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ENVIRONMENTAL ASSESSMENT REPORT

Mulungushi Investments Limited (MIL)
Engineering and Tooling Facility
Natwange Road
Kitwe, Zambia

Date Assessed : May 10, 1995

Prepared for the
ZAMBIA PRIVATISATION AGENCY

Prepared by
P H ASSOCIATES, INC.

July 26, 1995

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1. INTRODUCTION

An environmental assessment was conducted by PH Associates, Inc. of Mulungushi Investments Limited (MIL) Engineering and Tooling Facility, Kitwe, 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. The ZPA questionnaire was returned 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 and is attached in Appendix B.

MIL Engineering and Tooling is located at the north corner of Plot 3624 Natwange Road in Kitwe, Zambia (Section 7, Figures 1 and 2). The site is situated in the heavy industrial area and immediately surrounded by Chloride (battery manufacturer), Pigott Maskew (rubberizing plant), and African Wire Ropes (cable manufacturer).

The factory produces carbide (high carbon) drill steel for Zambia Consolidated Copper Mines (ZCCM). The drill steel is manufactured onsite by induction heating and brazing carbide steel rods and heads. The hexagonal carbide steel rods are imported from Europe. The facility produced nickel drill bits for ZCCM from 1983 to 1993.

The MIL property on Natwange Road also comprises buildings for MIL Sawmilling and Joinery operations, and MIL Construction offices (Section 7, Figure 2). The entire property was initially owned and managed by Mining Timber Company in the 1950s, until Circuit Construction took over operations in the 1970s. MIL purchased the property in 1982. Mining Timber and Circuit Construction were sawmilling, joinery, and wood

treatment manufacturers for ZCCM. The MIL Engineering and Tooling factory initially commenced operations in 1983.

MIL Sawmilling and Joinery and Construction offices are assessed by PH Associates in a separate report. The MIL Construction offices oversee operations at the Sand and Crusher Plants and perform general construction management, cost estimating, accounting, surveying, and procurement of construction equipment and materials for various construction sites. The MIL Sand and Crusher Plants are also assessed by PH Associates in separate reports.

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 28, 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

There were no available ministry records for MIL Engineering and Tooling.

4.2 Aerial Photographs

There were no available aerial photographs of the MIL Engineering and Tooling site.

4.3 Facility History and Records

On May 10, 1995, Ms D Himes of PH Associates interviewed Mr Limbumbu Kahim, Works Engineer for the MIL Engineering and Tooling facility. The purpose of the interview was to obtain information on the site history, facility layout, products, services and available facility records. The Facility Site Plan provided in Section 7, Figure 2, shows the location of the Engineering and Tooling factory in relation to the other MIL buildings and structures. A Factory Layout Plan of the Engineering and Tooling building was drafted by PH Associates and is shown in Section 7, Figure 3.

The site was barren land until the Mining Timber Company constructed a sawmilling, joinery, and wood treatment facility sometime in the 1950s (exact year unknown). Circuit Construction bought the facility in the 1970s. According to Mr Kahim, the Engineering and Tooling building was probably used by Mining Timber and Circuit Construction to store wood products for retail to ZCCM. MIL purchased the site in 1982, took over sawmilling operations, and in 1983 converted the north corner building (an area of 1,004 square meters) into the MIL Engineering and Tooling factory (Section 8, Photograph 1).

4.4 Site Activities and Processes

The MIL Engineering and Tooling factory produces carbide drill steel (sizes 1, 2, and 3) for ZCCM drilling activities. Between 1983 and 1993, the facility produced nickel drill bits for ZCCM (Section 8, Photograph 2).

The carbide (high carbon) steel is initially imported from Europe in the form of hexagonal cold rolled steel rods measuring 1.5 meters in length, and 25 millimeters diameter. The carbide steel rods are then modified using taper and integral processes to form the final drill steel product. The tapering process cuts the steel rod to the desired length and alters or tapers the end. The integral process produces a variety of forged heads that attach to the end of the tapered steel rod. Two process flow diagrams for the taper and integral processes are attached in Appendix C. According to Mr Kahim, the facility manufactures approximately 10 tons of carbide drill steel per month.

Both the taper and integral processes involve more than 36 different types of machines as listed in Appendix F. The drill steel is basically manufactured using induction heating and brazing (Section 8, Photograph 3). The machinery is cooled using either recirculated water

or coolant oil (Section 8, Photograph 4). At various stages the steel rods are cleaned by submersing them into a 1.5 meter deep solvent degreaser pit filled with perchloroethylene (PCE) or trichloroethylene (TCE). There is a vehicle and machinery maintenance area located next to the Engineering and Tooling factory.

4.5 Environmental Setting

The environmental setting of the MIL Engineering and Tooling facility including topography, geology, and hydrogeology is summarized below.

4.5.1 Topography

The MIL Engineering and Tooling facility is situated in Kitwe. The topography generally consists of gently sloping terrain with numerous natural and manmade drainages. The MIL facility is located on relatively flat terrain at an approximate elevation of 1,220 meters above mean sea level.

Manmade drainage ditches surround the north and east sides of the MIL property. There is an approximate 5 meter drop in elevation from the south to the north end of the property. Based on the topography, surface water at the MIL site flows north into partially lined drainage ditches eventually discharging into the Mindola River. The area immediately surrounding the Engineering and Tooling building is unpaved, allowing for downward infiltration of surface water.

The Mindola River is located about 500 meters north of the site and is a main tributary of the Kafue River. The Mindola River enters the Kafue River approximately 5 kilometers northeast of the MIL site. The Kafue River is the major river drainage basin for the Copperbelt region. Major towns are located along the course of the Kafue River making it the most utilized and important river basin in Zambia (GOZ, 1994). The Kafue River generally flows to the south and discharges into the Zambezi River.

4.5.2 Geology

The surficial geology of the MIL site consists of varying thickness of laterite soil underlain by Precambrian bedrock. Laterite or residual soils are typically reddish in color and develop on the upper portion of bedrock through weathering and leaching processes. The vertical and lateral extent of these soils is unknown.

The bedrock is highly deformed and consist predominately of undifferentiated Pre-Katanga Basement Complex schists (ZGSD, 1981). This bedrock was structuraly deformed into the northwest-trending Kafue Anticline (open-ended dome) during the Katanga Orogeny (uplift) approximately 460 million years ago (ZGSD, 1972). The site is also located at or near the contact of the main copper and cobalt-bearing lower Roan conglomerates, quartzites, shales, and limestone's (ZGSD, 1981).

4.5.3 Hydrogeology

There is one borehole (well) located on the west side of the MIL property (Section 7, Figure 2). According to MIL, the borehole was installed in 1993 and groundwater was encountered at approximately 20 meters below the ground surface. No other borehole data was available. A water pump was never installed with the result that the borehole has never been used. No specific hydrogeologic reports for the Kitwe area were available for review by PH Associates.

The vertical migration of surface water is the major contributor to groundwater basins. The laterite soils that immediately underlay the MIL facility, developed on leached bedrock and are permeable depending on the clay content and stratigraphic horizons. Schists, the general rock type located beneath the laterite soils, tend to produce good to fair groundwater aquifers (NRGS, 1963). This aquifer is located within the Kafue groundwater drainage basin (GOZ, 1994).

4.6 Field Reconnaissance Results

On May 10, 1995, a tour of the MIL Engineering and Tooling facility with PH Associates was conducted by Mr Kahim, MIL Works Engineer. The results of the field reconnaissance and discussions about the Engineering and Tooling operations are presented in this section.

4.6.1 Utilities

The following is a summary of the utilities that service the MIL Engineering and Tooling site as reported by Mr Kahim. No electrical, water or sewer line layout plans for the Engineering and Tooling building were provided to PH Associates.

4.6.1.1 Electricity

Zambia Electricity Supply Corporation Limited (ZESCO) provides electricity to the facility. There is an electrical transformer substation owned by ZESCO located in a secured building adjacent to the Engineering and Tooling factory (Section 8, Photograph 5). PH Associates was unable to gain access into the locked transformer building.

4.6.1.2 Water Supply

The MIL facility water supply is obtained from the Urban District Council of Kitwe (Council). There is one borehole (well) located on the west side of the MIL property. According to MIL, the borehole was installed in 1993 due to the erratic supply of Council water.

Groundwater was encountered at approximately 20 meters below the ground surface, but since MIL never installed a pump, the borehole has never been used.

4.6.1.3 Sanitary Sewer

MIL management was uncertain whether sanitary wastes generated onsite discharged to the Council sewer system or onsite septic tanks and soakaways. The bathrooms throughout the entire MIL property have not worked for a very long time, and workers have to relieve themselves either onsite or offsite allowing for unsanitary conditions and the spreading of human wastes.

A Council sewer line is indicated on the MIL Facility Site Plan (Section 7, Figure 2). No septic tanks or soakaways were identified by PH Associates during the site visit.

4.6.1.4 Stormwater Control

The factory is enclosed inside a building that has concrete floors. The area outside the building is unpaved. A partially lined stormwater drain is located along the southwest side of the Engineering and Tooling building (Section 7, Figure 3). Stormwater at the MIL facility flows north into large partially lined ditches that surround the north end of the MIL property and eventually discharges northwest into Mindola river. Stormwater and wastewater in the unpaved areas infiltrate downwards into the subsurface soil.

4.6.2 Structures

The MIL Engineering and Tooling building has a concrete floor, brick walls, and metal sheet roofing. According to Mr Kahim, asbestos is not used onsite. The various rooms and work areas in the MIL Engineering and Tooling building are shown in the Factory Layout Plan (Section 7, Figure 3) and include:

- Upper floor management offices
- Degreaser pit (1.5 meters deep)
- One aboveground water tank for recycled water cooling system
- Storage and compressor rooms
- Vehicle maintenance area with service pit

4.6.3 Environmental Effects and Observations

Observations made during the field reconnaissance on May 10, 1995 and any potential environmental effects are discussed in the following sections.

