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DIGGING FOR OPPORTUNITIES: IMPACT ASSESSMENT OF LINMINE IN GUAYANA

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Introduction: EIA and Bauxite Mining In Guyana

Following the United Nations Conference on Environment and Development (UNCED) in Rio 1992 the nations of the world adopted Agenda 21; the Articles contained therein forming the foundation elements of sustainable development. Particularly, Environmental Impact Assessments (EIAs-Principle 17) have become a standard tool to guide developments of all types along a sustainable path. As the years progressed the EIA became a prerequisite for development planning of various types, providing to enforcement agencies a tool that can discern the impacts of a particular project on the environment and the mitigation measures to be adopted.

The need for EIA to be adopted as a tool to guide sustainable development in Small Island Developing States (SIDS) was reinforced in the Barbados Programme of Action (1994) that emerged from the UNCED-SIDS conference. This was particularly important to the Caribbean region in that the need to manage the natural resource base in a sustainable manner was concretized. In fact, it was following this landmark conference in the Caribbean that EIAs were institutionalized and States began to develop capacity and technical capabilities to administrate and regulate developments based on a sustainable paradigm.

Today, although EIAs are required for development of various types and magnitude in every State of the Caribbean the administrative, institutional, regulatory and technical capacity governing such, are at different stages of maturity. In some States such as Guyana the birth of an Environmental Protection Agency (EPA) in 1996 and supporting regulatory framework made the requirement for an EIA mandatory. Furthermore, guidelines and procedures were developed to facilitate the development application process, environmental permitting, conducting of EIA studies, and reviews.

Mineral extraction and processing is one of the areas of choice for the case studies examination across the Americas. Hence, the LINMINE ore extraction and bauxite processing facility was an ideal candidate for the Caribbean region. This company and its predecessors have crafted the socio-economic landscape of the community of Linden and is seen as the engine of growth and development for Administrative Region 10 (AR10) and the country of Guyana as a whole.

At the inception of bauxite mining operation in Guyana there was little regard to environmental protection and health considerations. Degradation of natural resources and pollution of the environment was

minimally regulated and the then existing bauxite mining and processing company had an open ticket to exploit resources and dispose indiscriminately all categories of waste. The major emphasis was the generation of economic benefits for the company and influx of revenue into the local community and the country. These signaled that the country was doing well and provided political mileage for the government in power however the environmental and health liabilities were significant.

As time progressed awareness of the need to protect the environment and manage natural resources became an issue in Guyana. Furthermore, and to a lesser extent when foreign companies became main shareholders they were in some cases obliged to incorporate environmental management practices from their country of origin. However, there is a general feeling that where significant costs were involved measures for pollution prevention were met with reluctance.

Although studies on specific aspects of the mining and processing operations were done as early as the 1980's the first EIA study was conducted in 2002 to facilitate the take over of LINMINE by Cambior of Canada. The study was prepared by SENES Consultants Limited and was completed in January of 2003. The prior studies were used to inform the EIA and were complemented by primary studies required by SENES and Cambior to fulfill the requirements stipulated by the Terms of Reference (TOR) issued by the EPA to guide the study.

Methodology

Five candidate case studies were proposed for the Caribbean region of which it was decided that three will be chosen. These are the Barbados Light and Power Company's generation plant at Spring Garden (representing power generation) and Port St. Charles Residential Marine (representing ports and harbour facilities), Barbados and the LINMINE/Cambior bauxite facility in Guyana. The LINMINE/Cambior bauxite facility was the case of choice to represent mineral extraction and processing. Specifically the aim of the case study is to examine *inter alia*:

- The administrative, institutional, policy and regulatory framework governing the EIA and EIA process;
- Available literature and studies;
- Primary information collected through interviews and consultations;
- Information and data acquired during site visits and from direct observations;
- The impact assessment procedures used to comply with the regulatory framework;

- The integration of health and environmental aspects in the assessment;
- Level and effectiveness of institutional coordination;
- Level, effectiveness and consideration given to public participation;
- Socio-economic impacts of the project and considerations of gender, indigenous people and less fortunate sector of society;
- Application of measures recommended in the EIA studies;
- Changes needed to improve the outcome of impact assessments in particular the integration of environmental and health aspects in a comprehensive way.

The EIA report conducted to facilitate the take over of LINMINE by Cambior was examined along with the laws, guideline, regulations and permitting process governing EIAs in Guyana. These laid the foundation and background for conducting the field component of the research.

The field research consisted of:

- Agency Survey: a checklist was developed to guide the data collection process during a site visit to the OBMI facility. Additionally, a number of government and private sector agencies, covering the regulatory institutions and key stakeholder institutions, were interviewed. These agencies include:
 - Environmental Protection Agency (EPA)
 - Linden Hospital Complex
 - Linden Chamber of Commerce
 - Linden Education Department
 - Mackenzie Primary School
 - Regional Environmental Health Dept
 - Regional Democratic Council #10
 - Linden Economic Advancement Programme (LEAP)
 - Omai Bauxite Mining Incorporated (OBMI)
 - Guyana Water Incorporated (GWI)
 - University of Guyana (UG)
 - Social Services Department
 - United Nations Development Programme (UNDP) Guyana
 - Pan-American Health Organisation (PAHO) Guyana
 - Guyana Forestry Commission (GFC)
 - Guyana Geology and Mines Commission (GGMC)
- Community surveys: a checklist was also developed to expedite and guide the data gathering exercise among residents of the community of Linden. Personnel from 25 households were interviewed at varying distances from the bauxite processing plant.

Case Details

A. History of LINMINE Bauxite Mining and Processing Facility

According to SENES, 2003, bauxite mining has roots in Guyana that were established more than eighty years ago when the Linden Bauxite Mine, originally founded by the Demerara Bauxite Company Limited (DEMBA), a subsidiary of the Aluminum Company of Canada, began commercially exploiting bauxite in 1916. Since that time, the mines and processing plants were expanded and infrastructure added to support the operation including maintenance workshops, power generation distribution systems, and a potable water supply system. In addition, the company developed personnel housing facilities and a hospital at Mackenzie, Linden. In 1971, the Government nationalized the DEMBA holdings and formed the Guyana Bauxite Company Limited. The Bauxite Development Company Limited was created in 1976 to manage the government's interests in producing, marketing, and shipping bauxite products. In 1977, Guyana Bauxite Company merged with BERMINE to form the Guyana Mining Enterprise Limited, which was disbanded some 10 years later, and resulted in the operations at Linden being renamed the Linden Mining Enterprise Limited (LINMINE).

After a continual wave of financial and economic distress experienced by LINMINE, Cambior of Canada was deemed a suitable partner to deliver a turn around in the bauxite industry. Prior to presenting Cambior's proposed approach to take over and operate LINMINE, the relationship between Cambior, Omai, and the proposed Project was clarified. Omai Gold Mines Limited (OGML) is a separate Guyanese company in which Cambior, a Canadian owned mining company with head offices in Montreal, Canada, holds a 95% interest and the government of Guyana holds 5% interest. Cambior representatives noted that the Linden mine is currently in a "death" or debt spiral with no sales, no revenue, and high losses. The current proposal that is being considered is for Cambior to take over ownership of the LINMINE operating assets in an effort to help the mine survive the current downturn and return it to some form of sustainable operation that contributes to the regional and local economy and society. Given the historic nature of the operation and current conditions, Cambior recognizes that this will be a challenging undertaking and proposed a two phase approach to allow a transition from the current situation. This led to the formation of a new company called Omai Bauxite Mining Company Inc. (OBMI) with a 70% ownership by Cambior and 30% ownership by Government of Guyana (GoG).

i. Location of Bauxite Mining and Processing Facility

OBMI operations are located at or around Linden, a town with about 50,000 population on the Demerara River, about 100-km south of Guyana's capital city of Georgetown (Appendix 1). The processing plant

itself (Figure 1.3.1) used for the preparation of the calcined products is located within Linden while the open pit mines that supply the raw materials are located in the immediate environs. These include the East Montgomery, Dacoura and Kara Kara mines which are active and the Arrocané and Haracaro which are worked-out (SENES, 2003).

The operations are historic and extensive, consisting of several former and two currently operable open-pit mines, an ore transportation system, a bauxite beneficiation plant, drying and calcination facilities, a tailings management area, a mine dewatering system, a potable water treatment plant, mine roads and railway line, a Bunker C fired steam-powered electrical power plant and additional generators, and maintenance and other service facilities. Recently, the power plant, and the potable water treatment plants have been operated by others.

The location of the mining and processing facility puts the residential, business and institutional community in close proximity to the emissions of the bauxite mining and processing operations. However, this has transcended the entire existence of Linden since it was established as a mining town to provide the workforce, goods and services to support the bauxite mining enterprise.



Figure 1.3.1: LINMINE Bauxite Processing Plant Linden, Guyana

ii. Bauxite Mining and Processing Operations

The mining and processing of the bauxite at OBMI is depicted in the flow chat (Figure 1.4.1) below. Two mines are currently in operation and the extraction method is a continuous stripping process in which the overburden is removed. Once exposed the bauxite is drilled and blasted or mechanically broke up and mined. Since the operation is usually below the water table the influx of groundwater compounded by rainfall necessitates draining into the natural watercourses with no form of treatment. Sedimentation thus becomes an issue.

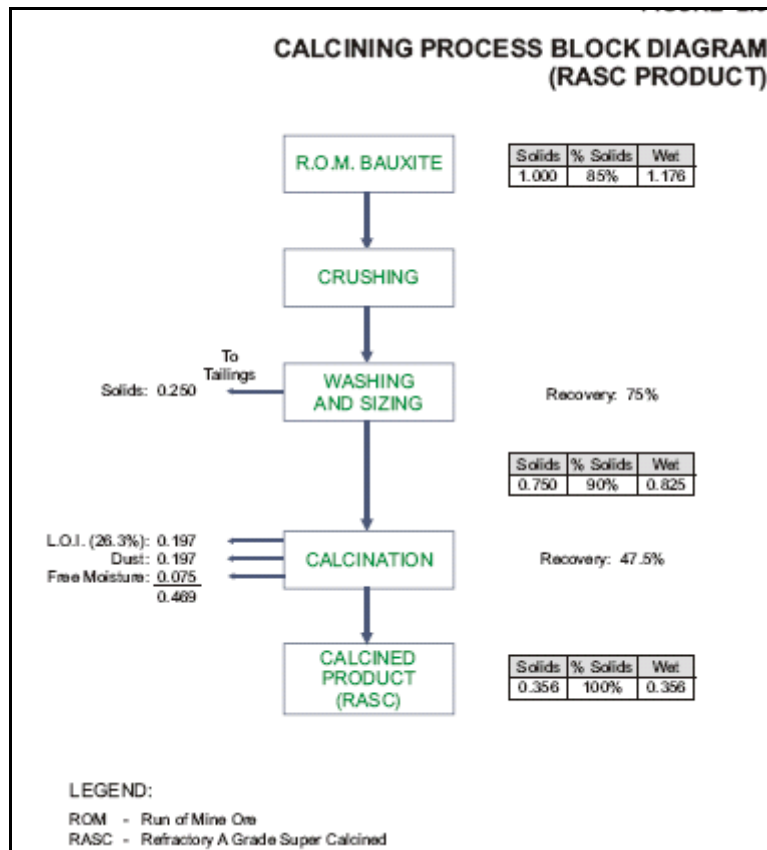


Figure 1.4.1: Bauxite Mining and Processing Flow Chart

The processing operation consists of three stages:

1. Size reduction limits the maximum particle size to the kiln to achieve uniform calcination of the material.
2. Beneficiation consists of removing higher silica content particles (principally clays) by removing fines from the crude bauxite as a higher concentration of silica-containing minerals is contained in the fine fraction. The removal of fines is also beneficial for calcining since the fine fraction is swept into the kiln exhaust as dust due to the high velocity of the combustion gas flow in the kiln.
3. The calcination stage is required in producing Refractory A Grade Super Calcined (RASC) whereby chemically combined water and surface moisture are removed in order to increase the percent alumina content of the crude bauxite to over 86% on a calcined basis. The main aim of calcination is to densify bauxite particles; and much less emphasis is placed on alumina content which is set by ore selection. Drying is only required to reduce the moisture content for shipping of dried products such as Chemical Grade Bauxite (CGB), Cement Grade Bauxite (CeGB) and Metallurgical Grade Bauxite (MAZ).

Recovery in the wash plant is estimated at 75%. The product from the wash plant is then sent for calcination where surface moisture and

combined water are driven off and a significant portion of washed product is released as dust through the stack. The recovery of the calcination stage is estimated at about 47.4% with losses of 29.2% representing combined water or loss on ignition and 16% dust loss through the stack. Therefore, the overall recovery for RASC is 32.9% on a dry basis or 28.0% (0.329/1.176) on a wet basis.

Dust from calcining is separated into two fractions. For the operation of kiln #13, a set of cyclones removes the coarse fraction, while the fines are swept up the stack and discharged into the atmosphere. The coarse fines are slurried with water and sent to the tailings pond.

B. Regulatory Framework

The Environmental Impact Assessment (EIA) Process in Guyana is relatively well developed compared to the other English speaking Caribbean Islands. Commitment by the Government of Guyana (GoG) to promote sustainable development of natural resources and with assistance from the Inter-American Development Bank (IDB) the institutional and administrative capacity for EIA evolved. The Environmental Protection Act (1996) was the tool for regularizing and legitimizing the requirements for EIA. The Environmental Protection Agency (EPA), provided for under the Environmental Protection (EP) Act and the inter-sectoral board of directors along with the incorporated technical arm known as the Environmental Assessment Board (EAB) laid the foundation for Environmental Assessments (EA) and EIA permitting process.

The legislative, regulatory and policy framework covering the EIA and permitting process include:

- The Environmental Protection (EP) Act No. 11 of 1996;
- National Environmental Action Plan, 2000 (NEAP);
- Draft Regulations (2000) associated with EP Act relating to Air Quality, Water Quality), Noise Management and Hazardous Wastes;
- Town and Country Planning Act;
- Public Health Ordinance;
- Occupational Safety and Health Act 1997;
- The Mining Act 1989;
- The Forestry Act and Policy;
- Wild Birds Protection Act;
- Guyana Energy Agency Act 1997;
- Electricity Sector Reform Act 1999;
- Public Utilities Commission Act 1992.

i. The Environmental Protection Act (1996)

The EP Act is divided into ten parts and schedules covering *inter alia*: institutional arrangements, administration, EIA (Part IV), prevention and control of pollution (Part V), investigations and prosecutions and environmental trust fund and finances. This Act provide for the management, conservation, protection and improvement of the

environment, the prevention or control of pollution, the assessment of the impact of economic development on the environment, the sustainable use of natural resources and for matters incidental thereto or connected therewith.

The environmental permitting system is based on pollution limits or mandatory performance standards for air, noise, water and waste is the main instrument used for the control of pollution. However, the criteria established by the permits are sector specific and allows for some flexibility based on the size of the development. Hence, both applicable limitations and method of compliance are tailored to the circumstances of the individual permit-holder (SENES, 2003). Processes that employ cleaner production technology that minimize pollution, reduce raw materials, reduce the environmental toxicity or volume of waste streams or improve energy efficiency will be prescribed for new industry while pollution control technologies will be required for existing industry. These limitations and standards form the basis of control for point source discharges which are implemented through the environmental authorization. Regulations under the Act require that if a facility discharges contaminants from any point source into the environment of Guyana, the operator must submit an application for an environmental authorization to the EPA. The authorization will establish standards or conditions necessary to protect the environment of Guyana.

ii. Environmental Protection Agency (EPA)

The EP ACT outlined that the EPA, which was established for its administration, should be guided by four principles namely, polluter pays, precautionary, strict liability and the state of technology principles (EP Act, 1996). Furthermore, it is dictated that the cost of an environmental authorization will reflect an assessment of the damage to the environment that will be caused by the "polluter". Environmental permits are enforced by the Authority albeit the mechanisms of self monitoring, reporting requirements, and scheduled or unscheduled site visits and monitoring by personnel from the EPA and other regulatory agencies. Prosecutions and civil procedures are outlined in the Act to address the issue of non-compliances and can range from fines to both fines and imprisonment.

