

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE KOUILOU POTASH PROJECT

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3. ENVIRONMENTAL POLICY AND OBJECTIVES

MagIndustries Corp. has developed an approach to sustainable development which covers the environmental and social, as well as health and safety aspects which will apply to MagMinerals Inc.'s Kouilou Potash Project and its other operations. The approach to sustainable development developed by the Company is aligned with the Sustainable Development Framework adopted by the International Council on Mining and Metals as far as these are applicable to the activities of MagIndustries Corp., and MagIndustries also adopts the World Bank Group (WBG) policies, guidelines and procedures. In addition, the Project has a number of Lenders who have their own specific policies; where these differ from the main international frameworks these are outlined.

The Republic of Congo's current regulatory framework does not include any numerical environmental standards, so internationally recognised standards applicable to the Potash Project have been selected for use during the development and operation of the Project. These are set out below.

3.1 International Policies

3.1.1 Equator Principles

The Equator Principles provide a framework for financial institutions seeking to manage environmental and social risks, and to promote best practice in this context. The signatories are predominantly financial institutions, such as the African Development Bank Group (AfDB), which provide project financing in developing countries. The signatories require borrowers to demonstrate that they have substantially met these principles or will do so in the development and management process of the projects for which they are requiring financing. These undertakings are aligned with WBG policies, procedures and guidelines, especially the International Finance Corporation (IFC) Performance Standards, and include a categorisation of the Project based on environmental and social screening criteria of the IFC for projects with a capital cost of USD 50 million or more, and which may have significant adverse impacts.

The categories are:

- Category A: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- Category B: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;

- Category C: Projects with minimal or no social or environmental impacts.

For Category A projects, such as MagMinerals Inc.'s Kouilou Potash Project, the following broad requirements need to be satisfied:

- Completion of an Environmental Assessment compliant with WBG standards and demonstration of compliance with applicable host country laws, regulations and permits required by the Project, WBG and IFC Environmental, Health and Safety Guidelines, as well as IFC Performance Standards;
- Implementation of an Environmental and Social Management System (ESMS) compliant with WBG standards;
- Consultation, in a structured and culturally appropriate way, with groups affected by the Project, including local non-governmental organisations (NGOs). The Environmental Assessment, or a summary thereof, must be made available to the public for a reasonable minimum period in the local language and in a culturally appropriate manner;
- Appointment, as necessary, by lenders of an independent environmental expert to provide additional monitoring and reporting services;
- Agreement to comply with the ESMS and report thereon.

The first group of Equator Principles adopted the policies, guidelines and procedures of the WBG. However, in April 2006, a set of Performance Standards and a Disclosure Policy were introduced by the IFC, the private sector arm of the WBG, to replace various guidelines, policies and procedures. These Performance Standards were also adopted by the Equator Principles in June 2006. Since then, several new IFC Guidelines were released and one specifically on Mining in December 2007. MagIndustries Corp. is committed to adhering to the IFC's new Performance Standards and Guidelines, which can be seen in full at www.ifc.org. The eight Performance Standards and IFC Guidelines used to determine the environmental objectives of the Kouilou Potash Project are listed below.

IFC Performance Standards

- Performance Standard 1: Social and Environmental Assessment and Management Systems;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Pollution Prevention and Abatement;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;

- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management;
- Performance Standard 7: Indigenous Peoples;
- Performance Standard 8: Cultural Heritage.

IFC's Environmental, Health, and Safety (EHS) Guidelines used to Determine the Environmental Objectives of the Kouilou Potash Project

- General EHS guidelines:
 - Air Emissions and Ambient Air Quality;
 - Waste Water and Ambient Water Quality;
 - Noise.
- Industry sector guidelines:
 - Mining;
 - Phosphate Fertilizer Manufacturing.

The EHS Guidelines for Phosphate Fertilizer Manufacturing, which includes limits for process wastewater from compound fertilizers production – including potassium – have been used as a reference since, according to the World Bank General EHS Guidelines, Wastewater and Ambient Water Quality, projects for which there are no industry-specific guidelines should reference the effluent quality guidelines of an industry sector with suitably analogous processes and effluents.

3.1.2 African Development Bank Group

The African Development Bank Group (AfDB) (www.afdb.org) is a regional multilateral development finance institution engaged in mobilising resources towards the economic and social progress of its Regional Member Countries (RMCs), of which the Congo is a member. Its headquarters are in Tunis, Tunisia. The AfDB's mission is to promote economic and social development through loans, equity, investments and technical assistance. In December 2005, a Country Strategy Paper 2005-2007 was tabled and approved by the African Development Fund. This document served to establish a reference framework for the reengagement of the AfDB in the Congo after a long period of inactivity. One of the priorities identified in the Country Strategy Paper is the strengthening of economic management capabilities. The AfDB has approved, in December 2006, the Expenditure Circuit and Poverty Indicators Improvement Support Project presented by the Congo. The present Environmental and Social Impact Assessment (ESIA) has taken cognisance of the applicable AfDB policies which are outlined below.

3.1.2.1 Policy on Poverty Reduction

The goal of AfDB's Policy on Poverty Reduction is to ensure that poverty in Africa is reduced. This involves development of strategies that facilitate national ownership, participation and working towards improving in the welfare of the poor, especially in the achievement of the Millennium Development Goals (MDG). Five priority development areas have been selected, namely: agriculture and rural development – including rural infrastructure, human resources development, HIV/AIDS, private sector development, good governance and two cross-cutting issues, *i.e.* gender and the environment.

