

Advice on Terms of Reference for
SEA Gran Salar de Uyuni

- Bolivia -

24 December 2004

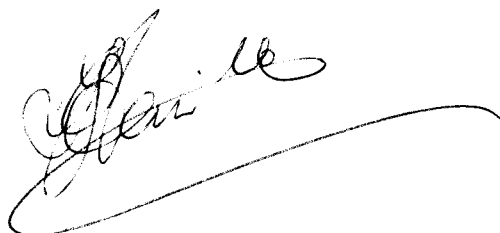
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Advice on Terms of Reference for SEA
Gran Salar de Uyuni, Bolivia

Advice submitted to the Vice Minister of Natural Resources and Environment
of the Ministry of Sustainable Development (MDS) in Bolivia by a working
group of the Commission for Environmental Impact Assessment in
the Netherlands

Technical Secretary

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Ms. Ineke Steinhauer

Chairman

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Mr. Klaas Jan Beek

Utrecht, 24 December 2004

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1. INTRODUCTION

1.1 SEA Salar de Uyuni, Bolivia

The Vice Ministry of Natural Resources and Environment (VMRNMA) of the Ministry of Sustainable Development (MDS) has identified the introduction and development of Strategic Environmental Assessment (SEA) in Bolivia as a priority issue for the next couple of years. On request of MDS, The Netherlands Commission for Environmental Impact Assessment (EIA)¹ contributes to this introduction. One of the first activities in the framework of SEA development is the undertaking of pilot SEAs. These pilot-SEAs are designed as a joint activity of the Commission and the Bolivian EIA authorities at central (national) and decentralised (departmental) levels, mobilising their expertise in the practice of impact assessment and providing a possibility for 'training-on-the-job' in SEA.

MDS has selected Puerto Busch as the first SEA pilot. Terms of Reference for both process and contents of this SEA have been drafted in September 2004². A second case has been selected: Salar de Uyuni (salt lake), because of its valuable mineral resources and because of its high potential for tourism. Uyuni has attracted many people during the development of the railway network in Bolivia, but nowadays has an impoverished population, where social needs are high.

1.2 Why would SEA be useful?

The Bolivian government has identified the Gran Salar de Uyuni and its surrounding area as an area of strategic importance, because of its resources and their potential for development.

The purpose of this pilot SEA is to assess strategies for the exploitation of mineral resources in mutual relationship with strategic plans for tourism development in Uyuni and its surroundings, taking into account that the Salar de Uyuni is an area with unique natural values. This can result in a long term vision on the development of the region: which plans should receive priority or offer good possibilities from an environmental/social and economic point of view, what are alternative options, which plans are less suitable/not sustainable? etc. The exact scope and objectives of this pilot SEA however, will be addressed further in this advisory report, as well as the planning process in which the SEA is meant to be integrated.

¹ Henceforth referred to as 'the Commission'

² Advice on Terms of Reference for a n SEA for the Polo de Desarrollo (Puerto Busch) Bolivia, 30 September 2004

1.3 Request of the MDS and involvement of the Commission

In July 2004, the MDS invited the Netherlands Commission for EIA (see letter appendix 1), to assist MDS with the start of the introduction on SEA in Bolivia. The objective of the involvement of the Commission in this second pilot SEA for the Salar de Uyuni is specified in appendix 2 and can be summarised as:

- Assist in developing methodologies for this second pilot SEA.
- Assist in defining the Terms of Reference (ToR) for the execution of the SEA.
- Assist in integrating the consultation with public and private organisations in the ToR.

The expected results are:

- A generic document with methodologies and procedures for the development of SEAs which facilitates the Bolivian government in decision making on projects of national character.
- Interactive capacity building of the team of the Vice-Ministry of Natural Resources and Environment, the Prefectura of Potosí, municipalities and related institutes in the realisation of SEAs.
- Structured ToR for the SEA, which have been discussed with related stakeholders, to guide the sustainable development and environmental quality in the area of the Salar de Uyuni.