The EPA was given the responsibility of:

- Taking steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection, and sustainable use of its natural resources;
- Promoting the participation of members of the public in the process of integrating environmental concerns in planning for development on a sustainable basis;
- Establishing, monitoring and enforcing environmental regulations;
- Prevention or control environmental pollution;
- Ensuring that any developmental activity which may cause an adverse effect on the natural environment be assessed before

such activity is commenced and that such adverse effect be taken into account in deciding whether or not such activity should be authorised;

- Advising the Minister on the criteria and thresholds of activity for specifying what may amount to a significant effect on the environment;
- Requesting, examining, reviewing, evaluating and approving or rejection environmental impact assessments and risks analyses and make suitable recommendations for the mitigation of adverse effects of any proposed activity on the environment;
- Conducting studies and making recommendations on standards relating to the improvement of the environment and the maintenance of a sound ecological system;
- Monitoring and co-ordinate monitoring of trends in the use of natural resources and their impact on the environment;
- Producing sectoral guidelines on what may constitute significant effects on the environment;
- Obtaining expert or technical advice from any suitably qualified person on such terms and conditions as the Agency shall think fit;
- Maintaining and making available to members of the public during normal working hours a register of all environmental impact assessments carried out, environmental authorisations granted and other information in accordance with section 36.

iii. Environmental Impact Assessment

The EP Act dictates that a developer of any project which may significantly affect the environment shall apply to the Authority for an environmental permit and shall submit with such application the fee prescribed and a summary of the project including information on: the site, design and size of the project, possible effects on the environment, the duration of the project, and a non-technical explanation of the project.

Where the developer is uncertain as to the significance of the project on the environment submission of the project summary and pertinent information on the project will have to be made to the EPA. The decision of the Authority will then be published in a newspaper indicating a requirement for or exemption from an EIA. This allows for the elements of public information by the EPA and the submissions of queries, concerns, objections and appeals by the public to the EAB. The EAB will then within reasonable time publish a decision confirming or setting aside the Authority's decision.

The EIA once requested will be conducted by an independent and suitably qualified person approved by the Authority and shall identify, describe and evaluate the direct and indirect effects of the proposed project on the environment including *inter alia*: human beings, flora, fauna, species habitats, water, soil, air, material aspects, cultural heritage and landscape, natural resources, ecological balance and ecosystems, interactions of natural systems. Importantly the Agency is mandated to

assess every project with a view to the need to protect and improve human health and living conditions and the need to preserve the stability of ecosystems as well as the diversity of species.

The components of the EIA study report which mirrors that constituting the Environmental Impact Statement (EIS) required for project under the International Finance Corporation (IFC) are also outlined. Interspersed between the suites of environmentally related elements are:

- The emission of contaminants, the creation of nuisances and the elimination of waste, and a description by the developer of the forecasting methods used to assess the effects on the environment;
- An indication of any difficulties (technical deficiencies or lack of knowledge or expertise) encountered by the developer in compiling the required information;
- A description of any hazards or dangers which may arise from the project and an assessment of the risk to the environment.

The need for and procedure for public consultation and input is iterated once again. Hence, the Agency is mandated to at the developer's cost publish in at least one daily newspaper a notice of the project and make available to members of the public the project summary. Members of the public shall have twenty-eight days from the date of publication make written submission to the Agency setting out those questions and matters which they require to be answered or considered in the EIA study. Submissions made and matters raised by the public have to be included in the terms and scope of the EIA set by the Agency. Furthermore, the need for engagement of the public on a continuous basis is ensured by stipulating:

- During the course of the EIA the developer and the person carrying out the study shall consult members of the public, interested bodies and organizations;
- Provide to members of the public on request, and at no more than the reasonable cost of photocopying, copies of information obtained for the purpose of the EIA;
- The developer and the person carrying out the study shall submit EIA together with an environmental impact statement (EIS) to the Agency for evaluation and recommendations and publish a notice in at least one daily newspaper confirming that the EIA and EIS have been submitted to the agency and members of the public shall have sixty days from the date of publication of such notice to make such submissions to the Agency as they consider appropriate;
- The EIA and the EIS shall be public documents and the developer and the Agency shall have such documents available

for the duration of the project and five years thereafter for inspection, subject to the deletion therefrom of such information as may disclose intellectual property rights, during normal working hours at their respective offices and shall supply on request and on payment of cost of photocopying copies of such documents;

- The Agency shall submit the EIA together with the EIS to the EAB for its consideration and recommendation as to whether they are acceptable;
- The Agency shall publish its decision and the grounds on which it is made.

The Agency shall approve or reject the project after taking into account:

- Recommendations of the EAB;
- Views expressed during the consultations;
- The EIA and EIS.

A decision by the Agency to issue an environmental permit for a project shall be subject to conditions which are reasonably necessary to protect human health and the environment and an assessment of the capacity and capability of the developer to comply with the inherent terms and conditions. Cancellations and suspension of the permit and obligations of the developers are also contained therein.

Measures for the protection of health and the environment including non-compliance rests with the Minister who may in co-ordination with other appropriate governmental entities undertake such emergency response activities as are required to protect human health or the environment. Furthermore, the Minister may make regulations establishing the criteria and thresholds to determine which projects may have significant effects on the environment.

The need for EIAs was also extended to development activities whose impacts can be as a result of cumulative and synergistic effects. Additionally, the adoption or alteration of policies, programmes or plans by a public authority which may have significant effect on the environment then the conduct of an EIA for such policy, programme, plan or alteration is required.

iv. Environmental Assessment Board (EAB)

The EAB functions in a technical and advisory capacity to the EPA and has the following mandate:

- Conduct public hearings into all appeals submitted to it against a decision of the EPA to exempt a project for the requirement of the EIA;
- Advise the EPA as to whether the EIA should be accepted, amended or rejected;

- Whether an environmental permit should be issued;
- Finalising the TOR and scope of works for the EIA;
- What terms and conditions should be included in the environmental permit.

v. Prevention and Control of Pollution

The EP Act specifically address activities that is likely or may have adverse effect on the environment. No person shall discharge or cause or permit the entry into the environment of any contaminant in any amount, concentration or level in excess of that prescribed by the regulations or stipulated by any environmental authorisation. In cases of contravention the reporting requirement is stipulated, investigation criteria noted, restoration measures outlined, incurring cost associated with investigation, restoration and compensation identified and order of the Minister directed to responsible entities indicated.

Reporting on the environmental performance of facilities that are involved in processes and operations that can have a deleterious effect on the environment is allowed for. This includes:

- Addressing and controlling the alteration of the process, production and rate of discharge of any contaminants;
- The issuance of prohibition notices demanding cessation where activities may pose a serious threat to natural resources or the environment or a risk of serious pollution of the environment or any damage to public health;
- Alluding to and clarification of environmental harm as involving actual or potential harm to the health or safety of human beings that is of a high impact or on a wide scale, or other actual or potential environmental harm (not being merely an environmental nuisance) that is of a high impact or on a wide scale.

vi. Emissions and Ambient Environmental Standards

The EP Act (Section 68 (1)) confers on the Agency the power to make and enforce emissions and environmental quality standards for the effective management of the natural environment in Guyana (SENES, 2003).

The provisions of the regulations include:

- Standards and codes of practice with respect to the protection and rehabilitation of the environment and the conservation of natural resources;
- The quantity, condition or concentration of substances that may be released into the environment;

- The establishment of ambient air quality standards, an air pollution monitoring system and index, and the manufacture, use and emission of air contaminants;
- The design, construction, operation, maintenance and monitoring of facilities for the control of pollution and the disposal of waste;
- The protection of particular species of prescribed fauna and flora;
- Classifying contaminants and sources of contaminants including the designation of certain contaminants as hazardous;
- Prohibiting or regulating and controlling the discharge of any contaminant or contaminants into the natural environment from any source of contaminant or any class thereof;
- Prescribing the maximum permissible concentration or level in water of any contaminant either generally or with respect to any part of the waters of Guyana specified in the regulations;
- Prohibiting the dumping of waste into the marine environment;
- Prohibiting or halting the emission of sounds or vibrations or prescribing maximum levels of sounds and vibrations and the procedures for determining the levels of sounds or vibrations that are emitted;
- The principles to facilitate the participation of communities which are likely to be adversely affected by the activity of a developer, taking into account the rights of indigenous communities;
- The utilisation of forest resources and the extraction of mineral resources;

The existing regulations include:

- Environmental Protection (Air Quality) Regulations 2000;
- Environmental Protection (Water Quality) Regulations 2000;

Guyana has interim numerical industrial effluent standards which cover end-of-pipe discharges but they do not apply to mining, forestry and agricultural activities (SENES, 2003):

- Environmental Protection (Noise Management) Regulations 2000
- Hazardous Wastes Management Regulations, 2000

Furthermore, clauses are embedded in the regulations to ensure compliance by new and existing development and operations.

The variables used in the control of environmental impacts include:

- **Atmospheric emissions:** smoke, solid particles, sulphuric acid mist or sulphuric trioxide, fluoride compounds, hydrogen chloride, chlorine, hydrogen sulphide, nitric acid or oxides of nitrogen, carbon monoxide.

- **Aqueous emissions:** ammoniacal nitrogen, sulphate, chloride, cobalt, colour, detergents, anionic, fluoride (as F), molybdenum, phosphate (as P), polychlorinated biphenyls, selenium, silver, beryllium, vanadium, radioactive material, nitrate nitrogen, temperature, pesticides (fungicides, herbicides, insecticides, rodenticides, fumigants or any other biocides or any other chlorinated hydrocarbons), a substance that either by itself or in or in combination with other waste or refuse may give rise to any gas, fume or odour or substance which causes or is likely to cause pollution combination with other waste or refuse may give rise to any gas, fume or odour or substance which causes or is likely to cause pollution.

- **Noise emissions:** categories in respect of which permissible noise levels are to be fixed are, residential, institutional, educational, industrial, commercial, construction, Transportation and recreational.

vii. The Mining Act (1989) (SENES, 2003)

The Guyana Geology and Mines Commission (GGMC) is responsible for the implementation of the Act. A mining license is required in order to mine any mineral and is issued at the discretion of the Commissioner. The Act empowers the Minister to make regulations for the carrying on of all operations relating to prospecting and mining; the conservation and prevention of waste of minerals; health, safety and welfare standards; the cutting and use of timber from State lands for purposes connected with mining; and other matters. The rights of persons in possession of lands grants as well as the privileges of Amerindians in relation to prospecting, mining, quarrying are preserved under this Act. A Memorandum of Understanding (MoU) exists between GGMC and EPA whereby licenses will only be provided after ensuring that developments are in compliance with the Environmental Protection Act.

viii. Occupational Safety and Health Act (1997)

The Act makes provision for the formation of an advisory council and authority on occupational health and safety. This council is responsible for the formation of a national policy, programmes and public awareness on occupational safety and health. The structural stability of the buildings used for conducting industrial activities as well as the safety of machinery and components are covered. Specific mention is made with reference to mines and in both cases proof of certification by an engineering firm is necessary. Section 15 calls for the appointment of medical practitioners to be medical inspectors under the Act. Determination of fitness for work is done by the medical practitioners and verified by the inspectors. Special emphasis is placed on young persons although an age limit is not specified. Technical examiners are also alluded to in the Act to review technical specifications of buildings and machinery with regards to health and safety.

- Joint safety and health committee for workplace of more than 20 workers;
- The Act does not apply to machinery used in the State before the commencement of the Act;
- Speaks to adequate ventilation and lighting;
- Supply and access to potable water;
- Change room and sanitary conveniences;
- Employer has duty to ensure that the safety and health of workers on the construction site is protected;
- Take any precaution reasonable in the circumstances for the protection of the worker;
- Provide and maintain safe, sound, healthy and secure working environment as far as is reasonably practicable;
- Ensure that, as far as reasonably practicable, the chemicals, physical agents and biological agents shall under his control are without risk to safety and health when the appropriate measures of protection are taken;
- Keep record of the handling storage and disposal of the chemical and biological agents;
- Monitor at intervals the levels of the agents in the work place;
- Ensure a medical surveillance programme;
- Comply with any standards limiting the exposure of a worker to chemicals, physical agents or biological agents as prescribed;
- Age limit for employment of persons set as the age of compulsory schooling and not less than 14 yrs.

Without prejudice to the provisions of any Act that governs environmental protection and pollution control in Guyana, work in a workplace is carried out without causing a discharge of noxious, hazardous, or polluting matter into air, water, or soil so far as is reasonable practicable or except under and in accordance with any license for the purpose granted under the authority of any Act.

The Act specifies that there is a need to acquaint a worker or a person in authority over a worker of any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment, chemical, physical agent or biological agent.

Furthermore, the occupier of every industrial establishment shall be under a duty to take steps to protect the safety and health of the public in the vicinity of his industrial establishment from dangers created by the operation or processes carried on therein, and shall take special care to ensure that plant and equipment used therein are of such integrity and that such adequate safety systems exist as to prevent the occurrence of hazardous emissions.

Where the Authority is of the view that the steps taken in an industrial establishment or in its vicinity are inadequate to prevent injury to the public directions may be given under subsection such as:

- Obtaining and implementing advice from specialist or expert consultants;
- Implementing measures to abate nuisances arising from the operations carried on in industrial establishment;
- Implementing measures to prevent the occurrence of hazardous emissions.

The Act requires an inventory of hazardous and dangerous substances and specifies the kind of information required for such substance.

ix. Public Health Ordinance (SENES, 2003)

The Ordinance provides for the delegation of authority for the implementation and enforcement of its provisions regulating environmental health conditions to local health authorities including the abatement of nuisances, the removal of refuse and sanitary control of water pollution, workplace air quality and surface drainage.

x. Forestry Commission Act and The National Forest Policy (1997)

The Guyana Forestry Commission Act guides the functions and responsibilities of the Guyana Forestry Commission (GFC) and along with the National Forest Policy (NFP) provide the framework for the sustainable management of forest resources in Guyana. The GFC is governed by a board of directors appointed by the President. The board is responsible for the performance of the functions conferred on the Commission by the Act.

A National Forest Policy was approved by the Government in 1997 through a process that involved extensive consultation with interest groups. The new policy responds to significant changes in Guyana's economic, social and political environment and addresses the country's national and global responsibility for the sustainable management of the forests. The policy recognizes the vital role of the forests in maintaining the earth's climate and ecosystems and that they are an increasingly important source of income and wealth for national development. Forest laws are being reviewed and updated to support the implementation of the new policy.

The overall objective of Guyana's National Forestry Policy is:

- The conservation, protection, management and utilization of the nations forest resources, while ensuring that the productive capacity of the forests for both goods and services is maintained or enhance.

Specific objectives are to:

- Promote sustainable and efficient forest activities which utilize the broad range of forest resources and contribute to national development while allowing fair returns to local and foreign entrepreneurs;
- Achieve improved sustainable forest resource yields while ensuring the conservation of ecosystems, biodiversity, and the environment;
- Ensure watershed protection and rehabilitation: prevent an arrest the erosion of soils and the degradation of forests, grazing and reforestation; and protect the forest against fire, pests and other hazards.

xi. Guyana's National Environmental Action Plan (NEAP)

The NEAP was developed through inter-agency collaboration under the auspices of the EPA and set out the goals for sustainable development and environmental protection in Guyana.

Based on national consultation, the main focus of the NEAP were:

- The prevention or control of pollution in order to maintain the integrity of the land and the natural purity of the air and water resources;
- The general preservation and conservation of ecological integrity and the protection of natural habitats and fragile ecosystems;
- Ensuring sustainability through best practice of the management and use of natural resources for economic development.

In the NEAP Guyana unequivocally declares commitment to Sustainable Development including Sustainable Human Development as one of the major pillars of the country's socioeconomic programme. This integrates economic, environmental and social values during planning, and distributes benefits equitably across socio-economic strata and gender upon implementation. It also ensures that opportunity for continued development remains undiminished for future generations. It also clearly defines the need for environmental protection to be treated as a cross-sectoral matter applied to all aspects of developmental process (SENES, 2003).

Some of the NEAP's programme areas include:

- Environmental pollution – regulatory standards and control;
- Settlements – impact of humans on the environment;
- Occupational safety and health – facilitate industrial compliance;
- Natural resources – sustainable land management and resource use;
- Fisheries – management of aquatic ecosystems.

The proposed means for implementation of the NEAP are through financial mechanisms and strategies, environmental education, public awareness and involvement, interagency collaboration for monitoring and enforcement and ratification or accession to multilateral environmental agreements.

xii. Interagency Collaborations

In order to reduce the level of conflict with responsibilities for some aspects of environmental management the EPA has established memoranda of understanding (MoU) between the different Agencies.

These agencies include:

- Guyana Geology and Mines Commission (GGMC);
- Ministry of Health (MoH);
- Guyana Forestry Commission (GFC);
- Ministry of Public Works and Communications (MoPW);
- Ministry of Local Government (MOLG).

These MoUs reinforces the need for the particular sector agency will ensure compliance with the EP Act before issuing contracts, licenses or permits for projects.

xiii. Categories of International Finance Corporation Projects (From SENES, 2003)

Projects proposed for International Finance Corporation (IFC) financing are required to undergo environmental assessment (EA) to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The process is described in *International Finance Corporation, Operational Policies, Environmental Assessment, OP 4.01, October 1998* and it closely resembles that required by the Guyana EIA process.