3.1.2.2 Policy on the Environment

The specific objectives of the Policy on the Environment emphasise enhancement of the carrying capacity of RMCs, improving the access of the poor to environmental resources, helping RMCs to bring about institutional changes to achieve sustainable development, and strengthening partnerships with international agencies and networking with international, regional, and sub-regional organisations.

Relevant environmental sustainability considerations include the following:

- Reversing land degradation and desertification;
- Improving public health;
- Promoting sustainable industry, mining and energy resources;
- Institution and capacity building;
- Increasing awareness.

3.1.2.3 Involuntary Resettlement Policy

This Policy has been developed to address the involuntary physical displacement or loss of other economic assets of people caused by AfDB-financed projects and programmes. The Policy applies to all of the AfDB-funded operations, in public and private sector, whether AfDB financing is directly channelled as investment loans or is administered by a financial intermediary.

The overall goal of the AfDB's Involuntary Resettlement Policy is to ensure that when people must be displaced they are treated equitably, and that they share in the benefits of the project that involves their resettlement. The Policy seeks to avoid involuntary resettlement where feasible, or to minimise resettlement impacts where population displacement is unavoidable, exploring all viable project designs. It promotes resettlement assistance, preferably under the project, so that standard of living, income earning capacity, and production levels are improved.

The Policy framework provides explicit guidance to AfDB staff and to borrowers on the conditions that need to be met regarding involuntary resettlement issues in AfDB operations in order to mitigate the negative impacts of displacement and resettlement and establish a sustainable economy and society.

3.1.2.4 Gender Policy

The main thrust of the Gender Policy is to promote gender mainstreaming in AfDB-funded programmes and projects as well as all policy documents. The AfDB recognises that inequitable gender relations cannot be addressed by focusing on women in isolation. The major objectives of AfDB's Gender Policy are two-fold: to promote gender mainstreaming in AfDB operations and to support RMCs' efforts to attain gender equality.

3.1.2.5 Population Policy

The key objectives of the Population Policy are to:

- Support programmes and direct intervention aimed at reducing fertility, as high birth rates are a major impediment to poverty reduction and sustainable development;
- Ensure the quality and enhancement of human resources through the implementation of appropriate education and health programmes;
- Assist African countries in achieving a balance between population growth and economic growth, by making available to RMCs relevant information on the population and development interrelationship through training and awareness creation.

3.2 Sustainable Development Policies of MagIndustries

MagIndustries is committed to managing its extensive mineral, energy and forestry resources in a responsible way, to the benefit of its relationships with host communities, the environment and the business itself. MagIndustries recognises the need to contribute to sustainable development and aligns itself with the Sustainable Development Principles developed by the International Council on Mining and Metals, which can be seen in full at www.icmm.com/icmm_principles.php.

Sustainable Development Policies have been drafted and approved by the Sustainability, Environment, Health and Safety (SEHS) Committee and the Board of Directors of MagIndustries in February 2008. The SEHS Committee operates at Board level and considers, on an on-going basis, the management of environmental

and health and safety issues within its business units. Each business unit has a representative responsible for SEHS issues. Although they are supported by staff members who provide specialised advice and support in managing all aspects of EHS, ultimate responsibility rests with the senior management teams for each business unit, *i.e.* Minerals, Metals, Forestry and Energy. The highest SEHS governance body is the SEHS Committee which reports directly to the Board.

The Policies cover environmental, community, and health and safety issues. Copies of the Policies are provided below.

3.2.1 Environmental Policy

MagIndustries Corp. (the “Company” or “MagIndustries”) and its controlled affiliates recognizes environmental management as a corporate priority and is committed to the integration of environmental and social considerations at all levels of project development and operation. (There are separate Policies relating to Health and Safety and to Community Development).

The Company will develop an environmental programme and environmental management procedures for its operations, aimed at minimising and mitigating any adverse environmental impact and protecting biodiversity and taking cognizance of conservation opportunities.

The Company will seek to develop environmental management procedures at the Company’s operations consistent with the Equator Principles, and thus the World Bank Group (WBG) policies, guidelines and procedures, as at February 4, 2008, and internationally recognized industry best practice.

The implementation of the Environmental Policy and environmental management procedures will be key requirements during all phases of project development. The Company will also seek to require its consultants, contractors, suppliers and subsidiaries to adopt the principles of this Environmental Policy as a minimum standard.

MagIndustries is cognisant of the principles of sustainable development, which is taken to mean “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Accordingly, the Company is committed to the harmonisation of economic development with the health and wellbeing of the natural and human environments.

MagIndustries believes that setting and meeting high environmental standards are prerequisites for carrying on business in a sustainable society, and the Company is committed to good stewardship in the protection of life, health and the environment.

Environmental Policy Implementation

Technically sound and economically feasible environmental protection measures will be adopted throughout the exploration (where appropriate), development and operational phases of its projects, as well as on closure.

