

Prepared for:



AIR QUALITY MANAGEMENT PLAN

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1. SCOPE

The Air Quality Management Plan (AQMP) addresses all atmospheric emissions from the plant and other Project facilities, as well as the ambient air quality monitoring program.

The AQMP also includes activities related to noise control during the construction phase, plant site and mining field operational phase, and from vehicles.

The Plan does not specifically address odours because none are expected from the Project activities.

The AQMP covers both the construction and operational phases of the Kouilou Potash Project. It constitutes the initial document which will be modified and updated as the Project unfolds.

2. PURPOSE AND ENVIRONMENTAL OBJECTIVES

The AQMP aims to prevent adverse effects from the Project activities on ambient air quality. The purpose is twofold:

- Define operational practices and actions for the Project to comply with:
 - World Bank Group (WBG) and World Health Organisation (WHO) guidelines for ambient air quality and atmospheric emissions and noise (Tables 1, 2, and 3);
 - Congolese legislation pertaining to the protection of atmosphere.
- Measure the Project's environmental performance through air quality monitoring of atmospheric emissions, ambient air quality and ambient noise.

Table 1 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
Sulphur 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 of ESIA), the environmental objective during the wet season is 50 µg/m³ and 62.5 µg/m³ during the dry season.

Table 2 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		
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 Environmental Objectives for Noise Emissions.

Daytime	Receptor	L _{Aeq} (dBA)	Reference
07:00 - 22:00	Residential; institutional; Educational	45	WB, Environmental, Health, and Safety (EHS) Guidelines General EHS guidelines: environmental – Noise management, April 2007
07:00 - 22:00	Industrial; commercial	55	
22:00 - 07:00	Residential; institutional; educational	70	
22:00 - 07:00	Industrial; commercial	70	

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3. DEFINITIONS AND ABBREVIATIONS

Definitions

CFC: Chlorofluorocarbons, refrigerant gases that are harmful to the ozone layer. They are the subject of an international initiative to eliminate their use. The less damageable refrigerants are the HFCs and the PFCs. (see Environment Canada website for good information [Stratospheric Ozone – Substances and Sectors](#))

ODS: Ozone Depleting Substances, compounds that degrade under ultraviolet light in the stratosphere, releasing chlorine or bromine atoms that in turn deplete stratospheric ozone.

Environmental Objectives: overall environmental goal consistent with the policy and set by MPC itself.

Abbreviations

AQMP: Air Quality Management Plan

CPAR: Corrective-Preventive Action Register

ESIA: Environmental and Social Impact Assessment

EMP: Environmental Monitoring Plan

HCFC: Hydrochlorofluorocarbons

HFC: Hydrofluorocarbons

HSE: Health, Safety and Environment

PAH: Polycyclic aromatic hydrocarbons

PFC: Perfluorocarbons

PAH: Polycyclic Aromatic Hydrocarbon

PM_{xx}: Particulate matters ≤ xx µm

SOP: Standard Operational Procedure

WBG: World Bank Group

WHO: World Health Organisation

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4. ACTIVITIES

4.1 Context

4.1.1 Baseline Conditions

Air quality baseline conditions were assessed from May to September 2007, during the dry season, from an air sampling station located close to Marcel-Rigny Camp, near Mengo (Map 1 of EMP). In general, the ambient air quality is good and contains very few nitrogen dioxides, heavy metals or polycyclic aromatic hydrocarbons (PAH). Concentrations of PM₁₀ particles generally comply with the environmental standard of 50 µg/m³ for a 24-hour period. During the dry season however, the airshed is degraded because of dust suspended by wind, which causes fairly high concentrations of particulate matter (PM₁₀).

The air quality baseline conditions will be further characterized through subsequent and ongoing monitoring of air quality and atmospheric emissions, and will be used as reference data in the future updates of the AQMP.

4.1.2 Impacts of the Project on Air Quality

The impacts of the Project on air quality are essentially associated with the emission of gaseous pollutants and the dispersion of dusts and particulate matter. The components likely to be released in the atmosphere include particulate matter PM_{tot}, PM₁₀, PM_{2.5}, nitrogen oxides NO_x, sulphur dioxide SO₂, benzene and benzo(a)pyrene.