Additionally, in the IFC process, there is an initial step required to categorize the project according to the kind of EA required:

- Category A projects for which a full EA is required, are those expected to have “adverse impacts that may be sensitive, irreversible, and diverse” (OP 4.01), with attributes such as direct pollutant discharges large enough to cause degradation of air, water, or soil; large-scale physical disturbance of the site or surroundings; extraction, consumption, or conversion of substantial amounts of forest and other natural resources; measurable modification of hydrologic cycles; use of hazardous materials in more than incidental quantities; and involuntary displacement of people and other significant social disturbances.
- Category B projects, for which some environmental analysis is necessary, have impacts that are “less significant, not as sensitive, numerous, major or diverse. Few, if any of these impacts are irreversible, and remedial measures can be more easily designed” (OP4.01). Typical Category B projects entail rehabilitation, maintenance, or upgrading rather than new construction.
- Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no

further EA action is required for a Category C project Based on these definitions it has been concluded that the Cambior proposal would be a Category B project.

xiv. IFC Guidelines

Projects must comply with World Bank Group policies and guidelines, which emphasize pollution prevention, including the use of cleaner production technologies. The intent of the guidelines is to minimize resource consumption, including energy use, and to eliminate or reduce pollutants at the source. The *Pollution Prevention and Abatement Handbook*, World Bank Group, Effective July 1998, provides General Environmental Guidelines as well as specific emission and ambient guidelines for specific industries and specific categories of pollutant. They cover requirements for air emissions, liquid effluents, hazardous chemicals and wastes, and solid wastes. Sections on ambient noise and monitoring requirements are included.

Environment, Health and Safety Guidelines Open Pit Mining and Milling

2.7.3.1 Tailings Disposal

Tailings must be disposed of in a manner that optimizes protection of human safety and the environment. On-land tailings impoundment systems must be designed and constructed in accordance with internationally recognized engineering practices, local seismic conditions, and precipitation conditions. On-land disposal systems should be designed to isolate acid leachate-generating material from oxidation or percolating water. Marine discharges of tailings must not have a significant adverse effect on coastal resources. Riverine discharges are not acceptable unless the project sponsor provides thorough documentation regarding: 1) environmental analysis of alternatives, and 2) effects on aquatic resources and downstream users of riverine resources. If the mining operation involves a series of open pit operations, project sponsors must evaluate the feasibility of using abandoned open pits for tailings disposal.

2.7.3.2 Liquid Effluent

The following are guidelines for effluent discharged to receiving waters from tailings impoundments, mine drainage, sedimentation basins, sewage systems, and stormwater drainage. They do not apply to direct discharge of tailings to the marine environment.

pH	6 to 9
BOD5	50 mg/l
Oil and Grease	20 mg/l
Total Suspended Solids	50 mg/l
Temperature	- at the edge of Max 5 °C above ambient temperature a designated mixing zone of

receiving waters - max 3 °C if receiving waters >28 °C

2.7.3.3 Residual Heavy Metals

The following are recommended target guidelines below which there is expected to be no risk for significant adverse impact on aquatic biota or human use. In cases where natural background concentrations exceed these levels, the discharge may contain concentrations up to natural background levels. Concentrations up to 110% of natural background can be accepted if no significant adverse impact can be demonstrated.

Arsenic	1.0 mg/l
Cadmium	0.1 mg/l
Chromium, Hexavalent	0.05 mg/l
Chromium, Total	1.0 mg/l
Copper	0.3 mg/l
Iron, Total	2 mg/l
Lead	0.6 mg/l
Mercury	0.002 mg/l
Nickel	0.5 mg/l
Zinc	1.0 mg/l

2.7.3.4 Ambient Air

Concentrations of contaminants, measured outside the project property boundary, should not exceed the following limits:

Particulate Matter (<10 µm)	
Annual Arithmetic Mean	100 µg/m ³
Maximum 24-hour Average	500 µg/m ³
Nitrogen Oxides, as NO ₂	
Annual Arithmetic Mean	100 µg/m ³
Maximum 24-hour Average	200 µg/m ³
Sulfur Dioxide	
Annual Arithmetic Mean	100 µg/m ³
Maximum 24-hour Average	500 µg/m ³

2.7.3.5 Other General Environmental Requirements

Project sponsors are required to prepare and implement an erosion and sediment control plan. The plan should include measures appropriate to the situation to intercept, divert, or otherwise reduce the stormwater runoff from exposed soil surfaces, tailings dams, and waste rock dumps. Project sponsors are encouraged to integrate vegetative and non-vegetative soil stabilization measures in the erosion control plan. Sediment control structures (e.g., detention/retention basins) should be

installed to treat surface runoff prior to discharge to surface water bodies. All erosion control and sediment containment facilities must receive proper maintenance during their design life.

2.7.3.6 Mine Reclamation Plan

Project sponsors are required to prepare and implement a mine reclamation plan. The plan should include reclamation of tailings deposits, any open pit areas, sedimentation basins, and abandoned mine, mill, and camp sites. The main objectives of the mine reclamation plan are:

- a) return the land to conditions capable of supporting prior land use or uses that are equal to or better than prior land use, to the extent practical and feasible
- b) eliminate significant adverse effects on adjacent water resources.

Mine reclamation plans should incorporate the following components:

- a) conserve, stockpile, and use topsoil for reclamation
- b) slopes of more than 30% should be recontoured to minimize erosion and runoff
- c) native vegetation should be planted to prevent erosion and encourage self-sustaining development of a productive ecosystem on the reclaimed land
- d) budget and schedule for pre- and post-abandonment reclamation activities
- e) plan views that show areas cleared, mined, refilled, and revegetated during each of the next 5 years and estimated activities at subsequent 5 year intervals

2.7.3.7 Sewage Sludge Disposal

Sewage sludge must be disposed of in an environmentally acceptable way in compliance with local laws and regulations. Project sponsors are encouraged to evaluate the environmental and health implications of using sewage sludge in reclaiming tailings deposits, waste rock dumps, and mined out areas.

Solid Wastes Disposal Project sponsors are encouraged to recycle or reclaim materials where possible. If recycling or reclaim is not practical, these wastes must be disposed of in an environmentally acceptable way in compliance with local laws and regulations. Solvents and similar hazardous materials must not be disposed of in a manner likely to result in soil or groundwater contamination if groundwater is potentially useable for potable water or irrigation purposes. Waste rock dumps should be designed and engineered so that materials with high potential to generate acid leachate are isolated from oxidation or percolating water.

2.7.3.7 Workplace Air Quality

- a) Periodic monitoring of workplace air quality should be conducted for air contaminants relevant to employee tasks and the plant's operations.
- b) Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well maintained.
- c) Protective respiratory equipment must be used by employees when the exposure levels for welding fumes, solvents and other materials present in the workplace exceed local or internationally accepted standards, or the following threshold limit values (TLVs):

Arsenic	0.5 mg/m ³
Carbon Monoxide	29 mg/m ³
Copper	1 mg/m ³
Free Silica	5.0 mg/m ³
Hydrogen Cyanide	11 mg/m ³
Hydrogen Sulfide	14 mg/m ³
Lead, Dusts & Fumes, as Pb	0.15 mg/m ³
Nitrogen Dioxide	6 mg/m ³
Particulate (Inert or Nuisance Dusts)	10 mg/m ³
Sulfur Dioxide	5 mg/m ³

2.7.3.8 Workplace Noise

- a) Feasible administrative and engineering controls, including sound-insulated equipment and control rooms should be employed to reduce the average noise level in normal work areas.
- b) Plant equipment should be well maintained to minimize noise levels.
- c) Personnel must use hearing protection when exposed to noise levels above 85 dBA.

2.7.3.9 Hazardous Materials Handling and Storage

- a) All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labeled containers or vessels.
- b) Storage and handling of hazardous materials must be in accordance with local regulations, and appropriate to their hazard characteristics.
- c) Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulation, to prevent fires or the release of hazardous materials to the environment.

2.7.3.10 Health Aspects

- a) Sanitary facilities should be well equipped with supplies (e.g., protective creams) and employees should be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens.
- b) Ventilation systems should be provided to control work area temperatures and humidity.
- c) Personnel required to work in areas of high temperature and/or high humidity should be allowed to take frequent breaks away from these areas.
- d) Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to toxic or radioactive substances.

2.7.3.11 Record Keeping and Reporting

- a) The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies.

C. Environmental Permitting and EIA and Process

Regulation and control of development activities that impacts the environment takes the form of two mandatory measures: 1. Registration and environmental permitting (Figure 2.8.1) and 2. Requirement of conduct of EIAs (Figure 2.8.2).

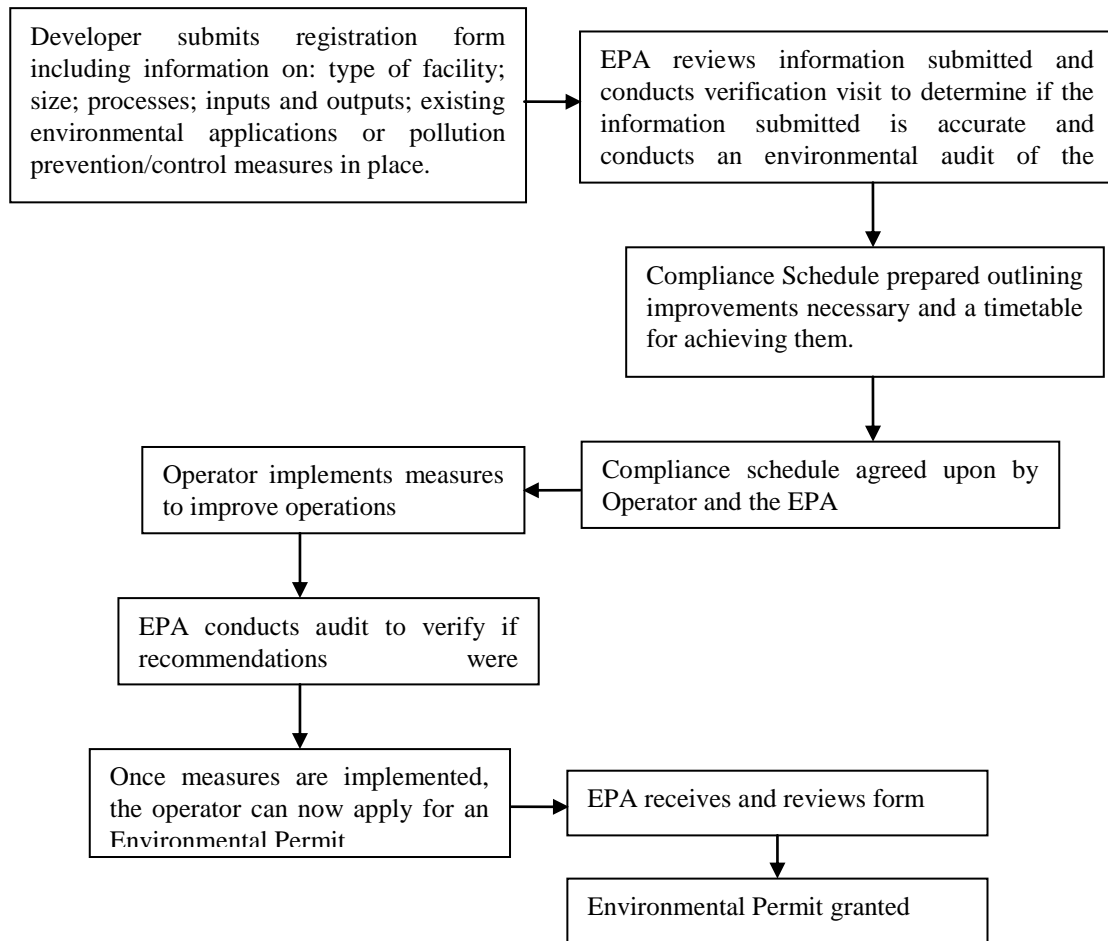


Figure 2.8.1: Guyana EPA Registration Process

EPA will provide the developer with a list of consultants for selection. The developer will submit to the EPA the choice of consultants to conduct the EIA for approval

Duration: 14 days



EPA reviews the team of consultants so as to ensure that the required expertise is present and notifies the developer as to whether the consultants have been approved.



EPA publishes in a daily newspaper notice of the project and makes available copies of the project summary. The public has 28 days to make written submissions on the issues/concerns they wish to be considered in the EIA.

Duration: 28 days

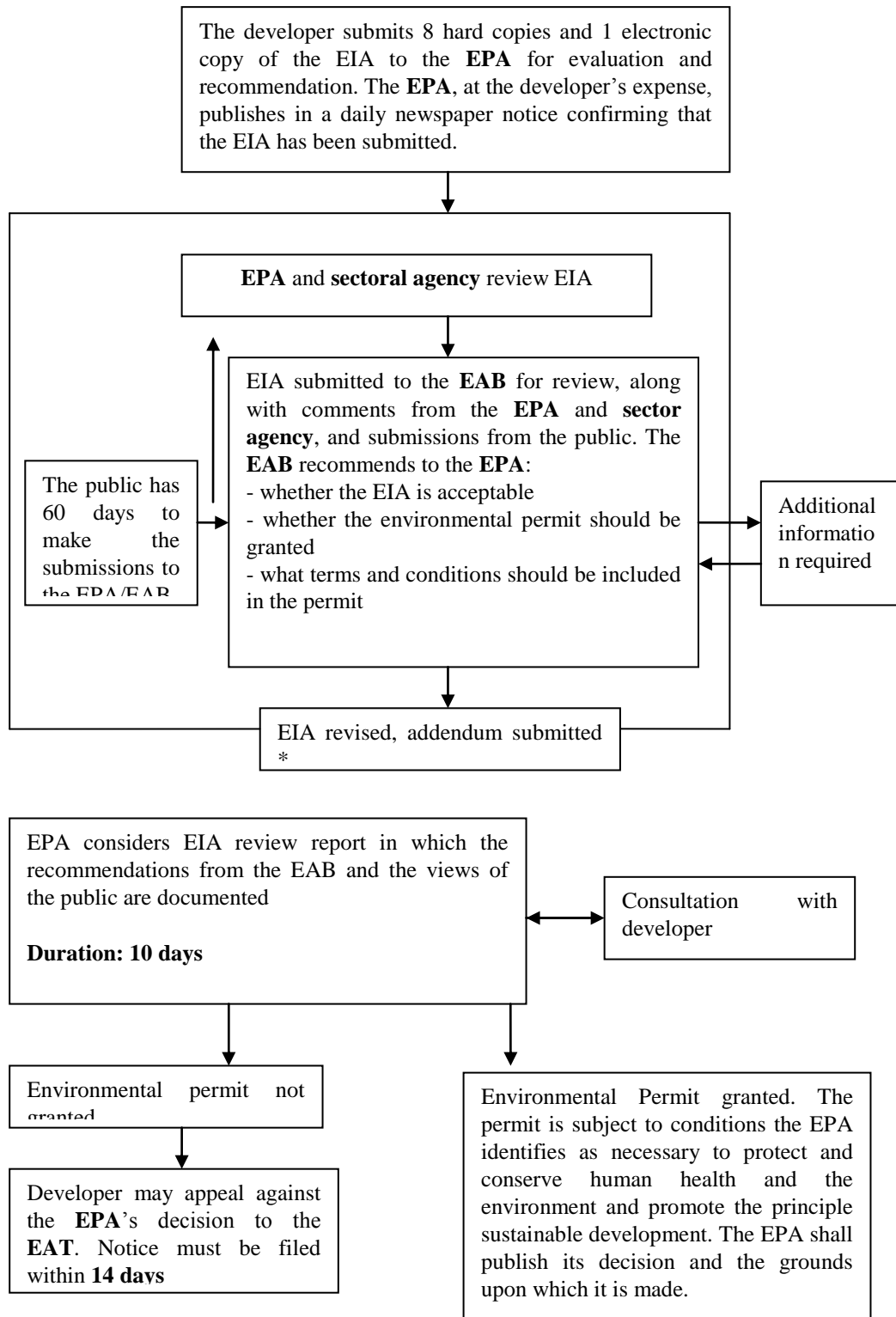


EPA and the EIA consultants, facilitated by the **EAB**, carry out a scoping exercise and develop the terms of reference for the EIA, taking into account both written submissions from the public and concerns raised at any public consultation during the 28-day period.



