

Guidelines for *preparing an Environmental Impact Assessment (EIA)* report for mineral exploitation in Greenland





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1 Introduction



1.1 Background

These guidelines for preparing an Environmental Impact Assessment report (EIA, in Danish VVM – Vurdering af Virkninger på Miljøet) apply to mining companies (companies) operating in Greenland.

According to the Act of 2009 on mineral resources and mineral resource activities (the Mineral Resources Act) with later amendments, the companies must provide an Environmental Impact Assessment (EIA) for public consultation and government approval in connection with the development of a mining project (project).

Supplementary requirements for exploitation of minerals containing naturally occurring radioactive materials (NORM) will be given in supplementary guidelines.

The purpose of the EIA guidelines is to make companies aware of the environmental issues which must be addressed as part of an EIA at an early stage in the project. The procedures and requirements for the EIA process shall be integrated into the company's plans already in the exploration phase.

1.2 Aims of the EIA

Aims of the EIA are:

- To estimate and describe the nature and the environment as well as the possible environmental impacts of the proposed project
- To provide a basis for the consideration of the proposed project for Naalakkersuisut (the Government of Greenland)
- To provide a basis for public participation in the decision-making process
- To give the authorities all information necessary to determine the conditions of permission and approval of a proposed project

1.3 Basis for the EIA

The exploitation shall be carried out in accordance with good international practice and in a safe and environmentally acceptable manner, e.g.:

- The Best Available Technique (BAT), Best Environmental Practice (BEP) and Best Practicable Control Technology (BPT) shall be applied at all times. Reference is made to BAT reference documents (BREF documents)
- Discharges/emissions from power plants, fuel combustion plants, incineration plants, process plants and others shall as a main rule comply with EU standards (EU Directive on Industrial Emissions – IE Directive). US or DK standards shall be used if EU standards are not available. Other standards may be used, if they according to BAT, BET and BPT represent a better solution

- Emissions from non-road mobile machinery (e.g. excavators, bulldozers, front loaders, back loaders and drilling equipment) shall as a main rule comply with EU environmental standards (EU directives on emissions from non-road mobile machinery etc). US or DK standards shall be used if EU standards not are available. Other standards may be used, if they according to BAT, BET and BPT represent a better solution
- All relevant national rules and guidelines in Greenland shall be met
- All relevant international rules, guidelines and conventions shall be met (IMO Ballast Water Convention, IMO MARPOL etc.)
- The threshold values for discharges/emissions and environmental quality criteria determined by the Mineral Resources Authority (MRA) shall be met. Dilution of waste water, process water and other water with river water, for example in order to comply with the threshold values, is not an acceptable practice
- The environmental management shall comply with the requirements set out in ISO 14001 or equivalent standard. A self-control programme shall be set up to ensure and document that discharges/emissions to the environment, activities, handling and other processes comply with requirements and limits specified by MRA

1.4 Requirements to the EIA



Requirements to the EIA are that:

- The EIA shall identify, predict, describe, assess and communicate potential environmental impacts of a proposed mining project in all its phases including exploration, construction operation, closure and after closure
- The EIA shall cover the entire area that may be affected by the project. If the project includes areas outside the mining area, for instance roads, harbours, pipelines, airstrips and shipping routes, effects of these shall be covered as well
- The EIA shall present measures to address and mitigate the identified impacts
- The EIA shall include all aspects in relation to nature, wildlife and public health regarding exposure to hazardous substances
- The EIA report shall be prepared not later than when a company decides to apply for an exploitation license for a mineral deposit
- The MRA may require the EIA updated if, among others, processes, area and activities are changed
- The EIA report shall be based on environment baseline studies typically covering 2-3 years before the area will be affected by activities and construction

1.5 Costs

In accordance with the provisions in the Mineral Resources Act, the company shall cover and refund all costs associated with the preparation of, among others, EIA reports, studies, official consultations, permits, approvals and agreements.

2 Workflow for the EIA

2.1 Introduction

Already in the exploration phase of a project, the company shall evaluate potential environmental impacts.

Scoping shall identify environmental issues to be addressed in the EIA report and be used to plan the environmental study programme of the project. MRA publishes the company's project description and scoping documents for public pre-consultation for 35 days in accordance with the provisions of The Mineral Resources Act. The company must evaluate the comments received during the public pre-consultation and consider revision of the project as a result of the public consultation.

A detailed plan for the EIA process, including an environmental study programme, shall be forwarded to and approved by the MRA prior to the start of the EIA process. The plan shall include a preliminary assessment of the potential environmental impacts of the project.

