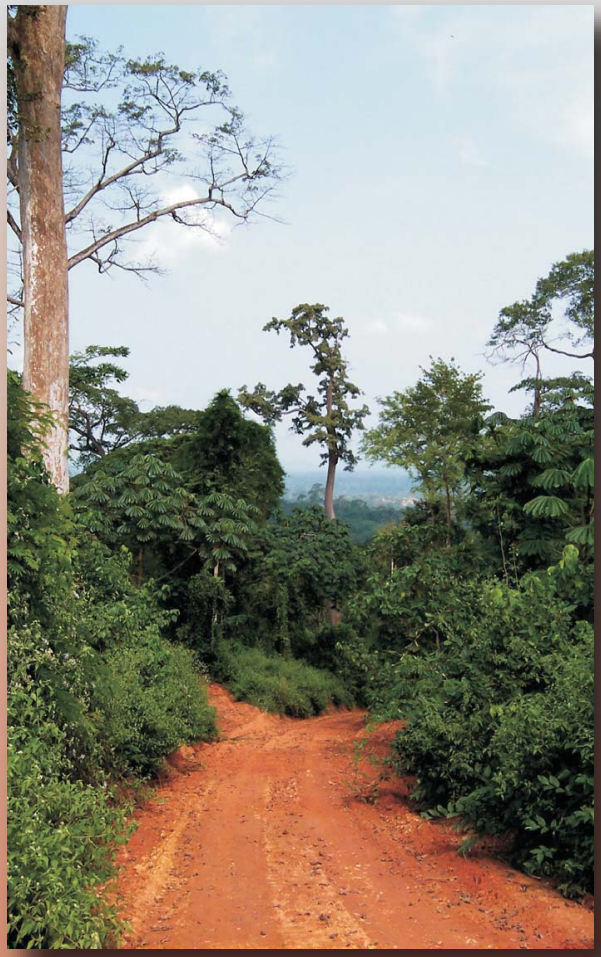
ANNEX E



ENVIRONMENTAL MONITORING METHODOLOGIES GENERAL DESCRIPTION

AIR QUALITY MONITORING

Fugitive Dust

Results of air modelling indicate that expected effects of the Project on the airshed are minimal. The primary emission source associated with the Project is fugitive dust. Fugitive dust emissions would be controlled through use of direct water application, chemical binders or wetting agents and revegetation of disturbed areas concurrent with operations. All ore transfer points in the processing plant would be equipped with water sprayer units. Dust deposit gauges and volumetric sampling methods would provide specific information appropriate to assess health and safety issues at key locations in the Study Area. Additionally, PM10 monitoring would be implemented to further define potential impacts specific to respiratory health for both workers within the Proposed Mining Area and at targeted hamlets and communities.

Gaseous Emissions

Gaseous emissions from the carbon regeneration kiln would be scrubbed to remove volatized heavy metals and toxic gases. Emissions from the kiln would be monitored periodically to ensure compliance with relevant air emissions standards.

Current Monitoring

Baseline air quality and climatological data are being collected within the Proposed Mining Area to allow comparison to future data collected under the Company's air quality monitoring program.

METEOROLOGICAL MONITORING

The Company has installed a complete meteorological (weather) station within the Proposed Mining Area and has been collecting data since early 2007. The weather station records wind speed, wind direction, rainfall, temperature, evaporation, and humidity. These data are validated, entered into the Project data base and are periodically reported. This information will continue to be collected throughout the life of the mine and through the reclamation period.

WATER RESOURCES MONITORING

Surface Water

The primary purposes of water resources monitoring within the Study Area are to establish existing conditions and to collect data that can be used to demonstrate and report any changing conditions as mining commences. A consistent surface water monitoring programme was initiated within the Study Area in early 2007 and includes designated monitoring stations located upstream and downstream of proposed locations of major mine facilities (mine pit, waste rock disposal facilities, and tailings storage facility). This programme

produces data that complement water quality and flow data collected by various investigators of the Study Area for the past several years. Currently, water quality and flow rates are measured routinely and the results are input to the Project data base and reported periodically. An inventory of springs and seeps in the Study Area has been completed and these features are included in the monitoring program.

Under the longer term water resources monitoring program, water quality samples would routinely be collected and analyzed for parameters such as pH, temperature, specific electrical conductivity, dissolved oxygen, turbidity, dissolved and suspended solids, oil and grease, total and faecal coliform bacteria, nutrients, chemical oxygen demand, biological oxygen demand, cyanide, iron, manganese, aluminium, arsenic and other trace metals. Surface water flow would routinely be measured at designated points in drainages within the Study Area including the Pra River, Mamang River and tributaries (including Afosu, Adentosu, Akwasi, Adenkyerensu, Beayaa, Akrawasu, and Aprapon streams).