EIA study and preparation of report

Note: The process should be interactive in so far as the (a) multidisciplinary approach (b) baseline data, (c) Impact Assessment and (d) Environmental Management Plan, are concerned



* Depending on the significance of the information requested, the EIA may need to be re-submitted either as a revised document or as an addendum to the EIA

Figure 2.8.2: EIA Required Process

I.

i. Terms of Reference and EIA Process Followed by Cambior

Cambior prepared TOR in consultation with the EPA to ensure that the EIA satisfy the requirements of regulatory authorities in Guyana and also meet international standards.

In general the EIA was to:

- Describe the current major project operations and their environmental aspects, mining, processing, waste and tailings disposal, and site services (roads, power, administration, and maintenance facilities);
- Document the biological, ecological, geographic and socio-economic attributes of the facilities;
- Describe and quantify the associated environmental impacts and assess the significance of the impacts;
- Develop an Environmental Management Plan (EMP) that should be implemented to mitigate any adverse and potentially adverse environmental impacts associated with operation of a well-managed plant;
- Prepare a preliminary decommissioning concept for closeout of mines and unused facilities and the permanent disposal of wastes;
- Present the principals of an EMS that meets ISO 14001 standards.

Background information available and stipulated in the TOR to be reviewed by SENES for the EIA included the following:

- An “Environmental Assessment and Management Plan” (Rescan, 1993) for the site which identified the following were significant environmental issues:
 - Air quality – principally fugitive emissions from kiln operation;
 - Tailings management – embankments, water and sediment transport;
 - Diesel fuel and Bunker C oil management;
 - Sediment transport from mines and mined-out areas.
- “Tailings and Water Management Feasibility Study” (Golder, 1994) that concluded the tailings facility needed remedial work and should be replaced by a new facility and that mine dewatering equipment should be improved.
- A report entitled “Environmental Matters of Relevance to the Proposed Restructuring and Privatization of the Linden Mining Enterprise (Linmine)” (The Adam Smith Institute, 2002) which concluded and noted that:
 - Soil and groundwater contamination existed at several locations at the processing facility (principally hydrocarbons);

- Significant aerial emissions of dust originated from the two remaining operating kilns;
- Raw water supply for the processing facility was contaminated with bacteria and other substances from the Demerara River;
- Absence of solid waste management;
- Possibility of polychlorinated biphenyls in electrical equipment;
- Concerns about the stability of tailings containment.

In addition to the above, Cambior had undertaken limited environmental investigations which determined that concerns reported in these reports remain. Cambior has also determined that mine water and process tailings water contain small amounts of acidity. As part of its initial investigations Cambior also took samples of capacitor and transformer oils, and identified the existence of asbestos board and insulation at the processing facility. Some additional sampling of soils, sediments and waters is expected to be required. These aspects were also included in the development of the EIA.

- Visiting the Linmine facilities to assess site conditions and review site data and drawings, environmental conditions, and information assembled over the last 10 years.
- Addressing environmental impacts that may be associated with the proposed new operating conditions after acquisition including:
 - using standby diesel-generated power (units from Omai);
 - converting mining operations from drag line to truck-and-shovel operation;
 - shutting down the existing rail and constructing a new dedicated road from Montgomery mine to processing plant;
 - development of mine overburden, water and sediment management;
 - designing for and implementing progressive mine site reclamation for operational and future mines;
 - installing dust recovery systems for kilns;
 - managing air and water discharges;
 - remediating contaminated soils at the processing facility;
 - solid waste management;
 - implementing an Environmental Management System (EMS) that meets international standards (ISO).

Table 1.3 summarizes the actions taken by Cambior to ensure that this EIA complies with Guyanese and IFC policies.

Table 1.3: EIA Preparation and Approval Process of Guyana and IFC

Item	Description	Comments
1. Application for Environmental Permit, EIA Decision & Public Notification	Project summary required including information on: design and size of the project; possible effects on the environment; the duration of the project; and a non-technical explanation of the project.	The followed an inception meeting with Cambior and EPA and publication of the decision of the EPA requesting an EIA
2. Terms of Reference (ToR)	Project scoping, information dissemination and consultation with public, EPA and EAB over 28-day period to scope key issues, incorporating input into ToR	<ol style="list-style-type: none"> 1. EPA and Cambior consultants held meeting. 2. Stakeholder group meeting convened. 3. Review of IFC criteria. 4. Appointment of internationally recognized EIA consulting team.
3. EIA Coverage	<p>The elements of the EIA as required by Guyana are:</p> <ol style="list-style-type: none"> a) project description and alternatives to the project, including anticipated emissions and disruptions; b) environmental baseline study of the area of influence; c) assessment of the significance of direct, indirect and cumulative impacts on the physical, biological, social, health cultural, historical, archaeological and economic components of the environment; d) Environmental management plan (EMP); e) Environmental impact statement (EIS). 	EIA conducted following EPA and IFC criteria
4. Prepare and submit EIA	<ol style="list-style-type: none"> 1. Guyana advises ongoing consultation between developer, the EPA and the sector agency (Guyana Geology and Mining Commission GGMC). 2. EIA submitted to EPA. 3. EPA publishes a notice notifying the public of the submission of the EIA. 4. Public has 60 days to make submission to the EPA and/or EAB. 	<ol style="list-style-type: none"> 1. Meeting held to review ToR. 2. Public meeting held. 3. Prepare EIA according to ToR. 4. Draft EIA report submitted
5. Authorities (EPA, EAB, IFC) Review of EIA	<ol style="list-style-type: none"> 1. Review of EIA by sector agencies. 2. EIA and finding of EPA and sector agencies passed to EAB for review and recommendation. 3. EAB make recommendation based on EIA and findings. 4. EIA revised to address all issues raised. 5. EPA review environmental permit and conditions. 	<ol style="list-style-type: none"> 1. Draft EIA and EPA response submitted to IFC. 2. EAB hold public hearing and incorporate comments; 3. Appraisal mission by IFC to assess the adequacy of the regulatory institutions and determine if EIA's recommendations are properly addressed in project design and economic analysis.

ii. Public Consultation

As stipulated by law and dictated by the guidelines provided by the EPA a public consultation program was carried out by Cambior's staff to inform local stakeholders of the proposed Project, to provide a forum for public feedback, expressions of support or concern with respect to the project and for finalizing the scope of the EIA. The public consultation sessions provided stakeholder groups with information on the nature of the proposed Project, the timing of the related assessments and activities, and an outline of the potential benefits, issues and challenges.

The objective of the consultation process was to communicate with all interested stakeholders including the:

- Guyanese Public at large;
- Community representatives;
- Church and Social Groups;
- Government;
- Business;
- Unions;
- Employees (ex-employees) and their families.

iii. Mechanism of Public Consultation

The public consultation program was carried out from October to December 2002 and took the form of a number of meetings (Table 3.2.2.1). Through the public consultation program, Cambior provided insights into the proposed plans, issues, challenges, and benefits that could be associated with the proposed acquisition of the Linden Mine by Cambior.

The three key topics presented at the public meetings were:

- An outline of the LINMINE Restructuring Plan;
- Presentation of Cambior's plans for the future of the operation;
- An outline of Cambior's plans to address environmental issues.

Table 3.2.2.1: Public Consultations Held by Cambior (SENES, 2003)

Meeting No.	Date & Time	Participants OMAI team and the following groups	No. of participants
1	2 Oct. 2002 – 9:04 am	Linden Utilities Co-op Society Limited	12
2	3 Oct. 2002 – 10:39 am	Regional Democratic Council, Region 10 and Mayor and Town Council	27
3	3 Oct. 2002 – 1:04 pm	Bauxite Unions – GMM&GWU and GB&GWU	19
4	3 Oct. 2002 – 2:10 pm	Linden Economic Advancement Program (LEAP)	13
5	9 Oct. 2002 – 6:14 pm	Catholic Church Group of St. Joseph the Worker Catholic Church	28
6	9 Oct. 2002 – 7:50 pm	Linden Chamber of Industry and Commerce	17
7	13 Oct. 2002	Christ the King Anglican Church Group	23
8	17 Oct. 2002 – 5:31 pm	Critchlow Labour College, 35 th Anniversary	48
9	23 Oct. 2002 – 7:39pm	The Upper Demerara Lions and Leos Club	19
10	3 Dec. 2002 – 6:10 pm	Residents of the village area of Coomacka	90
11	4 December 2002, 5 pm	General Public Meeting	18

D. Implications of Proposed Project

At all the consultations representatives of Cambior and of the GoG made it clear that if the current operation remains as is without change it can be expected that bauxite production will collapse and that all skills, jobs (some 1200) and markets associated with the operation will be lost. If a new company is formed by Cambior, it is likely that the new company will employ about 400 employees. Economic impacts would include injection of foreign currency, payment of corporate taxes as well as employment, skills training, and indirect benefits to the local area.

Environmental issues and improvements would include:

- Management of air quality issues through improvements associated with the process plant through the installation of wet exhaust gas scrubbers and the management of fugitive releases through an active dust control program, thus reducing dust impacts on the community;
- Mitigation of impacts on local surface waters through improved mine water management practices and site runoff controls aimed at controlling surface water runoff from mining areas and reducing erosion and sediment loadings;
- Assessment and management of contaminated soils;
- Assessment and management of the existing mill tailings area.

Cambior has experience in the development and implementation of an Environmental Management Plan (EMP) such as the one developed for Omai and presented at the various public consultation meetings. A similar EMP will be specifically developed for the bauxite operation if Cambior becomes the operating company. Cambior has also implemented an ISO 14001 Environmental Management System (EMS) at the Omai Mine and is committed to the development of a similarly effective ISO 14001 EMS for its activities at LINMINE.

Key aspects that were emphasized at the meetings by Cambior with respect to the proposed LINMINE takeover included:

- The transition process will be slow and incremental;
- The fact that rebuilding market share and product confidence will be a challenge;
- Operating methods, size of operation, and operating approach will be significantly different from past and current operations;
- The significant capital improvements that will be required;
- The environmental aspects associated with the Project; and
- The terms of reference for the EIA.

v. Results of Public Consultations

In general, the meetings were well attended and the proceedings of the meetings were carried out in an orderly fashion. Feedback was encouraging and environmental issues and concerns raised by participants at the meetings, as summarized in Table 3.2.4.1, were in keeping with Cambior's expectations based on its assessment of the past and existing operation.

Table 3.2.4.1: Environmental Aspects Raised in LINMINE/Cambior's EIA Public Consultations Scoping Meetings (SENES, 2003)

Date, Time	Group	Environmental Issue Raised	Comments
Oct 2, 9AM	Linden Utility Services Coop Society	<ul style="list-style-type: none"> • Erosion • Drainage • Environmental Trust Fund • ISO Certification 	<ul style="list-style-type: none"> • Road induced erosion • Drainage in ditches • Funding • ISO for Power Gen and Dist'n
Oct 3 1 PM	Bauxite Unions	<ul style="list-style-type: none"> • Kiln Dust • Tailings 	<ul style="list-style-type: none"> • Respiratory and gastro intestinal problems • Murky water
Oct 3, 10:30AM	Regional Democratic Council, Region 10 Mayor and Town Council	<ul style="list-style-type: none"> • Mine Runoff • Environmental Trust Fund • Control of Dust • Bunker C containment • Tailings ponds 	<ul style="list-style-type: none"> • Coomacka Creek area • Gov't position and funding • Cambior plans re dust • "shoring up" storage • impact on creeks in town
Oct 3, 2 PM	LEAP – Linden Economic Advancement Programme	<ul style="list-style-type: none"> • Elimination of dust • Garbage • "Beautification" of Linden • ISO Certification 	<ul style="list-style-type: none"> • Cambior's intentions • School downwind of dust • At tailings area
Oct 9, 6PM	Catholic Church	<ul style="list-style-type: none"> • Location of Mine Road • Trapping of Dust • Tarring of Road into Linden 	<ul style="list-style-type: none"> • From kilns • Eliminate dust
Oct 9, 7:50 PM	Linden Chamber of Industry and Commerce	<ul style="list-style-type: none"> • Dust removal from kilns • Kara Kara pit • Environmental Trust Fund • Reclamation of open pits • Mine as a tourist attraction • ISO Certification • Appreciation of Cleaned-up environment 	<ul style="list-style-type: none"> • Used to dust in homes • Use for tailings disposal • Question Gov't intention
Oct 13, 4:15 pm	Anglican Church	<ul style="list-style-type: none"> • Dust form process • Dust from roads and yards • Water supply and fire protection • Erosion and drainage • Safety of Tailings Pit 	<ul style="list-style-type: none"> • Reduction in releases, dust lost in kilns • Experience with haul road like Wismar • Low pressure and sediment in water, fire water supply by Linmine • Concern re ongoing • Containment for flooding
Oct 17, 5:30 pm	Critchlow Labour College	<ul style="list-style-type: none"> • Reclamation of mined out areas • Road construction 	<ul style="list-style-type: none"> • Will historic areas be reclaimed • Materials of construction, dust and erosion
Oct 23, 7:30 pm	Upper Demerara Lions and Leos Clubs	<ul style="list-style-type: none"> • Location of haul road • Reclamation of mined out areas • Plant site demolition and cleanup 	<ul style="list-style-type: none"> • Where will it be routed • Would Cambior "fill up holes" • Would something be done with unneeded structures to enhance environment
Dec 3, 6:10 pm	Residents of Coomacka	<ul style="list-style-type: none"> • Location of haul route • Discharges to Demerara River 	<ul style="list-style-type: none"> • Would haul road construction require relocation of homes • River is being impacted from mine runoff at present
Dec 4, 5 pm	General Public Meeting Chaired by Guyana Environmental Assessment Board Chairm	<ul style="list-style-type: none"> • Terms of Reference of Environmental Impact Assessment • Noise • Road Traffic 	<ul style="list-style-type: none"> • EIA terms of reference outlined by SENES • Noise from operations • Interaction of haulage road with public road

vi. Efficiency and Effectiveness of the Regulatory Process

The regulatory process governing EIA in Guyana is relatively advanced compared to most States in the Caribbean. The evolution of the Environmental Protection Act (1996), the Environment Protection Authority (EPA) and the Environmental Assessment Board (EAB) have led to the advanced regulation of the EIA process compared to that of other States. This together with the insistence of the international funding institutions and agencies to incorporate EIAs in their project cycle has contributed immensely to the formalization of the process. Furthermore, the EIA requirements to support development permission applications for projects have become an expected norm by governmental agencies, the private sector and the public as a whole.

Development of the capacity and capability to institutionalize and administrate planning permission, regulation of development and incorporation of EIAs as a requisite tool for development control was obtained through extensive contributions from the Inter-American Development Bank (IDB). Development in equipment, training, human resources and documentation has been extensive over the last 10 years.

The procedure and process governing the granting of environmental permits have led to early intervention in the project planning through the scoping and screening exercises. This allows the EPA and other collaborating agencies to contribute to the identification of all environmental impacts at an early stage in the project development and provide due input to the TOR along with continued dialogue with the investors. The inter-sectoral constituent of the EAB that reviews the planning applications, EIAs and the reports submitted by the EPA and sectoral agencies before making a final decision allow for a somewhat holistic intervention in the environmental management process. The stipulation of public review by the Act and the outlined process allows for the input of public participation at crucial stages of the project. A memorandum of understanding (MoU) also exists between the EPA and other governmental agencies for the sharing of data and technical resource for the holistic delivery of environmental management. This has formalized the interagency collaboration on the EIA and development authorization with a high level of success.

The EPA and when necessary in collaboration with other government agencies is responsible for the monitoring of environmental compliance and level of implementation of the EMP for development projects. With specific reference to the LINMINE/Cambior project it was noted in the EIA report that economic factors were given priority considerations. Hence, enforcement of some conditions that were stipulated in the EIA with particular reference to the management of air emission were waived or given extended periods to implement the outlined measures.

According to the EP Act, a decision by the Agency to issue an environmental permit for a project shall be subject to conditions which are reasonably necessary to protect human health and the environment and an assessment of the capacity and capability of the developer to comply with the inherent terms and conditions.

This was crucial and laid the basis for approval, approval with conditions or refusal of grant of permission for a project. Additionally, the EIA outlined that air quality should be managed issues through improvements associated with the process plant through the installation of wet exhaust gas scrubbers and the management of fugitive releases through an active dust control program, thus reducing dust impacts on the community. The importance of this for the protection of the health of the community can not be overstressed. However, this requirement was never enforced due to economic considerations signifying a breach in the ability of the EPA to regulate in an efficient and uninterrupted manner.