2.2 Steps in the preparation of the EIA report

Preparation of an EIA report before project approval includes the following steps:

Step	Topic
1	Scoping phase. After preliminary consultations between the company, MRA and MRA's scientific advisors (DCE/GINR ¹) the company prepares a scoping report and forwards the report to MRA.
2	MRA publishes the company's scoping report and terms of reference (ToR) for public pre-consultation for 35 days.
3	The company evaluates the comments received during the public pre-consultation and considers revision of the project.
4	The company prepares a final scoping report and terms of reference for approval by MRA.
5	The company prepares an environmental study programme including a programme for environmental baseline studies, project-related studies and other studies in consultation with MRA and MRA's scientific advisors. This programme shall be prepared and kept updated to secure data necessary to produce the final EIA. The programme shall be approved by MRA involving consultations on a regular basis.
6	The company proposes a table of contents for the EIA to MRA.
7	MRA and MRA's scientific advisors review the proposed table of contents for the EIA and provide feedback.
8	The company forwards an EIA draft to MRA.
9	MRA and MRA's scientific advisors review the EIA draft and provide feedback.
10	The company forwards a revised EIA draft including appropriate revisions to MRA as part of the application for the exploration and the exploitation.
11	MRA publishes the revised EIA draft for public consultation for minimum 8 weeks in accordance with the Mineral Resources Act. During the consultation period, public hearings shall be organized in towns and villages which are particularly affected by the activities.
12	The company prepares a white paper which addresses the questions and comments raised during the public consultation and hearing meetings.
13	MRA and MRA's scientific advisors review and give feedback on the white paper to the company.
14	The company submits a final EIA draft including the white paper to MRA for Naalakkersuisut's approval.
15	If Naalakkersuisut decides to grant an exploitation license, MRA will use the EIA as a basis document for defining terms and requirements for approval of the company's exploitation and closure plans.

¹DCE: Danish Centre for Environment and Energy, dce.au.dk/en. GINR: Greenland Institute of Natural Resources, www.natur.gl/en.

2.3 The contents of the EIA report

The following elements shall be included in the EIA:

- An **extended non-technical summary including maps and figures**. The document must be easy to read and understand for the public and decision makers as a stand-alone document
- An **introduction** describing the project, its background and objectives
- A thorough description of the state of the **environment** before the start-up of mining activities
- A description of the **mine project** including all phases from exploration to closure and beyond
- A description of considered **alternatives** and why they were rejected
- An assessment of **environmental impacts** of the project from exploration to closure and beyond, with an evaluation of alternative options to the preferred project option
- **Cumulative impacts** of existing and expected future already planned projects that could influence the conclusions of the EIA.
- An **environmental management plan (EMP)** describing management, control and mitigation of the identified impacts, emergency plans for unplanned events (fire, transport accidents and releases to the environment) and training programmes for employees related to, for example, environmental matters.
- An **environmental monitoring plan** describing how all aspects relevant to environmental issues will be monitored, such as discharges/emissions to water and air, use and handling of fuel and chemicals, production and handling of waste rock and tailings, concentrations of, among others, metals, nutrients, chemicals and their effects on the environment and disturbance of wildlife.
- An assessment of issues related to any **archaeological findings**.
- An assessment of environmental issues related to the **closure plan and following environmental monitoring**.
- **Public consultation**.
- **Conclusions**.
- **References** used in the EIA process and **glossary** of terms and abbreviations.

Appendix 1 outlines in more detail the proposed structure and content of an EIA report.

The EIA report, the summary and the appendices must be prepared in Greenlandic, Danish and English. An extended non-technical summary with maps and illustrated project plans must be prepared in Greenlandic, Danish and English. The white paper must similarly be prepared in Greenlandic, Danish and English.

