.e. maintenance shops, petroleum storage areas, chemical storage areas, production and process areas for each product, laundry areas, etc.) and the activities at each:

1. OFFICES AND CANTEEN	850m <sup>2</sup>	ADMINISTRATIVE FUNCTIONS
2. PRODUCTION SHED	2250M <sup>2</sup>	SLEEPER PRODUCTION
3. LABORATORY	100M <sup>2</sup>	
4. STORE	60M <sup>2</sup>	
5. WORKSHOP	100M <sup>2</sup>	
6. WAREHOUSE	200M <sup>2</sup>	
7. RESIDENTIAL COLONY	72,000M <sup>2</sup>	
8. VEHICLE SHED	105M <sup>2</sup>	
9. FUEL PUMPS	60M <sup>2</sup>	
10. SAND AND STONE STORAGE AREA	3200M <sup>2</sup>	
11. BLOCKS & OTHER PRODUCTS		
MANUFACTURING AREA	1600M <sup>2</sup>	
12. BOILER ROOM	95M <sup>2</sup>	
13. SUBSTATION	110M <sup>2</sup>	
14. BATCHING AREA	600M <sup>2</sup>	

4) Please list the solid/sludge wastes per process disposed of by your facility, their contents, and estimated volumes of each per month:

1. CONCRETE WASTE - CONTAINS SAND, CEMENT & STONE - 30M<sup>3</sup>/MONTH
2. BROKEN BLOCKS - CONTAINS SAND AND CEMENT - 5M<sup>3</sup>/MONTH

5) Briefly describe the facility's solid/sludge waste disposal methods of each waste by process (i.e. incinerators, onsite burial, onsite stockpile, municipal landfill or incinerators, etc.):

BOTH WASTES GIVEN OUT FOR USE AS

1. HARDCORE FILLING IN BUILDINGS
2. MAKING LOW GRADE CONCRETE
3. LANDFILL

6) Please describe each liquid discharge at the facility by listing the associated process, estimated monthly volume, and contents(i.e. chemicals, suspended solids, BOD, pH, etc.):

N/A

7) Briefly describe the treatment/disposal methods of each liquid discharge by process at the facility (i.e. onsite lagoons, stormsewers, open ditches, council sewer, ground surface, etc.):

N/A

8) Please describe the land use immediately surrounding your facility (i.e. residential, heavy, medium, or light industry, commercial, mixed, etc.) and list the name(s) and type of company (ies) neighboring your facility:

INDUSTRIAL AND TRANSPORTATION

ZAMBIA RAILWAYS LIMITED - 2 SIDES

NITROGEN CHEMICALS OF ZAMBIA LTD - 1 SIDE

UNDEVELOPED INDUSTRIAL PLOT - 1 SIDE

9) Please list any surface body of water (i.e. stream, river, lake, reservoir, marsh, etc.) within 1km of your facility:

NIL

10) Does the company operate any boreholes, how many, active or inactive/abandoned, approximate depth? Does your company use the council water supply? Approximate volume/day of water used in processes at the facility from boreholes, from the council supply?

1 BOREHOLE - DEPTH 50M

YES, COUNCIL WATER IS USED

WATER USE - AV. TOTAL 3,000,000 LITRES

COUNCIL 2,800,000 LITRES

BORE HOLE 200,000 LITRES

11) What is the approximate depth to groundwater beneath the facility (i.e. static or non-pumping level)? 15M

12) Are asbestos-containing materials used or present at the facility? Describe:

AS ROOFING SHEETS ONLY

13) Are there any transformers at your facility? How many? Do they contain hydraulic or heat transfer oils? Have they been tested for PCBs. Has any leaks or releases of oils from the transformers ever occurred?

THREE TRANSFORMERS OWNED AND MAINTAINED BY ZESCO

THERE HAS BEEN NO LEAKS OR RELEASES OF OILS

14) Please list any above ground and below ground storage tanks at the facility, each tanks age and volume, and contents stored. Are the tanks vented? Has any leaks or releases ever occurred? If so, please describe the material and quantity released.

1. CEMENT SILOS - 3 NO. X 50 TONS EACH - ERECTED 1981 - VENTED
2. WATER TOWER - 132M<sup>2</sup> - VENTED

NO LEAKS AND RELEASES

15) Has your facility ever used or disposed of any radioactive materials or wastes? If so, describe: NO

16) Has your company implemented any process monitoring, chemical, or waste discharge monitoring or tracking programs at the facility? If so please briefly describe each program.  
NO

17) Does your facility use a septic tank(s)/leach field(s) or the council sanitary sewer for disposal domestic wastes. If your facility has septic tank(s), are any process waste discharged to them?  
COUNCIL SANITARY SEWER

18) Please describe all air emissions ( i.e. boilers, tanks, processes) at your facility, contents, pounds/day of constituents, associated process, and any pre-emission treatment.

CEMENT DUST

19). Describe all permits acquired by your facility for discharges of solid and liquid wastes, and air emissions.

NIL

20) Please complete the following chemicals, petroleum, and process materials table:

Description	Average Monthly Usage	Average Stored Quantities	Storage Method	Any Other Information
Petroleum and Lubricants				
Petrol	2,500 litres	3,000 litres	} UNDERGROUND } TANKS	
Diesel	3,500 LITRES	3,000 LITRES		
Oil	2 DRUMS	1 DRUM	210 LITRE DRUMS	DRUMS KEPT IN
Hydraulic oil	3 DRUMS	1 DRUM	210 LITRE DRUMS	STORE AT FILLING STATION
Turpentine	NIL			
Other	NIL			
Other	NIL			
Other	NIL			
Pesticides and Herbicides				
		N/A		
Solvents, Degreasers, Cleaners				
Toluene				
Benzene		N/A		

Description	Average Monthly Usage	Average Stored Quantities	Storage Method	Any Other Information
Nitrates, Phosphates, Sulfates, Chlorates, etc.				
		NIL		
Acids (Sulfuric, Hydrochloric, Phosphoric, Nitric, Acetic, Chromic, Hydrocyanic, Hydrofluoric, Perchloric, etc.)				
		NIL		



Description	Average Monthly Usage	Average Stored Quantities	Storage Method	Any Other Information
		NIL		
Oxidizers (Sodium Peroxide, Hydrogen Peroxide, etc.)				
		NIL		
Others				
Ammonia		NIL		
Chlorine				



**Appendix C**  
**MINISTRY RECORDS, REVIEW AND INTERVIEWS**

## MINISTRY REVIEWS AND INTERVIEWS

PH Associates interviewed Ministry personnel and other pertinent organizations to discuss the current state of environmental affairs and regulations in Zambia. Ministry records pertaining to assessed sites were requested, however, minimal data was acquired because many of the environmental Ministries are either relatively new and have limited records or there is a lack of funding for the environmental programs and inspections. A more detailed discussion of the environmental regulations for Zambia are presented in Appendix D and a summary of interviews are discussed below.

### ENVIRONMENTAL COUNCIL OF ZAMBIA

Mr Julius Kanyembo - Director  
Mrs I Mbewe - Legal Officer

On April 13, 1995, Ms Elena Pomar/PH Associates visited Mr Julius Kanyembo, Director of the Environmental Council of Zambia (ECZ). Information on the enforcement of the regulations was obtained on April 24, 1995 from Mrs Mbewe, Legal Officer for the Environmental Council of Zambia. The ECZ was started in 1990 to develop and implement regulations under the Environmental Protection and Pollution Control Act, but it was not functionally operating until June 1992. Legislation and regulations on water pollution control, waste management, environmental impact assessments were recently enacted in 1993 and 1994 and are currently in the process of enforcement. Inspection and site assessments have been conducted in very limited, selected cases. No enforcement activities have been conducted for the Pesticides and Toxic Substances Regulations. Regulatory policy and resolutions are currently being drafted on air pollution and wetlands management. The Environmental Council has set the following regulations in place under the Environmental Protection and Pollution Control Act of 1990:

#### The Water Pollution Regulations, 1993

These regulations determine the type and amount of effluent that can be discharged from a site and permit requirements.