IV. Environmental and Health Aspects and Evaluation Techniques of the EIA

a. EIA Outline

The EIA Associated with Acquiring and Operating Major Components of Linden Mining Enterprise Limited (LINMINE) prepared for Cambior Inc. of Canada by SENES Consultants Limited (2003) consisted of an executive summary, five major sections and eight Appendices. This was based on the guidelines for conducting EIA and the ToR produced by the EPA/EAB. The EIA report consisted of:

- Executive Summary
- Description of Project and Alternatives
- Environmental Baseline
- Environmental Impact Assessment
- Environmental Management Plan
- Interagency and Public or NGO Involvement
- Appendices: eight major studies used consolidate the assessment.

b. Environmental Aspects of Development Proposal

In the EIA report the consultant succinctly summarizes the environmental aspects of Cambior’s proposal and alternatives which are presented in Table 4.2.1 (SENES, 2003);

Table 4.2.1: Summary of Environmental Aspects of Project Proposal

Aspects	Cambior Bauxite Project Proposal
1. Environmental Benefits	
Air Quality	<ul style="list-style-type: none"> • Improvement due to abatement measures and new equipment introduced

	<ul style="list-style-type: none"> • Reduction of fugitive dust • Reduce particulate NO_x and SO_x • Decreased CO and CO₂ emissions
Noise	<ul style="list-style-type: none"> • Improvement due to noise control measures • Minimise noise from haul road
Storm water and tailings management	<ul style="list-style-type: none"> • Implement storm water management at tailings area • Sedimentation pond for fine tailing • Implementation of closure plan
Soil remediation	<ul style="list-style-type: none"> • Improvement due to improvement of remedial plan
Groundwater	<ul style="list-style-type: none"> • No change
Aquatic environment	<ul style="list-style-type: none"> • Reduced sediment loading will improve aquatic environment
Terrestrial environment	<ul style="list-style-type: none"> • Improvements through better management • More certain improvements at decommissioning time
Waste management	<ul style="list-style-type: none"> • Improved solid and hazardous waste disposal system • Allowances for problematic waste • Improve management of waste oils • Reduced hazardous conditions from abandoned equipment
2. Socio-Economic Benefits	
Employment	<ul style="list-style-type: none"> • 300 – 400 jobs
Government costs	<ul style="list-style-type: none"> • Eliminate government subsidies • Income tax revenue ultimately stabilised
Community services and infrastructure	<ul style="list-style-type: none"> • Some current health services maintained • Training assisted by Cambior • Fire protection support

c. Project Interaction with the Environment and Mitigation Measures

i. Surface Water

The principal drainage systems of the mines are tributary to the Demerara River which has an average flow of about 115 m³/s with a measured range of 11 to 447 m³/s. The maximum flow in a tributary creek is probably in the order of about 25 m³/s (Kara Kara Creek) with others being significantly less. The Demerara River is subject to tidal influence and reverses flow from time to time to points upstream of the mining operations. LINMINE's operations are located in the lower portion of the Demerara River drainage basin along the east and west banks of the Demerara River.

Surface water was found to be acidic at all the stations, with pH varying between 4.40 and 2.62. The lowest values of pH were found at stations located in worked areas and corresponded to elevated acidity (110-720 mg/L) and sulphate values (110-730 mg/L). The conductivity in two samples taken from the worked areas was high (approximately 10 times the background level) and corresponded to high concentrations of total dissolved solids (810 and 1,500 mg/L, respectively).

The background water quality characteristics of the Demerara River include its relatively low pH (~4 units) and its highly coloured nature. It also has high concentrations of aluminum and iron that exceed normal drinking water and aquatic habitat standards. A comparison of the Demerara River water sample taken in 1973 and the 1993 water samples collected by Rescan and the 2002 samples collected by Cambior, do not reveal any significant changes in water quality parameters with the exception of pH, which shows a slight decrease over the 30 year period. Nutrient concentrations were found to be very low to undetectable in the surface water samples for all years.

Flooding of residences in the Mackenzie and the Noitgedacht residential areas is in part caused by the lack of storm water surge capacity of the tailings facility and the mined-out areas. The flood waters typically carry substantial sediment loads.

Acidic drainage is occurring from the waste stockpiles, tailings basin and mining areas. Unlike many acid generating mines, the acid production does not produce elevated levels of metals but rather the primary consequence is low pH and moderate levels of acidity.

When the weak acid-generating characteristics are viewed in combination with the receiving water impacts, it would appear that the acidity in the water is having minimal to no impact on the Demerara River. This will need to be verified through additional environmental effects monitoring programs.

ii. Tailings, Mine, Process Drainage and Quality (pH and Suspended Solids)

Historic water quality data was reported by Rescan in 1993. The quality surveys were performed in August and October 1993 in order to assess the existing water quality conditions at the mine site and surrounding areas. These were complemented by more recent water quality data generation through sampling and analysis conducted by Cambior.

From the water quality data the following key water quality characteristics are noted:

Tailings Effluent

Low pH and moderate acidity, low metals, high TSS

Operating Mine Dewatering Discharges

- Low pH and moderate acidity, low metals, very high TSS

Waste Pile Seepage

- Low pH and moderate acidity, low metals, very high TSS

Closed/Historic Mines

- Water quality is highly variable at closed mines with some sites similar to background while other sites reflecting a transition water quality from operating conditions;

- The pH at some sites remains depressed while acidity levels are greatly reduced from several hundreds of mg/L in operating mine discharges to tens of mg/L in old mine discharges;
- TSS levels range from low to high;
- No material effects on receiving streams were noted except where erosion continues.

Process Plant Site Drainage

- Although not sampled during this period, the primary issue would appear to be elevated levels of oils and grease.

iii. Organics

Elevated concentrations of oil and grease as well as mineral oil and grease (total extractable hydrocarbons) were probably the result of diesel and oil leakage from the machinery (especially the mine dewatering pumps) on site.

Comparison between Demerara River upstream and downstream sites in 1993 does not reveal any significant change in chemical and physical parameters, with the exception of the oil and grease content which was 7 mg/L upstream from the plant operation and 66 mg/L downstream. This increase in oil and grease concentrations likely reflects ongoing oil leakage, from the Bunker C transfer line and regular plant operations, into the river both through groundwater discharge and direct spillage during tank filling operations. There are no significant changes in the chemical and physical parameters measured in the upstream and downstream samples collected in 2002.

iv. Metals

Generally the concentrations of metals in the samples were found to be within acceptable guideline levels. Concentrations of iron and aluminum (total and dissolved) appear to be high in all the samples. Such high background concentrations, common in waters of tropical regions, can be explained by the area's highly weathered soils, enriched in both elements (Rescan 1991). However, the highest total concentrations of the two metals (Al > 46 mg/L, Fe > 47 mg/L) correspond to elevated concentrations of manganese (Mn > 0.23 mg/L), nickel (Ni > 0.08 mg/L) and zinc (Zn > 0.48 mg/L). Such elevated concentrations are likely derived from weathering of freshly exposed rock both from natural processes and mine sources.

v. Surface Water Usage

There are water extraction facilities which supply Linden and its bauxite mine process operations. The water supply for the area is primarily taken from the Demerara River and passed through water treatment plants before distribution to residential and commercial users. Dacoura Creek, on the east bank of the Demerara River, is also used as a raw water supply for potable water.

vi. Groundwater

Groundwater levels in the vicinity of the mining operations are generally lower than surrounding areas. In some locations there appears to be higher than normal acidity and sulphate concentrations, probably due to long exposure of sulphide-bearing geological formations to oxidation, hydrolysis of aluminum, release of hydrogen ions, and the dissolution of metals (principally iron, aluminum and calcium). The only domestic or industrial use of groundwater in the region is up gradient of the mining operations.

Samples taken in the Kara Kara worked area displayed high acidity, (330 - 430 mg/L), low pH values and high sulphate concentration (210 - 610 mg/L). These elevated numbers are likely indicative of acid rock drainage in the worked area. Both samples also displayed high concentrations of aluminum, iron, manganese, nickel and zinc (Al > 30,000 µg/L, Fe > 80,000 µg/L, Mn > 250 µg/L, Ni > 80 µg/L, Zn > 350 µg/L). Such elevated metal concentrations are probably a result of weathering of the recently exposed material. The Amelia's Ward groundwater is also acidic with a natural pH of 4.5. Conductivity and metals levels are low and are similar to water quality in the Demerara River.

With the exception of the Amelia's Ward potable water well, groundwater is not exploited for potable water use in this area. Few data on groundwater resources and groundwater quality are available however, most of the shallow streams in the vicinity obtain their base flow from groundwater in the uppermost permeable stratum. Unconfined shallow groundwater levels in the vicinity of the streams can therefore be inferred from topographic elevations of the streams.

Due to the impermeability of materials at the bedrock and bauxite horizons, there appears to be little downward infiltration of mine waters and thus little if any contamination of the lower aquifers. Although impacted groundwater, (i.e. water that is acidified as a result of dewatering) may exist at Linmine, it is not considered to present a significant risk. This is both because of the quality of the water and because the ground waters are not used for water supply, except in the area of Amelia's Ward, which is upgradient of historical and proposed mining activities. Based on observations associated with historical operations, the changes in groundwater quality and quantity on the local creeks and the Demerara River are not believed to be significant. It is considered, therefore, that there would be no need to undertake remediation works on the groundwater at Linden. Although the planned program of site reclamation may bring the groundwater table back to higher levels, it would be unlikely that many of the existing features such as perched water tables would be fully re-established.

vii. Air Quality

The tropical climate of the area is typified by high rainfall, high evapotranspiration, with

average temperatures of about 27 °C and light winds with sometimes stronger winds from the north-east in storm events. Particulate concentrations, in and around Linden, may be high at times due to stack emissions and fugitive dusts from the plant site and local roads. Modeling indicates that PM₁₀ (particles < 10 microns) values would at times exceed World Bank guidelines and that there may be a concern over the silica content of the particulates. Cambior has analysed kiln dust samples and has determined that there is no free silica content in these dusts, but have a high fraction of PM₁₀ sized particles. This has health implications for the workers and the residents in and around Linden.

Other than the measurements previously made at the LINMINE and vicinity areas no other air quality data currently exist in Guyana for the area. Prior personal observation of the team members (Young 2001), found ambient air quality to be generally good although blowing dust and emissions may have occasional localized impacts.

viii. Air Pollution Measurements

A total of 24 personal samples were collected (Rescan 1993) by a range of process plant staff to reflect exposures to total and respirable dust.

The results showed that:

- 1 sample exceeded OSHA criteria for total dust exposure of 10,000 µg/m³.
- 3 samples exceed the WHO standard of 5000 µg/m³ for respirable dust

A total of 41 low volume samples were also collected in the community at six locations over a period of 10 days. From this sampling program, only one sample exceeded the OSHA standard for total dust, and all other samples were below World Bank guidelines.

ix. Ambient Dust Measurements

A total of 6 Hi-Vol air samples were collected over a one-week period at 2 stations, the Linden Church and the Day Centre. The samples were analyzed for TSP (Total Suspended Particulate Material) and PM₁₀. The analysis showed that the ambient total dust levels were elevated above background levels but below the then World Bank 24-hour standard of 500 µg/m³ during the period of sampling. Modeling of the stack emissions was also conducted and indicated that guideline levels would be exceeded under some conditions within the Linden community however, SENES believes that this modeling maybe flawed. An analysis of total metal levels in dust was also carried out and determined that total metals levels would be well below guidelines (none were found in 2002– limit of detection 0.1%).

x. Impacts of Operational Air Emissions

There are two areas where air quality must be assessed:

- On-site (worker health and safety) assessed through respirable and total PM compared to occupational exposure guidelines;
- Off-site (population at large exposure) assessed both through total and respirable PM compared to ambient air quality standards.

On-site air quality reported by the Rescan study shows respirable PM ranging from roughly 300 to 14000 $\mu\text{g}/\text{m}^3$ as compared to the WHO standard of 5000 $\mu\text{g}/\text{m}^3$, with total PM ranging from 340 to 244,000 $\mu\text{g}/\text{m}^3$ compared with a WHO standard of 15,000 $\mu\text{g}/\text{m}^3$. Rescan's off-site air quality measurements indicate good air quality. These data showed ambient concentrations of total (TSP) in the range of 30 to 140 $\mu\text{g}/\text{m}^3$ (24 hr average) and respirable ($\text{PM}_{10} < 10$ microns diameter) airborne particulates in the range of 26 to 75 $\mu\text{g}/\text{m}^3$ (24 hr average) without stack scrubbing. Rescan's models however suggested much higher levels. SENES has reviewed the modeling from the 1993 report and has serious reservations about its validity. It reported 24-hour average ground level concentrations of TSP ranging from 8,000 to 55,000 $\mu\text{g}/\text{m}^3$ and annual average concentrations of 2,500 to 9,100 $\mu\text{g}/\text{m}^3$. At these levels, no vegetation would exist and people would be seriously affected.

Given the emissions from Kilns #13 and #14 and Dryer #10 and making assumptions based on personal knowledge of the site, a maximum ground level concentration was estimated to be 18,000 $\mu\text{g}/\text{m}^3$ (24-hour average) at a distance of 1 kilometre from the plant. This level does not match the observed off-site measurements, which ranged from 30 – 140 $\mu\text{g}/\text{m}^3$ (24-hour average) at some unknown location. If these values were measured close to the plant boundary they could be correct, as emissions from a tall stack will not reach the ground for some distance. If they were measured some distance from the plant, then there may be an error in the estimated emission rates. If there is no obvious vegetation impact about 1 kilometre from the plant, then the estimated emissions are too high. This will need to be verified.

There are no World Bank guidelines for particulate matter in ambient air however, Canadian standards for TSP are:

- Maximum 24-hour average = 120 $\mu\text{g}/\text{m}^3$
- Annual arithmetic mean = 60 $\mu\text{g}/\text{m}^3$

Canadian standards for PM_{10} are:

- Maximum 24 hour average = 50 $\mu\text{g}/\text{m}^3$

SENES' (2003) conclusion is that monitoring data off-site indicates that both TSP and PM_{10} currently occasionally exceed ambient standards, which are set to protect human health. On-site occupational exposure can also exceed World Health Organisation's (WHO) Guidelines, exposing workers to unhealthy levels of particulate matter. Currently there may or may not be a problem with silica levels. Samples collected by Cambior in 2002 revealed no free silica was present in the kiln dust. Ore samples also indicated no significant quantities of free silica.

xi. Silica Exposure

Dust and silica are both health-related issues and both must be assessed. The Ontario Ministry of the Environment Standards, for each of cristabolite, quartz and tridymite, are $5 \mu\text{g}/\text{m}^3$ (24-hour average). If the preliminary SENES modeling maximum of $18,000 \mu\text{g}/\text{m}^3$ (24-hour average) is correct and the α -quartz silica is $\frac{1}{2}$ of the detection level of 0.1%, the maximum concentration would be $9 \mu\text{g}/\text{m}^3$ (24-hour average) or about double the MOE standard. This will also have to be verified. With any level of control above 50% this would not be an issue, and Cambior's proposed controls will be extremely effective.

Rescan analyzed raw dust from the kiln and dryer and determined that the crystalline silica content of the dust was less than 0.5%. Based upon this finding, Rescan calculated the potential exposure to silica assuming all dust collected has the same silica content. Based upon this methodology, Rescan assessed that 16% of the personal dust samples would exceed World Bank guideline levels for crystalline silica. This finding should be reviewed as, based on the analysis of the two dust samples it is expected that silica content in the raw kiln dust samples is lower. However, the ambient air samples could well be higher

xii. Kilns and Driers

At present, approximately 18% of production is wasted and released to the environment as dust coming from the stacks from the kilns and the drier. The resulting effect on air quality in and around Linden is of major concern to residents. As a priority item, Cambior intends to install wet scrubbers on the off-gases from the kilns and drier designated for refurbishment and continuous operation. The expected impact of this action would be to reduce stack emission concentrations by about 99.9% of the estimated 1993 unscrubbed gas concentrations of $35.9\text{-}49.9 \text{ g}/\text{m}^3$. This would leave a residual of about $0.05 \text{ g}/\text{m}^3$, which is less than the World Bank Guidelines (General emissions maximum value of $0.1 \text{ g}/\text{m}^3$).

The impact of wet scrubbing of stack gases would be to remove essentially all of the PM_{10} particles and 99.9% of the larger ones. It is anticipated that international guidelines would thus be met for both respirable dust and silica dust exposure. Determinations of heavy metals in the dusts in 1993 did not give rise for concern. Analyses of dust samples and ore samples by Cambior in 2002 confirmed these results. With the installation of wet scrubbing, it would be necessary to manage the scrubber water. The spent scrubber water will contain a significant level of suspended solids, heat and probably, acidity. Engineering design is not yet complete but the water management concepts are based on using as much as possible of this water in the wash plant, thereby reducing the amount of fresh water that would otherwise be needed and ultimately discharged to tailings. Because of acidity that will be encountered in the stack gases, lime addition to this water will be needed to reduce corrosion potential and to discharge waters at acceptable pH (> 6).