Specific objectives

The Company will address the following specific objectives in its commitment to environmental management:

- as a minimum, to assess, design and operate its activities in order to comply with all relevant national legislation relating to the environment;
- in the absence of comprehensive national legislation, then as a minimum requirement to seek to apply the policies, guidelines and procedures of the Equator Principles and thus those of the World Bank Group as of February 4, 2008;
- as far as possible, to plan for operation, closure and reclamation of each new project at the design stage;
- to implement an Environmental Management Plan which contains, *inter alia*, procedures covering all aspects of operations, and aimed at ensuring compliance with legislation, EP policies, guidelines and procedures as of February 4, 2008, and the requirements of the Company;
- to carry out periodic, systematic, internal environmental audits and to use the results as a basis for planning continual improvements in environmental performance;
- to develop and maintain staff training programmes to promote both awareness of environmental issues, and practices designed to protect the environment and natural resources;
- to promote the efficient use of energy, materials and other resources at the Company's operations;
- to promote reuse and recycling as far as economically justifiable;
- to provide adequate resources to meet environmental management obligations for the development, operation and closure of each operation;

- to work with employees, regulatory agencies and the local communities to promote awareness of, and ensure preparedness for possible emergencies;
- to consult with stakeholders such as employees, government and local communities, to maintain open and constructive communication and participation, and to address environmental priorities and concerns;
- To review this policy periodically and update as necessary.

3.2.2 Community Development Policy

MagIndustries Corp. (the “Company” or “MagIndustries”) and its controlled affiliates recognises that it has responsibilities towards the local communities in which its projects are based. The Company is committed to the integration of community consultation, liaison and development at all levels of project development and operation, and seeks the best possible participatory relationships with all parties.

The implementation of the Community Development Policy will be a key requirement at all phases of project development. MagIndustries will also seek to require its consultants, contractors, suppliers and subsidiaries to adopt the principles of this Community Development Policy as a minimum standard.

The Company is committed to facilitating sustainable contributions to the physical and economic development of communities close to its project sites and ultimately to limit the dependence of these communities on mining and other projects with a limited lifespan.

MagIndustries is cognisant of the principles of sustainable development, which is taken to mean “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

MagIndustries will assist in the improvement of conditions and infrastructure in communities close to its project sites, while recognising that it cannot undertake major infrastructure development projects. The Company will, in due course, seek to provide a specific amount of financial support to a Not-For-Profit Foundation or site specific community development projects at each of its project sites depending on the financial success of the operations. It is intended that each Not-For-Profit Foundation will be established and managed with the purpose of financing sustainable community development initiatives, within carefully prescribed guidelines.

Policy Implementation

Technically sound and economically feasible approaches to community development will be adopted throughout the exploration, development and operational phases of its projects, as well as on closure.

Specific Objectives

The Company will address the following specific objectives in its commitment to community development:

- to adhere to all community laws, regulations and guidelines that are applicable to its project sites. Where no such national framework exists, the Company will seek to apply the requirements of the Equator Principles as at February 4, 2008;
- to respect diversity and cultural differences;
- to work with government, stakeholders and local communities at its project sites to maintain open and constructive communication and to address priorities and concerns, where possible through Partnership agreements;
- to undertake a series of projects to benefit the local community at each project site, to be identified, evaluated and approved, based on local needs identified in consultation with communities, their representatives and leaders, government and NGOs as appropriate. Such programmes must be shown to be efficient, equitable and transparent;
- where appropriate, to invite NGO partners to assist in implementing aspects of the Community Development Policy and Community Development Plan at each project site, which will be a product of the Environmental and Social Assessment process;
- to provide a scholarship scheme for local students;
- to employ skilled Community Nursing personnel at its project sites, where appropriate, to provide a Health Advisory Programme that will include *inter alia* education programmes on basic hygiene, nutrition, family planning, malaria and HIV/AIDS;
- to establish and provide the initial seed capital to a Not-For-Profit foundation or site specific community development projects to enable financing of Sustainable community development issues in specified communities close to its project sites;
- to engage in open dialogue with stakeholder groups and communities at each project site to assist in defining, prioritising, implementing and maintaining community development projects;

- to ensure that community development is managed by appropriately qualified local staff who are aware of local issues;
- to ensure that the results of the community development initiatives at each project site will be monitored by a Public Liaison Committee made up of individuals and representatives of the local population, MagIndustries, appropriate local Government officials and appropriate NGO representatives in terms of success, sustainability and compliance with this Community Development Policy;
- to work with employees, regulatory agencies and local communities to promote awareness of community health and safety and to ensure preparedness for possible emergencies related to each of the Company's project sites;
- to work effectively with stakeholders such as employees, government, and local communities to maintain open and constructive communication at each of its project sites;
- This Policy will be reviewed periodically and updated as necessary.

3.2.3 Health and Safety Policy

MagIndustries Corp. (the "Company" or "MagIndustries") and its controlled affiliates recognises its responsibilities as regards health and safety. The Company is committed to the integration of health and safety issues at all levels of project development and operation. This policy also links with the Community Development Policy and the Environmental Policy.

The Company will seek to develop an employee health and safety programme (including management procedures for its operations), in accordance with local legislation, lenders' requirements and internationally recognised industry best practice. MagIndustries will implement training and development programmes as part of its objective of aiming continually to improve health and safety performance in the workplace and community.

The implementation of the health and safety programme will be a key requirement at all phases of project development. MagIndustries will also seek to require its consultants, contractors, suppliers and subsidiaries to adopt the principles of the Health and Safety Policy as a minimum standard.

The Company recognises the presence of HIV/AIDS in Africa and is committed to developing an HIV/AIDS policy, and where appropriate a programme of information, including training on universal precautions, for the workforce.

Policy Implementation

The Company is committed to protecting the health, wellbeing and safety of its employees, and the safety of the communities affected by its project operations.