References and background material, such as laboratory test reports, external assessments and all data collected in connection with preparation of the EIA (including baseline and monitoring studies), prepared as part of the EIA process and not published otherwise, shall be made available to the public for investigation in a way similar to external references that are published and as such accessible for investigation and cross referencing. This may be done by complying with the following conditions:

- The material mentioned above must be referred to as background material and thus not as an appendix to the EIA report
- When the company submits the EIA, the submission shall include reasoning why material as that mentioned above is not attached to the EIA as appendices. MRA will evaluate the reasoning and decide whether the content of such material is addressed adequately in the EIA report
- Material as that mentioned above is expected to be presented in Greenlandic and Danish or in English
- Material as that mentioned above shall be made accessible to the public by the company, for instance at the company's website, no later than at the time when the public consultation begins

3 Environmental study Programme



3.1 Introduction

An environmental study programme shall be approved by MRA after completion of the scoping phase. This programme shall be prepared and kept updated to secure that data necessary to produce the EIA are available. The programme shall be developed in cooperation with MRA and MRA's advisors. The programme shall include the main activities outlined below:

- Environmental baseline studies
- Project-related studies
- Other environmental studies

The purpose of the environmental baseline studies is to describe the state of the environment prior to exploration, construction and operation of the mine. Baseline studies are needed in order to assess the potential environmental impacts from the mining operation as well as to establish a baseline for the monitoring programme during the construction and production phases. Pre-mining baseline data also serve as valuable standards for the closure and rehabilitation plan.

The purpose of the project-related studies is to identify and quantify sources of possible contamination. In the pre-mining phase, it is important to carry out studies on, for example, the chemical composition of the ore, the acid-generating potential of the residues and the potential ecological toxicity of the ore, waste rock, tailings and process chemicals.



Other environmental studies may include issues that need to be clarified for the EIA such as distribution and migration of wildlife, hydrogeological studies and water balances, toxicity and degradation of process chemicals in the recipient.

The programme for environmental baseline studies, project-related studies and other environmental studies shall be developed in consultation with MRA, and MRA shall approve the final programme. DCE/GINR will maintain a database of all environmental data collected in connection with mining activities. Data must be submitted to DCE/GINR in formats agreed to by the company and MRA and will be available to both the company and to MRA and DCE/GINR. All data may be made available to the public.

3.2 Environmental baseline studies

The environmental baseline studies aim to describe the state of the environment prior to mining and mining development activities.

The environmental baseline studies shall cover at least the following issues:

- Chemical and ecotoxicological aspects (pollution)
- Disturbance aspects (impacts on flora and fauna)
- Local use and local knowledge study

Environmental baseline studies shall cover a number of years to ensure that annual and seasonal variations in environmental parameters are taken into account. The number of years needed to conduct the environmental baseline studies depends on the project and the site. Often 2-3 years of studies are needed prior to the EIA report preparation and these shall be conducted during the scoping phase of the project. Analysis must be carried out at accredited laboratories.

3.2.1 Chemical and toxicological aspects

The environmental baseline studies shall identify background concentrations and natural variability of key elements in the environment at the project site and in the surrounding area. They shall identify media, locations and contaminants for subsequent monitoring during the exploitation and post-closure phases. The environmental baseline studies shall sufficiently document concentrations of metals and other relevant elements in water, sediment, soil, plants, lichens, fish, sea weed, mussel etc.

Sampling locations shall be distributed in a network with the centre close to the mining activities, for instance the pit, shaft and tailings area. Also roads, harbour facilities and airstrips shall be covered. Most sampling locations shall be near the mine, the process plant and other areas potentially impacted by the mining activities. Further away from the centre, up to typically 20 km, one or a few reference stations shall be placed at sites that are comparable with the mine site and are expected to remain undisturbed by the mining activities. The sampling locations shall be approved by MRA.

Water samples shall be analysed shortly after collection according to instructions from DCE/GINR. Chemical analysis of selected samples may await the decision to start up the mine or the decision to prepare the EIA report. If the company wishes to postpone the chemical analysis of samples, they shall contact MRA. The samples collected or duplicates of the samples shall be forwarded to an environmental sample bank administered by DCE/GINR together with the sampling information.



3.2.2 Disturbance aspects

A mining project will affect vegetation and fauna in the mining area. Therefore, baseline data about vegetation and fauna shall be presented in the EIA, including an evaluation of the ecological importance of the different areas affected by the project. The information can be obtained from own specific field studies, from published information (e.g. DCE and GINR reports) and from local knowledge. The EIA shall include possible mitigation measures of potential adverse impacts.

3.2.3 Local use and local knowledge study

It is important to include local knowledge in the preparation of the EIA report. Special attention shall be aimed at mitigating conflicts between the mining activities and the local use of the area for hunting, fishing, recreation and tourism. Inclusion of local knowledge can be through interviews with and questionnaires distributed to representative groups such as local hunters and fishermen, tourist operators and local industries. Those interviewed shall be given an opportunity to review and comment on the presentation of their input to the study.