Gaseous Pollutants

Gaseous emissions include combustion gases, organic vapours and Ozone Depleting Substances (ODSs) caused either by the combustion of hydrocarbons, the storage of hydrocarbons, or the use of cooling and air conditioning equipment.

There are nine gaseous emission sources at the potash plant and two at the port facilities (map 4.3 from ESIA). At the plant, there is a flare stack for occasional burning of unwanted gas or unplanned over-pressure, various stacks at the gas turbines, boilers, cooling towers, crystallisation vacuum pumps, compaction baghouse, loading building and exhaust from diesel generators.

A series of three heavy duty industrial gas turbines will be installed to produce the power required for the operation of the Project. It will be equipped with a standard NO_x burner and the emissions are expected to be below 267 mg NO₂/m³ at 25 °C or 142 ppm NO_x.

Brine will be pumped into the evaporator to decrease water content prior to the potash crystallisation step. Water vapour produced will be forced through a condenser to recover large quantities of water. During normal operating mode, 273 m³/h of water vapour will be released to the atmosphere through stacks.

Dust and Particles

Suspension of dust and sand particles will be caused by the construction of access roads, drilling platforms and other earth works, as well as the circulation of machinery and vehicles. The removal of vegetation and surface stripping of organic soils may expose the underlying fine sand.

Aside from the primary stacks, the loading, transport and transshipment activities will generate the suspension of potash particles in the atmosphere of the handling areas, which are all enclosed or covered to protect the potash from rain. The maintenance buildings and potash storage buildings will be equipped with dust collectors and fans. The emissions from these units will be similar to those from other stack dust collectors, *i.e.* less than 50 mg/Nm³ PM₁₀.

Traffic of heavy equipment on non paved roads will generate dust emissions, particularly during the dry season. If not mitigated, this could have a negative impact on the local fauna and flora as well on the global air quality in Mengo.

Greenhouse Gases

Other atmospheric emissions at the potash plant are related to the combustion of fossil fuels, such as diesel, gasoline and natural gas. During the construction phase, about 12 million litres of diesel fuel and 5 million litres of gasoline could be required to power heavy equipment, trucks, service vehicles, drilling gear and power generators. Such combustion engines would release 17,750 t of CO₂/year into the atmosphere. During operation, the generator sets, drill rigs, heavy machinery, lorries, trains and all other types of power-driven vehicles will consume around 3,400,000 litres of diesel fuel annually, which will emit 9.5 t/a of CO₂ in the ambient air.

A reduction in air quality will occur near vehicles, and other combustion engines.

4.1.3 Impact of the Project on Ambient Noise

Noise generation is associated with well drilling, infrastructure construction activities, operation of heavy equipment at the plant, operating activities of the pumping station and transportation activities. The latter includes railway transport

and circulation of heavy vehicles on the route connecting the port of Pointe-Noire to the plant via *Route Nationale* no.5 and on *Route Nationale* no.1 through the village of Mengo. However, measurements and modelling of noise propagation have indicated that noise emissions will not affect the plant's closest village, Boutoto, and that operation activities' noise levels comply with environmental objectives.

4.2 Gaseous Emission Control

Emissions of gaseous pollutants are mainly associated with vehicles and power-generation equipment. Main control measures for gaseous pollutants therefore involve the following:

- Use of clean air technologies for all power-driven equipment and vehicles;
- Regular maintenance of all vehicles and power-driven equipment, in particular their combustion and exhaust system.

4.3 Dust and Suspended Particle Control

4.3.1 Control of dust and suspended particles from the plant site

At the plant site, activities which can raise dust particles include soil surface stripping, excavation, cutting and backfilling activities. To minimise dust suspension, mitigation measures will include:

- Using the dust collector silo and maintaining it appropriately;
- Using appropriate filters for the stacks of the bagging building;
- Using the exhaust stacks for the crystalliser's vacuum pumps.

The emergency NaCl storage area will have a capacity of seven (7) days only, in case both the dissolving or reslurrying systems cannot operate. This will not be a source of dust, as the salt will be moist and will be either reslurried back to the spents caverns or dissolved in the waste brine before it has a chance to dry.

4.3.2 Control of dust and suspended particles from the circulation of machinery and vehicles

To limit the suspension and entrainment of dust particles by the circulation of machinery and vehicles, the following actions will be undertaken:

- A Standard Operational Procedure (SOP) will be developed and implemented regarding the sprinkling of water as a dust control agent on roads which are most frequently used during the dry season;

- During construction and until the completion of National route 1, a speed limit of 30 km/h will be implemented for project vehicles when passing through the village of Mengo as well as on construction site roads.;
- For the rail transportation of potash, each wagon will be equipped with a latched cover to protect the load from wind erosion and rain.