4.6.3.1 Chemicals, Petroleum, and Process Materials

Details concerning the specific type and quantities of chemicals, petroleum, and process materials used onsite were provided to PH Associates. According to Mr Kahim, in 1994 the facility used the following quantities of chemicals, fuels, and lubricants during production activities:

- 420 liters of PCE or TCE (degreasing solvent)
- 421 liters of Teepol (detergent)
- 114 liters of methylated spirit (flax melting agent)
- 105 liters of paint thinners
- 152 liters of coolant oil
- 100 liters of engine oil
- 20 liters of transformer oil

Mr Kahim was uncertain if the transformer oil used in some of the machinery contains PCBs. These products and other supplies (including the carbide steel rods and vermiculite, a metal softening agent) are used at the factory and stored in the vehicle maintenance area, store room, and next to the spent oils drum (Section 7, Figure 3). Carbide steel consists

mostly of iron with some nickel, chromium, molybdenum, manganese, carbon, and silica.

4.6.3.2 Process Waste Streams

Trash generated by the Engineering and Tooling factory includes paper, metal, and oil and solvent containers. No trash is trucked offsite by the Council or MIL. The paper and swarf (scrap metal) are placed outside at the front of the building in recycling bins (Section 8, Photograph 6).

According to MIL, the swarf is periodically picked up by a company that uses scrap metal to produce metal balls for rock crushing machines. The large (210 liter) oil and solvent drums are recycled by local people. MIL was unclear on what happens to the oil containers (coolant and transformer oils). PH Associates observed during the site visit that some wastes are discarded on the ground onsite and burned at various locations on the MIL property.

Spent waste oils are placed in half of a 210 liter drum and reused for various purposes (Section 8, Photograph 7). All of the machines have lubricating parts that require periodic maintenance. Much of the factory floor is stained with spilled oils. PCBs may be present in the machinery transformer oils used onsite.

The degreaser pit was constructed in the floor of the building in 1983 (Section 7, Figure 3), is concrete lined and approximately 1.5 meters deep. According to Mr Kahim, the degreaser pit has never been emptied or cleaned out so the actual condition of the pit is unknown. The pit is filled with either PCE or TCE, strong degreasing solvents, that may potentially dissolve the aging (12 years old) concrete or seep down through cracks into the underlying soil. As the PCE or TCE solvent is used and evaporated it is continually refilled up to the 1.5 meter line. Mr Kahim stated that no changes in the solvent loss rate has been noticed, thus suggesting no leaks have occurred.

There is a vehicle and machinery maintenance area located next to the Engineering and Tooling factory. Spilled oils and petroleum products were observed on the concrete floor inside the maintenance area. The concrete lined vehicle maintenance pit was observed to have oily fluids in the bottom.

Some of the machines, particularly the forging machines, are cooled with recirculated water. The cooling system pumps water from a holding basin through pipes attached to the machines, circulating back to an aboveground water tank. The wastewater from the tank then flows by gravity through a series of corrugated metal sheets which cools the water. The cooled water spills back into a concrete lined holding basin where the process begins again (Section 8, Photographs 8 and 9). Recirculated water heated up during contact with machinery and carbide steel may pick up metals and grease during the process.

The water tank and corrugated metal cooling sheets are located east outside the Engineering and Tooling building (Section 7, Figure 3). Some of the recirculated wastewater splashes and spills over the holding

basin onto the concrete floor and adjacent ground potentially contaminating soil (Section 8, Photograph 10).

Wastewater from a facility sink located in the south end of the building flows directly outside into a partially lined drainage ditch along the southwest side of the Engineering and Tooling building (Section 7, Figure 3). The sink has a water tap that is used with Teepol detergent for washing greasy hands, machinery parts, and other factory maintenance tools. Oily wastewater was observed in the outside drainage ditch during the site visit (Section 8, Photograph 11). The drainage ditch connects to the larger drainage system which surrounds the northern part of the MIL facility. The larger drainage system and its connector drains eventually discharge into the Mindola River.

The MIL bathroom facilities have not functioned for a very long time, resulting in unsanitary conditions existing at the site. Human wastes were observed on the ground at the side of an MIL building during the site visit.

4.6.3.3 Air Emissions

Minor air emissions are generated by the MIL Engineering and Tooling factory from the use of PCE or TCE degreasing solvents. However, the degreaser pit has a cover to minimize emissions and evaporation loss of the solvent.

4.6.3.4 Pesticide/Herbicide Use

According to Mr Kahim, small quantities of pesticides are used several times a year inside the facility to kill cockroaches and rodents. Several cans of pesticides are purchased from a local store each time they spray. It is uncertain how MIL disposes of these used containers.

4.6.3.5 Underground/Aboveground Storage Tanks

There are no underground fuel storage tanks (USTs) located at the MIL Engineering and Tooling building. One aboveground water tank used for the recycled water cooling system is located on the east side of the Engineering and Tooling building (Section 7, Figure 3).

4.6.3.6 Releases/Spill Controls

Oily spills from machinery maintenance was observed throughout the factory and maintenance areas. These spills occur on the concrete floor. The wastewater cooling system on the east side of the building overflows the holding basin and partly spills onto the ground. This wastewater potentially contains various metals and grease from contact with the carbide steel and machinery. The facility sink disposes of oily wastewater into the drainage ditch located along the west side of the building and into larger drains that eventually flow into Mindola River.

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 oil products, metals, PCE, TCE, paint thinners, and PCBs may potentially contain specific constituents at levels that could be identified as hazardous and regulated once guidelines are enacted. Applying regulations adopted by the United States Environmental Protection Agency these constituents potentially pose a threat to human health and the environment, based on ignitability, toxicity and human carcinogenic risk potential (Cal EPA, 1992).

PCE and TCE are extremely hazardous chemicals that are also considered toxic air pollutants (Cal EPA, 1992).

4.6.3.8 Waste Disposal

The environmental impacts for the process waste streams discussed in Section 4.6.3.2 include metals, PCE and TCE, paint thinners, leaded fuel, coolant and transformer oils, other petroleum-based products, and possibly PCBs potentially contaminating the soil, surface water, and groundwater. Unsanitary conditions onsite (no working bathrooms or sewage system) promote spread of infectious diseases by potentially adversely affecting the surface water and groundwater quality.

4.7 Applicable Environmental Regulations

A summary of the applicable environmental regulations for Zambia is presented in Table 2 of Appendix D. Based on a review of these regulations and information obtained during the site interview, the MIL Engineering and Tooling facility is:

- illegally discharging wastewater offsite
- illegally dumping and burning trash onsite

Based on the Water Pollution Control (Effluent and Wastewater) Regulations of 1993, all commercial, municipal, and industrial facilities that discharge wastewater that may pollute the environment, must possess a license from the Environmental Council of Zambia (ECZ). The conditions of the license include discharge record keeping, weekly sampling and testing of wastewater, and submission of a bi-annual report to ECZ. The discharged wastewater must meet the standards (limits) for parameters listed in Table 3 of Appendix D. In addition, the discharger has 12 hours to report any abnormal wastewater discharges (above limits) to ECZ.

The Environmental Protection and Pollution Control Act (EPPCA) of 1990 states that it is illegal to dump wastes anywhere but at a licensed disposal facility. Contrary to the EPPCA, MIL disposes of some trash onsite. The facility is likely unaware of these regulations due to the lack of enforcement by local authorities.

5. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are presented addressing areas of environmental concerns at the MIL Engineering and Tooling facility based on the findings of the environmental assessment.

- The facility has an aging (12 year old) degreasing pit that is concrete lined and 1.5 meters deep. The degreasing pit is filled with extremely toxic PCE or TCE solvents that may potentially leak into the subsurface soil and groundwater by dissolving the concrete or seeping down through cracks.
- MIL recycles most of their wastes but illegally dumps and burns some wastes onsite. Site trash including paper, metal, and other wastes are discarded on the ground and some burned. These conditions may potentially adversely affect soil, surface water, and groundwater quality in the area.
- Wastewater spilled on the ground at the machinery water cooling system may contain various metals and oils potentially adversely affecting soil, surface water, and groundwater quality.
- Oily wastewater from the facility sink flows directly into a drainage ditch that eventually flows offsite into Mindola River potentially adversely impacting the river water quality.
- Oils have been spilled throughout the factory, maintenance area, vehicle maintenance pit, and in the vicinity of the spent waste oil drums. These spills occur on concrete but eventually seep through cracks potentially impacting the environment.
- No bathroom facilities are working onsite promoting the spread of infectious diseases by potentially impacting the quality of the surface water and groundwater.
- One onsite borehole (well) that has never been used, is located downgradient next to the grease interceptor and vehicle maintenance disposal areas potentially impacting the quality of the groundwater and borehole water.
- Asbestos is not used at the facility.
- Transformer oils used in the facility machinery may potentially contain polychlorinated biphenyls (PCBs). No testing for PCBs has been performed.
- MIL Engineering and Tooling lacks an environmental and procedures plan detailing storage, handling, cleanup, and disposal procedures for the facility, especially for wastewater disposal, maintenance of trash, and sanitary waste disposal.
- Based on the field reconnaissance of the area surrounding the MIL Engineering and Tooling site, neighboring facilities may potentially adversely affect the environmental conditions at the site and adjacent Mindola River with chemicals from the manufacturing of batteries, rubber, and cable wire.

PH Associates recommends that

- MIL investigate soil and groundwater quality at the aging PCE and TCE degreaser pit. The investigation should include collecting soil and groundwater samples, beneath the degreaser pit, to assess the level of possible adverse effects. If soil has been impacted, it should be removed and disposed of at an appropriate disposal facility.
- MIL replace the degreaser pit with a new tank that has an adequate monitoring and leak detection program such as secondary containment to prevent adverse effects from possible future releases.