3.3 Project-related environmental studies

3.3.1 Chemical environmental studies

The project-related chemical environmental studies shall identify and quantify sources of contamination related to the project. In the pre-mining phase, it is important:

- To determine the chemical composition of ore, waste rock, tailings and other products
- To investigate the acid-generating potential and the possible ecological toxicity of ore, waste rock, tailings and other products, including process chemicals potentially acting as a source of contamination
- To undertake ecological toxicity tests on the ore, waste rock, tailings and chemicals using a selection of relevant organisms such as crustaceans, algae and fish. If relevant, these tests may be conducted on species collected locally or in similar environments



A test production of a bulk sample in a pilot plant will often provide the basis for gaining the necessary knowledge of the above issues. It is important to emphasise that if the chemical composition of the bulk sample differs significantly from the mined ore and the waste produced, new studies shall be performed. With knowledge of the chemical composition of ore, waste rock and tailings, it is possible to target the chemical analyses of the biological and non-biological (sediments, water and dust) samples collected during the baseline study. Based on the pre-mining studies, a prediction of the mining-related discharges and emissions to the environment and their impact on the chemical composition of drainage water, recipient water and air quality shall be made.

3.4 Other environmental studies

Such studies are decided in collaboration with MRA. It can be studies of topics such as the distribution of wildlife or vegetation, the acoustic environment in a fjord with regard to disturbance of whales, degradation and toxicity of process chemicals in the recipient, hydrogeological studies, water balances and pit slope stability.

4 Criteria for emissions to the environment and environmental quality criteria



Mining companies shall use Best Available Technique (BAT), Best Environmental Practice (BEP) and Best Practicable Control Technology (BPT) to reduce discharges/emissions to the environment and minimise the risk of environmental impacts.

4.1 Discharges/Emissions to the environment

Emissions from power plants, fuel combustion plants, incineration plants, process plants and similar shall comply with EU standards (the EU Directive on Industrial Emissions, IE Directive). Emissions from non-road mobile machinery (e.g. excavators, bulldozers, front loaders, back loaders and drilling equipment) shall comply with EU environmental standards (EU directives on emissions from non-road mobile machinery). US or DK standards shall be used if EU standards are not available. Emissions from means of transport such as ships shall meet EU, IMO and DK standards.

4.2 Environmental quality criteria

Environmental quality criteria defined by MRA for water, sediment, biota and air shall be met. Appendix 2 presents the Greenland water quality criteria for freshwater and seawater. Appendix 3 presents air quality criteria. For elements, substances and chemicals not included in these lists, environmental quality criteria will be determined on the basis of EU/DK guidelines. The quality criteria are developed in order to protect the environment and the biota. The quality criteria shall be met outside a pre-defined mixing zone and buffer zone. The criteria for compliance with threshold values and the size of the mixing zone will be determined by MRA.



4.3 Noise

Indicative Danish noise limits for environmental noise from activities, installations, machinery, road and ship traffic, etc. shall be met. Final limit values for environmental noise are determined by MRA.

4.4 Dust

Limit values for dust concentration in the air and the deposition of dust outside the defined buffer zones must be observed. MRA determines the size of the buffer zone. MRA will also set limit values for the content of hazardous substances in dust, including limits for containing metals, radioactive substances, etc.

5 Environmental Management Plan



The Environmental Management Plan (EMP) is a site- or project-specific plan that shall ensure that appropriate environmental management practices are followed during a project's construction and/or operation phase. The Environmental Management Plan shall address all identified environmental risks of the proposed project. It shall also address the possible effects, possible avoidance or mitigation and management of the mitigation procedures.

An effective Environmental Management Plan shall:

- Ensure the application of best environmental management practice in the project
- Describe how the company will handle the identified environmental effects of the proposed project
- Ensure that the company properly manages the environmental risks associated with the project
- Include an 'Emergency Preparedness and Response Plan' demonstrating that the company will be prepared for possible spills or environmental contamination due to an accident

The company shall establish, implement and maintain a complete project-specific Environmental Management System (EMS) for the organisation. The EMS shall fulfil the intentions of the international standard for environmental management ISO 14001 or equivalent standards. The persons responsible for the environmental management shall refer directly to the top management of the project.

This section shall describe in detail how the company intends to reduce the different identified impacts and how effective the measures are expected to be. Impacts shall be reduced by, for instance, using BAT and BEP. It shall be assessed whether the residual effects, after mitigating measures have been introduced, are significant and adverse. The EMP shall describe, as detailed as possible, how the mitigating measures are organised and who is responsible for carrying out the mitigation. An EMP shall be developed during the lifetime of the mine based on the results of the environmental monitoring.