#### The Waste Management Regulations, 1993

Requires licensing for transporters of solid and hazardous waste and for operators of waste disposal facilities.

#### Environmental Impact Assessment Regulations, 1994

These regulations require an environmental evaluation and licensing for new project developments, repairs, and expansion to existing projects.

#### The Pesticides and Toxic Substances Regulations, 1994

Requires registration with ECZ if manufacturing or importing/exporting a new pesticide or toxic substance.

The ECZ has very limited documentation on contaminated sites or industrial discharges since the Council was only established in 1990.

MINISTRY OF ENERGY AND WATER DEVELOPMENT

Mr Stan Chisala - Senior Engineer Water Affairs

On April 18, 1995, Ms Pomar visited Mr Stan Chisala, Senior Engineer of the Water Affairs Department (WA), in the Ministry of Energy and Water Development. The WA was established by the Water Act of 1949, which provides for the control, ownership, and use of water. Mr Chisala stated that the Ministry does not keep any environmental pollution records for any industry in Zambia.

PH Associates was provided with a copy of the November 1994 National Water Policy issued by the Ministry of Energy and Water Development. This document serves as a guide to conservation management, demand, and supply of water resources in the country. The National Water Policy, however, has no specific policy regarding contamination or water quality control by major industries, including the Council water supply.

The Water Supplies and Water Resources Management Division of WA is expected to have a program in place within a year to monitor the quantity and quality of groundwater boreholes. Enforcement of this program will be made by the Environmental Council of Zambia. Water Affairs also hopes to have the funding to do more adequate monitoring of boreholes for bacteriological analysis in the future. They currently have a chemist to conduct sampling and analysis but these activities have not been performed due to lack of funding.

Mr Chisala discussed some of WA's concerns about industrial and domestic wastewater discharges into some of the major surface water bodies of Zambia. Industries such as textile mills, tanneries, fertilizer producers, breweries and domestic sewage are of great concern in the potential contamination of rivers. Solid waste was also pointed out to be a potential contamination problem in Zambia since most of the municipal councils do not have designated areas for the disposal of these wastes. Wastewater drainage was discussed as being inadequate since the problem of stagnation is present throughout the industrial and urban areas of the country.

MINISTRY OF LABOR AND SOCIAL SECURITY

Mr K Mapani - Chief Inspector of Factories  
Mr Kakoma Chivundu - Inspector of Factories  
Mr Lukwesa - Inspector of Factories

Mr K Mapani, Chief Inspector of Factories for the Ministry of Labor and Social Security, was interviewed on April 20, 1995, by Ms Pomar to request available information on the sites where environmental assessments are to be conducted by PH Associates. There is approximately 10 years of available data for facility site inspections at the Ministry of Labor and Social Security. Mr Mapani stated that his office is basically concerned with inspections of factory sites where accidents or complaints have been filed.

The Chief Inspector of Factories currently has approximately 364 factory/industrial sites entered into a database, and a series of old reports. A database template was prepared for each site and includes a workplace number, industry classification and various parameters on Worker Health and Safety. The database was found to be poorly maintained and apparently the best information is found in the original site inspection reports. According to Mr Mapani, the department is currently understaffed by about 50%, thus regular visits to all facilities are difficult to perform.

On April 28, 1995, Ms Pomar met with Mr Kakoma Chivundu and Mr Lukwesa, both Factory Inspectors. PH Associates were provided with site inspection reports for several sites where environmental assessments will be performed. These are summarized in the individual reports, where applicable. Typical problems that are encountered during their site inspections include old and outdated machinery that can cause accidents, lack of maintained fire extinguishers, and noise and air quality problems.

#### MINISTRY OF MINES AND MINERALS DEVELOPMENT

Mr O Mg'ambi - Acting Director of Geological Survey Department  
Mr Clement Namateba - Senior Geologist (PGR), Geological Survey

PH Associates met with Mr O Mg'ambi, Acting Director and Mr Clement Namateba, Senior Geologist of the Geological Survey Department to discuss the regional geologic and hydrogeologic setting of Zambia. A listing of available geologic and hydrogeologic reports and maps were provided by the Department, and those covering the sites to be assessed were purchased.

#### INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

Mr Gedion Nkojo - Resident Representative, World Bank  
Mr Julius Chileshe - National Resource Economist, World Bank

On April 24, 1995, Ms Pomar met with Mr Gedion Nkojo, Resident Representative and Mr Julius Chileshe, National Resource Economist of the World Bank to request any information regarding historical data for the sites where environmental assessments are to be conducted. Mr Nkojo and Mr Chileshe stated that there was no specific environmental information for the sites.

The importance of having a unified and more focused plan for addressing environmental concerns in the country on behalf of the Government of Zambia (GOZ), NGOs (Non-Government Organizations), International Development Organizations (such as World Bank, UNDP, African Development Bank, etc), and other donor countries, was discussed at great length. The World Bank is presently working on an Environmental Support Program to be included in the National Environmental Action Plan for the Secretariat of the Ministry of Environment and Natural Resources.

**Appendix D**  
**ENVIRONMENTAL REGULATIONS OF ZAMBIA**

## ENVIRONMENTAL REGULATIONS OF ZAMBIA

As part of the PH Associates scope of work, legislative Policies, Acts, and Regulations enacted by Zambia were reviewed for their applicability to completing environmental assessments of the enterprises identified by the ZPA for privatisation. The purpose of the review was to evaluate and summarize those guidelines pertaining to environmental issues which industries in Zambia are required to adhere. The industries to be assessed include food, agricultural and livestock farmlands, pharmaceutical drug, textile, sawmilling, storage and transportation, construction and engineering, mining and petroleum.

Regulations addressing the protection of human health and the environment have only recently been enacted in any detail. Prior to the passing of the Environmental Protection and Pollution Control Act of 1990 and the establishment of the Environmental Council of Zambia, legislation mostly addressed issues of worker health and safety.

Twelve regulations were selected for review based on their potential applicability to the assessed sites, and are listed in Table 1. Six of these regulations address environmental issues concerning air, soil, and water pollution and include:

- Water Act of 1949
- Environmental Protection and Pollution Control Act of 1990
- Water Pollution Control Regulation of 1993
- Waste Management Regulations of 1993
- Mining (Dumps) Regulations of 1972
- Mines and Minerals Act of 1976

These regulations are summarized in Table 2 and used to evaluate the environmental compliance of the facilities assessed by PH Associates. Of the six regulations listed above, the first four comprise the majority of established environmental legislation and are applicable to most of the assessed industries.