- MIL stop illegally dumping and burning wastes onsite and have the Council remove and dispose of non-recycled wastes at an appropriate disposal facility.
- MIL analyze the wastewater in the drainage ditch and recycled water cooling system for total petroleum, volatile organics (including benzene) and inorganics (metals), to determine if these wastewater streams are adversely impacting soil, groundwater, and river water quality (Mindola River).
- MIL contact the Environmental Council of Zambia to determine their regulatory responsibilities for discharging wastewater offsite.
- MIL provide adequate sanitary facilities for workers.
- MIL analyze the water from the onsite borehole to see if the potential upgradient grease interceptor and maintenance wastewater have impacted the groundwater (and borehole water) quality at the site.
- MIL obtain information from the transformer oil product manufacturer to determine if it contains polychlorinated biphenyls (PCBs). If PCBs are found, MIL should find an alternative brand of transformer oil that does not contain PCBs.
- MIL develop and implement an environmental safety and procedures plan detailing storage, handling, monitoring, cleanup, and disposal procedures for the facility to minimize potential adverse effects to the environment in the future.
- MIL maintain inventory and waste disposal records specifically listing the types and quantities of chemicals, fuels, oils, and other materials brought onsite, and 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

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GOVERNMENT OF ZAMBIA

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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

GOVERNMENT OF ZAMBIA

National Water Policy, 1994, Department of Energy and Water Development

KAIHIM, L

MIL Engineering and Tooling, Works Engineer, Personal Interview, May 10, 1995

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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

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Outline of the Geology of Zambia, 1972, Occasional Paper No 50. Drysdall A R, Johnson R L, Moore T A, and Thieme J G

ZAMBIA GEOLOGIC SURVEY DEPARTMENT

Geologic Map of NE Quadrant of Zambia, 1981. Scale 1:1,000,000

7. FIGURES

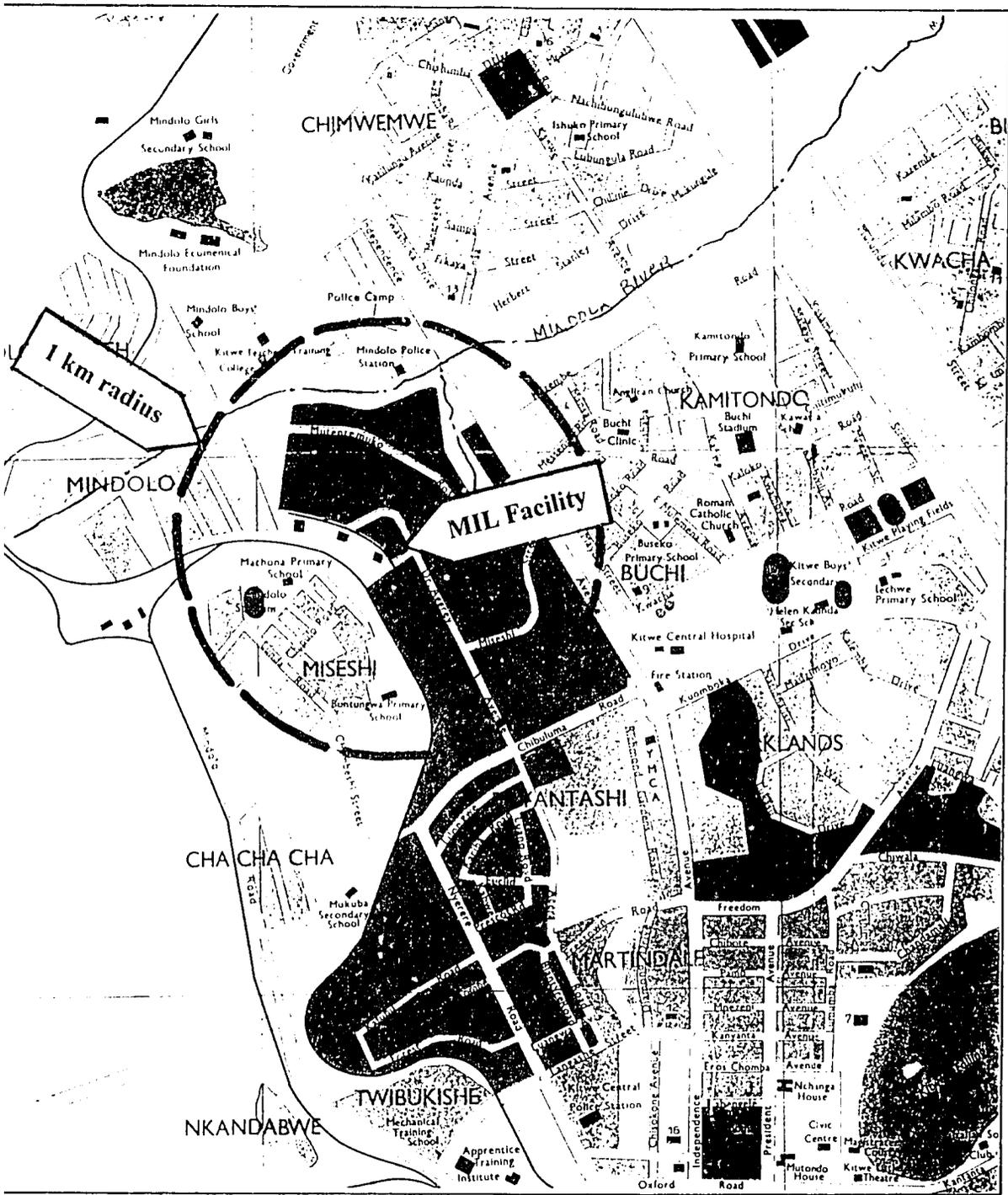
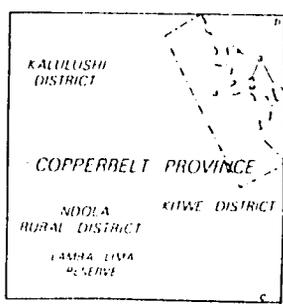
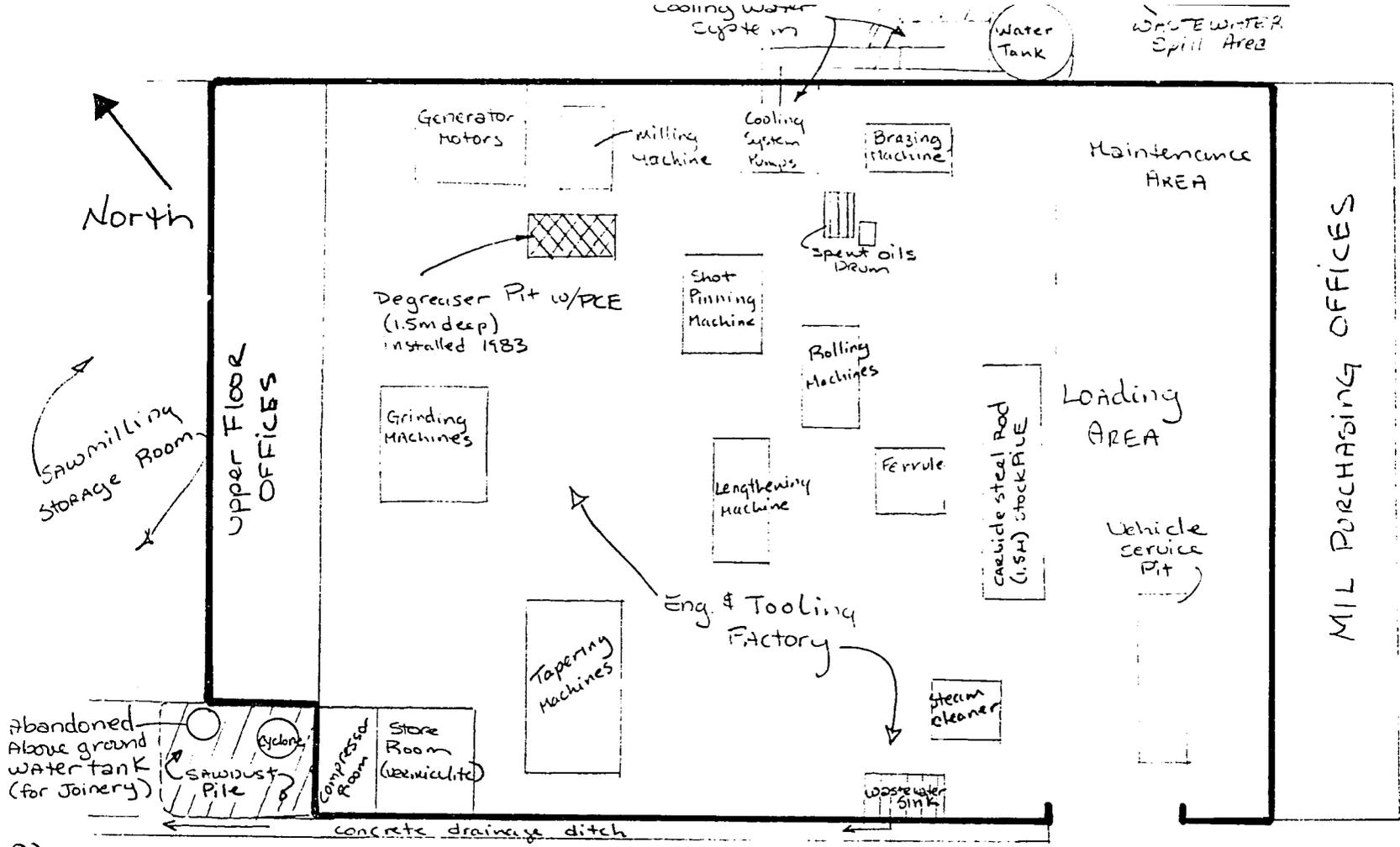