4.3.3 Conservation of Vegetation and Revegetation of Cleared Areas

Cleared and bare soil areas will be minimised by limiting deforestation, land stripping, excavation and vegetation removal and by implementing revegetation activities, as described in the Soil Management Plan and Biodiversity Management Plan.

4.4 Refrigerant Gases

The Procurement Department will ensure that all refrigerants used during the operation phase of the Project comply with the Montreal Protocol requirements. This will be part of the contract requirements for procuring plant equipment.

The Maintenance Department will recover used ODSs and dispose according to best practices based on available resources in country.

A register of refrigeration equipment will be kept up to date by the maintenance department along with records on the type of refrigerant, quantity of used refrigerant gases and estimated remaining lifespan of the refrigerant.

Gases shall be recovered prior to the repair of cooling equipment, prior to the disposal of cooling equipment or in any situation which requires the drainage of the refrigerant charge from the cooling equipment. This will be specifically addressed through a SOP on Cooling Equipment Maintenance.

Refrigerant gas will be stored in appropriate storage cylinders, clearly labelled and handled in accordance with the procedures defined in the Hazardous Material Management Plan. Stored gas will be re-used as required.

Inert gas, such as nitrogen, is used for leakage inspection. This will be specifically addressed through a SOP on Cooling Equipment Inspection.

4.5 Greenhouse Gases

The Maintenance Department will implement a preventive maintenance programme on combustion equipment, which will contribute to minimising the greenhouse gas emissions produced by the combustion of hydrocarbon fuels.

A record of all hydrocarbon fuels used by the Project will be maintained for reporting purposes

4.6 Ambient Noise Control

4.6.1 Control of Noise Generated During Construction

Measures intended to limit noise generation at the plant and brine field during construction include:

- Use of noise reduction technologies for power-driven equipment, whenever technically and economically feasible;
- Curfew or limitation of noisiest activities during night-time period;
- Preservation of tree screen between construction site and communities.

4.6.2 Control of Noise Generated During Operation

Measures intended to limit noise generation at the plant during the operational phase include:

- Use of noise reduction technologies for power-driven equipment whenever technically and economically feasible;
- Curfew or limitation of noisiest activities during night-time period;
- Minimisation of deforestation and vegetation removal, in compliance with the Soil Management Plan, and in order to maximize the attenuation of noise propagation.

Acoustic screens will be constructed around the pumping station on the bank of the Loémé River. These barriers will be composed of vegetated earth embankments.

4.6.3 Control of Noise Generated from Machinery and Vehicle Circulation

A Good Practice Code for the Project's drivers will be implemented and appropriate training given before and during the onset of the construction phase. This code will notably stipulate the reduction of speed in built-up areas, and prohibit the use of the horn except for emergencies.

Shrubs and eucalyptus will be planted along the roads, providing acoustic screens as well as dust and traps for suspended particles.

4.7 Indoor Air Quality of Project Buildings

Indoor air quality of Project buildings will be maintained through regular maintenance and inspections of equipment and appropriate ventilation. This is specifically addressed in the Occupational Health and Safety Management Plan.

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5. PERFORMANCE MONITORING

5.1 Inspections

Sites inspections are performed by the Health, Safety and Environment (HSE) Department. Sites have been divided by sectors and are inspected on a continuous basis. An official documented inspection is conducted each month. Inspection ensures that specific air quality management aspects are verified and that all commitments of this AQMP are implemented.

5.2 Air Quality Monitoring

Air quality will be monitored in the plant area during the construction and operational phases. The monitoring program will provide information on the air quality conditions, allow the early detection of any degradation of air quality, and orient the implementation of required adjustments.

Atmospheric emissions will be monitored from the gas turbine exhausts and steam stack emissions. In addition, the Environmental Monitoring Plan (EMP) will include monitoring of ambient air quality by means of air sampling.

The measured parameters and frequency of air sampling are detailed in the EMP, while sampling procedures are specified in SOPs for Air Sampling Protocol, Devices Calibration and Analysis Protocol.