Thorough and technically appropriate health and safety protection measures will be developed and put in place at the earliest stages of project development, through exploration, construction, operation and closure.

Specific Objectives

The Company will address the following specific objectives in its commitment to the management of health and safety:

- to adhere to all employment, safety and health laws, regulations and guidelines that are applicable to its projects. Where no such national framework exists, the Company will seek to apply the requirements of the Equator Principles as at February 4, 2008;
- to respect diversity and cultural differences;
- to work with employees, government, stakeholders and local communities to maintain open and constructive communication and to address priorities and concerns;
- to put in place a programme to train employees in health and safety issues. Safety procedures and protocols for employee activities will be developed and detailed training given, covering methods of working, use of Personal Protective Equipment (PPE), first aid and actions in case of emergencies;
- to provide a health screening programme as appropriate for employees and a clinic to treat minor emergencies at each of its project sites;
- to establish accountability for occupational health and safety performance amongst employees;
- to work with employees, regulatory agencies and the local communities to promote awareness of community health and to ensure preparedness for possible emergencies that might arise from the Company's operations;
- to monitor the results of the health and safety initiatives in terms of both success and compliance with the Health and Safety Policy;
- This Policy will be reviewed periodically and updated as necessary.

3.3 Environmental Objectives of the Kouilou Potash Project

In order to protect the environment, numerous countries and international organisations have adopted many standards, directives and guidelines. The lack of environmental standards in the Congo can technically be compensated by international standards or those of other countries, although they may not necessarily be applicable, neither legally or scientifically, in the context of the ROC.

In consideration of the legal, financial and environmental context of the Project, it is proposed to use the guidelines published by the WBG and the World Health Organization (WHO) as the environmental objectives for the Kouilou Potash Project (Table 3.1). For each type of guideline, all the parameters are listed and an environmental objective is determined for this parameter (Tables 3.2 to 3.7). Generally, when several criteria exist for a given parameter, the objective is the most relevant or constraining, *i.e.* restrictive, criterion value.

The environmental objectives for the Kouilou Potash Project, aim to:

- Determine the design parameters of industrial processes as well as the technical specifications of anti-pollution equipment;
- Conduct an initial characterisation of the environment before the implementation of the Project;
- Evaluate the potential impact of the Project on the current state of the environment;
- Elaborate and implement the Environmental and Social Management System (ESMS) aimed at detecting the actual impact of the Project on the environment, throughout the lifetime of the Project.

Table 3.1 Guidelines selected to determine the Environmental Objectives of the Kouilou Potash Project.

Category	WBG	WHO
Ambient air quality	X	X
Atmospheric emissions from energy production units	X	
Ambient noise	X	
Mining and storm water effluents	X	
Treated sanitary discharge	X	
Drinking water		X

3.3.1 Ambient Air Quality

The aim of the ambient air quality guideline is the protection of people and the environment (Table 3.2).

Table 3.2 Environmental Objectives for Ambient Air Quality.

Parameter	Unit ^[A]	Application condition	World Bank Group ^{[1][B][C]}	WHO ^[2]	Environmental Objective	Source ^[3]
<i>Physical parameters</i>						
Particulates < 10 µm	µg/m ³	mean over 24 h	50	50	50 - 62.5 ^[D]	WBG-WHO
		annual mean	20	20	20	WBG-WHO
Particulates < 2.5 µm		mean over 24 h	25	25	25	WBG-WHO
		annual mean	10	10	10	WBG-WHO
<i>Inorganic compounds</i>						
Nitrogen dioxide (NO ₂)	µg/m ³	mean over 1 h	200	200	200	WBG-WHO
		annual mean	40	40	40	WBG-WHO
Sulfur dioxide (SO ₂)		10 minutes	500	500	500	WBG-WHO
		mean over 24 h	20	20	20	WBG-WHO

[1] World Bank. 2007. *Air Emissions and Ambient Air Quality. General Environmental, Health, and Safety Guidelines: Environmental*.

[2] World Health Organisation. 2005. *WHO air quality guidelines*. Global update 2005.

[3] WBG = World Bank Group; WHO = World Health Organisation.

[A] The quality criteria are expressed in µg/Nm³, where N means normalised conditions (293 K and 101.3 kPa).

[B] Limit value based on WHO Ambient Air Quality Guidelines.

[C] As a general rule, this guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed (US EPA Prevention of Significant Deterioration Increments Limits applicable to non degraded airsheds).

[D] Since the Project Area is located in a degraded airshed (see Appendix 4.2), the environmental objective during the wet season is 50 µg/m³ and 62.5 µg/m³ during the dry season.

During the operational phase of the Project, these environmental objectives will apply to the air emanating from the Project's property and which, under the effect of the wind, can affect neighbouring communities. Air quality will be monitored at a permanent station located near Mengo and at a mobile station used on request.

3.3.2 Atmospheric Emissions

Guidelines applicable to atmospheric emissions aim primarily at protecting the quality of ambient air (Table 3.3). Solution mining atmospheric emissions are mainly caused by the operation of energy production units.

These standards are used during the Project design stage, for the selection of equipment, filters and treatments necessary for the control of particulate and inorganic compounds emissions generated by the energy and potash plant.

During the operational phase of the Project, these environmental objectives will apply to emissions sampled directly at the source, *i.e.* at the exit of stacks or at any ventilation exit of a building.

3.3.3 Ambient Noise

The ambient noise guidelines aim to limit the increase of noise in residential, institutional and educational areas, as well as in industrial and commercial areas (Table 3.4).