**TABLE 1  
ENVIRONMENTAL REGULATIONS AND  
ENFORCING MINISTRIES OF ZAMBIA**

<b>Policy, Act, or Regulation</b>	<b>Year Adopted</b>	<b>Responsible Ministry</b>
Water Act	1949	Ministry of Energy and Water Development (Water Board)
National Water Policy	1994	Ministry of Energy and Water Development
Environmental Protection and Pollution Control Act	1990	Environmental Council of Zambia
Water Pollution Control (Effluent and Wastewater) Regulations	1993	Environmental Council of Zambia
Waste Management (licensing of Transporters of Wastes and Waste Disposal Sites) Regulations	1993	Environmental Council of Zambia
Pesticides and Toxic Substances Regulations	1994	Environmental Council of Zambia
Environmental Impact Assessment Regulations	1994	Environmental Council of Zambia
Petroleum Act	1930	Ministry of Energy and Water Development (Department of Energy)
Petroleum (Exploration and Production) Act	1985	Ministry of Energy and Water Development (Department of Energy)
Agricultural (Fertilizers and Feed) Act	1990	Ministry of Agriculture
Mining (Dumps) Regulations	1972	Ministry of Mines and Minerals Development
Mines and Minerals Act	1976	Ministry of Mines and Minerals Development

**TABLE 2  
APPLICABLE ENVIRONMENTAL REGULATIONS  
OF ZAMBIA**

ACT OR REGULATION	APPLICABLE REGULATIONS
The Water Act 1949	<ul style="list-style-type: none"> <li>• Any person(s) shall have the right to the primary use of public water which is found in its natural channel where access is lawful.</li> <li>• A person(s) must have permission from the Water Board (WB) to impound, store, or divert water from a public stream for primary (drinking), secondary (irrigation), or tertiary (mechanical or industrial) use.</li> <li>• Any land owner must have permission from WB for use of private water supply.</li> <li>• Local authorities must get permission from WB to use public water for primary or tertiary use.</li> <li>• Any person(s) who willfully or through negligence pollutes or fouls any public water so as to render it harmful to man, beast, fish, or vegetation, shall be guilty of an offense.</li> </ul>
The Environmental Protection and Pollution Control Act 1990	<p><u>Water Regulations</u></p> <ul style="list-style-type: none"> <li>• No person may discharge (directly or indirectly), poisonous, toxic, obnoxious or obstructing matter, radiation or other pollutants into surface or groundwater bodies.</li> <li>• Industrial/trade owners or operations that discharge effluent from the facility into existing sewage system must obtain written permission from the local authority.</li> <li>• Local authority sewage systems may impose special conditions (ie pretreatment) to facilities that discharge effluent into their system.</li> <li>• Effluent may be mixed for treatment prior to discharge or for conveyance to common point of discharge.</li> <li>• No local authority sewage system or industry/trade shall discharge (directly or indirectly) effluent into surface water or groundwater environment without a license. Any changes to the type, quantity of pollutant, or discharge location must be authorized by the Inspectorate.</li> </ul> <p><u>Waste Regulations</u></p> <ul style="list-style-type: none"> <li>• No person(s) shall discharge waste so as to cause pollution in the environment. Based on the interpretation of this regulation by the ECZ, it is illegal to dump or bury waste anywhere but at a licensed disposal facility (no backyard dumping).</li> <li>• No person(s) shall transport waste to any site other than a licensed disposal facility.</li> <li>• Any person(s) intending to operate a waste disposal plant or generate hazardous waste must have a license.</li> <li>• No person(s) shall import any hazardous waste into Zambia.</li> <li>• No hazardous waste shall be exported to any country without a Council (ECZ) permit and consent of receiving country.</li> <li>• No hazardous waste shall be transported within or through Zambia without a Council permit.</li> </ul>

63

ACT OR REGULATION	APPLICABLE REGULATIONS
<p><b>Water Pollution Control Regulations of 1993</b></p>	<p><u>License to Discharge Wastewater</u></p> <ul style="list-style-type: none"> <li>• All commercial, municipal, and industrial facilities must possess a license to discharge wastewater that may pollute the environment.</li> <li>• Keep facility records of the licensed activities.</li> <li>• Conduct weekly sampling and testing of discharged wastewater at locations designated by ECZ Inspectorate.</li> <li>• The quality of wastewater discharged must meet the conditions and standards for all parameters contained in Table 3. If any wastewater test results exceed these standards, they must be reported to the Inspectorate within 12 hours.</li> <li>• Monitor the volume of wastewater discharged from the site using a metering device.</li> <li>• Submit bi-annual reports to the ECZ Inspectorate including the mean monthly test analyses results and mean monthly volume of wastewater being discharged.</li> </ul> <p><u>License to Withdraw Water</u></p> <ul style="list-style-type: none"> <li>• Facilities must possess a license to withdraw water from a watercourse for the purpose of diluting effluent.</li> <li>• The source of water being withdrawn would not significantly affect the water course.</li> <li>• The license holder must treat effluent so there are no adverse effects to the surface and groundwater environment.</li> <li>• The license holder must keep a record of licensed activities and provide a report to ECZ Inspectorate every six months.</li> <li>• The license holder must conform to all the following wastewater discharge regulations.</li> </ul>
<p><b>Waste Management Regulations 1993</b></p>	<ul style="list-style-type: none"> <li>• All commercial, municipal, or industrial facilities must possess a license to transport solid wastes offsite.</li> <li>• During loading and transport, wastes cannot be scattered, flowing out, or emitting bad smells.</li> <li>• Vehicles must transport wastes along approved, scheduled routes.</li> <li>• Transporter license may be valid from 6 months to 3 years depending on the transporters compliance with these regulations.</li> </ul>
<p><b>The Mining Regulations 1972</b></p>	<ul style="list-style-type: none"> <li>• Supervise/inspect site for the prevention of pollution of the surroundings or abatement of any nuisance.</li> </ul>
<p><b>The Mines and Minerals Act 1976</b></p>	<ul style="list-style-type: none"> <li>• Avoidance of wasteful mining practices or wasteful metallurgic practices.</li> <li>• Any effluent water discharged from any treatment or other process at a mine must comply with the provisions of the Water Act.</li> </ul>

## **THE WATER ACT**

### **Chapter 312, Adopted 1949, Amendments up to 1970**

The Water Act provided the initial guidance for the control, ownership, and use of water in Zambia. This Act established the Water Board (WB) in the Ministry of Energy and Water Development.

The purpose of the Water Board is to supervise all public streams in Zambia, protect the source of water streams, maintain and improve streams, and help prevent unlawful acts (polluting) of streams. The Act does not apply to the Zambezi, Luapula, and part of the Luangwa River.

### **Applicable Regulations**

The Act provides for some basic laws on water rights, some of the regulations that may apply to the assessed sites include:

- Any person(s) shall have the right to the primary use of public water which is found in its natural channel where access is lawful.
- A person(s) must have permission from the WB to impound, store, or divert water from a public stream for primary (drinking), secondary (irrigation), or tertiary (mechanical or industrial) use.
- Any land owner must have permission from WB for use of private water supply.
- Local authorities must get permission from WB to use public water for primary or tertiary use.
- Any person(s) who willfully or through negligence pollutes or fouls any public water so as to render it harmful to man, beast, fish, or vegetation, shall be guilty of an offense.

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## NATIONAL WATER POLICY OF 1994

This policy discusses planning, implementation strategies, management, and development of water resources for Zambia, and was issued as an internal guidance document under the National Water Policy Development Initiative (Water Development Board) by the Ministry of Energy and Water Development. The Water Development Board proposes and amends existing legislation and enacts new legislation.

### Applicable Regulations

None. The policy does not provide any water regulations.

**THE ENVIRONMENTAL PROTECTION AND  
POLLUTION CONTROL ACT  
Act No 12, Adopted 1990**

This Act provides for the protection of the environment, the control of pollution, and the establishment of the Environmental Council of Zambia (ECZ). The ECZ consists of representatives from 25 different ministries, and formulates policies relating to environmental management of natural resources and the control of industrial and other sources of pollution. The Council reviews environmental government reports, conducts studies and promotes research, educates the public about environmental issues, and conducts other relevant tasks.

