

Advisory review of the  
Draft Comprehensive Environmental Evaluation  
Water sampling of the subglacial  
Lake Vostok, Antarctica

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## **1. INTRODUCTION**

The State Secretary for Housing, Spatial Planning and the Environment has requested the Commission for Environmental Impact Assessment (EIA) to prepare an advisory review of the *Draft Comprehensive Environmental Evaluation (CEE) Water sampling of the subglacial Lake Vostok, Antarctica, 2003*. The State Secretary indicated his wish to use this advice when preparing the Dutch contribution to discussions in the *Committee for Environmental Protection (CEP)* and the *Antarctic Treaty Consultative Meeting (ATCM)* to be held in Madrid on 9–20 June 2003.

## **2. SUMMARY OF THE DRAFT CEE**

In the Draft CEE a Russian scientific team from the AARI describes a proposal for ice coring into the subglacial Lake Vostok in Antarctica. The lake is covered by an approximately four-kilometre thick ice sheet and has long been isolated from the surrounding environment. The drilling has already reached the layer of frozen lake water at a depth of 3600 metres and more below the surface of the ice sheet, but has not yet reached the lake water itself (see Annex 12 of the Draft CEE).

Research has revealed that the surface of the water in the lake lies about 130 metres below the lowest point of the present borehole. The team wants to drill down to the water over a period of three (summer) seasons. It is assumed that the pressure difference between the lake and the borehole will force the water up the borehole, where it will freeze. It can then be sampled.

The Draft CEE states that the scientific team is investigating the types of living organisms in the lake. The lake ice recovered from the deepest part of the present borehole was found to contain bacteria, yeasts and similar organisms. Only a few species were identified as indigenous to the Lake Vostok ecosystem.

The project proponent expects the drilling will have no or negligible environmental impacts on the atmosphere, on the surface, in the ice column, at the ice-water interface or in the lake. According to the proponent only the research station itself will have an environmental impact, affecting the surface of the ice in the surrounding area, but this impact will not be greater than at present. The drilling fluid, which consists of a mixture of kerosene and Freon F-141b, has hydrophobic properties and the pressure difference between the lake and the borehole will force the drilling fluid back up the borehole. The likelihood of any drilling fluid coming into contact with the lake water is thought to be small and any effect it may have is expected to be small. The proponent says that no alternative drilling locations exist and that the extreme conditions severely limit the scope for using alternative techniques. The proponent argues that further delay cannot be tolerated because movement of the ice is deforming the borehole.

### **3. INTERNATIONAL AGREEMENTS, REVIEW BY THE COMMISSION**

The proposed activity falls under the category of the most comprehensive environmental impact assessments in Annex I of the Protocol on Environmental Protection to the *Antarctic Treaty*. Article 3 and subsequent articles in Annex I require that a CEE is conducted for the proposed activity. The Draft CEE must be submitted for consideration by the states party to the Protocol and will be discussed at the 26<sup>th</sup> ATCM in Madrid, 9-20 June 2003. The CEP advises the ATCM (see Article 3, paragraph 5 of Annex I to the Protocol).

The Commission for EIA has reviewed the Draft CEE against the provisions of the Protocol on Environmental Protection. The main provisions relating to this project are contained in Article 3 of the Protocol, Article 3 of Annex I (requirements for a CEE) and Annex III (waste disposal and waste management). The Netherlands is one of the countries that have signed and ratified both the *Antarctic Treaty* and the Protocol on Environmental Protection. The Commission's advisory review aims to contribute to the Dutch input to the CEP and the ATCM.

In the Netherlands, environmental impact assessments are carried out for certain proposed activities. The Commission plays an advisory role in this process in its capacity as independent expert. It assembles working groups of experts, who are members of the Commission, for each project (see Annex 2 for the composition of the advisory working group *Water sampling of the subglacial Lake Vostok, Antarctica*). The Commission assesses whether the information presented is sufficient to enable full consideration of the environmental interests during the decision making process. It focuses on the essential information, such as the aims of the initiative, possible alternatives and their environmental impacts. This implies that the Commission restricts its advice to the main issues and does not address inaccuracies or shortcomings of minor importance.

In view of the international cooperation under the *Antarctic Treaty*, in which the contracting parties inform each other of activities they propose to undertake in the *Antarctic Treaty* area, and given the positive spirit of scientific cooperation between the research activities in the Lake Vostok area (the *Subglacial Antarctic Lake Exploration* expert group of the *Scientific Committee on Antarctic Research*), the Commission trusts that its advice will help to ensure a role for environmental interests in the further decision making process.

### **4. THE COMMISSION'S EVALUATION OF THE DRAFT CEE**

In the Commission's opinion the Draft CEE complies for the most part with the international legal framework (the *Antarctic Treaty* and the Protocol on Environmental Protection). The proponent already possesses considerable practical experience with drilling and ice coring. In the Draft CEE, the proponent describes the activities, alternative options and expected impacts of the proposal in considerable detail. The Commission was impressed by the information contained in the Draft CEE. However, the Commission recommends that the concerns discussed below receive attention in the final CEE.