During the operational phase of the Project, the environmental objectives will apply to the noise measured at the limit of the Project's property.

3.3.4 Mining and Storm Water Effluents

The aim of guidelines applicable to mining and storm water effluents is the protection of the environment (Table 3.5).

In the specific context of the Project, it is planned to discharge at sea a brine effluent either produced from the development of the mining caverns or as a by-product of the industrial process of potash crystallisation.

Since there is no specific water quality criteria for salt content increase associated with brine discharge at sea, an increase of 0.3 % at a distance of 250 m from the sea outfall was defined arbitrarily as an environmental objective.

Table 3.3 Environmental Objectives for Atmospheric Emissions from Energy Production Units.

Parameter	Unit ^[A]	World Bank Group ^[B]		Environmental Objective	Source ^[2]
		Air Emissions ^{[1][C]}			
		Boiler	Turbine		
<i>Inorganic compounds</i>					
Nitrogen oxide (NO _x)	mg/Nm ³	320 ^[D]	51.25 ^[E]	320 ^[D] 51.25 ^[E]	WBG

[1] World Bank. 2007. *Air Emissions and Ambient Air Quality*. General Environmental, Health, and Safety Guidelines: Environmental.

[2] WBG = World Bank Group.

[A] The standards expressed in mg/Nm³ are given for reference conditions, which are: dry gases at a temperature of 273 K (0°C) and a pressure of 101.3 kPa.

[B] All of the maximum levels should be achieved for at least 95 % of the time the plant or unit is operating, to be calculated as a proportion of annual operating hours. The assumptions are, for coal, flue gas dry 6% excess O₂ -assumes 350 Nm³/GJ.

[C] Small Combustion Facilities Emissions Guidelines – 3 MWth to 50 MWth. Guidelines values apply to facilities operating more than 500 h/a with an annual capacity utilisation factor of more than 30 %.

[D] Guidelines for gas boiler. Concentration measured for flue gas dry 3% oxygen.

[E] Guidelines = 51.25 mg/Nm³ or 25 ppm for natural gas turbine = 15 MWth to < 50 MWth. Concentration measured for flue gas dry 15 % oxygen.

Table 3.4 Environmental Objectives for Ambient Noise.

Receptor	Unit	Application Condition	World Bank Group ^[1]		WHO ^[2]		Environmental Objective	Source ^[3]
			Maximum allowable log equivalent ^[A]		Sound level			
			Day ^[B]	Night ^[C]	Day ^[B]	Night ^[C]		
Residential, institutional, educational	dBA ^[D]	Hourly	55	45	50 - 55		45 and 55	WBG
Industrial, commercial		measurements	70	70	70	70	70	WBG-WHO

[1] World Bank. 2007. *Noise Management*. General Environmental, Health and Safety Guidelines: Environmental.

[2] World Health Organisation. 2001. *Occupational and community noise*. Fact Sheet no. 258. Revised February 2001.

[3] WBG = World Bank Group; WHO = World Health Organisation.

[A] Noise abatement measures should achieve either the levels given in the table or a maximum increase in background levels of 3 dBA.

[B] Day = 07:00 to 22:00.

[C] Night = 22:00 to 07:00.

[D] Decibels audible.

Table 3.5 Environmental Objectives for Mining and Storm Water Effluents.

Parameter	Unit	World Bank Group		Environmental Objective	Source ^[3]
		Guidelines for Mining ^{[1][A]}	Guidelines for Phosphate Fertilizer Manufacturing ^{[2][B]}		
<i>Basic physico-chemical characteristics</i>					
Biochemical oxygen demand (BOD ₅)	mg/l	50		50	WBG
Chemical oxygen demand (COD)	mg/l	150		150	WBG
Total suspended solids (TSS)	mg/l	50	50	50	WBG
pH	pH Unit	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	WBG
Temperature (increase)	°C	< 3 ^[C]		< 3 ^[C]	WBG
<i>Major ions and nutrients</i>					
Ammonia	mg/l		10	10	WBG
Free Cyanides (CN ⁻)	mg/l	0.1		0.1	WBG
Total Cyanides (CN ⁻)	mg/l	1		1	WBG
Total Nitrogen	mg/l		15	15	WBG
Fluoride (F ⁻)	mg/l		20	20	WBG
Phosphorus (P)	mg/l		5	5	WBG
<i>Metals and metalloids</i>					
Arsenic (As) [total]	mg/l	0.1		0.1	WBG
Cadmium (Cd) [total]	mg/l	0.05	0.1	0.05	WBG
Chromium hexavalent (Cr VI) [total]	mg/l	0.1		0.1	WBG
Copper (Cu) [total]	mg/l	0.3		0.3	WBG
Iron (Fe)	mg/l	2		2	WBG
Mercury (Hg) [total]	mg/l	0.002		0.002	WBG
Metals, total	mg/l		10	10	WBG
Nickel (Ni) [total]	mg/l	0.5		0.5	WBG
Lead (Pb) [total]	mg/l	0.2		0.2	WBG
Zinc (Zn)	mg/l	0.5		0.5	WBG
<i>Organic compounds</i>					
Oil and grease	mg/l	10		10	WBG
Phenols	mg/l	0.5		0.5	WBG

[1] World Bank. 2007. *Environmental, Health and Safety Guidelines for Mining*.

[2] World Bank. 2007. *Environmental, Health and Safety Guidelines for Phosphate Fertilizer Manufacturing*.