The Act includes regulations for water, air, waste, pesticides and toxic substances, noise, ionizing radiation, and natural resource conservation. Many of these regulations are the basis for the updated Water Pollution Control Regulations (1993), Waste Management Regulations (1993), Pesticides and Toxic Substances Regulations (1994), and Environmental Impact Assessment Regulations (1994).

This Act and the ECZ were initiated in 1990, although the Council was not fully operational until June 1992 (Appendix C). Since the ECZ is still a relatively new institution, air, hazardous and toxic waste, and noise standards have not been established.

### **Applicable Regulations**

The Act provides generalized regulations that are applicable to discharge of solid waste and wastewater pollutants into the environment.

#### Water Regulations

- No person may discharge (directly or indirectly), poisonous, toxic, obnoxious or obstructing matter, radiation or other pollutants into surface or groundwater bodies.
- Industrial/trade owners or operations that discharge effluent from the facility into existing sewage systems must obtain written permission from the local authority.
- Local authority sewage systems may impose special conditions (ie pretreatment) to facilities that discharge effluent into their system.
- Effluent may be mixed for treatment prior to discharge or for conveyance to common point of discharge.
- No local authority sewage system or industry/trade shall discharge (directly or indirectly) effluent into surface water or groundwater environment without a license. Any changes to the type, quantity of pollutant, or discharge location must be authorized by the Inspectorate.

### Air Regulations

Based on discussions with the ECZ (Appendix C), legislation and standards on air pollution are currently being drafted. A review of the air pollution section of this Act shows the following areas will be addressed:

- No person(s) will be allowed to emit any pollutants above emission standards (to be developed).
- Polluting facilities will be required to have licenses, conduct period air sampling and testing, and provide reports to the Inspectorate.

Until these regulations are completed and adopted, there are no applicable air emission requirements for Zambia.

### Waste Regulations

Waste handling regulations are found in more detail in the Waste Management Regulations (1993).

- No person(s) shall discharge waste so as to cause pollution in the environment. Based on the interpretation of this regulation by the ECZ. (personal communication with Michael Sankwe/ECZ), it is illegal to dump or bury waste anywhere but at a licensed disposal facility (no backyard dumping).
- No person(s) shall transport waste to any site other than a licensed disposal facility.
- Any person(s) intending to operate a waste disposal plant or generate hazardous waste must have a license.
- No person(s) shall import any hazardous waste into Zambia.
- No hazardous waste shall be exported to any country without a Council (ECZ) permit and consent of receiving country.
- No hazardous waste shall be transported within or through Zambia without a Council permit.

### Pesticides and Toxic Substances Regulations

Many of the regulations regarding pesticides and toxic substances relate to the manufacture, import or process of a "new" pesticide or toxic substance. Currently, there are no guidelines or standards defining specific materials or chemicals as toxic or hazardous.

### Noise Regulations

No noise regulations are specified in the Act because the ECZ has yet to establish noise emission standards and guidelines.

## THE WATER POLLUTION CONTROL (EFFLUENT AND WASTEWATER) REGULATIONS OF 1993

These regulations are part of the Environmental Protection and Pollution Control Act of 1990. The regulations require that any local authority intending to operate a sewage treatment system or owner/operator of any industry that discharges wastewater (directly or indirectly) into any surface water or groundwater environment must apply for a license through the Environmental Council of Zambia (ECZ). Person(s) must also have a license from ECZ to withdraw water from a watercourse for the purpose of diluting effluent.

ECZ has developed standards (limits) for 59 physical, bacteriological, chemical, organic, metal, and radioactive parameters. These parameters and standards are listed in Table 3. Discharged wastewater may NOT exceed these parameter standards.

### Applicable Regulations

These wastewater discharge regulations are applicable to many of the sites to be assessed. The following conditions of the licenses are most noteworthy, refer to the original regulation for more specific details.

#### License to Discharge Wastewater

- All commercial, municipal, and industrial facilities must possess a license to discharge wastewater that may pollute the environment.
- Keep facility records of the licensed activities.
- Conduct weekly sampling and testing of discharged wastewater at locations designated by ECZ Inspectorate.
- The quality of wastewater discharged must meet the conditions and standards for all parameters contained in Table 3. Any wastewater test results which exceed these standards, must be reported to the Inspectorate within 12 hours.
- Monitor the volume of wastewater discharged from the site using a metering device.
- Submit bi-annual reports to the ECZ Inspectorate including the mean monthly test analyses results and mean monthly volume of wastewater being discharged.

#### License to Withdraw Water

- Facilities must possess a license to withdraw water from a watercourse for the purpose of diluting effluent.
- The source of water being withdrawn would not significantly affect the water course.
- The license holder must treat effluent so there are no adverse effects to the surface and groundwater environment.

- The license holder must keep a record of licensed activities and provide a report to ECZ Inspectorate every six months.
- The license holder must conform to all the wastewater discharge regulations.

<b>TABLE 3 , WATER POLLUTION CONTROL REGULATIONS STANDARDS (LIMITS) FOR EFFLUENTS AND WASTEWATER</b>	
Parameter	Standards (Unit)
Temperature	40° C
Color	20 (Hazen units)
Odor and Taste	Threshold odor number
Turbidity	15 NTU
Total Suspended Solids	100 mg/L
Settleable Matter	0.5 mg/L
Total Dissolved Solids	3000 mg/L
Conductivity	4300 US/cm
Total Coliform	25000/100 ml
Fecal Coliform	5000/100 ml
Algae	1000 cells/100 ml
pH	6.0 - 9.0
Dissolved Oxygen	5 mg/L
Chemical Oxygen Demand	90 mg (average)
Biochemical Oxygen Demand (BOD)	50 mg/L (Mean Value)
Nitrates	20 mg/L lakes 50 mg/L (watercourse)
Nitrite (NO <sub>2</sub> as nitrogen)	2.0 mg/L
Organic Nitrogen	5.0 mg/L (Mean)
Total Ammonia and Ammonium (NH <sub>3</sub> )	10 mg/L
Cyanides	0.2 mg/L
Total Phosphorous (PO <sub>4</sub> )	1.0 mg/L
Sulfates	1500 mg/L
Sulfite	1.0 mg/L
Sulfide	0.1 mg/L
Chlorides	8000 mg/L
Active Chloride	0.5 mg/L
Active Bromine (Br <sub>2</sub> )	0.1 mg/L
Fluorides	2.0 mg/L
Aluminium	2.5 mg/L
Antimony	0.5 mg/L
Arsenic	0.05 mg/L
Barium	0.5 mg/L
Beryllium salts	0.5 mg/L
Boron	0.5 mg/L
Cadmium	0.5 mg/L
Total Chromium	0.1 mg/L
Cobalt	1.0 mg/L
Copper	1.5 mg/L
Iron	2.0 mg/L

Parameter	Standards (Unit)
Lead	0.5 mg/L
Magnesium	500 mg/L
Manganese	1.0 mg/L
Mercury	0.002 mg/L
Molybdenum	5.0 mg/L
Nickel	0.5 mg/L
Selenium	0.02 mg/L
Silver	0.1 mg/L
Thallium	0.5 mg/L
Tin	2.0 mg/L
Vanadium	1.0 mg/L
Zinc	10.0 mg/L
Total hydrocarbons	10.0 mg/L
Oils (Mineral and Crude)	5.0 mg/L
Phenols	0.2 mg/L (steam dist) 0.05 mg/L (non-steam dist)
Fats and saponifiable oils	20.0 mg/L
Detergents	2.0 mg/L
Total Pesticides and PCB's	0.5 mg/L
Trihaloforms	0.5 mg/L
Radioactive materials	Not permitted
<b>NOTE</b> See original Water Pollution Control Regulations and third schedule for standard and test method details.	