The EMP shall include a comprehensive plan/programme for control and on-going monitoring of, for instance, emissions, discharges, disturbance of and damage to wildlife. The aim of the on-going monitoring is to secure that the levels of emissions/discharges/disturbance from the activities comply with the requirements and limits specified by MRA.

6 Environmental monitoring plan



The environmental monitoring plan shall describe how all aspects relevant to environmental issues are monitored such as a) discharges/emissions to water and air, use and handling of fuel and chemicals, production and handling of waste rock and tailings; b) concentrations of, for example, metals, nutrients and chemicals and their effects on the environment, including accumulation of heavy metals in sediment and indicator species and disturbance of wildlife. The environmental monitoring plan shall be developed in cooperation with MRA. The company shall prepare an outline of how to monitor issues relevant to item a) above. MRA will prepare an outline of issues relevant to item b), and monitoring studies related to b) will be carried out by DCE/GINR on behalf of the authorities. The monitoring plan shall cover both the construction phase of the mining project and the subsequent exploitation phase. A separate plan for monitoring after closure shall be developed in cooperation with MRA. These plans shall describe the duration, frequency and media to be monitored as well as the number of samples and parameters to be analysed. The monitoring programmes must be updated regularly during the mine's lifetime after consultation with MRA. All costs related to environmental monitoring shall be covered by the company.

7 Archaeological findings



The authority concerning archaeological findings is the Greenland National Museum and Archives (NKA). Often mining activities take place at locations that have previously not been examined by archaeologists or described by traditional users of the area. NKA shall therefore be contacted in the project's scoping phase to arrange for them to visit the location and perform a thorough viewing of the areas expected to be affected by the project. The purpose of the viewing is to ensure that unique archaeological structures will be registered and that suitable precautions will be taken to keep such cultural heritage protected. If archaeological features are present, these shall be described in the EIA and the protective precautions shall be described by NKA.

8 Closure Plan



The closure plan is a separate plan to be forwarded by the company to MRA as part of the approval of the project. The EIA shall address the environmental issues related to the closure plan. The closure plan shall be updated regularly, and the EIA for the final closure plan shall be subject to public consultation and government approval.

A photograph showing a man and a woman looking down at a document they are holding together. The man, on the left, is wearing a grey jacket over a white shirt and blue suspenders. He has glasses and is looking intently at the document. The woman, on the right, is wearing a black jacket over a white shirt and has her hand resting on her chin. They appear to be in a kitchen or a similar indoor setting, with a stove and some kitchen items visible in the background.

9 Public consultations

The public shall be involved throughout the EIA process and be informed about the activities when the mine is in production. As a minimum, the public shall be consulted during the scoping phase and when the final EIA draft is issued, as set out in The Mineral Resources Act.

During the scoping phase, the public consultation period is set to 35 days from the day of publication of the draft scoping documents. The comments received from the public consultation shall be addressed in a white paper (described below) and in the final scoping documents where relevant.

The final draft of the EIA must be published for public consultation by MRA.

The public consultation period is set to a minimum of 8 weeks from the day of publication of the final draft EIA report and must include public hearing meetings in the towns and villages affected by the project. The company shall prepare a so-called **white paper** dealing with all questions and comments from the public to the project. The white paper is a document containing the public consultation responses or a summary hereof, comments from the company to these responses, a description of how these comments will be addressed in the final EIA or a reason why they will not be addressed. MRA and its scientific advisors shall be given opportunity to incorporate their comments in the white paper.

The white paper including comments and a description of how these have been addressed shall be included in the final version of the EIA in the form of, for instance, an appendix. Following the public consultation, the EIA report shall be revised and a final version prepared for government approval of the EIA.

Section 95a of the Mineral Resources Act describes how citizens, NGO's and others can seek funding from the Greenland authorities for supplementary investigations and advice for clarification of specific issues related to the specific mining projects in Greenland.

As mentioned, the public shall be involved throughout the EIA process and be informed about the activities when the mine is in production. Besides the required public consultation on a work scope and on an EIA draft, the company is required to arrange a public information meeting at an early stage of the process concerning the project and the EIA process.

Appendix 1

Annotated table of contents for an EIA report for mineral exploitation in Greenland

The following is a list of issues to be considered when preparing the EIA report. All subjects must be dealt with in the EIA, but not all bullet points may be relevant to the specific mine project. Likewise, a specific mine project may include issues that are not covered by the bullets. Prior to the start of preparing the EIA report, a detailed table of contents of the EIA must be forwarded to MRA for approval. MRA may require that issues not mentioned in the table of contents shall be included in the EIA.