Figure 1
Site Location Map
MIL Facility
Kitwe, Zambia



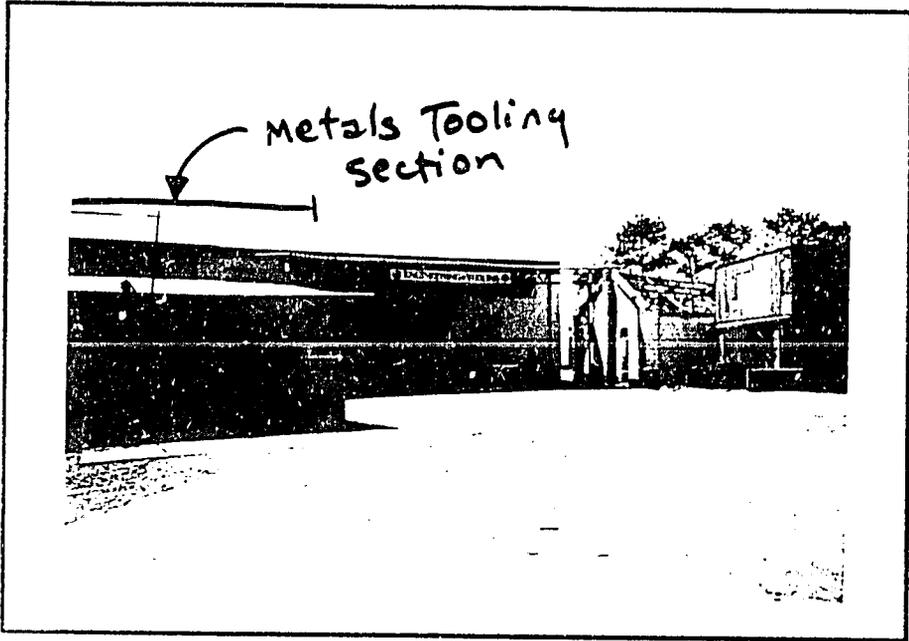


12

NOT TO SCALE
 DRAFTED BY PH ASSOC. 1995
 All machines not included on drawing

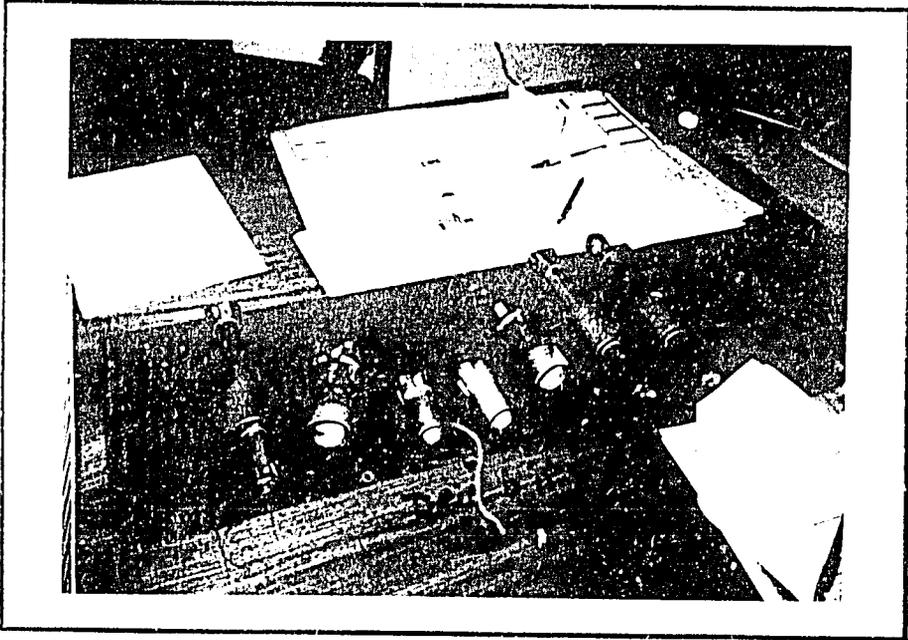
Figure 3
 Facility Layout Plan
 MIL Engineering and Tooling
 Kitwe, Zambia