Groundwater

Community and village water supply wells and boreholes within the Study Area have been inventoried to document locations and construction characteristics, to the extent possible. Water levels have been measured and samples from representative community and village wells have been collected to provide baseline information.

The groundwater monitoring programme to be implemented during construction, operation and closure of the Project would include both community and village water supply wells and boreholes and monitoring wells installed by the Company. The Company is installing monitoring wells at key locations upgradient and downgadient from major proposed mine facilities (mine pit, waste rock disposal facilities, and tailings storage facility) to ascertain hydrogeologic characteristics of the groundwater systems in the Proposed Mining Area as well as establish baseline conditions with respect to water levels, groundwater quality, and aquifer hydraulic characteristics. Selected monitoring wells and community and village water supply wells will be included in the longer-term groundwater monitoring programme for the Project; data from these wells will provide sufficient data to document any upsets in the groundwater systems and identify trends.

In addition, water levels would be measured and water samples would be collected and analyzed from wells and boreholes of nearby villages. If results of this monitoring show adverse effects from the Project, one or more appropriate mitigation measures would be implemented. Mitigation measures included in the Company's Plan of Operations are expected to prevent adverse impacts to water resources (see Section 5.0).

Sample Shipping and Analysis

Collected water samples (surface water and groundwater) will be preserved, shipped, analyzed and validated in accordance with accepted Ghanaian and international standards. A parameter list would be developed in consultation with EPA. An example parameter list is presented in **Table C4-4** (**Annex C**). Monitoring reports would be prepared and submitted to the EPA at a frequency as required by the agency.

Sewage treatment plant effluent would be monitored daily to ensure compliance with relevant discharge standards. Parameters monitored would include pH, conductivity, turbidity, total suspended solids, chemical oxygen demand, biological oxygen demand, total and faecal coliform bacteria, free chlorine, nitrate and phosphate.

Stormwater

Stormwater run off would be controlled through installation of physical barriers and drainage control features, utilization of best management practices to minimize erosion and by minimizing exposure of mine process materials to stormwater. The Company's practice is to sample stormwater prior to discharge from sediment control structures. Sampling and analysis of stormwater, including water impounded behind the sediment control structures, would ensure that no contaminants would be discharged from the Project site.

Impounded water would be used for dust suppression or released to natural drainages, providing water quality meets applicable discharge standards. If water quality issues are identified, the impounded water from the environmental control dams may be used as makeup water in the ore processing circuits or would be treated to meet applicable Ghanaian standards prior to discharging. Sediment would be periodically removed from these basins and stockpiled for later use in site reclamation.

Seepage From Waste Rock Disposal and Tailings Storage Facilites

Discharge from the under-drainage systems for the waste rock disposal and tailings storage facilities would be sampled periodically. A parameter list would be developed in consultation with EPA. An example parameter list is presented in **Table C4-4** (**Annex C**). During operations, this water would be recycled back into the tailings impoundment or process water pond. After mine closure, this water would be captured and treated or recycled in the tailings impoundment until the quality is acceptable for discharge to natural drainages, or until the flow ceases. Moisture content, density, and a visual survey of the tailings storage facility would be performed quarterly.

VEGETATION MONITORING

Vegetation monitoring would be conducted as soon as specific areas within the broader Proposed Mining Area have been reclaimed and following final reclamation of the site. Vegetation monitoring would continue for three years after final reclamation or until required success criteria are met. Information developed on revegetation of disturbed areas during the life of the mine would be used to modify final reclamation procedures as necessary. Vegetation monitoring would include annual sampling to determine plant community characteristics such as herbaceous cover, herbaceous production, and species diversity. Vegetation would also be inspected to evaluate success in stabilizing soil and minimizing erosion and to verify that noxious weed control programs are being successfully implemented.

FAUNA AND AQUATICS MONITORING

Fauna and aquatic monitoring will continue to be undertaken during and immediately following mining operations. The Company proposes to conduct two fauna surveys per year for the first two years following mine development, one at the end of the wet season and one at the end of the dry season to evaluate the fauna populations in and around the Proposed Mining Area. A less frequent monitoring programme is envisioned following the first two years; the specific plan would be developed in conjunction with the EPA and appropriate wildlife agencies. Fauna monitoring will be conducted in designated portions of both the Ajenjua Bepo and Mamang forest reserves and in areas that been revegetated as part of concurrent reclamation activities.

Aquatic surveys would initially be conducted once per year at designated locales in the Pra and Mamang rivers to document populations and species diversity during mining operations and for a period of time following reclamation. Following initial monitoring efforts, the frequency of monitoring and number of sites monitored will be adjusted to meet project objectives.