[3] WBG = World Bank Group.

[A] All of the maximum levels should be achieved, without dilution, at least 95 % of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Deviation from these levels in consideration of specific, local project conditions should be justified in the environmental assessment.

[B] According to the World Bank General Environmental, Health, and Safety (EHS) Guidelines, Wastewater and Ambient Water Quality, projects for which there are no industry-specific guidelines should reference the effluent quality guidelines of an industry sector with suitably analogous processes and effluents. EHS Guidelines for Phosphate Fertilizer Manufacturing, which include limits for process wastewater from compound fertilizers production – including potassium – has thus been used as reference.

[C] The effluent should result in a temperature increase of no more than 3 °C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

Also, a storm water drainage system will channel runoff waters from the plant site to a collection basin. This water will be recycled and reused in the potash plant to reduce consumption and only water that cannot be recycled in the event of a 1:100 a 24 h rainfall event will be discharged to the Tienga River.

Although standards exist for effluents generated by power generation stations, they are not considered here because, in the specific context of the Project, the power generator is air-cooled and there are no effluents.

At the design stage of the Project, the environmental objectives are used for the design of industrial processes and for the selection of equipment, filters and treatments, which are necessary for control of pollution from the effluents.

During the operational phase of the Project, these environmental objectives will be used to measure the performance of the Project against predictions made in the ESIA and as managed by the ESMP. Where applicable, the environmental objectives will apply to the effluents sampled: i) at the exit of the plant; ii) at the outlet of the pipeline discharging the brine effluent to the sea l; and iii) at the collection basin emergency spillway.

3.3.5 Treated Sanitary Discharge

The aim of the guidelines applicable to treated sanitary discharges is the protection of the environment (Table 3.6).

Table 3.6 Environmental Objectives for Treated Sanitary Discharge.

Parameter	Unit	World Bank Group ^[1]	Environmental Objective	Source ^[2]
<i>Basic physico-chemical characteristics</i>				
Biochemical oxygen demand (BOD ₅)	mg/l	30	30	WBG
Chemical oxygen demand (COD)	mg/l	125	125	WBG
Total suspended solids (TSS)	mg/l	50	50	WBG
pH	pH Unit	6.0 - 9.0	6.0 - 9.0	WBG
<i>Major ions and nutrients</i>				
Total Nitrogen	mg/l	10	10	WBG
Phosphorus (P)	mg/l	2	2	WBG
<i>Biological characteristics</i>				
Total coliform bacteria	MPN/100 ml ^[A]	400	400	WBG
<i>Organic compounds</i>				
Oil and grease	mg/l	10	10	WBG

[1] World Bank. 2007. *General Environmental, Health and Safety Guidelines: Environmental, Wastewater and Ambient Water Quality.*

[2] WBG = World Bank Group.

[A] MPN : most probable number.

Domestic sewage exiting from the temporary construction workers' camps and from the plant, will be sent to a sanitary wastewater treatment system. The treated effluent will be directed to the Tienga River, while the sludge will either be composted or buried in the landfill.

At the design stage of the Project, the environmental objectives are used for the design of industrial processes and for the selection of equipment, filters and treatments, which are necessary for control of pollution from the effluents.

During the operational phase of the Project, these environmental objectives will be used to evaluate the potential deterioration of the environment by normal discharge of effluents and by accidental spills. The environmental objectives will apply to the effluents sampled at the outlet of the sanitary wastewater treatment system.

3.3.6 Drinking Water

The aim of the drinking water quality guidelines is the protection of human health and to ensure a minimal aesthetic quality, in particular its appearance.

In the specific context of the Project, it is expected that drinking water needs will initially be satisfied by underground wells drilled in the water table in the Study Area, and the water will be treated. These wells will tap water from AQ-2, AQ-3 and AQ-4. Distribution points of drinking water for workers are also planned in the temporary construction workers' camp as well as in the plant. Drinking water needs in other places will be satisfied either by bottled water or by transport of water in water tanks or containers dedicated to this use.

The drinking water quality guidelines are used as environmental objectives during the Project design stage. Thus, the water treatment systems for drinking water comply with these environmental objectives.

During the operational phase of the Project, these environmental objectives will be used to monitor the quality of water from the Project's wells, from neighbouring village wells and any other sources of drinking water. The environmental objectives will be applied to drinking water quality at the point of water distribution to the consumer, *i.e.* at the pump or the tap, in order to determine if the water is of acceptable quality, or if the treatment carried out is sufficient, or if the distribution system is in good condition.

According to the current directives in the ROC the guideline values used for drinking water quality are those published by the WHO (Table 3.7). Consequently, these are used as the Project's environmental objectives.

Table 3.7 Environmental Objectives for Drinking Water Quality.