## WASTE MANAGEMENT (LICENSING OF TRANSPORTERS OF WASTES AND WASTE DISPOSAL SITES) REGULATIONS OF 1993

These regulations are part of the Environmental Protection and Pollution Control Act of 1990. The regulations only address the handling of "solid waste" generated by commercial, municipal, and industrial sites (personal communication, Michael Sankwe/ECZ). The regulations do not apply to hazardous or toxic substances, generated at commercial, municipal, industrial or household sites. They also do not apply to residential domestic solid wastes of less than 45 kg (99 pounds) per week, or to the transport of inert (construction) debris.

Person(s) who transport solid wastes or own / operate solid waste disposal facility must have a license from the Environmental Council of Zambia (ECZ) and comply with all Waste Management Regulations

### Applicable Regulations

PH Associates will not be assessing any solid waste disposal sites, but will identify each of the assessed facilities method of solid waste disposal. The following regulations are applicable to the transporters of solid waste.

#### License to Transport Solid Waste

- All commercial, municipal, or industrial facilities must possess a license to transport solid wastes offsite.
- During loading and transport, wastes cannot be scattered, flowing out, or emitting bad smells.
- Vehicles must transport wastes along approved, scheduled routes.
- Transporter license may be valid from 6 months to 3 years depending on the transporters compliance with these regulations.

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## THE PESTICIDES AND TOXIC SUBSTANCES REGULATIONS OF 1994

This regulation is part of the Environmental Protection and Pollution Control Act of 1990 and applies to person(s) intending to manufacture, import, export, improve, or process a "new" pesticide or toxic substance. The regulation includes specifications on product handling, use, storage, disposal, labeling, packaging, and worker health and safety issues.

### Applicable Regulations

None. PH Associates will be assessing a pharmaceutical drug company that does not manufacture, import, export, improve, or process new pesticides or toxic substances.

## ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS OF 1994

These regulations are part of the Environmental Protection and Pollution Control Act of 1990. The regulations require that a project brief and environmental impact study be performed for any new project, extension, repair, or maintenance of an existing project. This is to determine whether a project may have adverse or other significant impacts on the environment. Some of the projects that may require an environmental impact study include transportation, dams, mines, forestry, agriculture, industrial facilities such as refineries, tanneries, mineral and lime processing, foundries, breweries, motor assemblers, food processing, electrical substations, gas or fuel storage, and solid or hazardous waste disposal site.

### Applicable Regulations

None. The environmental impact assessment regulations apply to new projects or existing projects where extension, repair, or maintenance occur. All facilities that PH Associates will assess are existing projects where there are no changes occurring, or operations which are closing down.

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**THE PETROLEUM ACT**  
**Chapter 424, Adopted 1930, numerous amendments up to 1969**

The Act regulates the importation, conveyance, and storage of petroleum and other inflammable oils and liquids. This includes all petroleum, coal, schist, shale or other bituminous by-products. The Act requires licensing to transport or possess dangerous petroleum (gasoline, diesel etc.) and other dangerous petroleum. Dangerous petroleum transported on a public road must be in suitable and secure vessels that are certified and licensed by the Road Traffic Commissioner.

Licenses are required for possession of dangerous petroleum (exceeding 44 gallons) stored in non-inflammable storage sheds. A 55 foot buffer zone should surround the shed, and no storage sheds must be spaced less than 3 feet apart. Petroleum tanks located outside of sheds must be fenced with a 50 foot buffer zone.

**Applicable Regulations**

None. The Petroleum Act deals mainly with safety requirements and does not address underground storage tank or environmental issues such as storage tank integrity, leaks, or proper abandonment of tanks. Therefore, the Act does not apply to air, soil, or water pollution issues.

76

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**THE PETROLEUM (EXPLORATION AND PRODUCTION) ACT  
No 13, Adopted 1985**

This Act regulates petroleum exploration, development, and production in Zambia. It establishes a Petroleum Committee that regulates titles, contracts, and the control of petroleum operations prior to the export or entry into a refinery.

**Applicable Regulations**

None. The Act does not apply to petroleum depots, refineries, or gas stations, which are the type of sites to be assessed by PH Associates.

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**THE AGRICULTURAL (FERTILIZERS AND FEED) ACT**  
**Chapter 351, Adopted 1990**

This Act regulates and controls the manufacture, processing, importation, and sale of agricultural fertilizers and farm feed. It also provides effectiveness and purity standards for fertilizers and feed.

**Applicable Regulations**

None. The Act does not address the usage or disposal of fertilizers and feed at agricultural and livestock farms and therefore does not apply to any of the assessed sites.

## THE MINING (DUMPS) REGULATIONS Chapter 329, Section 132, Adopted 1972

These regulations provide guidelines for the maintenance of mine dumpings (consisting of solid or liquid materials) such as proper water drainage and diversion, and generally keeping the dump site stable. A designated Chief Mining Inspector regulates changes relating to the design and nature of the mine dumpings and requires periodic reporting from the management.

### Applicable Regulations

The regulation does not address specific environmental issues on air, soil, and water pollution. There is one very general provision included in the regulation:

- Supervise/inspect site for the prevention of pollution of the surroundings or abatement of any nuisance.

**THE MINES AND MINERALS ACT**  
**Chapter 329, No 32 Adopted 1976**  
**Amendments in 1981, 1984, and 1992**

The Act determines the policy requirements for exploration, prospecting, and mining licenses and regulates the renewal and termination of mining rights. The amendments mainly deal with increased licensing, permit, and surveying fees. The Act requires proper sanitation and adequate water supply for workers, and many health and safety issues such as exposure and safe handling of inflammable, explosive, and radioactive materials.

### Applicable Regulations

Environmental issues relating to air, soil, and water pollution, generated by surface and underground mining operations are generally not addressed by the Act, with the exception of the following:

- Avoidance of wasteful mining practices or wasteful metallurgic practices.
- Any effluent water discharged from any treatment or other process at a mine must comply with the provisions of the Water Act.

Reference can be made to the Water Act for specifics relating to discharged wastewater. The Mines and Minerals Act does have some mine siting criteria and abandonment requirements. However, these requirements do not apply to the existing (active) mine site to be assessed by PH Associates.