#### 4.1 Added value of sampling the lake water

Lake Vostok is a unique subglacial lake, situated in a ravine and with a unique ecosystem of great intrinsic value. The precautionary principle implies that any activity that will or may have negative environmental impacts on this system must be justified. Section 2.4 of the Draft CEE contains a description of the need and advisability of the proposal.

There appears to be a scientific consensus that samples of the lake water could contain information of scientific interest. The Commission understands that samples taken at a depth of 3600 metres and below consist of frozen water from the lake. Based on Annex 12 of the Draft CEE, the Commission concludes that the existing borehole extends into the frozen lake water. In view of the unique value of the subglacial lake, the Commission recommends that in the final CEE the proponent includes an indication of the additional value of drilling through this layer of lake ice and sampling the water itself.

#### 4.2 Ecological impacts, technical risks, worst case scenario

The proponent has many years experience with drilling and ice coring and says it will make best use of this expertise in the proposed research activities at Lake Vostok. The proponent estimates that by using the best available technology the proposal will have “*no impacts*” or “*impacts less than a minor or transitory*”.

Given the unique ecological situation and the extreme conditions under which the ice coring operation has to take place, some risks do exist. The lake system may be highly sensitive to external influences. From studies on lake ice and sea ice elsewhere in Antarctica we know that the ice-water interface is a place of relatively high biological activity. If the drilling fluid, which is less dense than water, comes into contact with the surface of the water it will spread across this ice-water interface, probably forming a film. Even limited contamination of the ice-water interface could have a large impact on the biota of Lake Vostok.

In the final CEE the proponent could include an indication of the state of equilibrium in the lake ecosystem. Samples that have already been taken from the frozen lake water may provide an indication of the possible effects of exogenous viruses and/or microorganisms and any resulting disruption to the ecological balance.

The Draft CEE does not contain a description of a worst case scenario and its impacts. In the worst case scenario all the drilling fluid would leak into the lake water, exposing the lake to contamination with viruses and/or microorganisms. The Commission suggests to include a description of a worst case scenario in the final CEE.

In the Draft CEE, the proponent indicates that under the prevailing physical conditions there can be no gas beneath the ice layer (e.g. thermal gases from the geological substrate or biogas from organisms). The Commission suggests to preclude every risk of a blow-out and to determine the measures that could be taken to reduce this risk as much as possible.

The drilling fluid will remain in the borehole after drilling has ceased. The Commission recommends examining the possibility of recovering all or some of the drilling fluid after the operation has ceased, and recycle or reuse the fluid. Removal of the drilling fluid from the site is considered by the proponent to be too drastic a measure, but treatment or reuse options could be devised in cooperation with other research teams so as to benefit all parties and the environment.

### 4.3 Optimum results through collaboration

The three prime objectives of the *Antarctic Treaty* are keeping the peace, safeguarding scientific research and protecting the Antarctic environment. All three require good international cooperation, and so it is not surprising that the *Antarctic Treaty*, many of the adopted Recommendations and the Protocol on Environmental Protection all emphasise the importance of cooperation. The CEE procedure contained in Annex I of the Protocol on Environmental Protection highlights the importance of international cooperation and consultation in identifying and describing the risks and negative impacts of major projects or activities in Antarctica.

Given the unique character of the subglacial lake, the considerable technical risks of the operation and the high level of scientific interest, the proponent, correctly, wants to limit the risks and environmental impacts as much as possible. It may be possible through international exchange to make the best use of the available expertise and technologies, while respecting the contributions of participating parties and countries, to design the project in a way that provides a better guarantee of limiting risks and minimising impacts. This could take place within the framework of scientific cooperation on research activities in the Lake Vostok area (the *Subglacial Antarctic Lake Exploration* expert group of the *Scientific Committee on Antarctic Research*).

Above all, cooperation can be a good way of giving more concrete expression to the precautionary principle: exposing risks and knowledge gaps through consultation and discussion and jointly exploring the possible consequences of this information (e.g. possibilities for obtaining knowledge and dealing with incomplete knowledge during decision making). Cooperation and consultation can promote a more objective view of the issues. In the light of what has been stated in Section 4.2, the Commission was struck by the fact that the Draft CEE devoted relatively little attention to the gaps in knowledge.

By cooperating, research teams can coordinate their efforts to improve the value of each other's projects. Obtaining the maximum possible scientific returns from just one ice coring could even make future drillings, with negative environmental impacts, unnecessary. Cooperation with other expeditions could also lead to a lower net impact in the end because fewer logistical and back up operations (e.g. transport, stations) would be needed.

While the Commission fully recognises that the Protocol on Environmental Protection does not place the formal decision making responsibility for the proposed project with the CEP or the ATCM, we believe that the unique character of this project and the ecological value of the lake are such that the activities and the assessment of the consequences and risks should first command widespread recognition from within the international scientific community.