Parameter	Unit	WHO ^[1]	Environmental Objective	Source ^[2]
<i>Basic physico-chemical characteristics</i>				
Colour	T.C.U.	<15	<15	WHO
Turbidity	N.T.U.	0.1 ^[A]	0.1 ^[A]	WHO
<i>Major ions and nutrients</i>				
Bromate	mg/l	0.01 ^{[B][C][D]}	0.01 ^{[B][C][D]}	WHO
Nitrite (NO ₂ ⁻) (short-term exposure)	mg/l	3	3	WHO
Nitrite (NO ₂ ⁻) (long-term exposure)	mg/l	0.2 ^[E]	0.2 ^[E]	WHO
Nitrate (NO ₃ ⁻)	mg/l	50 ^[F]	50 ^[F]	WHO
Chlorine (Cl ⁻)	mg/l	5 ^{[G][H]}	5 ^{[G][H]}	WHO
Cyanide total (CN ⁻)	mg/l	0.07	0.07	WHO
Fluoride	mg/l	1.5 ^[I]	1.5 ^[I]	WHO
<i>Metals and metalloids</i>				
Antimony (Sb)	mg/l	0.02	0.02	WHO
Arsenic (As)	mg/l	0.01 ^[E]	0.01 ^[E]	WHO
Barium (Ba)	mg/l	0.7	0.7	WHO
Boron (B)	mg/l	0.5 ^[D]	0.5 ^[D]	WHO
Cadmium (Cd)	mg/l	0.003	0.003	WHO
Chromium total (Cr)	mg/l	0.05 ^[E]	0.05 ^[E]	WHO
Copper (Cu)	mg/l	2 ^[J]	2 ^[J]	WHO
Manganese (Mn)	mg/l	0.4 ^[G]	0.4 ^[G]	WHO
Mercury (Hg)	mg/l	0.006 ^[K]	0.006 ^[K]	WHO
Molybdenum	mg/l	0.07	0.07	WHO
Nickel (Ni)	mg/l	0.07	0.07	WHO
Lead (Pb)	mg/l	0.01	0.01	WHO
Selenium (Se)	mg/l	0.01	0.01	WHO
Uranium (U)	mg/l	0.015 ^{[D][E]}	0.015 ^{[D][E]}	WHO
<i>Chlorinated compounds</i>				
Cyanogen chloride	mg/l	0.07 ^[L]	0.07 ^[L]	WHO
Dichloroacetate	mg/l	0.05 ^{[B][D][M]}	0.05 ^{[B][D][M]}	WHO
Dichloroacetonitrile	mg/l	0.02 ^[E]	0.02 ^[E]	WHO
Epichlorohydrin	mg/l	0.0004 ^[E]	0.0004 ^[E]	WHO
Monochloramine	mg/l	3	3	WHO
Monochloroacetate	mg/l	0.02	0.02	WHO
Trichloroacetate	mg/l	0.2	0.2	WHO
<i>Microbiological parameters</i>				
Thermoresistant (faecal) coliforms	Number/100 ml	0 ^[N]	0 ^[N]	WHO
Faecal Coliforms (<i>Escherichia coli</i>)	Number/100 ml	0 ^[N]	0 ^[N]	WHO
Cyanobacteria toxins (Microcystine_LR)	mg/l	0.001 ^{[E][O]}	0.001 ^{[E][O]}	WHO
<i>Specific parameters</i>				
Edetic acid (EDTA)	mg/l	0.6 ^[P]	0.6 ^[P]	WHO
Chlorate	mg/l	0.7 ^[M]	0.7 ^[M]	WHO
Chlorite	mg/l	0.7 ^[M]	0.7 ^[M]	WHO
<i>Volatile organic compounds (VOC)</i>				
Bromodichloromethane	mg/l	0.06 ^[B]	0.06 ^[B]	WHO
Bromoform	mg/l	0.1	0.1	WHO
1,2-Dichloroethene	mg/l	0.05	0.05	WHO
1,2-Dichloroethane	mg/l	0.03 ^[B]	0.03 ^[B]	WHO
1,2-Dichlorobenzene (o-)	mg/l	1.0 ^[G]	1.0 ^[G]	WHO
1,4-Dichlorobenzene (p-)	mg/l	0.3 ^[G]	0.3 ^[G]	WHO
Benzene	mg/l	0.01 ^[B]	0.01 ^[B]	WHO
Chloroform	mg/l	0.3	0.3	WHO
Vinyl Chloride	mg/l	0.0003 ^[B]	0.0003 ^[B]	WHO
1,4-Dioxane	mg/l	0.05 ^[B]	0.05 ^[B]	WHO
Dibromochloromethane	mg/l	0.1	0.1	WHO

Table 3.7 (continued) Environmental Objectives for Drinking Water Quality.