## REFERENCES

### ENVIRONMENTAL COUNCIL OF ZAMBIA

Conditions Governing the License to Discharge Effluent and Wastewater, The Water Pollution Control (Effluent and Wastewater) Regulations, 1993

### GOVERNMENT OF ZAMBIA

Agriculture (Fertilizers and Feed) 1990, Chapter 351 of the Laws of Zambia

### GOVERNMENT OF ZAMBIA

Environmental Impact Assessment Regulations 1994, Environmental Protection and Pollution Control Act No 12 of 1990

### GOVERNMENT OF ZAMBIA

The Environmental Protection and Pollution Control Act, No 12 of 1990

### GOVERNMENT OF ZAMBIA

National Water Policy, 1994

### GOVERNMENT OF ZAMBIA

The Mines and Minerals Act, 1976, Chapter 329 of the Laws of Zambia

### GOVERNMENT OF ZAMBIA

The Mining (Dumps) Regulations, 1972, Chapter 329 of the Laws of Zambia, Section 132

### GOVERNMENT OF ZAMBIA

The Pesticides and Toxic Substances Regulations, 1994, Environmental Protection and Pollution Control Act No 12 of 1990

### GOVERNMENT OF ZAMBIA

The Petroleum (Exploration and Production) Act, 1985

### GOVERNMENT OF ZAMBIA

The Waste Management (Licensing of Transporters of Waste and Waste Disposal Sites) Regulations, 1993 - Statutory Instrument No 71 of 1993, The Environmental Protection and Pollution Control Act No 12 of 1990

### GOVERNMENT OF ZAMBIA

The Water Pollution Control (Effluent and Wastewater) Regulations, 1993 - Statutory Instrument No 72 of 1993, The Environmental Protection and Pollution Control Act No 12 of 1990

### REPUBLIC OF ZAMBIA

The Petroleum Act, 1930, Chapter 424 of the Laws of Zambia

### REPUBLIC OF ZAMBIA

The Water Act, 1949, Chapter 312 of the Laws of Zambia

### SANKWE M K

Environmental Council of Zambia, P O Box 35131, Lusaka, Zambia; telephone 224009; Personal Communication, May 19, 1995

**Appendix E**  
**ENVIRONMENTAL ASSESSMENT CHECKLIST**

CONFIDENTIAL

## ENVIRONMENTAL ASSESSMENT CHECKLIST

Facility ZAMBIA CONCRETE LTD.  
Location Plot 163A Kafue Industrial Area  
Date Assessed 5/8/95

Prepared for  
Zambia Privatisation Agency

## CONFIDENTIALITY STATEMENT

This is an internal document, prepared by PH Associates, Inc., for the use of USAID.

The information contained in this document is confidential and proprietary in nature, and is to be used in conjunction with other facts and data for the sole purpose of providing information concerning potential environmental liabilities.

### 1.0 GENERAL INFORMATION

1.1 Facility Name

1.2 Locations(s)

only location

1.3 Dates of Assessment(s) 5/8/95

1.4 Assessors J. Holloway

### 2.0 FACILITY PROFILE

2.1 Address Operations began: 1981

2.2 Telephone 311020

2.3 Telex / TWX / Fax 311288

2.4 Facility Manager / Assessment Contact Mr. Ziko/GM

2.5 Individuals consulted as part of this assessment, including their affiliation and titles

NAME (S)	TITLE (S)
B. Saka/og	Head of Production

2.6 Number of employees full time 160

Number of employees part time

2.7 Operational schedule (number of shifts / hours per day / days per week) ① 8 5

2.8 Total site area 41,000 m<sup>2</sup> Factory 72,000 m<sup>2</sup> Residential

2.9 Total number of buildings

ES

2.10 Facility inputs (raw materials, chemicals, fuels, lubricants, pesticides, etc)

Input	Quantity / Year
SAND	3,942 tonnes
STONE	6,366 "
CEMENT	2,938 tonnes
STEEL REINFORCEMENT	752 "
(Use to add Comix additive to sleepers & slabs H <sub>2</sub> O is used)	
(3 million l) of H <sub>2</sub> O / yr.	

2.11 Describe facility production processes of environmental consequence

Concrete mixed at Batching Plant then poured into molds

2.12 Facility products

Product	Quantity / Year
Bridge Beams	only by contract
Fencing Pole	"
Pre-stressed Concrete Sleepers	47,000 (2 meter length)
Curbings & Slabs	4,000 pieces
Blocks L x W x H	(25,000/month)
(6") 400mm 150 200mm	
(4") " 100 "	
(8") " 200 "	

2.13 What sources of energy are used at the facility? (Electric, oil, coal, wood, charcoal)

Boiler (1)

used for steam production in process

7.0

### 3.0 FACILITY HISTORY / LAND USE / PERMITS

3.1 Age of facility and date operations began *1981 production*

3.2 Land use prior to current enterprise  
*Undeveloped*

3.3 Is there a history of potentially hazardous solid waste or waste water? *NO*

3.4 Any accidents or spills that may have resulted in environmental contamination?  
*potential dry cement during transfer for petroleum*

3.5 Do any environmental permits exist, and if so, is the facility in compliance? *NO*

3.6 Review of the sites within one kilometer radius of the site and document other enterprises that may adversely affect the environment at the site through migration of contaminants or other mechanisms.

	Facility Name	Location	Problems identified
1.	Mitsubishi Chemicals	200m W	possible groundwater, soil, air emission
		W	" " " " "
3.	BATA Tannery	W	" " " " "
2.	ZESCO	W	" " " " "
4.	KAFUE Textiles	W	" " " " "

*↳ up road (W)*

3.7 Describe surrounding land use.

*Industrial*

3.8 Describe all operations and processes that are now closed down.

*None*

#### 4.0 MANAGEMENT / DOCUMENTATION OF POTENTIALLY HAZARDOUS MATERIALS

4.1 Are any potentially hazardous raw materials or products stored and/or used onsite?

Y      N      List

Substance	Quantity	Use	Lgth of Storage
<i>Petroleum</i>			

4.2 Have there ever been any incidents or accidents (spills, fires, injuries, etc) involving any of these materials?

Y      N      Describe  
*Various spills around site*

4.3 ~~Are incompatible materials segregated and labelled?~~

Y      N      Describe

4.4 Are pesticides stored or used onsite?

Y       N      List

4.5 Based on management knowledge, are there asbestos containing materials onsite?

(Y)

N

U

Describe

Roofing sheets, pipe insulation

4.6 Describe, in general, the level of environmental safety measures and practices at the site.

Not good

4.7 Review of records from the facility's Maintenance Department for documentation of releases of potentially hazardous materials.

None

4.8 Review of any additional information and documentation concerning areas of environmental concern.

None

### 5.0 AIR EMISSIONS

5.1 Total number of plant emission sources (stacks and vents) exhausting to the atmosphere.

Nine

5.2 Type of emission and discharge cycle from each source. None

Source	Emission	Cycle (continuous, batch)

5.3 Is there an air emission monitoring program? NA

Y

N

Describe

5.4 Is there another source of air pollution nearby?

Y N Distance 5 Km (W) Describe Nitrogen chemicals

5.5 Describe emissions in detail if applicable.

6.0 WATER / WASTEWATER DISCHARGES

6.1 Describe all sources and volumes of wastewater / effluent. List composition of wastewater.

Source	Volume	Composition
Sanitary Process	?	sewage
	500,000 l	pH elevated H <sub>2</sub> O

6.2 Do chemical quality data exist for these sources? If yes, attach the results or describe the data.

Y N

6.3 Does wastewater collection system combine different sources? (process + laboratory + non-contact cooling + sanitary + storm)? Where does this effluent discharge?

Y N Describe separate

6.4 Is wastewater treated? If yes, describe the process:

Y N Describe onsite → offsite to Council Sewer

3.5 Does the facility have a pretreatment plant?

Y  N Describe type of pretreatment

3.6 Has wastewater ever been discharged to onsite lagoons, leach (soak away) fields, septic systems, spray irrigation, or other system?

Y  N Describe

6.7 Is the wastewater treated by the City Council and does this facility have limitations on quantity or quality of effluent that it will accept?

Y  N Describe

*Council treated  
ZCL has no permits for discharge*

6.8 Do any wastewater / effluent permits exist?

Y  N Describe

6.9 Has the facility ever been inspected by permitting authorities?

Y  N Describe

*Factory inspector for boiler*

6.10 Are there restroom facilities onsite and if so, do they discharge to a septic field or other system. What type of system?