8. PHOTOGRAPHS



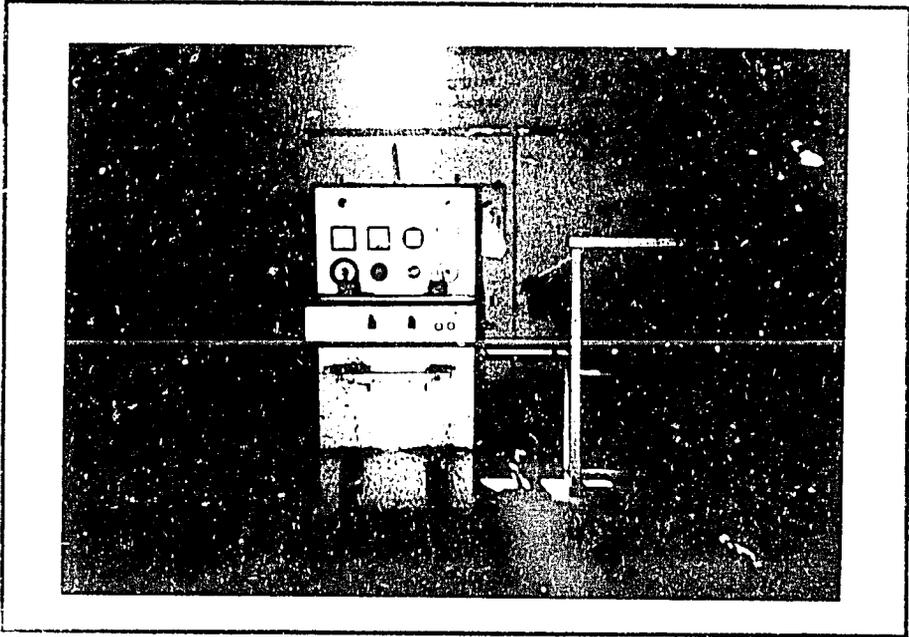
Photograph 1

MIL ENGINEERING AND TOOLING BUILDING



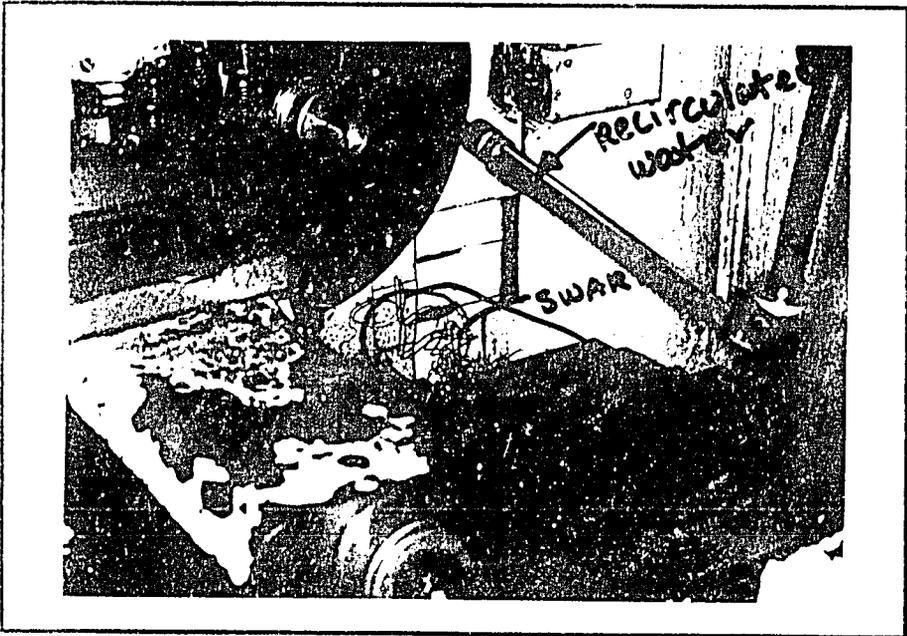
Photograph 2

MIL FORGED HEADS AND DRILL BITS



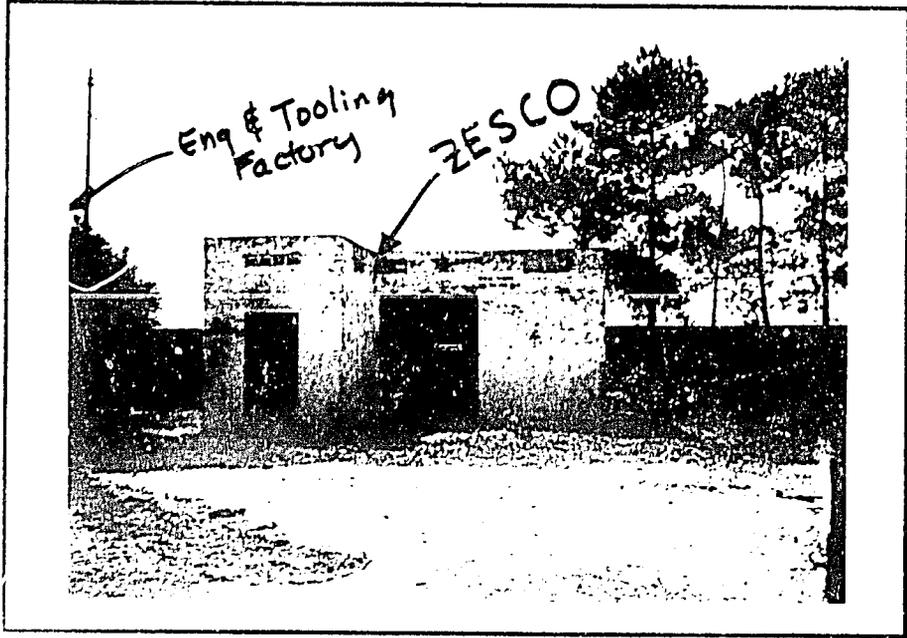
Photograph 3

BRAZING MACHINE



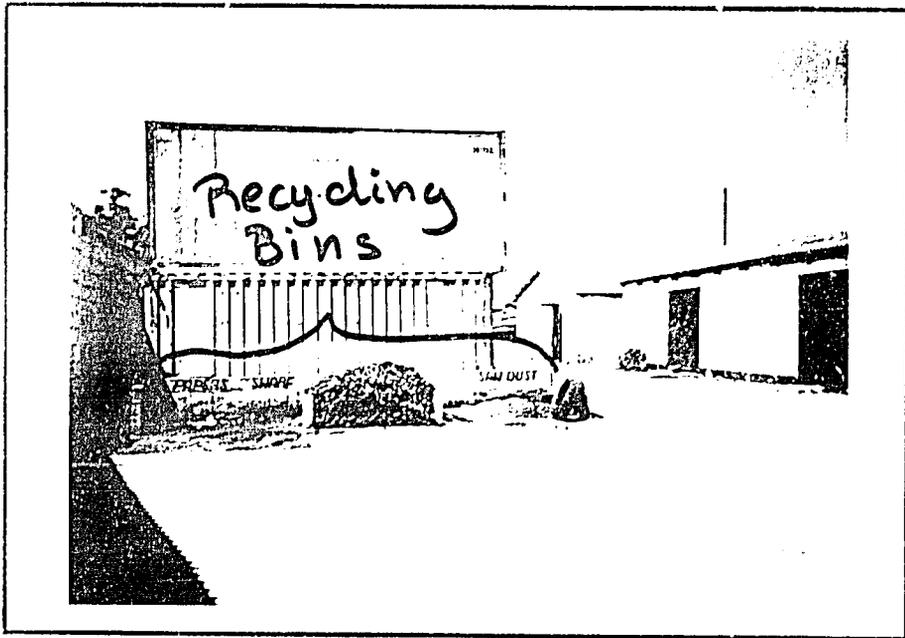
Photograph 4

MACHINE USING RECIRCULATED WATER TO COOL METAL WHILE TAPING.



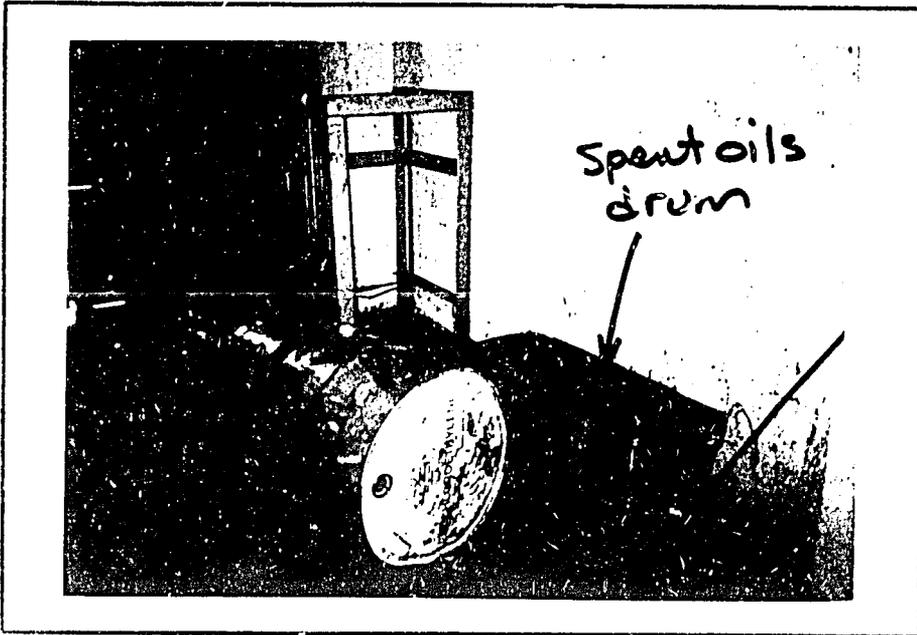
Photograph 5

ZESCO ELECTRICAL TRANSFORMER SUBSTATION



Photograph 6

RECYCLING BINS



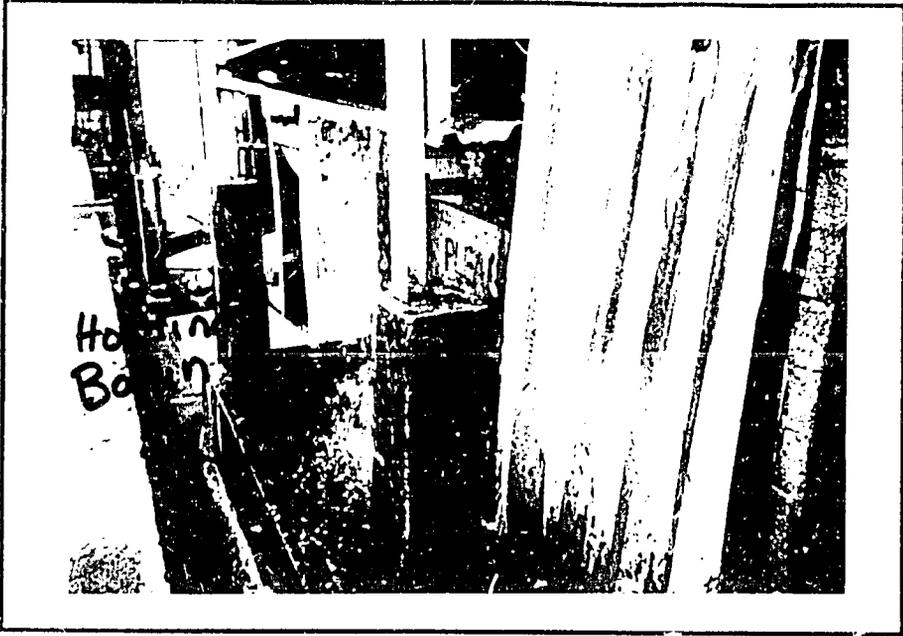
Photograph 7

SPENT OILS DRUM AND SOLVENT DEGREASER DRUM



Photograph 8

WATER TANK AND COOLING SYSTEM



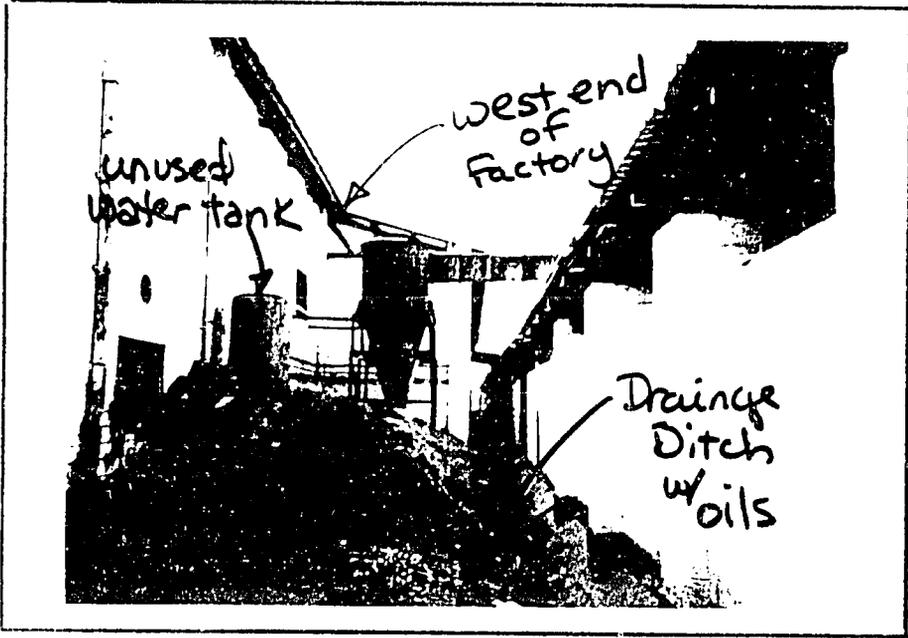
Photograph 9

HOLDING BASIN WITH COOLING WATER



Photograph 10

SPILLED WASTEWATER



Photograph 11

DRAINAGE DITCH ALONG SOUTHWEST SIDE OF BUILDING.

9. APPENDICES

Appendix A
ZPA QUESTIONNAIRE

ZAMBIA PRIVATIZATION AGENCY
QUESTIONNAIRE ON ENVIRONMENTAL INPUT

Name: Engineering And Tooling - Mulungushi Investments

Industry:..... Manufacturing

Business Profile: Mining equipment - Drill Steel, Bits, and Components

Turnover: .K840 million per annum

Capital Employed: K100,000,000 (One Hundred Million)

Employees: 50

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

..... One

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

..... 6,000 Sq. mtrs.

3. Chain of title documentation: ..One unit of a large company.....

4. Business Start Date: 1983

5. Building Type, Steel frame, brick etc.:

..... Brick + Mortar

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

Drill Bits and Drill Steels - no waste streams etc.

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

..... Nil

(cont'd)

ZAMBIA PRIVATIZATION AGENCY
QUESTIONNAIRE ON ENVIRONMENTAL INPUT

- 8. Previous site and land use.: Nil.....
- 9. Surrounding land use within 1 km of the site.:
..... Industrial.....
- 10. Does the site have any permits, operational etc.?
..... Manufacturing Licence.....
- 11. Is the site within a flood plain?
..... No.....
- 12. Source of Water supply at the site (city water, water well etc.):
..... City water and Borehole.....
- 13. Site drainage by open drains, covered drains, into a sewer etc.
..... Open drains and into sewer.....
- 14. Type of discharges metal, organic, inorganic, liquids, solids.
..... Metal.....
- 15. Any known Air quality odor problems. None.....
- 16. Occurrence of any fires at th facility: Rare.....
- 17. Are there any drums/containers having oil, grease, benzene, diesel stored at the site. If so, how many drums and what type?
..... 10 - Oil, Meths, Tricothelene.....