Parameter	Unit	WHO ^[1]	Environmental Objective	Source ^[2]
<i>Volatile organic compounds (VOC) (continued)</i>				
1,2-Dibromo-3-chloropropane	mg/l	0.001 ^[B]	0.001 ^[B]	WHO
1,2-Dibromoethane	mg/l	0.0004 ^{[B][E]}	0.0004 ^{[B][E]}	WHO
1,2-Dichloropropane (1,2-DCP)	mg/l	0.04 ^[E]	0.04 ^[E]	WHO
1,3-Dichloropropene	mg/l	0.02 ^[B]	0.02 ^[B]	WHO
Dicloromethane	mg/l	0.02	0.02	WHO
Ethylbenzene	mg/l	0.3 ^[G]	0.3 ^[G]	WHO
Styrene	mg/l	0.02 ^[G]	0.02 ^[G]	WHO
1,1,2,2-Tetrachloroethene (Tetrachloroethylene)	mg/l	0.04	0.04	WHO
Carbon tetrachloride	mg/l	0.004	0.004	WHO
Toluene	mg/l	0.7 ^[G]	0.7 ^[G]	WHO
1,1,2-Trichloroethene (Trichloroethylene)	mg/l	0.02 ^[E]	0.02 ^[E]	WHO
Trihalomethanes	mg/l	^[Q]	^[Q]	WHO
Xylenes	mg/l	0.5 ^[G]	0.5 ^[G]	WHO
<i>Semi-volatile organic compounds (SVOC)</i>				
Di(2-ethylhexyl)phthalate	mg/l	0.008	0.008	WHO
Hexachlorobutadiene	mg/l	0.0006	0.0006	WHO
<i>Phenols</i>				
2,4,6-Trichlorophenol	mg/l	0.2 ^{[B][G]}	0.2 ^{[B][G]}	WHO
Pentachlorophenol (PCP)	mg/l	0.009 ^{[B][E]}	0.009 ^{[B][E]}	WHO
<i>Polycyclic aromatic hydrocarbons (PAH)</i>				
Benzo(a)pyrene	mg/l	0.0007 ^[B]	0.0007 ^[B]	WHO
<i>Organochlorinated pesticides</i>				
Aldrin + Dieldrin	mg/l	0.00003	0.00003	WHO
DDT and metabolites	mg/l	0.001	0.001	WHO
Endrin	mg/l	0.0006	0.0006	WHO
Lindane (BHC - Gamma)	mg/l	0.002	0.002	WHO
Methoxychlor	mg/l	0.02	0.02	WHO
Chlordane total	mg/l	0.0002	0.0002	WHO
<i>Organophosphorated pesticides</i>				
Alachlor	mg/l	0.02 ^[B]	0.02 ^[B]	WHO
Atrazine	mg/l	0.002	0.002	WHO
Carbofuran	mg/l	0.007	0.007	WHO
Chlorpyrifos	mg/l	0.03	0.03	WHO
Cyanazine	mg/l	0.0006	0.0006	WHO
Dimethoate	mg/l	0.006	0.006	WHO
Fenoprop	mg/l	0.009	0.009	WHO
Simazine	mg/l	0.002	0.002	WHO
<i>Weedkillers</i>				
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	mg/l	0.009	0.009	WHO
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/l	0.03 ^[P]	0.03 ^[P]	WHO
2,4-DB	mg/l	0.09	0.09	WHO
Chlorotoluron	mg/l	0.03	0.03	WHO
Dichlorprop (2,4 DP)	mg/l	0.1	0.1	WHO
Isoproturon	mg/l	0.009	0.009	WHO
MCPA	mg/l	0.002	0.002	WHO
Mecoprop	mg/l	0.01	0.01	WHO
Molinate	mg/l	0.006	0.006	WHO
Pendimethalin	mg/l	0.02	0.02	WHO
Terbutylazine	mg/l	0.007	0.007	WHO

Table 3.7 (continued) Environmental Objectives for Drinking Water Quality.

Parameter	Unit	WHO ^[1]	Environmental Objective	Source ^[2]
<i>Other pesticides</i>				
Aldicarb	mg/l	0.01 ^[R]	0.01 ^[R]	WHO
Metolachlor	mg/l	0.01	0.01	WHO
Permethrin	mg/l	0.3 ^[S]	0.3 ^[S]	WHO
Pyriproxyfen	mg/l	0.3	0.3	WHO
Trifluralin	mg/l	0.02	0.02	WHO
<i>Other organic compounds</i>				
Nitritotriacetic acid (NTA)	mg/l	0.2	0.2	WHO
Acrylamide	mg/l	0.0005 ^[B]	0.0005 ^[B]	WHO
Dibromoacetonitrile	mg/l	0.07	0.07	WHO

[1] World Health Organisation. 2006. *Guidelines for Drinking-Water Quality*. First Addendum to Third Edition, Recommendations, Volume 1. Geneva, 2006.

[2] WHO = World Health Organisation.

[A] No health-based guideline value for turbidity has been proposed; ideally, however, median turbidity should be below 0.1 NTU.

[B] For substances that are considered to be carcinogenic, the guideline value is the concentration in drinking-water associated with an upper-bound excess lifetime cancer risk of 10⁻⁵ (one additional cancer per 100 000 of the population ingesting drinking-water containing the substance at the guideline value for 70 years). Concentrations associated with upper-bound estimated excess lifetime cancer risk of 10⁻⁴ and 10⁻⁶ can be calculated by multiplying and dividing, respectively, the guideline value by 10.

[C] Provisional guideline value because calculated guideline value is below the achievable quantification level.

[D] Provisional guideline value because calculated guideline value is below the level that can be achieved through practical treatment methods, source protection, etc.

[E] Provisional guideline value, as there is evidence of a hazard, but where the available information on health effects is limited.

[F] Short-term exposure.

[G] Concentrations of the substance at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints.

[H] For effective disinfection, there should be a residual concentration of free chlorine of ≥ 0.5 mg/l after at least 30 min contact time at pH <8.0.

[I] Volume water consumed and intake from other sources should be considered when setting national standards.

[J] Staining of laundry and sanitary ware may occur below guideline value.

[K] For inorganic mercury.

[L] For cyanide as total cyanogenic compounds.

[M] Provisional guideline value because disinfection is likely to result in the guideline value being exceeded.

[N] Although *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests must be carried out. Total coliform bacteria are not acceptable indicators of the sanitary quality of water supplies, particularly in tropical areas, where many bacteria of no sanitary significance occur in almost all untreated supplies.

[O] For total microcystin-LR (free plus cell-bound).

[P] Applies to the free acid.

[Q] The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1.

[R] Applies to aldicarb sulfoxide and aldicarb sulfone.

[S] Only when used as a larvicide for public health purposes.

3.4 References

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