NOISE AND VIBRATION MONITORING

A noise monitoring programme would be implemented to ensure noise generated by mining activities and equipment does not exceed noise guidelines established by the Ghanaian EPA at the residential site nearest the Proposed Mining Area. Vibration monitoring would also be completed to ensure blast velocities are within Ghanaian guidelines at appropriate distances from the Proposed Mining Area. This monitoring will be supplemented with a building and foundation monitoring programme to be designed in consideration of changes to cracks and other partings in target structures as compared to background conditions. Such a monitoring plan will be developed in consultation with appropriate Ghanaian governmental agencies and area stakeholders.

EROSION AND SEDIMENT CONTROL MONITORING

The Company will develop a sediment and erosion control programme to minimize the impacts of mining on the aquatic ecosystem and water users downstream of the Proposed Mining Area. The programme would be designed to ensure Total Suspended Solids concentrations meet standards at various points of compliance and erosion and sediment generation resulting from mine development activities is controlled through Best Management Practices. The transport of sediment particles would be controlled operationally through maintenance of intermediate sediment control Best Management Practices and Total Suspended Solids discharge concentrations would be maintained at the property boundary through settling in sediment control structures.

A sediment and erosion control monitoring plan will be prepared that will guide trained staff in monitoring key operational areas on a regular basis and maintaining Best Management Practices, as necessary, to control erosion at the source. Best Management Practices may

include silt fencing, brush barriers, check dams in ditches and sediment sumps. As part of the monitoring program, the Company will record key performance factors associated with the Best Management Practices, conduct any necessary maintenance or clean out sediment to ensure the effectiveness of the method employed. Additionally, the Company would sample stormwater prior to discharge from environmental control dams to ensure water quality standards of any effluent released from the dams meets appropriate Ghanaian standards.

GEOCHEMICAL MONITORING

The Company would conduct ongoing testing of rock materials at the Project site to confirm site-specific geochemical processes that result from exposure of geologic materials to weathering. In response to this information, alternatives and/or mitigation measures can be designed that minimize or abate potential adverse effects of those processes. Exposure of rock has potential to change local rock-water interactions from existing conditions, thereby initiating geochemical reactions that may require additional mitigation steps beyond the environmental controls designed into the Project.

Predicting potential metals release from waste rock over the long-term can be difficult due to the complexity of accurately simulating weathering processes and the number of physical, chemical, biochemical, mineralogical and hydrogeological variables involved. The Company would develop material sampling and analysis strategies in response to results of predictive geochemical modelling that will be conducted prior to mine development and refined as the mine is developed. Ongoing geochemical monitoring and modelling will help to ensure the behaviour of the waste rock is consistent with that predicted and that any perturbations in the results can be used to mitigate potential environmental impacts through operational changes, as necessary.

As part of the geochemical monitoring plan, specific data would be collected and/or used to identify the geochemical processes associated with the waste rock produced by the mine including:

- Baseline water quality data (see *Water Resources* section).
- Chemical analysis of ore and waste rock material using acid-base accounting static tests of oxide and sulphide samples for acid neutralization potential (ANP), acid generation potential (AGP), and net carbonate value (NCV), expressed as $\%CO_2$.
- Mineralogical composition for determining percentage of carbonate minerals and sulfide minerals in samples from the mine pit area.
- Monitoring of effluents from column testing of whole waste rock samples collected from the mine which would be analyzed for selected metals to determine metal mobility.
- Chemical analyses of process solutions and results of cyanide detoxification tests.

This information would allow the Company to confirm existing data (acid-base accounting and neutralization potential) and identify the need for alternative material handling procedures and/or mitigation measures. Once new data are available, geochemical models would be created or revised to predict changes to: (1) the quality of water that would result

from exposure of geologic materials to surface weathering processes during construction of the mine pit, waste rock disposal facilities and roads; (2) the quality of water that could seep from the waste rock disposal facility and discharge from the tailings storage facility underdrain system; (3) the quality of water that may collect in the mine pit during and after operations; and (4) chemical constituents that would be present in process solutions.

OPERATIONAL MONITORING

The Company would require its Operations Department to develop Standard Operating Procedures defining routine facility inspection programs and specific parameters to be monitored, such as the pressure within the tailings piping system, cyanide concentrations in the tailings, fuel usage, hazardous materials usage, and inputs and outputs from system components that are necessary to ensure safe operation and prevent accidents which could cause damage to human health and the environment. These operational requirements would become part of the Project Environmental Management Plan. The Company's Environmental Department would then assess and audit the implementation of these requirements on a regular basis to ensure that Operations staff is in compliance with the established Standard Operating Procedures.