(cont'd)

ZAMBIA PRIVATIZATION AGENCY
QUESTIONNAIRE ON ENVIRONMENTAL INPUT

18. Storage of any chemicals, pesticides at the site.

..... Nil

19. Owner/operator's disclosure of known environmental issues/
liability.

..... Nil

20. Remarks/comments:

..... Nil

.....

.....

.....

.....

.....

.....

.....

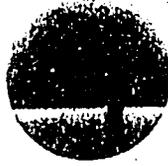
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Appendix B
PH ASSOCIATES QUESTIONNAIRE

THE DIRECTOR
ZAMBIA PRIVATISATION
AGENCY
17 JUN 1994
RECEIVED



Engineering & Tooling

Northend Road P.O. Box 21491 Tel:212662 Telex:ZA 51750 Kitwe,Zambia

FAX: 02 - 210213

TO: Z P A

FROM: JOHN TURNER

COMPANY: P.H. ASSOCIATES
ROOM 212

DATE: 17.06.94

FAX: 225270

PAGE 1 OF 1213

RE: Z.P.A. - P.H. ASSOCIATES ROOM 212

FOLLOWING ARE YOUR FORMS COMPLETED AND RETURNED AS REQUESTED.

REGARDS

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:

FACTORY BUILDING - INCLUSIVE OF OFFICES AND STORES.

PLOT 3624 NATWANGE ROAD

HEAVY INDUSTRIAL AREA, KITWE

PHONE 217933, 212976, 212662

FAX 210213

CONTACT : JOHN TURNER - MANAGER

Please complete the following for each facility listed above:

Facility Name: ENGINEERING & TOOLING

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

Hollow mining drill steels
Manufactured by induction heating and brazing
Raw material is hollow hexagonal cold rolled steel bars

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

60 feet x 180ft (120 sq. yds)

1,004 sq meters

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:

All facilities are included in the above area.

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

N/A

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.):

N/A

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:

Heavy Industrial
Chloride - Batteries Mfg., African Wire Ropes - Cable Mfg.,
Pigott Maskew - Rubberising plant

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

N/A

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?

N/A

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

120 ft.

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

N/A

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?

N/A

14) Please list any above ground and below ground storage tanks at the facility, each tank's 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.

N/A

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		NONE		
Diesel				
Oil				
Hydraulic oil				
Turpentine				
Other				
Other				
Other				
Pesticides and Herbicides				
		N/A		
Solvents, Degreasers, Cleaners				
Toluene		N/A		
Benzene				

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

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.

N/A

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

N/A

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

Appendix C
MINISTRY REVIEWS 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.

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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 I
ENVIRONMENTAL REGULATIONS AND
ENFORCING MINISTRIES OF ZAMBIA**

Policy, Act, or Regulation	Year Adopted	Responsible Ministry
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"> • 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 Water Board (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.
The Environmental Protection and Pollution Control Act 1990	<p><u>Water Regulations</u></p> <ul style="list-style-type: none"> • 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 system 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. <p><u>Waste Regulations</u></p> <ul style="list-style-type: none"> • 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). • 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.

ACT OR REGULATION	APPLICABLE REGULATIONS
<p>Water Pollution Control Regulations of 1993</p>	<p><u>License to Discharge Wastewater</u></p> <ul style="list-style-type: none"> • 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. If any wastewater test results exceed these standards, they 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. <p><u>License to Withdraw Water</u></p> <ul style="list-style-type: none"> • 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 following wastewater discharge regulations.
<p>Waste Management Regulations 1993</p>	<ul style="list-style-type: none"> • 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.
<p>The Mining Regulations 1972</p>	<ul style="list-style-type: none"> • Supervise/inspect site for the prevention of pollution of the surroundings or abatement of any nuisance.
<p>The Mines and Minerals Act 1976</p>	<ul style="list-style-type: none"> • 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.

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.

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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.

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- 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.

tol

**TABLE 3
WATER POLLUTION CONTROL REGULATIONS
STANDARDS (LIMITS) FOR EFFLUENTS AND WASTEWATER**

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 ₂ as nitrogen)	2.0 mg/L
Organic Nitrogen	5.0 mg/L (Mean)
Total Ammonia and Ammonium (NH ₃)	10 mg/L
Cyanides	0.2 mg/L
Total Phosphorous (PO ₄)	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 ₂)	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

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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
NOTE	
See original Water Pollution Control Regulations and third schedule for standard and test method details.	

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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.

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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 substitutions, 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

NOTE: 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.

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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.

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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.

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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.

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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

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Appendix E
ENVIRONMENTAL ASSESSMENT CHECKLIST

CONFIDENTIAL

ENVIRONMENTAL ASSESSMENT CHECKLIST

Facility MIL Metals Tooling Factory
Location Kitwe, Zambia (Eng. & Tooling Ltd.)
Date Assessed May 10, 1995

Prepared for
Zambia Privatisation Agency

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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.

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1.0 GENERAL INFORMATION

1.1 Facility Name *MIL Engineering & Tooling OR*
 1.2 Locations(s) *Kitwe, Zambia Metals Tooling?*

1.3 Dates of Assessment(s) *May 10, 1995*
 1.4 Assessors *Dorinda Himes*

2.0 FACILITY PROFILE

2.1 Address *Plot 3624 Matwange Road
 Kitwe, Zambia*

2.2 Telephone

2.3 Telex / TWX / Fax *212 462*

2.4 Facility Manager / Assessment Contact
John Turner

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

NAME (S)	TITLE (S)
<i>Limbanbae Kabu M</i>	<i>works engineer (with MIL 10 years)</i>

2.6 Number of employees full time *39*

Number of employees part time *none*

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

2.8 Total site area *134.5 m² (?)* *8hrs/day 5 days/wk*

2.9 Total number of buildings
one

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

Input	Quantity / Year
Methylated Spirit (melting agent) mix w/ oil	114 l/yr
engine oil	>100 l/yr
coolant oil	152 l/yr
paint thinners	105 l/yr
M.E.K. thinners (not used here)	243.5 l/yr
transformer oil (for welding machines)	20 l/yr
Trichloroethylene (cleaning agent)	420 l/yr
Teepol (cleaning soap)	421 l/yr
5' long high carbon steel rods (hexag-25mm φ)	peritopepe

2.11 Describe facility production processes of environmental consequence

They supply ZCCM w/ Drill steel (sizes 1, 2 & 3) for underground chiselling & blasting

They forge carbide steel heads → melt & form high carbide steel contains (mostly Fe & some C, Si, Mn, Ni, Cr, B)

2.12 Facility products

Product	Quantity / Year
Drill steels w/ forged carbide heads	10 tons/month

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

↳ EESCO

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3.0 FACILITY HISTORY / LAND USE / PERMITS

3.1 Age of facility and date operations began

Metals tooling section was installed/started in 1983.

Site formerly used for sawmilling (formerly called Mining Timber)

3.2 Land use prior to current enterprise

Sawmilling - mainly wood storage in building(?)

Don't know when sawmilling began

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?

No, not to Mr Kahum's knowledge - NO liquid waste
 Metals waste (scrap) is recycled - melted into metals balls for crushing rock.

3.5 Do any environmental permits exist, and if so, is the facility in compliance? NONE

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
Chloride	across st	Paints Mnf.
American Wire Ropes	SW	Cable Mnf
Pigetti Mas. Kow	west	Rebberising Plant

nextdoor

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3.7 Describe surrounding land use.

Heavy commercial & industrial

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

They use to make Drill bits & 4 yrs ago. (out of nickel)
 also nuts, bolts, shafts etc. for machinery jobs.

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
See	2.10		

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

Y N Describe

4.3 Are incompatible materials segregated and labelled?

Y N Describe

4.4 Are pesticides stored or used onsite?

Y N List

Insecticides = very small quantities (they buy 5 cans & spray-thru-out bottles) for cockroaches

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

Y

N

U

Describe

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

Worker protection; gloves, cloth masks
They have first aid box,
Machine guards - metals

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

No

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

They have decreasing pit.

Mr. Kahin has never noticed any factory inspectors onsite.

5.0 AIR EMISSIONS

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

N/A

5.2 Type of emission and discharge cycle from each source.

Source	Emission	Cycle (continuous, batch)
	N/A	

5.3 Is there an air emission monitoring program?

Y

N

Describe

5.4 Is there another source of air pollution nearby?

Y

N

Distance

Describe

See 3.6

5.5 Describe emissions in detail if applicable.

NA

6.0 WATER / WASTEWATER DISCHARGES

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

Source	Volume	Composition
- Wastewater is recycled, & some goes off site water from Council		clean
factories haven't worked for long time - make septic tank or connected Council sewer		

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

to concrete drainage channel

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

Y

N

Describe

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6.5 Does the facility have a pretreatment plant?

Y

N

Describe type of pretreatment

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

Y

N

Describe

Concrete
DRAIN on side of Buildings
may have wastewater

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

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

No to his knowledge
(last 10 years)

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

bathrooms in adj. buildings
do not work.

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

Y

N

Describe frequency of clean / fill

unknown

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
Paper/trash - to council dumping area ???	