Environmental studies (baseline studies and project-related studies) must be initiated prior to the start-up of mining operations and included in the EIA. Baseline studies must be performed in the pre-mining phase because the state of the environment shall be determined prior to a possible impact from the mining activities.

Social and archaeological aspects are not included in the EIA guidelines of this appendix.

1. Extended summary

A non-technical summary including maps and figures describing in short the project and a conclusion including preferred options compared to alternative solutions, important potential environmental effects, mitigating actions, decommissioning and remediation, uncertainties and public concerns shall be prepared and presented in Greenlandic, Danish and English.

2. Introduction

The introduction shall contain a description of the mine project, its background and objectives, including:

- Description of the mining company
- Geographical placement of the mining activities with presentation of the location on regional and local maps
- Description of, among other aspects, geography, geology, climate, environment and the local population
- Background and objectives of the mine project
- Description of alternatives to the proposed project such as tailings placement and infrastructure
- Timetable for construction, mine start-up and operation
- Reference to the Mineral Resources Act and other relevant legislation

3. The environment

A comprehensive description of the environment before the mine start-up shall include:

- A detailed description of climate, geology (e.g. earthquakes), geography (e.g. fast ice and icebergs, avalanches), freshwater and sea water quality and hydrology
- Baseline concentrations of metals and of other relevant pollutants
- Flora and fauna (e.g. rare and sensitive species, larger aggregations of animals during breeding, moulting and migration)
- Important areas for wildlife (DCE-designated areas), protected areas (e.g. national parks and Ramsar sites) and other areas
- Local inhabitants and their use of the area (e.g. fishery, hunting and agriculture)
- Tourism
- Any archaeological findings

4. The project

This section in the EIA shall contain all phases of the mine project from exploration to closure, including decommissioning and rehabilitation. Relevant illustrations, diagrams and maps with plans shall be included in the description to give:

- An overview of mineral exploration in the area performed to date
- A description of the mine plan, planned processes, plant facilities, vehicles, vessels, shipping routes, handling and storage of reagents and explosives
- Description of chemicals that will be applied in the project, including composition and CAS numbers and data on toxicity, bio-degradability and bio-accumulability of the chemicals. The application shall also contain information about the quantities of the mentioned chemicals and reagents that the company intends to use and the estimated concentrations and quantities in tailings and drainage water
- Energy requirements (energy sources and supply) and handling and storage of fuel
- Gas, dust and particulate matter emissions and the amount of greenhouse gases
- Water supply (quantity and quality, sources, supply requirement in per cent of source)
- Water discharge
- Workforce, accommodation, handling of waste and wastewater
- Tailings, waste rock, other waste from production and discharge water (both direct and indirect, for instance seepage)
- Transportation to and in the mining area (e.g. harbour, airstrip, roads, vehicles, vessels and shipping routes)
- Storage of tailings and waste rock (stability of dams and pits)
- Alternatives to the preferred project option
- Closure and decommissioning of the mine
- Rehabilitation of the mine area, including a description of permanent changes introduced to the mine area



5. Environmental impacts and mitigation

The criteria used to assess the different impacts must be clear, and impacts must be quantified, where possible. It is important to include a discussion of environmental impacts from the alternative options identified in Chapters/Sections 2 and 4 and compare these with those of the preferred option. Issues where information is lacking, incomplete or uncertain shall be identified. Long-term and short-term effects during development, operation and closure of the mine shall be considered. Effects and risk of possible malfunctions or accidents must be described. Topics that do not require further attention shall be specified. If the project is likely to have a significant effect on a neighbouring country, these effects must be described and the neighbouring country informed as soon as possible during the EIA process.

Physical changes

Physical changes include:

- Area impacted and potential landscape disturbed
- Erosion (land, river banks, coasts along fjords etc.)
- Hydrological changes of rivers, lakes and fjords
- Qualitative and quantitative impacts on freshwater and sea water (e.g. changes in turbidity, pH, temperature, conductivity, oxygen content and flow)
- Dust
- Noise and vibration
- Light, heat and radiation

Ecological and chemical changes

Ecological and chemical changes encompass:

- Pollution from ore, tailings, waste rock and other sources (studies on, for example, chemical composition, leaching elements, acid drainage, toxicity for relevant species and bioaccumulation, greenhouse gases and public human health)
- Removal or damage of vegetation and effects on the greenhouse gas exchange balance
- Disturbance of wildlife (degree of impacts on breeding, moulting, feeding and migration sites; some species may be attracted by the mine activities)
- Loss of habitats
- Creation of new habitats
- Loss of biodiversity
- Introduction of non-native species of flora and fauna
- General impacts on ecosystems

Local and other land use

Local and other land use involves:

- Obstruction of (or other impacts on) other land use such as hunting, fishery, conservation, exploration and exploitation of other mineral resources, other industry and tourism
- Increased demand on existing resources such as water
- Effects of opening up the area for other land use through major changes in infrastructure such as building of roads, harbours, airstrips, houses and power supply (e.g. hydropower)
- Cumulative impacts – an evaluation of the impacts caused by the activities in combination with other industrial operators in the region and in combination with other human activities in the area (e.g. fishing and hunting)

6. Environmental management plan (EMP)

This section shall describe in detail how the company intends to reduce the different identified impacts and how effective the measures are expected to be. Impacts shall be reduced by using BAT and BEP. It shall be assessed whether the residual effects, after mitigating measures have been introduced, are significant and adverse. If so, compensatory measures shall be included in the EMP. Often the EMP will develop during the lifetime of the mine based on the results of the environmental monitoring. The EMP shall describe, as detailed as possible, how the mitigating measures are organised and who is responsible for carrying out mitigating and monitoring activities.

The company shall establish, implement and maintain a complete project-specific EMS for the organisation. The EMS shall fulfil the intentions of the international standard for environmental management ISO 14001 or equivalent standards. The people to conduct environmental management shall refer directly to the top management of the project.

The EMP shall include a comprehensive programme for control and on-going monitoring of emissions, discharges, disturbance of and damage to wildlife, emergency preparedness and other issues. The aims of the on-going monitoring activities are to control if the emissions/discharges/disturbance of the activities comply with the requirements and limits specified by MRA in the approval.

7. Environmental monitoring

This section shall describe a programme for which parameters, compartments, species and other elements are to be monitored on the basis of the environmental impacts identified in the EIA process and the findings of the environmental baseline study. The environmental monitoring report shall assess the results and include a comparison with the findings of the baseline studies and, when possible, with environmental criteria. The report shall be used to propose necessary changes in monitoring and in mine management plans and procedures.

Measurements/calculations of the emission of greenhouse gases shall be included in the monitoring programme.

8. Public consultations

The public consultations are described in Chapter 9/Section 9 of the Guidelines.

The final EIA version for government approval must incorporate the white paper and thus the changes or amendments that have been made to the EIA as a result of the public consultations. The white paper may be included as an appendix to the final EIA version.

A list of people, institutions, organisations and others who were consulted and who commented on the draft report shall also be included in the final EIA version.

9. Conclusions

This section shall describe the most important conclusions regarding, for instance, preferred options compared to alternative solutions, important potential environmental effects, mitigation, decommissioning and remediation, uncertainties and public concerns.

10. References, authors and glossary

The glossary shall explain technical terms used and contain a list of abbreviations. References shall be made according to good scientific traditions.



Appendix 2

Greenland Water Quality Criteria for mining activities

The following water quality criteria will be applied to mining operations in Greenland. The listed metal concentrations are for dissolved metals, here defined as metals that can pass through a 0.45 micron filter. DCE/GINR recommend that both filtered and unfiltered water samples are taken (for dissolved and total metals, respectively) as part of the environmental studies. Please consult DCE/GINR in advance on which filtering equipment to use because some systems are prone to contaminate the samples.

Greenland Water Quality Criteria for mining activities.

	Freshwater (µg/l)	Sea water (µg/l)
Arsenic (As)	4	5
Cadmium (Cd)	0.1	0.2
Chromium (Cr (III))	3	3
Copper (Cu)	2	2
Iron (Fe total)	300	30
Lead (Pb)	1	2
Mercury (Hg)	0.05	0.05
Nickel (Ni)	5	5
Zinc (Zn)	10	10
Cyanide (CN free)	5	2
Nitrogen (N total)	300	
Phosphorus (P total)	20	
Total suspended solids*	50000*	50000*

*Or maximum increase of 10 % if baseline concentration is above 50000 µg/l

The Greenland Water Quality Criteria (GWQC) are developed in order to protect living organisms in streams, lakes and in the marine environment from pollution due to disposal of mine tailings, waste rock, sewage and other substances derived from activities in connection with mining in Greenland.