Cambior intends to research techniques whereby a market can be developed for reclaimed solids from the gas scrubbing operation, but this will not be sought for some time. These dusts are expected to contain over 80% alumina and may be suitable for the cement-making industry. However settling and dewatering characteristics have yet to be determined. In the short term, the kiln dust particles will be disposed in the tailings facility with wash plant solids.

xiii. Fugitive Dusts

Fugitive dusts from conveyors, transfer points, materials storage and handling and traffic can contribute to airborne particulates to a level that is of occupational as well as ambient health and safety concern. New enclosed conveyors and dust control measures would be designed for these operations to ensure that international guidelines for dust levels in the workplace are met. Roadways and haulage would be a key area for future potential dust emissions associated with truck ore haulage. Watering of roadways in close proximity to Linden would minimize dust from ore haulage. Frequent wetting and cleaning of plant site access ways will also reduce dust from current levels.

xiv. Other Gaseous Emissions

Bunker C fuel oil is burned to provide energy for steam to heat fuel feed lines to the driers and kilns as well as provide fuel to dry and calcine bauxite. Combustion gases would include particulate matter, sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide, carbon dioxide and volatile organics. This mode of energy production may continue, but Cambior will consider alternatives that reduce cost and gaseous emissions. An option under consideration by Cambior would be to change the fuel from Bunker C, which is an expensive fuel that requires careful management, to either coal or an oil-coal emulsion for kiln operation. There has been no decision taken in this regard. Whatever system is installed, Cambior would ensure that it meets World Bank guidelines for gaseous emissions.

xv. Noise and Operational Noise Impacts

Although noise is not a concern at mine sites, measurements of noise at the processing plant site in 1993 indicated that World Bank guidelines were exceeded at many work locations and a hearing protection program was recommended. Cambior would ensure that such a program is part of the occupational health and safety aspects of the EMP. Ambient noise levels around the plant, particularly with the introduction of generators to provide reliable power, will need to be assessed to determine if the impacts of the proposed operation is negative or positive with respect to existing background conditions. Based on the results of the assessment, mitigative management measures may be required to meet local and international standards.

The noise impact study would be undertaken to determine the impact of the proposed project and would involve four key tasks:

- Community noise monitoring to establish the existing community noise levels;
- Define the noise level limit for the facility operations based on international criteria, such as World Bank limits;
- Predict noise levels from the proposed project at specified community locations;
- Propose mitigation measures, if necessary, should the on-site noise exceed the ambient noise levels at the specified community locations.

Although no modeling has been undertaken, no significant noise impact is expected from haul trucks along the haulage route since the site-related traffic is expected to be very small at two or less vehicles per hour. This limited traffic volume is unlikely to increase hourly ambient sound levels. Off site noise measurements and noise modeling are proposed to assess the impact of the on-site noise sources such as diesel generators, kilns, etc., on nearby receptors.

Drilling, blasting, shovels and trucks would be the most significant sources of noise from the proposed operation. Exhausts from mobile equipment would be appropriately muffled to meet occupational health and safety standards. When sources cannot be feasibly controlled directly, worker safety equipment would be issued. As the scale of operation is quite small, noise impacts on surrounding environment would not be expected to be significant. The proposed mining areas are relatively distant from all communities, operating noise will be buffered by the natural embankments of the excavation, and large truck traffic along the haul road will likely be in the order of 1 to 2 trucks per hour, plus miscellaneous small vehicle traffic. Off-site noise levels can be monitored to confirm operational impacts, and if necessary, additional measures can be implemented to control operating related noise.

xvi. Mining Operations

A matter of principal environmental concern, as evident from historic data and observations, is the disrupted, unstable landscape resulting from past mining operations and the linked, but separate, concern of the erosion transport of solids to local creeks and eventually the Demerara River. At acquired mine sites Cambior would implement measures to minimize the quantities of minewater and surface water discharge and its content of contaminants. The new company would practice reclamation of disturbed sites and would implement a program of rapid development of vegetative cover of the areas for which it is responsible in its mining operations.

Impacts on the ecosystem caused by existing operations will significantly decrease due to the implementation of the new mining method and environmental management measures. It has been concluded that given the baseline conditions the decreased impacts would be acceptable.

xvii. Processing Plant

In overview, the environmental impacts of the Cambior Project would be overwhelmingly positive relative to the current situation, as well as being in accord with international guidelines for acceptable practice.

Actions that are planned to be undertaken by Cambior include:

- Undertaking a Phase 2 Environmental Site Assessment to quantify existing environmental problems and implementing an EMP containing actions to develop solutions, set priorities for remediation and implement appropriate remedial measures;
- Developing pollution prevention techniques including waste minimization, reduction, recycling and reuse;
- Implementing wet gas scrubbing to virtually eliminate particulate air emissions from bauxite drying and calcination processes;
- Designing new conveyors and dust control measures to control fugitive dusts to meet international guidelines for dust levels in the environment and in the workplace;
- Implementing noise monitoring and reporting program as well as a hearing protection program to guard against the impacts of excessive workplace noise conforming to international standards;
- Installing a surface drainage collection and water retention system that would incorporate the capability to remove settleable solids and floatable materials (oil and grease) prior to discharge to the receiving environment;
- Providing secondary containment for all hazardous materials and equipment containing hazardous materials in accordance with recognized good environmental practice;
- Refurbishing fuel storage and transfer facilities where necessary to meet acceptable handling storage and containment standards;
- Instituting a regular maintenance and monitoring program for sanitary sewage management in the EMP to ensure that discharges to the environment meet acceptable standards;
- Contributing on a shared basis to improvements to roads to improve environmental quality;
- Providing reliable power for the bauxite facility.

Cambior's primary objectives are to improve reliability of production and to operate more efficiently. The intention would be to have the kilns and driers operating without downtime for a period of 18 months and to increase the recovery of alumina from the bauxite ore from the present 25% to as high as 40%. A portion of this increase (about 10%) would be realized from improved mining operations with the remainder being achieved at the processing site. Gaseous, solid and liquid waste emissions are expected to decrease and environmental impacts should all be positive (reduced from present levels).

xviii. Impact from Existence and use of Haul Road

To accommodate the proposed truck and shovel operation a new haul road running directly from the Ituni road at the Montgomery Mine to the process plant would be developed. This route would keep mining traffic at a reasonable distance from existing habitation. Public access will be limited, and dust will be controlled in the Linden area by spraying the road with water. Between 1 and 2 trucks per hour are expected to be used. The existing road and rail would be used for hauling ore from the Dacoura Mine.

Potential impacts associated with the new road from the Montgomery Mine and the means to address them are note below:

- Two public road crossings would be needed, one crossing, the Ituni road to the south, and one crossing the Linden – Georgetown highway next to the plant. As traffic is light on the Ituni road, it is likely that a manned gate on the mine road could serve the Ituni road crossing. The Linden – Georgetown highway crossing may require a different approach as traffic is much heavier and more constant at this location. A concept would be developed in association with the local community.
- Recognized good practice would be used in the design of the road to provide satisfactory drainage, to minimize erosion and to prevent eroded material entering local water courses. The running surface would be crowned with a compacted layer of waste capping, over a graded compact clay and sand base with ditches on both sides to catch and direct water to local watercourses. The capping material traditionally used in the area originates from the mine overburden and is prone to compact and harden and resemble a low-grade concrete.
- Three watercourses would need to be crossed, the Dorabece creek (which the mine dewatering will discharge into), and two additional drains in the Kara Kara area. Surplus kiln-shell sections of approximately 3 metres in diameter are available as culvert for the Dorabece crossing, while conventional corrugated steel culverts could be used for the other smaller streams.
- The location of the final section of the haul road approaching the bauxite processing plant around or across the tailings area from the old Kara Kara mine has yet to be determined. The route will be selected to ensure public safety and mininization of nuisance from dust and noise. If as is likely, the Noitegacht dike is chosen for the access road, proximity to habitation (about 150 metres) may be an issue. In this region, the road would be kept wet with water to suppress dust. It is likely that the current vegetation in the area will adequately suppress noise.

Roads frequently can inhibit terrestrial wildlife movement in their vicinity. Although a wide range wildlife is known to be present in the area, it is unlikely that the new road would have a significant negative impact on the quality of their habitat as the area has been significantly disturbed in the past for travel and hunting for many years, and the frequency of vehicles using the road, in terms of harming wildlife, would be very low. Public access to the road would need to be restricted for safety reasons and therefore hunting pressure will be diminished. In addition it should be noted that the haul road will use the existing rail right-of-way and thus there would be minimal impacts associated with development of the haul road corridor.

B. Environmental Issues and Mitigation

i. Tailing Management

From a technical perspective, the existing and potential environmental issues associated with tailings facility are relatively limited when compared with issues related to many other mine tailings areas. Only lime is expected to be added to the tailings from the processing plant in the new Project. The lime will be added to neutralize acidity formed in the dryer and kiln dust scrubbers and to permit the recycling of these waters to the bauxite wash plant. The tailings materials themselves are relatively inert, but the small amount of iron sulphide can create low levels of acidity which is observed in current tailings facility overflow. The current levels of acidity will be reduced as a result of the lime addition for gas scrubbing. As report by Golder (2002), the impoundments dikes are relatively low; and, for the most part, the area is inherently stable with a limited elevated phreatic level. Nonetheless, concerns exist with respect to present operations in that the existing tailings pond is essentially full and has no storm water surge retention capacity. Outflow from the ponds flows out of the basin immediately as rapid runoff response to rainfall events which results in the movement of settleable, suspended and colloidal solids from the tailings area to two major creeks, the Hymara and the Cockatara, on which the town of Linden is dependent for drainage.

Siltation of these drainage ways and roadside ditches (plus plugging with debris) reduces their carrying capacity and results in occasional flooding in these areas. In addition, silt loadings from the creeks have resulted in noticeable discoloration in association with turbidity entering the Demerara River during erosional runoff periods. Some garden and agricultural plots have been reported to flood from time to time. The other potential impact that the outflow from the tailings area has on the environment is its pH which has been recorded as being around 3 pH units. The impact on the Demerara River is not noticeable from available measurements. This may be due to its naturally low pH and its larger flows.

At the present time, some minor remedial work is being done to prevent overflow or breaching of the north embankment. Overall however, no embankment instability was observed (Golder, 2002). Consideration has been given to the future use of the Northeast Kara Kara flooded mine pond for tailings deposition as it appears to be large enough for tailings deposition as well as collecting materials eroded from mine spoils from previous operations. However, its distance from the plant site, close proximity of the eastern dyke to the Kara Kara River and significant earth works that would be required, makes this option less preferable in respect to other measures for improving the existing tailings area. Initially, Cambior would raise the dykes of the existing tailings pond about 2 m and manage the tailings disposal basin more carefully.

Through this method it is anticipated that 4 to 5 years of additional capacity could be realized. A detailed management plan will be developed that would:

- Ensure that the dykes are stable and would provide enough storage capacity for tailings and stormwater management.

- Create a new, single discharge to Kara Kara Creek with storm water handling capacity.
- Develop and maintain a sedimentation pond.
- Eliminate the carry-over of tailings into the Hymara and the Cockatara creeks and the roadside ditches of Linden thereby preventing flooding due to tailings pond operations.
- Develop and implement a closure plan that is self-sustaining.

ii. Surface Drainage

Equipment maintenance, fuel storage, fuel handling and traditional plant activities can result in contaminants entering surface drainage and groundwater reaching the Demerera River. Concentrations of oil and grease downstream from the processing plant have been measured at a level as high as 66 mg/l. With the introduction of a truck fleet, different maintenance activities will be required. Potential contaminants include oil and grease, suspended solids, and contaminants leached from materials deposited on the site. While potential quantities and associated hazards are not known at this time, the environmental impact of potential hazards associated with such contaminants can be mitigated with sound design and operation and management practices. A contained waste oil and lubricant system will be installed.

In this respect, Cambior would install a surface drainage collection and wet detention system that would incorporate the capability to remove settleable (solids) and floatable (oil and grease) materials prior to discharge to the receiving environment. The system would also provide for an emergency capability to control any unexpected spills of such materials.

Pollution prevention measures would be the primary safeguard against discharge of dissolved contaminants to the environment. Key aspects would include the following:

- All hazardous materials and equipment containing hazardous materials would be stored in appropriate containment areas, in accordance with recognized good environmental practice. Disposal options would be developed as necessary.
- Where appropriate and necessary and within Cambior's operating areas, contaminated soils would be excavated and replaced with clean material. The contaminated soils would either be stored in an environmentally sustainable manner or they would be treated by methods considered to be good environmental practice.
- Laboratory chemicals would be collected and stored or disposed of, according to their specific character, in an environmentally sound fashion.
- Fuel storage and transfer facilities would be assessed and existing facilities will be upgraded to ensure proper containment and spill protection in accordance with appropriate storage and handling

designs and procedures, including secondary containment systems. It is intended that 3 of the 4 large fuel storage tanks and fuel handling systems on site would be decommissioned and contaminated materials removed.

There are many areas of hydrocarbon contamination associated with the present fuel storage system and handling facilities on the plant site including oil holding pits, contaminated soils, contaminated groundwater and abandoned pipes. Cambior would undertake a Phase 2 Environmental Assessment (sampling of soils etc) that will quantify existing environmental problems. The EMP would contain actions to develop solutions, set priorities for remediation and implement appropriate remedial measures. The consequent environmental impact of Cambior's undertakings would be a significant potential improvement in the quality of surface drainage and subsurface infiltration from the site, relative to the existing situation.

iii. Liquid Effluents

A new crushing and washing plant would be constructed to accommodate truck dumping and loader feeding as well as replacing a close-to-derelict facility and greatly improving efficiency. It is proposed that only high silica bauxite would be washed to improve recovery. The low silica bauxite would go straight to the kiln to be processed. A secondary crusher would also be installed. The estimated impact of these changes would be a reduction in the amount of wash water used and thus a smaller discharge to the tailings area. Implementation of the Project concepts will represent a significant improvement over existing practice.

iv. Solid and Hazardous Wastes

Solid wastes are presently disposed of in a haphazard manner without planned and approved disposal sites and methods. The impact on the environment has not been determined quantitatively, but observation shows extensive quantities of inert, decomposable and potentially hazardous materials on the tailings facility and in the old mining areas. The Bunker C supply lines to the kilns and driers are lagged with asbestos insulation, some of which is in distressed condition. If this becomes waste for one reason or another e.g. change of fuels or type of insulation, it would be disposed of in a safe and environmentally appropriate manner. The old electrostatic precipitator on kiln #14 contains asbestos sheeting and insulation and when this facility is demolished in year 2, the asbestos will be properly handled and disposed in the landfill site or in the tailings area, if appropriate.

Pollution prevention techniques involving waste minimization, reduction, recycling and reuse would be at the core of a solid and hazardous waste management plan that would be a component of the EMP. Engineered and secured, environmentally sound solid waste disposal and hazardous waste storage sites would be operated. They would be designed to accommodate

those wastes for which there are no current feasible disposal techniques in Guyana. Waste oils would be recovered and burned in the kilns as is the current Practice. The difference is that the waste oil handling system would be brought up to acceptable standards. Hazardous conditions due to abandoned equipment would be remediated through the institution of a scrap removal and disposal program for the facilities that are acquired.

C. Socio-Economic Impact Assessment

i. Synopsis of Socio-Economic Study

The bauxite plant is the economic and social life-line of Linden the second largest urban centre in Guyana and is the capital and economic heart of Region 10. The town evolved as a company town with the bauxite plant providing all amenities to the residents who were mainly employees. Furthermore, the infrastructure and all social services were provided and maintained as the responsibility of the bauxite extraction and processing company. LINMINE has been the major economic contributor in the area and has played a significant role in assisting the regional administration to provide needed infrastructure. Generally speaking, although forestry, agriculture and fishing contribute to the regional economy and employment, the success of local business and the standard of living of the residents of Linden tend to fluctuate with the prosperity or decline of the bauxite mining industry.

A socio-economic study has been carried out by Cambior as part of its feasibility study of the proposed operation. The main findings of the study were:

- At the time of Nationalization (1971) the facility employed between 5,000 and 6,000 workers down from a peak of 8,000. The facility may have supported as many as 32,000 people;
- The mine traditionally provided support for the community in the form of a ration store, housing, electricity, water, roads, hospital, fire service and garbage collection;
- At ten meetings hosted by Cambior in 2002, with 13 different organizations and groups represented, it was clear that the people understood the importance of the existence of the operation to the survival of the community and its facilities and infrastructure, even if employment was to fall;
- Their major concerns were environment, followed by employment, electricity, redundancy, training, and health and safety. There was particular interest in the nature of the final agreement between Cambior and the Government.