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

oils stored in one area
solvents in another

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

Y ~~N~~
ICE

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

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- 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) Engine oil Coolant oil transfer mer oil	2100 L/yr 152 L/yr 20 L/yr
Solvents, degreasers Trichloroethylene or (perchloroethylene) Methyleated spirit	420 L/yr 114 L/yr
Pesticides / Herbicides Some insecticides - Ranch control (5000 L over a few months)	
Paints, thinners Paint thinners - HEK thinners (not used on site?)	105 L/yr 483.5 L/yr
Organic Fertilizers / Feeds NA	
Process wastes (sludges, plating wastes, still bottoms, etc) Coolant & system wastewater recirculated	
Other waste storage or disposal Teepol (cleaning soap) Swarf (metal scraps) ARE RECYCLED BY COMPANY that takes metal filings & scraps & makes them into metal balls for crushing rock.	421 L/yr

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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

, On

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

Some scrap metal is recycled

7.10 Are any waste materials recycled or reused onsite?

 Y N

List wastes and recycling processes

◦ coolant oil - used for machines - is recycled

◦ cooling water in Forging machine and degreaser solvent recirculated
(most systems are self contained)

• WATER from sink drains offsite.

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8.0 STORAGE TANKS

8.1 Inventory of storage tanks (aboveground and underground)

Tank ID	Tank Size (M3)	Tank Material	Material Stored	Tank Age
One Aboveground		steel	(recirculated) tank machine cooling systems	
No UST's				

8.2 Are leak detection systems or groundwater monitoring systems employed?

Y N Describe

8.3 Do the tanks meet any design requirements?

Y N Describe

unknown

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 none onsite

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

Y N Describe Transformer oil used in some machines

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

Y

N

Describe

probably some

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

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

moderate levels - some employees use ear muffs

11.2 Have there been any complaints regarding noise from neighbours?

Y

N

Describe

inside building?

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).

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 One bore hole installed 3 yrs ago (1993)

13.2.2 Is there any observed soil contamination at the site?

Y N Unknown Enclosed area - surrounding area - sawmilling & joinery has soil contamination!

13.3 Groundwater / hydrogeology

13.3.1 Depth to groundwater

~ 35m to water
another MIL person said 20m to water

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 - discuss in sawmilling report

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

Well	Date Installed	Diameter	Depth to water	Pump rate	Yield per day
borehole		?	35 m	(well never been used)	No pump!

13.3.5 Have any groundwater samples ever been taken and analyzed?

Y

N

U

If yes, provide most recent results

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

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

- concrete drain outside.
- coolant water tank leaks / spills on ground in back

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

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 *We sketched during interview*

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

Y N *looked at during visit*

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

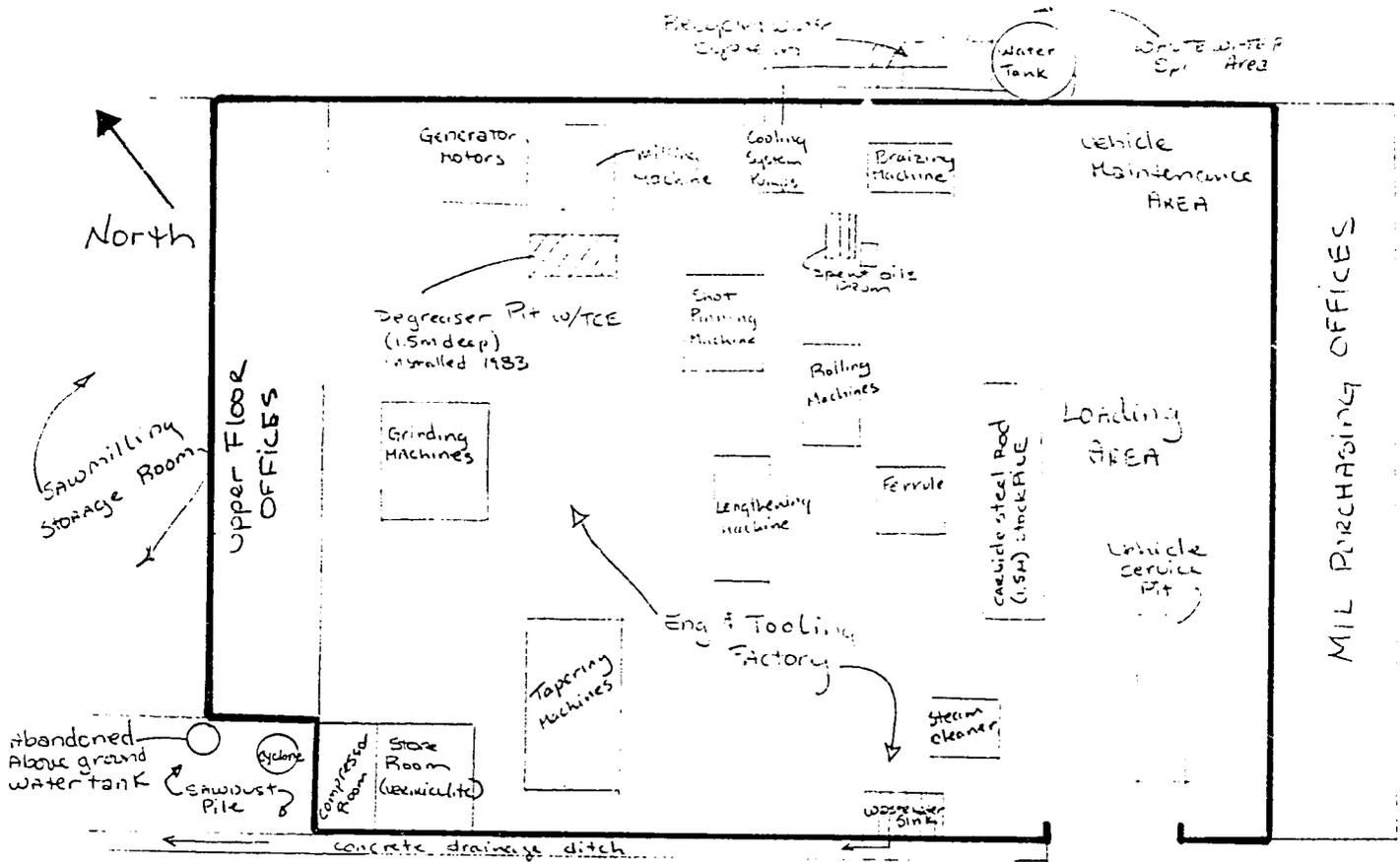
Underground storage tanks; construction details, number, capacities, and use

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



NOT TO SCALE

DRAFTED By PH ASSOC. 1995

All Machine. not included on drawing

Appendix F
FACILITY RECORDS

MIL/ENGINEERING AND TOOLING MACHINES - 1994

- | | |
|--|--|
| 1. Martin Friberg
Sandviken
Type: MF7 NR20 ENGLAND
380V, 20KW, 26.8HP | 13. 7/8" & 1" Rolling machine
Morton Air
No. 5663-9
ENGLAND |
| 2. Cresses (Ltd) Dimpling machine
P & V No. 1005
Makers No. 1457
Made in Italy
380V - 4KW | X14. Wax Bath Burner
Nu-Way Heating Plants
DROITWICH
Type: 2L2D - 1PH - 2 Pole
Serial No. 650/7
Model: 8879/6 |
| 3. Aeg Elotherm Twin Heater
1 - 10 KH Ferrant
Made in England
380V - 45KW - 6.1HP | 15. Radial cutting
(Abrasive saw)
Motor 1800 RPM
380V - 5.5KW |
| 4. Tos CSSR Milling machine
Type: FB32H - No. 48205
Model: 1971
Tos Kurim, Czechoslovakia
380V - 11KW main motor 125W -
Coolant motor | 16. Tapering machine
Brook Motors Limited
MUDDERFIELD
3.7KW - 4KW - 90W |
| 5. Degreasing Tank
380V - 9KW | K17. Spring Hammer
Pattinson Bros. Limited
SHEFFIELD
380V - 7.5HP (5.6KW) |
| 6. Peart INtegral Brazing machine
45KW
Ferrant -0- 300V, L250 V/metre
8.6 Kc/s Dynamometer Rectifier 460 50A
100S (airplugs) | 18. Pollard Vertical Drilling m/c
Type: A5 2HP
LEICESTER
380V - 1.5KW |
| A7. Shot Penner
St. Georges Engineering Ltd.
Manchester
Trafford Park 1207/8/9
ENGLAND
380V - 7.5KW | 19. Bits Threading machine
P & V No. 2463
Makers' No. 1508
ENGLAND
380V - 5KW - 746W - 90W |
| 8. Grundfos Circucat on pump
380V - 2 Pole
5.5HP
Motor 2.2KW | 20. Horizontal Grinding machine
Type: 'L' Plain Grinder
Max. wheel: 20" x 6" x 2"
Pulley spindle: Dia. 8.13/16"
- 7.3/32" - 5.7/16"
NEW WALL
380V - 13.4KW - 1.2KW - 3.5KW |
| X9. Straightening machine Drum type
Ingersoll Rand Company
New York City
Drill Sharpener
Size 1R24 - Sho No. 8766
USA | 21. Horizontal Plain Grinding m/c
supplied by RENEWALL
LUFFENHAM, LEICESTER
Serial No. 654
380V - 24HP - 18KW - 7.5KW
- 7.5KW - 93W |
| 10. Guyson (Sand Blasting machine)
Model 300/20 AB
Serial No. 34746
ENGLAND
380V - 1.5KW | 22. No. 3 Cincinnati
The Cincinnati Milling Co.
OHIO - USA
380V - 4.5HP - 3.5KW |
| X11. Puncher
Holman Carbone
Serial No. DHL 1114
P & V No. 1104
Makers No. 1114 DHL
Manuf. 111261
Inst. 1-62/61 ENGLAND | 23. Herbert No. 4
Senior Preoptive
3HP - 7.5HP
ENGLAND
380V - 5.6KW |
| X12. Vacublast medium
Slough Bucks Ajax Ave.
Model AE CL
Serial No. MED 2928
Design Press 16/M2, 110
ENGLAND | 24. Cevolani Bolocna
Thompson m/c Tools Ltd.
SHEFFIELD
380V - 4.5KW
ENGLAND |

2/.....