The criteria values will be used to set limits for effluent discharges to freshwater and to the sea. This will be done on a case-by-case basis, and several parameters including physical, chemical and biological conditions will be taken into account such as naturally elevated metal concentrations, biology and local use of receiving waters.

The water quality criteria have to be met outside a defined mixing zone. It could, for example, be at the entrance of a stream to a lake holding fish or to the sea and will typically be at an easy recognisable and accessible site. The criteria for compliance with threshold values and the size of the mixing zone will be determined by MRA.

For elements or substances that are not included in the Greenland list, water quality criteria will be determined by MRA on the basis of other existing guidelines from EU/Denmark or elsewhere, if relevant.

The criteria have been determined from published information on water quality criteria used in USA, Canada, Australia/New Zealand, Norway, the European Union and Denmark and from typical values found in Greenland waters. The Greenland criteria values were mostly selected among the lowest criteria values from these other countries using a safety factor reasonable for Arctic conditions. Baseline concentrations typically found in Greenland were also taken into account. The Greenland criteria values will ensure that good water quality will be maintained if discharges are properly managed.

In addition to these criteria, the following effluent criteria for the biological and chemical oxygen demand (BOD₅ and COD, respectively) as well as total nitrogen and phosphorus will be used to set discharge limits.

Parameter	Concentration (mg/l)
BOD ₅	15
COD	75
Total N	8
Total P	1.5



Appendix 3

Environmental Air Quality Criteria for mining activities in Greenland

The following air quality criteria will be applied to mining operations in Greenland. The purpose of the criteria is to protect living organisms outside the immediate vicinity of the mining areas against adverse effects of air pollutants (gasses and dust particles). Values for air pollutants are given as ambient air concentrations and deposition rates.

The EAQCG will be applied to areas outside defined buffer zones close to potential air pollution sources within the mining areas. Such potential pollution sources include ore crushers, open pits, waste rock and tailings deposits, air ventilation outlets from underground mines, roads and ports of shipping. Buffer zones will be defined on a case-by-case basis depending on, for instance, the type of mining and the background values in the recipient area.

Table 1. Environmental Air Quality Criteria for mining activities in Greenland (EAQCG). Values for ambient air concentrations are 24-hour means. Values for deposition rates are 1-month means.

	Ambient air concentrations ($\mu\text{g}/\text{m}^3$)	Deposition rates ($\mu\text{g}/\text{m}^2$)
Gasses		
Nitrogen dioxide (NO_2)	100	–
Sulfur dioxide (SO_2)	125	–
Particles		
Arsenic (As)	0.010	120
Cadmium (Cd)	0.010	60
Chromium (Cr)	0.50	–
Copper (Cu)	10	–
Cobalt (Co)	0.10	–
Iron (Fe)	4.0	–
Lead (Pb)	0.40	3000
Mercury (Hg)	0.10	1.5
Molybdenum (Mo)	5.0	–
Nickel (Ni)	0.10	450
Silver (Ag)	0.20	–
Thallium (Tl)	–	60
Uranium (U)	0.30	–
Vanadium (V)	0.30	–
Zinc (Zn)	60	–
Fluoride (F)	1.0	–
Particulate matter $<2.5 \mu\text{m}$ ($\text{PM}_{2.5}$)	30	–
Particulate matter $<10 \mu\text{m}$ (PM_{10})	50	–
Total particulate matter		4.0 g/m ² /month

The EAQCG were developed/determined from published information on air quality criteria used in Canada, US, EU, Denmark, Norway, Australia and Germany. Defining the EAQCG, the averaging time for ambient air was set to 24 hours. This averaging time was considered appropriate to account for short-term local variations in parameters such as wind speed and turbulence and considering the potential effects. The averaging time for both single element and total deposition was set to 1 month, which is similar to the Australian and Norwegian standards. The values in the EAQCG were set to the lowest of the guideline values used in those other countries selected regardless of the differences in averaging times. This precautionous approach was taken due to the general lack of studies and knowledge of how dust and particle contamination may affect Arctic ecosystems.

Emissions from, for example, power plants, fuel combustions plants, incinerations plants and process plants shall comply with EU standards (EU Directive on Industrial Emissions – IE Directive). Emission from non-road mobile machinery (e.g. excavators, bulldozers, front loaders, back loaders and drilling equipment) shall comply with EU environmental standards (EU directives on emissions from non-road mobile machinery etc.). US standards shall be used if EU standards are not available. Best Available Technique (BAT) is specified in BREF documents.



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