Y  N Describe

*Council*

6.11 Have any of these systems ever been cleaned or filled?

Y  N Describe frequency of clean / fill

*NA*

## 7.0 WASTE HANDLING, STORAGE, TRANSPORTATION, AND DISPOSAL

7.1 List the facility solid wastes that are not known to be potentially hazardous (trash, scrap metal, palletes, etc)

Waste Type	Amount Generated
Waste concrete	
Concrete Blocks (Broken)	30% of total production
Office Waste (burned)	1000 kg/yr
Waste oils	?

7.2 Where are the non-hazardous wastes stored and disposed of?

trash burned on-site  
 concrete sold to local contractors  
 waste oils recycled or burned

7.3 Does the facility currently generate, store and / or dispose of potentially hazardous wastes?

Y       N  
 petrol

7.4 In the past, has the facility ever generated, stored or disposed of any potentially hazardous wastes? (Include onsite lagoons, landfills, incinerators or treatment systems.)

Y       N      Unknown

7.5 With regard to 7.4 above, inventory of facility wastes (now or in the past) that are potentially hazardous.

Waste Type / Storage	Amount Generated
Lubricants	
Oils (transformer, hydraulic)	
Solvents, degreasers	
Pesticides / Herbicides	
Paints, thinners	
Organic Fertilizers / Feeds	
Process wastes (sludges, plating wastes, still bottoms, etc)	
Other waste storage or disposal	

7.6 Does the facility treat, or has it ever treated, potentially hazardous waste on site?

Y

N

Describe

7.7 Is the facility licensed to treat these wastes?

Y

N

Describe license

7.8 Is there any waste analysis plan in effect, including sampling / analyses prior to treatment, storage and / or disposal?

Y

N

Describe

7.9 Are potentially hazardous wastes shipped offsite?

Y

N

Identify shipper and destination of wastes

7.10 Are any waste materials recycled or reused onsite?

Y

N

List wastes and recycling processes

See 7.2

24

## 8.0 STORAGE TANKS

### 8.1 Inventory of storage tanks (aboveground and underground)

Tank ID	Tank Size (m <sup>3</sup> )	Tank Material	Material Stored	Tank Age
1	3,500 l	Steel	Diesel	installed 1980
2	3,500 l	"	Petrol	"

### 8.2 Are leak detection systems or groundwater monitoring systems employed?

Y       N      Describe  
 Dip stick

### 8.3 Do the tanks meet any design requirements?

Y       N      Describe

### 8.4 Have any tanks been pulled or abandoned?

Y       N      Describe

## 9.0 POLYCHLORINATED BIPHENYLS

### 9.1 Have transformers ever been used onsite?

Y       N      Describe

### 9.2 Have hydraulic or heat transfer oils ever been used on site?

Y       N      Describe  
UNKNOWN

26

9.3 Has any transformer, hydraulic, or heat transfer oil ever leaked or been spilled?

Y  N Describe

9.4 Has a survey ever been made to determine the presence or absence of PCB or PCB-contaminated oil in any operating or scrap units?

Y  N Describe

Unknown

### 10.0 RADIOACTIVE MATERIALS

10.1 Are any wastes generated onsite which contain radioactive materials?

Y  N Describe

10.2 Are radioactive materials disposed of onsite or offsite?

Y  N Describe disposal methods, containment etc

### 11.0 NOISE

11.1 Does the facility generate high levels of noise?

Y  N Describe *vibrators (give earplugs to workers)*

11.2 Have there been any complaints regarding noise from neighbours?

Y  N Describe

UNKNOWN

### 12.0 EMERGENCY PLANS

12.1 Does the facility have an Emergency Plan covering environmental emergencies and involving local authorities?

Y  N Describe

12.2 Does the facility have an emergency response team?

Y  N Describe

### 13.0 ENVIRONMENTAL SETTING

13.1 Describe topography (flat terrain, valley, vegetation).

*generally flat w/ slight slope towards south - southwest*

13.2 Soils / geology

13.2.1 Have soil borings and sampling activities ever been conducted? If yes, how many and describe:

Y  N Unknown

13.2.2 Is there any observed soil contamination at the site?

Y N Unknown

*petroleum spills many places  
Cement spill at Refining Plant*

13.3 Groundwater / hydrogeology

13.3.1 Depth to groundwater *30m ?*

13.3.2 Is there evidence that groundwater is affected by pollution? *Unknown*

13.3.3 Location of all operating and abandoned onsite wells (provide map if possible).

*1 borehole*

13.3.4 Well / borehole information (a) operating and abandoned wells / boreholes).

Well	Date Installed	Diameter	Depth	Pump rate	Yield per day (l) yr.
B1	1987		50m		200,000 ?
Council Water					2,500,000 ?

13.3.5 Have any groundwater samples ever been taken and analyzed?

Y  N  U  If yes, provide most recent results  
 use borehole for drinking

13.3.6 Have any groundwater studies been carried out? (ie pumping tests etc)

Y  N  U  Are they available?

13.4 Site drainage and surface water

13.4.1 Are there any surface water bodies known to be contaminated by any source in this area?

Y  N  Describe Kafue River

13.4.2 How is rain / storm water collected, where does it flow, and is there flooding during the rainy season?

rainwater runoff flows overground into Batching Plant area from paved areas on site

13.4.3 Any potential for adverse impacts to stormwater runoff due to operations or waste management practices at the facility?

May contain petroleum, infiltrates through cement grill; elevated pH

13.4.4 Is there potential for rain to fall directly onto chemicals or other materials that might have an effect on soils or groundwater?

No

# 14.0 SUMMARY OF ATTACHMENTS REQUESTED

## Check items received

Site maps of the facility identifying buildings, structures, and drainage details for inclusion in our report

Y                       N

Aerial photographs

Y                       N

Process flow diagrams for each process at the facility

Y                       N

Materials/Chemical inventory listing including quantities stored onsite, onsite use, and monthly usage and disposal rate

Y                       N

Copies of all environmental permits (discharge, etc.)

Y                       N

Data concerning any releases or spills of materials/chemicals at the facility

Y                       N

Address and type of industry listing of enterprises neighboring your facilities

Y                       N

Copy of laboratory analyses of process waste streams (liquid and solid)

Y                       N

Underground storage tanks; construction details, number, capacities, and use

Y                       N

Any information about the geologic and groundwater conditions at the facilities (i.e. soil types, depth to groundwater, onsite wells including depth, production, construction details, and groundwater laboratory analyses, etc.)

Y                       N

## 15.0 ADDITIONAL COMMENTS AND SKETCH OF SITE

**Appendix F**  
**FACILITY RECORDS**

4th December, 1984

The General Manager,  
Zambia Concrete Limited,  
P.O. Box 346,  
KAFUE.

Dear Sir,

NOISE LEVELS

Tests taken by sound level meter at your premises on Thursday 29th November, 1984, indicate that many workers are subjected to noise levels in excess of the Internationally agreed level of 90 Decibels.

Workmen in the casting section are subject to a level of between 94 to 98 decibels, this is at its peak when the vibrator is started on an almost empty mould. It is also intensified by the noise of the truck carrying the mixture.

At this level a worker wearing no ear protection should only be exposed to it for two hours per day, whilst wearing ear muffs properly fitted this level would be reduced by as much as 24 decibels and this would be satisfactory.

In the latching plant a steady level of 96 was recorded, once again this operator should wear protection whilst the machine is in operation.

The laboratory "vibrating table" registered 105 decibels at this level, the attendant must wear protection even though the machine only runs for short spells.