Active machines = 36 = 480.601 Kw ✓
 Inactive machines = 04 = 15.6 Kw ✓
 Existing Power Supply DB = 3pole 500 Amps Breaker - 20 sec... 93
 COMPRESSED AIR UP AND

- 25. Tos Lathe machine
Type: SN45 No. 451064
Tos TRENČIŤ NP
CZECHOSLOVAKIA
380V - 5.5KW
- 26. Triumph 7.5HP
Colchester Co. Ltd. ENGLAND
D-Drury & Co. Ltd.
Box 3929
JOHANNESBURG RSA
380V - 1.2KW
- 27. Bits Brazing machine
(Spec. Process Timer)
Chamberlain & Hookham
BIRMINGHAM, ENGLAND
COIL = 24V A/C
380V - 45KW
- 28. SSR Air compressor
Serial No. 89M90E60148
380V - 200A - 150KW & 4KW
Discharge pressure: 7.7
Bars 100 lb/m²
- 29. Wire brushing machine
380V - 3.2HP
2.4 KW
- * 30. Bore washing tank
380V - 1.5HP
1.1KW / 1.1
2-Heating elements x 2KW
- 31. 6" Bore direct driven grinder
380V - 2.2KW
- 32. 1½" Bore grinder
380V - 2.2KW
- 33. 1.1/4" Bore grinder 2.2kw
- 34. Powersaw machine
380V - 1.5KW
- 35. Small vertical portable
drilling machine
380V - 1.5KW
- 36. Welding machine
380V - 300A
(5.7KW)
- 37. Dalian No. 2 machine
Serial No. 91371
Model No. CW6230C Gaplathe
3 motors: 11KW - 1.1KW - 90W
CHINA

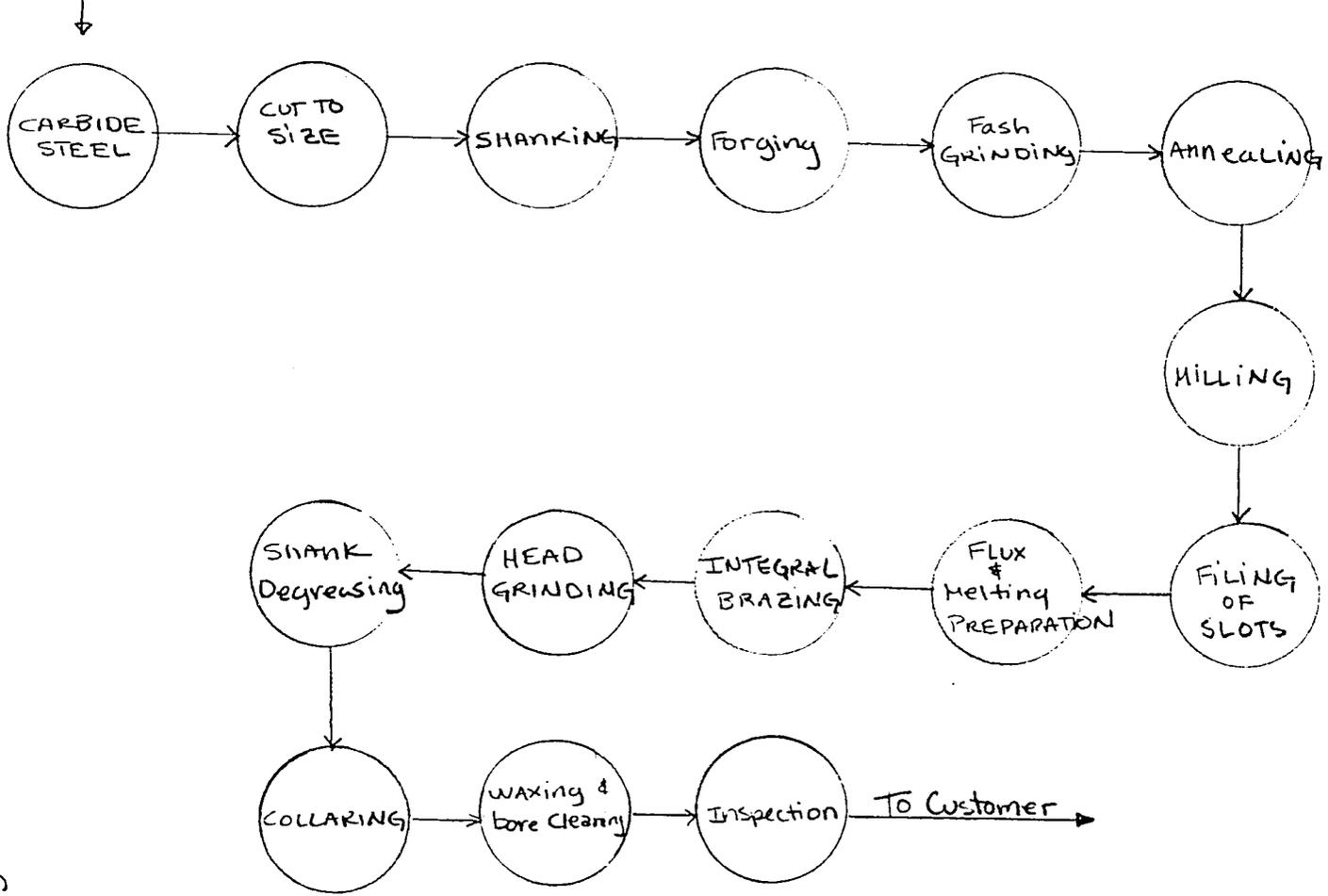
- 38. 45° Drill steel
drilling machine
380V - 33W
- * 39. Rigid machine
220V - 1PH series
Motor - 500W
- 40. Dalian machine
Serial No. N185
Model: CD6245B - CD6256B
3 motors: 7.5KW, 10HP
90W - 250W
CHINA

OTHERS

- a. 6 - Extractor fans
220V - 410W = 2.4KW
- b. 8 - Air conditioners
220V x 8 motors 400W = 3.2KW
200V x 8 compressors 746W = 6KW
9.2KW
- c. WAP - steam cleaner
Manuf. date: 1993
Serial No. : 3638110
Model : DX 820
RSA
2kw

Appendix G
PROCESS FLOW DIAGRAMS

RAW MATERIAL



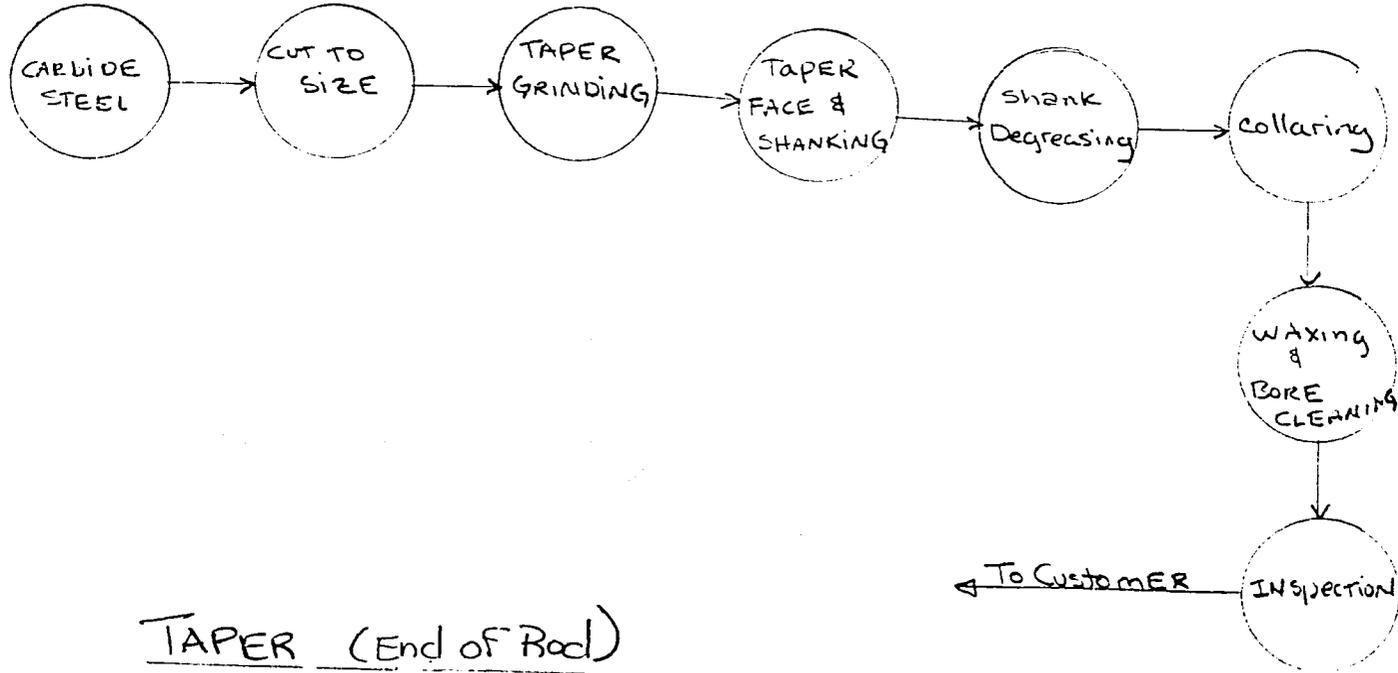
96

INTEGRAL (FORGED-HEAD)
PROCESS

INTEGRAL PROCESS FLOW DIAGRAM

MIL Engineering and Tooling
Kitwe, Zambia

Raw Material



TAPER (End of Rod)
PROCESS

Lb

TAPER PROCESS FLOW DIAGRAM

**MIL Engineering and Tooling
Kitwe, Zambia**

Drafted by PH Assoc. 1995.