Health care is provided by the public Wismar Hospital and for LINMINE employees the private Mackenzie Hospital. The latter provides support to

the public hospital in matters of medical personnel and equipment. LINMINE also manages a medical scheme for employees and funds and manages a School for Nursing. In the past LINMINE subsidized the administration of several schools around Linden and also ran a Technical Training School. These facilities are now operated by the Ministry of Education. Other support provided by Linmine to the community included infrastructure support for employee housing, provision of subsidized electricity to employees and many Linden residents, and maintenance of the Ituni-Linden road. The Guyana Water Authority (GUYWA) is responsible for supplying potable water to the community.

Some of the most obvious socio-economic benefits that would occur include the injection of foreign currency, and contributions to stabilizing the local community by maintaining and injecting earning power into the community. However, the Project would make redundant a net of about 800 jobs. In this regard, the Government has come to an agreement with the two bauxite unions on severance pay of 104 weeks plus a 10% training grant and other benefits. In addition, to the estimated 300 - 400 permanent positions that would eventually occur with operation, there would be temporary employment for around 100 people during the construction phase.

Additional socio-economic impacts could include:

- Education and Training - Cambior would work with the Linden Economic Advancement Program (LEAP) to see how training for self-employment could be accomplished;
- A medical program would be put in place for the new company employees. Continuity of a health plan for current and past LINMINE employees would be a responsibility of Government which is going to bring the health plan up to date;
- No changes to cultural and archaeological resources would be foreseen;
- Cambior's Project is at considerable distance from lands held by farmers. The area top soils are essentially composed of silica sands;
- Cambior would continue to render what assistance it can to the Linden municipal infrastructure but it would not take over the responsibilities for services as in a company town;
- Linden Power Company has gone into receivership and the equipment is in poor condition.

Cambior has considered three options to government:

1. Buy power plant from LPC once it can supply power reliably;
2. Operate the power company as it is now in receivership;

3. Provide power for Project needs in isolation from the community needs.
- The community potable water supply is the responsibility of the Guyana Water Authority (GWI);
 - At present garbage disposal is either poorly organized or non-existent in Linden.

Cambior would contribute to a municipal waste management and disposal system with details to be arranged with the municipality.

Socio-economic commitments by the new company included:

- Provide a severance pay of 104 weeks plus a 10% training grant and other benefits;
- Employ 300- 400 individuals in presently planned operations;
- Work with LEAP to see how training for self-employment could be accomplished;
- Attach some experts to the LTI to help with training;
- Put in place a medical programme for company employees;
- Provide a day care service to employee children;
- Employees of the company would be trained in workplace health and safety and environmental protection matters related to their functions within six months;
- Continue to render assistance with the Linden municipal infrastructure;
- Offer to take over the Linden fire service;
- Contribute to a municipal waste management and disposal system.

ii. Employment

While there would be temporary employment for around 100 people during the construction phase, operations once stabilized are expected to require only about 300 -400 employees. Thus the proposal if implemented, would make at least 800 of the approximately 1200 jobs at Linmine redundant. It is understood that the government has come to an agreement with the two bauxite unions to pay severance in the amount of 104 weeks plus a 10% training grant and other benefits. Cambior has met with Linden Economic Advancement Programme (LEAP) to discuss re-training and will work with LEAP to see how best this could be

accomplished. Some skilled persons would be attached to the Linden Technical Institute (LTI) to help with training.

iii. Costs and Benefits to the Government of Guyana

The current \$US 6-8 million subsidy would no longer be required. There would be an injection of foreign currency/capital that would have a positive effect on the overall economy. The experience at Omai Gold Mines is that 40% of \$75M US per year to operate Omai is spent in Guyana. The other 60% is spent overseas, for example, on truck tires and chemicals. All employees, national and expatriate pay income taxes in Guyana and 17% of the total income tax paid in Guyana is paid from the Omai operation. Cambior's philosophy, as evidenced at Omai, is to generate as much sales as possible in Guyana. Cambior is already spending substantially on local supplies, accommodation and the hiring of additional personnel for security.

iv. Health Care

Good health care is a part of Cambior's corporate philosophy. Omai has its own medical program. Every employee has a card which they use to obtain medical services. A similar program would be put in place for Project employees. It is anticipated that employees would go to the Linden Hospital for treatment, but the bills, etc. would be covered by an insurance scheme. Continuity of a health plan for current and past LINMINE employees would not be a responsibility of Cambior in the new Project. It is understood that the Government is going to bring the health plan up to date but Cambior is not aware if there is any continuity to the present program.

v. Cultural and Archaeological Resources

No changes to cultural and archaeological resources are foreseen, although the new company may consider assisting in conserving some of the former "colonial" buildings and rendering them suitable for continuous community use.

vi. Land and Resource Use

The Project would assume only a limited portion of the land and mineral holdings held by LINMINE. It would exclude lands held by farmers.

vii. Infrastructure General

Omai is presently involved in supporting infrastructure work in Linden, such as roads and electrical distribution (poles, wire, transformers, insulators, etc). Cambior will continue to provide limited assistance with the Linden municipal infrastructure.

viii. Fire Service

LINMINE presently provides a fire service, and Cambior would offer to maintain the facility as a public service. Cambior also plans to talk with the Chief Fire Officer about plans to have a fire station at Linden.

xiv. Waste Management and Disposal

Cambior would contribute to a municipal waste management and disposal system with details to be arranged with the Town Council. At present garbage disposal is not well organized and there could be a significant beneficial environmental impact of cooperating to incorporate the needs of industry and the Town. Cambior believes that domestic waste management in Linden is the responsibility of local citizens and their elected organizations. The lack of organized waste disposal is an issue of substantial importance to the local community and successful resolution of this very obvious problem will require a civic effort. Cambior is prepared to provide support in solving this problem including assistance with creating a waste disposal area that meets reasonable standards.

D. Inter-Institutional Collaboration

i. Collaboration Level Required

The inter-agency collaboration is an important component of the EIA process and is stipulated in the EP Act and guidelines to ensure compliance. This is reflected in the inter-agency representation in the Board of Directors of the EPA, the Environmental Assessment Board (EAB) and the memoranda of understanding between the EPA and sectoral agencies. The EAB has technical and independent oversight into application for environmental permit, review, and guide the decisions of the EPA. All development applications are reviewed by sector agencies that provide comments to the EPA. This is pertinent to smaller scale projects for which an EIA is not required to the larger projects requiring a full EIA.

The OBMI proposal for take over of LINMINE was of a magnitude that required traversing the full EIA process. Hence, the public notification of the project and the 28 days time frame for written submission of concerns to be considered in the EIA was done. This was followed by the scoping by personnel from the EAB, EPA and project to develop the TOR. At this stage public concerns are also included. At the scoping phase the sectors represented by the EAB have an opportune time to include all the concerns from their perspective to the developer and technical EIA consultants and ensure they are adequately reflected in the TOR. Once completed the EIA is again reviewed by the sectoral agencies and EPA and comments submitted to the EAB. The final decision on the grant of environmental permit is made by the EAB after consideration of the submissions made by all parties.

ii. Collaboration Realised

The assessment study conducted to support the take over of LINMINE by Cambior represented the first EIA of that magnitude in Guyana and provided the first real test for the EIA process administered by the EPA. The process was streamlined according to the regulatory framework and the sectoral input was done at the levels of scoping, development of the TOR and review of the EIA. However, the take over of LINMINE by Cambior was promoted by GoG as extremely urgent to address the financially depressing situation and treated with high priority. Hence, special concessions were given to Cambior such as neglect of the environmental liabilities of the predecessor company and time lapses in implementation of mitigation measures to prevent environmental pollution.

E. Impact of Public Participation

During the field visits and the conduct of interviews with the various NGOs and Government agencies there was knowledge of public consultation held in accordance with the EIA process. There was a general feeling that the public consultations were more based on formality and that the depressed economic state of the community and country as a whole did not leave much room for forceful negotiations. Resource persons within the organizations are aware of the environmental problems that persisted throughout the life of the plant and that it will continue in the new operation. However, the benefits procured by the residents of the community and the economy of Linden and the country from the operation of the bauxite plant were reducing the level of emphasis to be placed in the resulting environmental and health impacts.

At the community level there was less recollection of the public consultations associated with the EIA study conducted by Cambior. Over 75% of persons interviewed indicated that they had no knowledge that a consultation was held and that communications by the plant with the general public is less than ideal. The disadvantage is that at the local level details of the take over by the new company were limited.

F. Integrating Health and the Environment

i. Legal Framework

The EP Act clearly stipulate that the EIA to be conducted shall identify, describe and evaluate the direct and indirect effects of the proposed project on the environment including *inter alia*: human beings, flora, fauna, species habitats, water, soil, air, material aspects, cultural heritage and landscape, natural resources, ecological balance and ecosystems, interactions of natural systems. Importantly the EPA is mandated to assess every project with a view to the need to protect and improve human health and living conditions and the need to preserve the stability of ecosystems as well as the diversity of species.

It is therefore without doubt that the EP Act requires health aspects to be given considerations when conducting the EIA. It calls for the identification, description and evaluation of the direct and indirect effects of the proposed project on the environment including: human beings, soil, water, air, natural resources, ecosystems and interactions between environmental systems. Importantly every project should be assessed with a view to the need to protect and improve human health and living conditions and the need to preserve the stability of ecosystems as well as the diversity of species. The requirement for an EIA is also extended to any policy, programme, plan or alteration thereof that may significantly affect the environment. Hence, in this case the health aspects of such policy, programme or plan should be considered also.

In summary therefore, a decision by the EPA to issue an environmental permit for a project shall be subject to conditions which are reasonably necessary to protect human health and the environment and an assessment of the capacity and capability of the developer to comply with the inherent terms and conditions.

Determination of the risk to which humans are exposed can be done by the requirement in the EP Act for the EIA study to complete an estimate, by type and quantity, of expected contaminants, residues, and emissions (water, air and soil pollution, noise vibration, light, heat, radiation) resulting from the operation of the proposed project. Furthermore, there are clauses to reduce the impact on human health and risk to health through the requirement for description of any hazards or dangers which may arise from the project and an assessment of the risk to the environment, an emergency response plan for containing and cleaning up any pollution or spill of any contaminant and an environmental rehabilitation and restoration programme for which the onus is on the developer.

The specific concerns of the public at large with respect to health is also accounted for by the incorporation of ways of notification of the public of the project and receiving the concern of the public to be addressed during the conduct of the EIA study. The method of notification of the public of the EIA report and availability for review including the submission of concerns based on the findings or shortcomings of the study are also included.

The Minister may in co-ordination with other appropriate governmental entities undertake such emergency response activities as are required to protect human health or the environment. The Act gives the Minister the power to make regulations establishing the criteria and thresholds to determine which projects may have significant effects on the environment. The regulations shall cover the case of an individual activity and the cumulative effect of a number of activities.

In Part V of the EP Act, which covers the Prevention and Control of Pollution, it is stipulated that it is unlawful for persons to undertake activities to cause pollution of the environment unless all practical and reasonable measures are taken to prevent or minimize resulting adverse

effects. Additionally, the discharge into the environment of any contamination of any amount, concentration or level in excess of that prescribed by the regulations or stipulated by any environmental authorization is forbidden. The Act continues to outline the notification procedure following an incident, restoration of environmental integrity and liability for the cost associated with these activities. Information on the establishment and operation of pollution prevention/waste management facility should be submitted to the Agency. The specifics of such information and monitoring to determine the level of environmental performance and the risk to human health is also outlined.

The incorporation of elements for the protection of health and environment is also done at the level of the formation of the EAB the constituent of which is determined by the Minister. The Board shall conduct public hearings into appeals and EIA reports to recommend acceptance, amendment, rejection, issuance of environmental permit including terms and conditions to the Agency. Hence, this functions as an additional safety valve for the incorporation of health and safety concerns by the public at large. Additionally, this is important for securing the health of humans and environmental protection since persons with health and environmental background can be and should be appointed to the Board.

Taking actions to the Agency with respect to contravention of the conditions of the environmental permit and hence posing a threat to health and the environment include enforcement or a prohibition notice. The prohibition notice is served where it is possible that the contravention is such that there is potential for pollution of the environment or damage to public health; the steps to be taken in issuing the notice contents and requirements of the notice are also outlined. The level of harm to environment or health is also qualified and includes material environmental harm which manifest itself in the form of nuisances or actual or potential harm to the health and safety of human beings that is not trivial. Serious environmental harm is considered actual or potential harm to the health or safety of human beings that is of a high impact or a wide scale, or other actual or potential environmental harm (not merely an environmental nuisance) that is of a high impact or a wide scale.

Other areas outlined in the Act with respect to the protection of the environment and health includes:

- Financial assurance;
- Investigations, Prosecutions, Civil Proceedings;
- Establishment and Jurisdiction of the environmental tribunal;
- Environmental trust fund and finances;
- Miscellaneous.

ii. Level and Method of Health and Environmental Integration

The integration of health aspects into the EIA that was conducted was less than what can be considered appropriate or desirable. The public and intersectoral notification of the conduct of an EIA for the LINMINE facility

provided an avenue for the contribution by health personnel, agencies and organizations to the process. However, on review of the EIA report it is clear that actual health related comments, request for additional supportive studies and monitoring systems were minimal.

Basically, the World Bank (WB) and World Health Organisation's (WHO) guidelines for were used to assess the risk associated with emissions and the negative health implications on the community. The air emission studies conducted indicated that on occasions these standards were exceeded which can have consequent negative health implications.

iii. Gaps in Environmental and Health Integration

Emphasis on health aspects and research geared towards assessing the health impacts of LINMINE operation on the population of Linden was inadequate. Despite the requirement for health considerations in the EP Act, there were minimal level of collaboration with the various health institutions for the conduct and review of the EIA. Additionally, personnel with specific training in health to provide the knowledge, skills and experience required to meaningfully guide the health requirements and monitoring needed were absent.

The lack of direct involvement of the Environmental Health Department (EHD), Epidemiological Unit and medical resource persons resulted in the absence of conditions that will assess and monitor the health implications of the various emissions. The use of epidemiological studies to determine the cause effect relationships of respiratory conditions is notably absent and provides an example of derisory health input.

iv. Enforcement: Measures Recommended

The screening, scoping and monitoring provided by the EPA in concert with other agencies provided the platform for the enforcement of environmental responsibilities for projects. Notwithstanding the contribution of these agencies in the development of the ToR to guide the EIA and the suggestions and comments to enhance completeness, the backbone of enforcement is the formulation, implementation and monitoring of the environmental management plan (EMP). This provides the yardstick for which the measures recommended in the EIA, level of compliance and the corporate responsibility of Cambior operation can be measured. Monitoring of the plant is done by Environmental Officers of the EPA on a monthly basis.

Environmental issues and improvements for which monitoring and enforcement are required include *inter alia*:

- Management of air quality issues through improvements associated with the process plant through the installation of wet exhaust gas scrubbers and the management of fugitive releases through an active dust control program, thus reducing dust impacts on the community;

- Mitigation of impacts on local surface waters through improved mine water management practices and site runoff controls aimed at controlling surface water runoff from mining areas and reducing erosion and sediment loadings;
- Assessment and management of contaminated soils;
- Assessment and management of the existing mill tailings area.

G. Environmental Management Plan (EMP)

The EMP has several purposes. In addition to providing a framework for sound environmental practices, it also provides commitments and assurance to the Guyana EPA, other government agencies, the Guyanese public, and IFCs that the proposed procedures, actions and measures identified as part of alleviating environmental impacts of the Project will be effectively implemented. The EMP was prepared in accordance with the EPA's published, Guidelines for Preparing EMP, Environmental Impact Assessment Guidelines, Volume 2 – Generic, Version 4, November 2000.

i. Environmental Policy

The new company, Omai Bauxite Company Incorporated (incorporated in Guyana, November 22, 2002) is committed to sustainable development which embodies protection of human health, the natural environment and a prosperous economy. In addition to complying with legislative requirements and contractual commitments, it will diligently apply technically proven and economically feasible measures to advance the protection of the environment throughout exploration, mining, processing, manufacturing and site closure activities. A number of commitments were therefore made by the company ranging from environmental management, integrated management, risk management, and closure criteria within specified periods of time.

H. Mitigating and Compensatory Measures

i. Pollution Prevention

Pollution prevention techniques involving clean technologies, waste minimization and energy and materials recovery, recycling and reuse would be at the core of mitigating strategies and measures developed to minimize and remediate environmental impacts.

ii. Air Quality Management

Ambient air quality in the Linden airshed, insofar as they are influenced by company operations, particularly drying and calcining, will be controlled to World Bank standards for respirable dusts (PM₁₀) and combustion gases. The planned date for achieving the objective is 18 months from initiation of the Project. Wet scrubbers will be installed on the dryer and on each of the kilns. (One kiln will operate in current mode of discharging dust from the stack while the other will be refurbished and a wet scrubber installed).