Some Points on Noise:

Although as stated previously, the agreed level is 90 decibels, it is still not known at what level each individual persons hearing can stand. It is also not certain how much damage or impairment would be caused over a long period.

It is known that continued working where the levels are like the ones registered in your premises, can result in drowsiness and loss of concentration after four or five hours, this in turn would lead to lower production.

A first indication of impairment would probably be a "ringing" in the ears and abnormal vocal level, this may lead to short term deafness in one or both ears.

102

Recommendation:

Of the two types of protection available (ear plugs or ear muffs), the ear muffs which you have in stock are made to specification and should be suitable. Some modification should be made to the dump truck to decrease exhaust noise and gases.

Some hearing tests should be arranged by the company Doctor on a yearly basis.

Finally although it is the duty of management to supply ear protection, existing law does not allow me to enforce the workers to use them, this could only be done through the use of the Collective Agreement between Management and Unions.

I trust we have been of some service to you, should you have any further queries or would like me to meet with workers representatives, please contact me.

Yours faithfully,

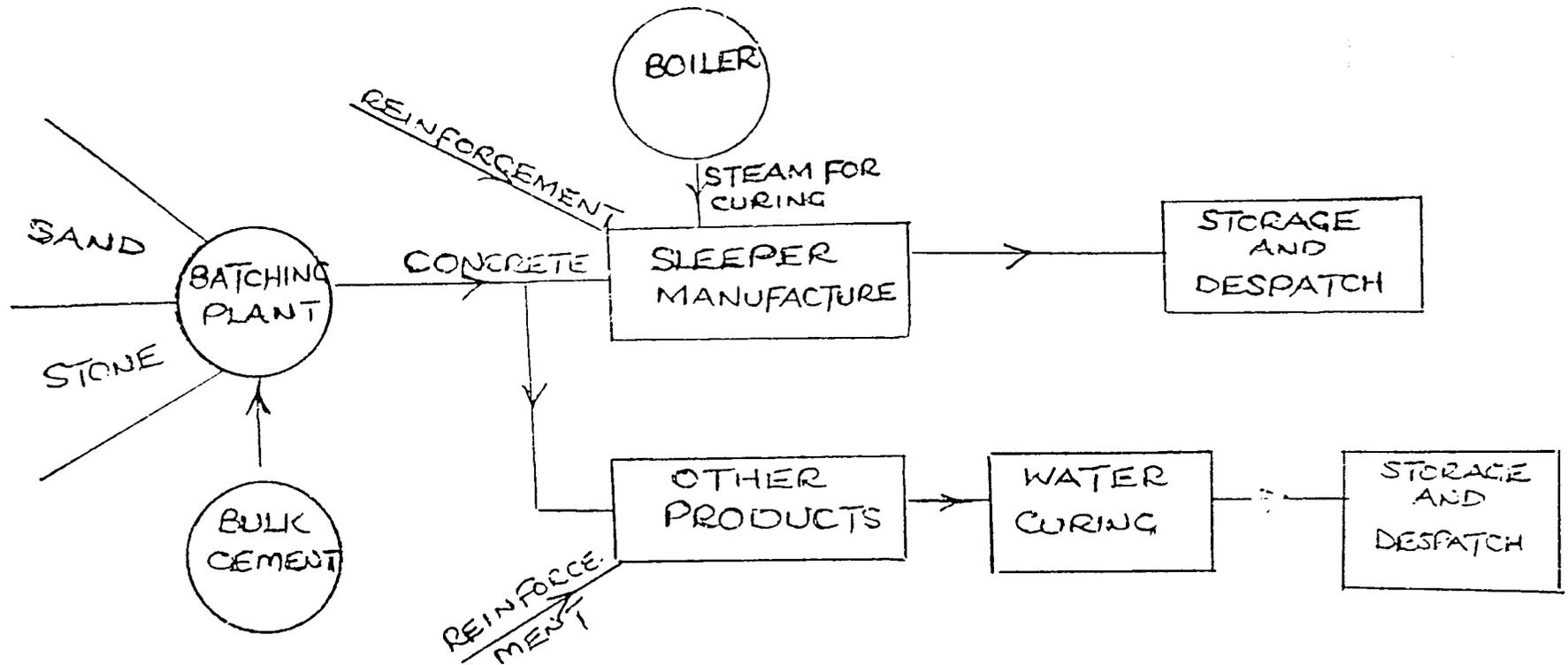
  
Milton J. White

MANAGER PERSONNEL ADMINISTRATION

c.c. Mr. M.M. Mulumula,  
Manager and Personnel  
Administration,  
Lambia Concrete Limited,  
P.O. Box 346,  
KAMPUR.

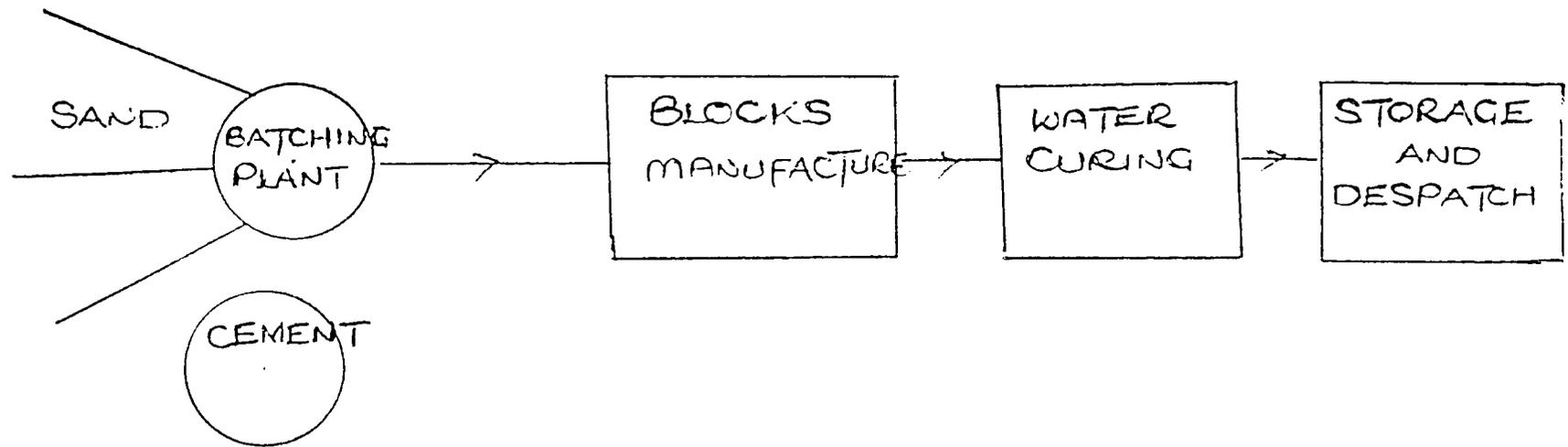
**Appendix G**  
**PROCESS FLOW DIAGRAMS**

# CONCRETE PRODUCTS



## TYPES OF WASTE AND DISPOSAL

- 1) LIQUID WASTE - COUNCIL STORM DRAINS
- 2) SOLID WASTE - DRIED AND GIVEN OUT TO BUILDERS AS CONCRETE RAW MATERIAL OR FOR EARTH FILLING
- 3) STEEL - OFF CUTS FROM SIEVED MANUFACTURE USED AND OTHER PRODUCTS



### TYPES OF WASTE AND DISPOSAL

- 1) LIQUID WASTE - COUNCIL STORM DRAINS
- 2) SOLID WASTE - DRIED AND GIVEN OUT AS EARTH FILL MATERIAL

1/1/21