Dust deposit gauge and soil sampling will be conducted in seven locations (Map 1 of EMP) localized as follow:

- three household gardens downwind from the stacks, respectively in Boutoto, Liambou and Massiela villages;
- one forest downwind from the stacks, on Mengo Plateau;
- three lower slopes downwind from the stacks, at increasing distances from the plant, and draining a significant catchment area.

Soil sampling SOP to be developed. Parameters are identified in the EMP.

5.3 Noise Emissions Monitoring

Noise levels will be monitored at the most sensitive locations. There will be one permanent sampling station on the plant site and one mobile station (Map 1 of EMP). The latter station will be hand-held and used to measure noise at different locations to be identified based on activities or complaints.

Frequency of noise sampling is detailed in the EMP, while sampling procedures are specified in the SOP for Noise Monitoring and Evaluation Protocol.

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6. PERFORMANCE INDICATORS

Measurement is an important tool in improving performance, and performance indicators help organisations to define and measure progress towards their goals. The results reflect current conditions and allow orientation and coordination of further actions towards sustainable exploitation.

6.1 MTE Notices of infraction

MTE officers may visit the Project facility at their convenience or if a complaint is filed. They will inspect compliance of the Project with the delivered permits and authorisations, as well as with applicable regulation. Any significant discrepancy will be reported through a notice of infraction

The Project's goal is to maintain a track record without any infringements. This indicator is not specific to the AQMP, but to all facets of the ESMS.

6.2 Environmental Audit Results

Environmental auditing is a key process in the implementation of the ESMS. Internal and external auditing procedures are described in Section 11 of the ESMS main document. The findings of each audit are registered in the CPAR database where corrective and/or preventive actions are prescribed, responsibilities assigned to people, deadlines established and necessary resources mobilised.

In compliance with the procedure, audit reports shall categorise the findings as being either "major", "minor" or "observation". The number of findings should decrease every year until the ultimate goal of zero major findings is achieved. This indicator is not specific to the AQMP, but to all facets of the ESMS.

6.3 Air Quality

To assess the performance of engineering control measures, measured concentrations of emissions and ambient air quality parameters will be compared to the Project's environmental objectives (Tables 1 and 2). Exceeding of environmental objectives will trigger corrective action.

6.4 Ambient noise

Noise level measured at the permanent and mobile locations will be compared to environmental objectives of Table 3. Exceeding of environmental objectives will trigger corrective action.

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7. RESPONSIBILITIES

The responsibilities of the AQMP interveners are presented herein (Table 4).

The HSE Department is responsible for:

- Collecting and interpreting air sampling data;
- Collecting soil samples;
- Collecting ambient noise data;
- Conducting site inspections.

During construction, the general contractor is responsible for:

- Monitoring and managing dust emissions at the construction site boundaries;
- Participating in the implementation of the AQMP.

The EPCM contractor is responsible for:

- Procuring dust collector for stacks;
- Procuring permanent noise meter equipment for plant;
- Designing the process in order to meet the environmental objectives of air emissions;
- Selection of alternate products to ODS-containing products.

The frigorist, from the maintenance department, is responsible for:

- Operation and maintenance of the refrigerant recovery system;
- Operation and maintenance of refrigeration, cooling and air-conditioning equipment;
- Training of the personnel assigned to the operation and maintenance of the refrigerant recovery system;
- Procuring refrigerant that comply with Montreal protocol and Congolese regulation;
- Inventory and storage of refrigerant gases for mobile cooling equipment at the mine and plant site;
- Monitoring refrigerant gases consumption and reporting results annually.

The Mechanical Superintendent is responsible for:

- Maintenance of all fuel-powered vehicles and machinery equipment;

- Operation and maintenance of power generators and stacks;
- Operation and maintenance of dust collector silo;
- Operation and maintenance of ventilation systems.