Plans to address control of fugitive dusts would begin immediately with some sources such as roads and some materials handling. Other sources are related to major construction activities at the processing plant and would follow the construction schedules for these activities.

iii. Environmental Information

The new company would implement a 6-12 month quality assured environmental investigation and monitoring program. The program would be designed to provide the information to make appropriate decisions on operations relative to environmental protection and sustainable development.

The principal components of the investigation and monitoring program would be measurements of surface water quality and air quality, along with a Phase 2 environmental assessment to quantify existing matters of environmental concern with a view to providing data essential to their timely resolution

iv. Environmental Audit

The new company would undertake a Phase 2 Environmental Assessment audit that would quantify existing environmental problems preparatory to implementing appropriate remedial measures. Targets of this assessment will be oil-contaminated soils as well as hazardous materials on site.

v. Mining Operations

The new company would change the mining method to a more environmentally friendly operation that will permit:

- Implementation of measures to minimize the quantities of minewater and drainage to be discharged and its exposure to contaminants;
- Progressive reclamation by replacement of disturbed materials and a programme of rapid development of vegetative cover of the areas for which it is responsible in its mining operations;
- The mining operation will be adjusted within six months to facilitate the reclamation of areas mined by the new company and to produce a stabilized geomorphology;
- Routing of mine drainage to abandoned mine ponds where settlement of suspended materials could take place;
- Implement pollution prevention practices and training of employees to enable them to be followed;
- Operating and maintenance procedures would be established to minimize sediment transport to the surface drainage network and

to minimize the release of hydrocarbons and other toxic material to the environment within six months;

- Ore transport operations would meet generally acceptable standards for safety, nuisance and pollution prevention, and protection of the aquatic environment within six months of start of new operations.

vi. Tailings Management

The structural integrity and capacity of the existing tailings area would be upgraded to meet appropriate engineering standards and process needs within a period of 12 months. The impoundment would be managed to meet applicable effluent quality guidelines when the modifications are complete. Controllable and relevant variables would include suspended solids, pH, and oil and grease. The value for pH would be managed so that it does not impact on the receiving environment. The new company would ensure the integrity of the tailings dykes and that the management of the tailings containment facilities is carried out in a manner that reduces tailings mobilization and solids discharge from the facility.

vii. Processing Operations

The following measures will be implemented in the processing operations site to ensure sound environmental management:

- Design, construct and operate wet gas scrubbing equipment on the exhausts of bauxite drying and calcination operations;
- Design and implement fugitive dust control measures from transport and materials handling and storage operations;
- Implement a hearing protection programme;
- Install a surface drainage collection and wet detention system;
- Surface and sub-surface drainage (primarily oil and grease, and suspended solids) from the site will not exceed World Bank guidelines. The anticipated date for achievement is within 6-10 months;
- Excavate and replace severely contaminated soils using good environmental practices;
- Repair or remediate fuel storage and transfer facilities to ensure that secondary containment is provided;
- Institute a regular maintenance and monitoring programme for sanitary sewage management;

- Contribute proportionally to improvements to roads to improve environmental quality;
- Hazardous and toxic materials, including fuels will be handled, stored and disposed of appropriately within 12 months;
- A solid waste management system will be implemented within 12 months;
- Practices and equipment will be in place that will meet international standards for workplace health and safety in an agreed to timeframe from Project initiation;
- Contingency plans and resources will be in place to respond effectively to an environmental emergency within 3 months of takeover.

viii. Institutional Measures for Implementing the EMP

To ensure the effective implementation of the EMP an organizational structure has been developed that defines roles, responsibilities and authority to managers, supervisors, technical and non-technical employees. Jointly they will be responsible for the day-to-day implementation of the environmental policy and the EMP. This responsibility will be facilitated by the establishment of an Environmental Management Department and appointment of an Environmental Coordinator to oversee the mandates.

ix. EMP Implementation and Maintenance

The detailed development of the EMP would be undertaken under the direction of the General Manager by the Environmental Coordinator in conjunction with Department Superintendents, Foremen, and representation from the employees.

Targets would be formulated to be consistent with the environmental policy and the contents of an Environmental Authorization from EPA. Each target would be associated with an attainment or performance indicator, and the environmental department would be responsible for maintaining records on the objectives, targets, programs and indicators and updating Senior Management on progress in obtaining the environmental objectives.

The EMP would include a series of procedures and work instructions and provide a framework for the implementation and control of activities through system procedures and operating procedures.

Maintenance of the EMP would include:

- Measurement and monitoring;
- Compliance audits;
- Internal and external EMS Audits.

I. Receptor Capacities and Economic Considerations

a. Economic Considerations and Responses

At the community level the ability of persons to recognize the environmental and health effects as a result of the operations of the bauxite mining and processing facility is significant. Residents interviewed all thought that the air pollution factor was significant and impacting negatively on the environment, health and social well-being of the community. It was claimed that some persons disadvantaged by the atmospheric pollution chose to migrate to other parts of Guyana or to other States. On the other hand, some Guyanese nationals relocate to Linden in search of jobs and livelihoods.

It is a known fact that residents overlook the environmental and health problems associate with the bauxite mining and processing due to the economic gains at the macro and micro level. Historically, the bauxite plant employed a significant percentage of the population of Linden and although these figures together with the social contributions made by the plant have decreased steadily over the years, production of bauxite and operation of the plant continue to be seen as priority over the continuing environmental repercussions. The steady generation of air emissions indicates that production of bauxite is maximized and that economic benefits with the concomitant multiplier effect will be optimized in the community.

The impetus behind the Cambior ownership of the bauxite plant was economic reasons and the EIA conducted by SENES (2003) concluded that in light of the existing conditions associated with LINMINE operations, the Cambior proposal is unlikely to have any significant adverse affects on the environment and the community. Given the residual impacts of past mining activities and the current poor financial condition of the operation, it is unlikely that physical and environmental conditions will improve over the current situation without the Project.

b. Political Factors

From inception the mining and processing of bauxite in Guyana have been highly politicized. As one of the main drivers of economic growth in the 1960s and 1970s, bauxite production and export remained high on the agenda of the political directorate. The operation of the LINMINE facility was subsidized to the tune of USD 6 million per year which provided the teeth for the political intervention in decision making. However, following the Cambior takeover, the provision of no subsidies and a 30% ownership by GoG the influence of the Government decreased drastically. The ability of GoG to dictate the kinds and levels of social services to be provided by the OBMI were limited. Hence, social responsibility and corporate environmentalism was left to the management of the bauxite plant. Reluctance to invest in social services and environmental protection was experienced due to the non-profitability claim by the company.

Conclusions

i. Needed Changes in Laws and Policies

The EP Act and NEAP represent relatively advance tools for environmental management in the region. Subsidiary legislation in the form of the pollution prevention regulations and rules has been evolving to complement the suite of applicable legal instruments. The amendment of these legislations to integrate health and environmental aspects that will make the impact assessment comprehensive can be one avenue to facilitate the adoption of this new initiative at the national level. This will entail the formulation of an intersectoral technical advisory body to advise and guide the requisite legal drafting.

Legal and environmental experts within the University of Guyana (UG) and the University of the West Indies (UWI) can be used to develop the new legislations that will integrate health and environment in the assessment process. The representation on the technical advisory body by resource persons of the medical and health profession will guide the elements of health that needs to be included. Furthermore, health monitoring systems and measures that needed as part of the ongoing impact assessment will be guided by professions specific to the field.

ii. Interactions by International Institutions

The concept of integration health and environmental aspects into a comprehensive impact assessment is relatively new to the region. Despite the fact that the EIA process and requirements has been fledged in Guyana, modification to include the health components will be needed.

Investments and interactions by international organizations can assist with:

- Procurement of technical resources to guide the mechanism and process to facilitate the integration of health and environmental considerations in the impact assessment laws and policies;
- Production of financial resources to support the requisite consultancies associated with the modification of the laws and policies to reflect the health oriented realm;
- Support the process associated with awareness building, consultation and consensus among the governmental agencies and private sector for the integration;
- Assist with capacity building among personnel from the relevant regulatory agencies and professional consulting fraternity so that delivery and review of the integrated impact assessment will be comprehensive;

- Conducting studies and research in the areas of health and environmental impact assessments.

iii. New Accord and/or Instruments

Following the commitments made at the 1992 Rio Conference and the efforts to deliver on the requirements of the Agenda 21, Guyana was in the forefront for the development of the administrative and institutional capacity and capability to stipulate EIAs for development project. This was realized with the implementation of the EP Act, EPA, EAB, formal system for collaborating agencies and development of guidelines for the EIA permitting process. Hence, the UNCED acted as the catalyst and impetus for the adoption of EIAs as a requisite tool to guide development in a sustainable manner. Furthermore, as environmental awareness increased the harmonization of the environmental permitting process into national development planning was enhanced.

For the State of Guyana we can conclude with a high level of confidence that the regulatory framework exist for the use of EIAs in the planning process. Hence, it is important to note that making the health component an integral part of the assessment should be relatively smoother in comparison to than some other States since modification of the requirements will be the main challenge.

Specific to Guyana and the region by extension suggested elements of the new accord should include:

- National and regional consultations: Promoting the need for an integrated impact assessment at the national and regional levels will be the prerequisite to allow for buy-in to the initiative and process. This can provide the awareness needed to make the transition from the traditional EIA or HIA into the comprehensive integrated EHIA.
- Provision for assistance to region and individual States for the development the technical capacity and capability: Currently the dearth of capacity for the conduct and regulation of integrated EHIAs means the emphasis will have to be given for investment in the development human resources. Situation analysis and needs assessment will guide the allocation of resources regionally and amongst States.
- Financial assistance: States that have signed unto the agreement will have to be provided with financial assistance to develop the infrastructure to regulate and administrate the EHIAs.
- Amendment of regulatory instruments and processes: In Guyana the existing EP Act and subsidiary legislation will have to be amended to stipulate the EHIA requirements. This can be conducted as a pilot study and used to guide the further expansion of the integrated impact assessment throughout the region. The relatively

advanced system which exists for EHIA will facilitate smoother transitioning than other States.

- Normalisation: The request for elaborate impact assessment studies to accompany developments can disadvantage small enterprises. This is particularly relevant to Guyana since small businesses are contributing significantly to the economy. The use of classification criteria for the environmental permitting that stipulates different requirements will be a useful measure. In Guyana the use of the environmental permit and the operational permit ensures that small enterprises are not burden with a full fledge EIA. However, they all are subjected to the scoping process at which the distinction is made based on professional judgment.
- EHIA promotion: Measures will have to be taken in the administration of the instrument to allow for continuous promotion throughout the Americas. This will facilitate the signing, accession, ratification and implementation at the national level.
- Timing: It is important to have a time element included in the agreement which will allow States to make the necessary legal and administrative arrangement to implement the requirements of the EHIA agreement at the national level.
- Private sector: Any environmental agreement to facilitate the institutionalisation of EHIAs should make allowances for the input of the private sector or NGOs at all stages. Health and environmental management services are conducted by the private sector and the EHIA studies will be conducted through consultancies. Hence, continuous dialogue with these sectors will add to the robustness of the agreement and in many cases the private sector can lobby governments to implement.
- Technical cooperation among countries: States with greater resources and more advance regulatory and institutional framework can advance the process of integrated EHIAs with the guidelines, procedure and processes developed available to be used by other States. Through collaborative efforts technical assistance can be provided to less fortunate States for the legal and institutional revisions components.

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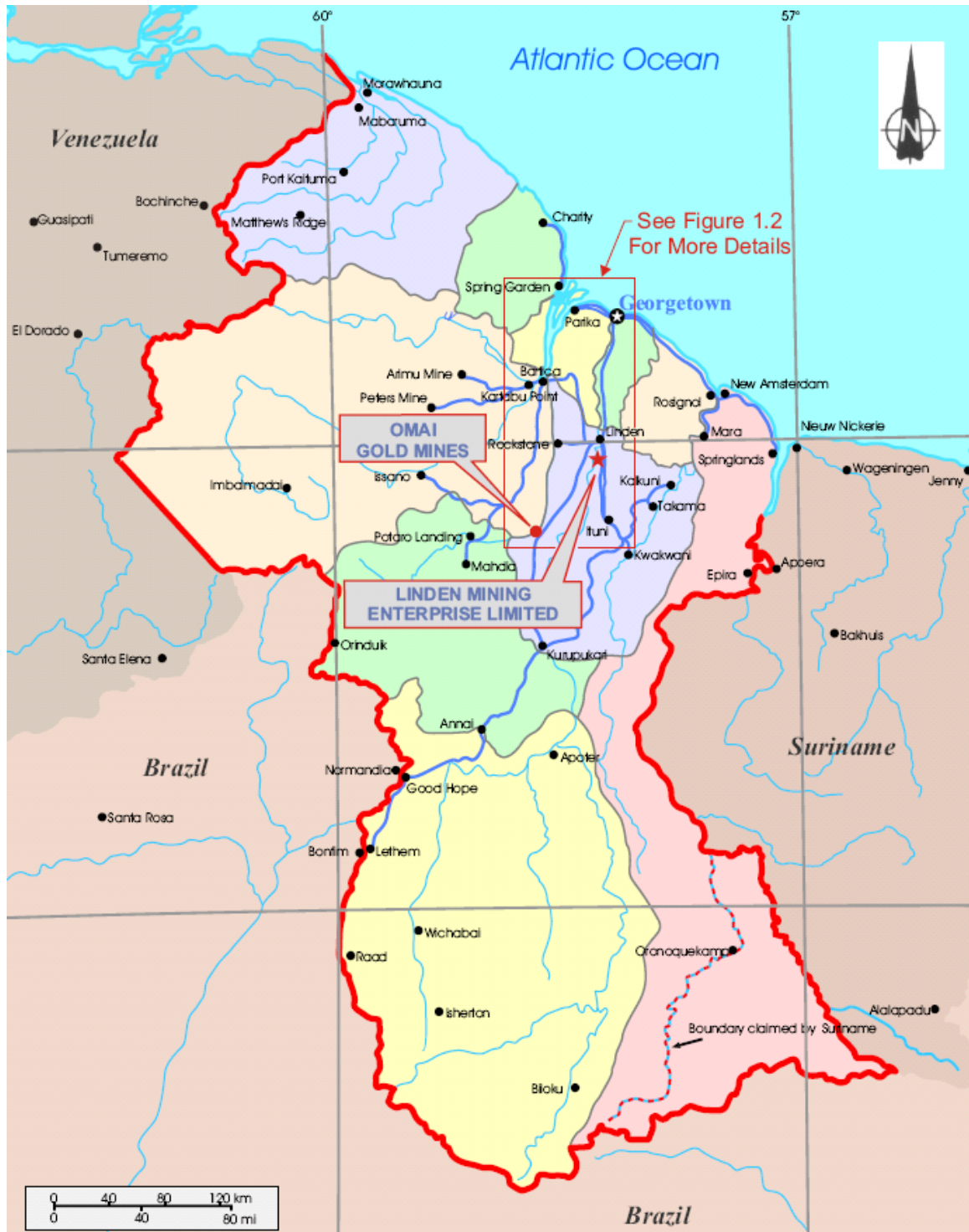
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Appendix 1: Location of LINMINE Bauxite Mining Facility



Centre for International Sustainable Development Law (CISDL)

The Centre for International Sustainable Development Law (CISDL) is an independent legal research institute that aims to promote sustainable societies and the protection of ecosystems by advancing the understanding, development and implementation of international sustainable development law.

As a charitable foundation with an international Board of Governors, CISDL is led by 2 Directors, and 9 Lead Counsel guiding cutting-edge legal research programs in a fellowship of 120 legal researchers from over 60 developing and developed countries. As a result of its ongoing legal scholarship and research, the CISDL publishes books, articles, working papers and legal briefs in English, Spanish and French. The CISDL hosts academic symposia, workshops, dialogues, and seminar series, including legal expert panels parallel to international treaty negotiations, to further its legal research agenda. It provides instructors, lecturers and capacity-building materials for developed and developing country governments, universities, legal communities and international organisations on national and international law in the field of sustainable development. CISDL members include learned judges, jurists and scholars from all regions of the world and a diversity of legal traditions.

With the International Law Association (ILA) and the International Development Law Organization (IDLO), under the auspices of the United Nations Commission on Sustainable Development (UN CSD), CISDL chairs a Partnership on 'International Law for Sustainable Development' that was launched in Johannesburg, South Africa at the 2002 World Summit for Sustainable Development to build knowledge, analysis and capacity about international law on sustainable development. Leading CISDL members also serve as expert delegates on the International Law Association Committee on International Law on Sustainable Development. For further details see www.cisdl.org.