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Table 4 Chart of Responsibilities

Objective / Action	Site General Manager	Risk & asset Protection Officer	Community Liaison Officer	HSEC Director	HSE Manager	maintenance department	Technician Environment	Mechanical Department	Construction Manager	Procurement Officer	Consultant	H&S Officer	External Auditors	Contractors (during construction)	External Laboratory	
Control of Gaseous Air Emissions																
Clean air technologies purchases	A			P				P		E						
Maintenance of vehicles and machinery	A					P		E							E	
Dust and Suspended Particles Control																
Operation and maintenance of dust collector silo	A					E		P								
Operation and maintenance of plant's stacks and filters	A					E		P								
Operation and maintenance of ventilation systems	A					E		P								
Road dust control					A	E									E	
Construction of dust-screens				A			P		P		P				E	
Refrigerant Gases Management																
Refrigerant purchases and inventory					A					E						
Refrigerant storage and inspections		P			A	E										
Operation and maintenance of cooling equipment						AE		P								
Air Quality Monitoring																
Air sampling and sampling stations installation	P			A	P		E									
Air and soil quality analyses					A		P								E	
Air and soil quality reporting			P	A	E											
Conduct environmental air audit				A	E	P	P							E		
Noise Control and Monitoring																
Noise reduction technologies for fuel-powered equipment purchases	A			P				P		E						
Curfew implementation and noise control during construction and operations	A			P					P						E	
Acoustic screens construction					A		P	P							E	
Vehicle and machinery circulation schedule	A					E		P	P							
Driver's good practice code implementation	A					E		P								
Noise monitoring and reporting			P	A	E		P									
Legend:	A	Approves														
	E	Executes														
	P	Participates														

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8. SCHEDULE AND BUDGET

An implementation schedule is defined for the various activities of the AQMP (Table 5). Dust screens, road dust control and revegetation activities will be initiated during the Project's construction phase. Other dust control equipments, including dust collector silo, plant's stacks and filters will be operated and maintained throughout the Project's operational phase. Air quality monitoring activities will be initiated in the construction phase and carried out on a continuous basis throughout the operational phase.

The budget is included in the overall budget of the ESMS presented in the main document. Procurement and maintenance are part of construction/operation cost. Sampling and analysis and procurement of monitoring equipment are presented in the ESMS as one common figure for all environmental plans.

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Table 5 Implementation Schedule for the Air Quality Management Plan

Objective/ Actions	Prior to construction.	During construction.	Project start up.	During operations.
Control of gaseous air emissions				
Clean air technologies purchases	X			X
Maintenance of vehicles and machinery		X	X	X
Dust and Suspended Particles Control				
Operation and maintenance of dust collector silo			X	X
Operation and maintenance of plant's stacks and filters			X	X
Operation and maintenance of water jets			X	X
Road dust control		X		X
Revegetation of cleared areas and bare soils		X		X
Construction of dust-screens		X		X
Refrigerant gases management				
Refrigerant purchases and inventory	X			X
Refrigerant storage and inspections	X			X
Operation and maintenance of cooling equipment		X	X	X
Air quality monitoring				
Air sampling and sampling stations installation	X	X		X
Air quality analyses	X	X		X
Air quality reporting (quarterly)				X
Conduct environmental air audit		X		X
Noise control and monitoring				
Noise reduction technologies for power-driven equipment purchases	X			
Curfew implementation and noise control during construction and operations		X		X
Acoustic screens construction		X		
Vehicle and machinery circulation schedule		X		X
Driver's good practice code implementation		X		X
Noise monitoring and reporting		X		X
Create SOPS				
Sampling, calibration and analysis.	X			
Drivers code of conduct	X			
Construction related procedures	X			
Operations related SOPS			X	

9. LIST OF SOPs

- Operation and maintenance of cooling equipment;
- Use and management of refrigerant gases, including procurement, storage, handling, operation and recycling;
- Refrigerant gas spill response – addressed within the Emergency Response Plan;
- Maintenance of fuel-powered equipment and vehicles;
- Application of anti-dust agents on roads and other devegetated areas;
- Air sampling protocol, devices calibration and analysis protocol;
- Noise sampling and evaluation protocol;
- Maintenance of stacks, dust filters and indoor ventilation ducts;
- Vehicles and machinery circulation schedule;
- Drivers Code of conduct.

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10. RECORD KEEPING

Records for the AQMP include:

- Power-driven Equipment Register:
 - Vehicles and machinery fleet description;
 - Vehicles and machinery maintenance record;
 - Fuel consumption record;
 - Power output from the fuel-powered generator.
- Maintenance registers for:
 - Dust collector;
 - Stacks;
 - Ventilation conduits.
- Record of refrigerant gases and cooling equipment;
- Air and soil Sampling Report and Laboratory certificates;
- Noise measurements records

Audits Reports

MTE notices

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