The Commission wants to emphasise that it has no opinion on the question of feasibility of existing plans and strategies for the Salar de Uyuni. The Commission **never** judges the acceptability of projects or plans, but tries to guarantee that all essential environmental (and socio-economic) information has been provided for sound and well balanced decision-making.

1.4 Approach taken by the Commission

In order to prepare an advisory report on the above mentioned requests, the Commission formed a working group of experts, representing the Commission, which comprises the following disciplines: mineral exploitation, geology, ecology, natural resource management and EIA application. The working group members of the Commission are listed in appendix 3. A Bolivian counterpart team (appendix 4) with representatives of MDS accompanied the working group during its visit. Originally, it was planned that the MDS team would include an expert on tourism development, but due to unforeseen circumstances this was not possible. The other experts therefore decided to pay explicit attention to this aspect.

The Commission visited Bolivia from 15-20 November 2004 (see appendix 5, working programme). The purpose of this visit was to:

- collect project- and site specific information (see appendix 7, list of documents) and discuss matters with several stakeholders.
- get the lead agencies and environmental authorities together to agree on the need, objectives and undertaking of this SEA.
- elaborate ToR for this SEA which is meant to be the result of a joint effort of the Commission and Bolivian EIA authorities and agree on next steps.

1.5 Outline of this advisory report

The Commission defines SEA as a way to bring people together in the planning process, and to structure and feed their debate on the environmental consequences of strategic decisions. More concrete, SEA is a tool to:

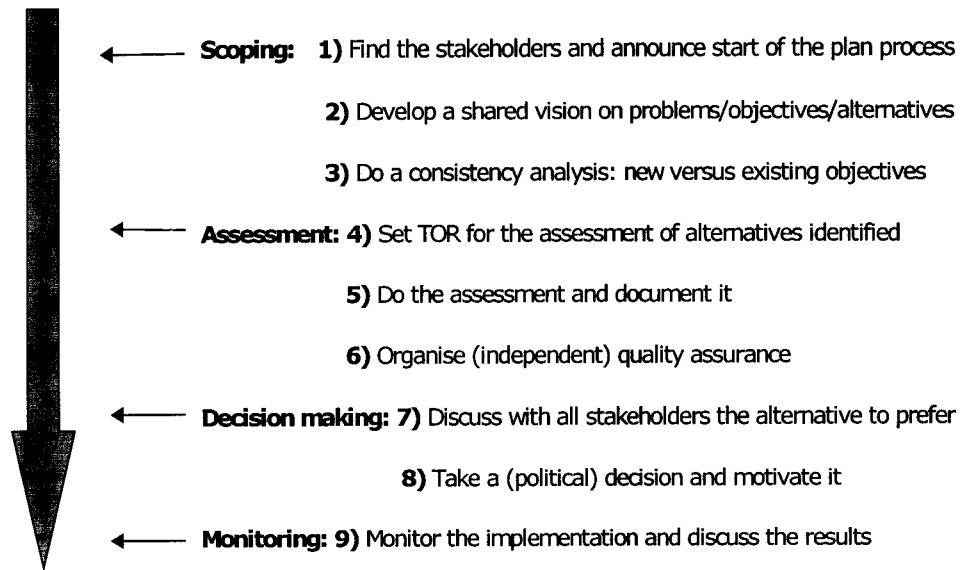
- structure the public and government debate in the preparation of policies, plans and programmes
- feed this debate through a robust assessment of the environmental, social and economic consequences
- ensure that the results of the assessment and debate are taken into account during decision making.

This means that public participation, transparency and good quality information are key principles. SEA is thus more than the preparation of a report; it is meant to improve the planning process and the quality of information used in the process. In summary, SEA is both process and contents oriented.

Therefore, the Commission chose to structure this advisory report along three chapters. Chapter 2 gives ToR for the SEA process and Chapter 3 focuses on ToR for the SEA contents. These ToR are presented at the end of each paragraph. Chapter 4 gives recommendations for the institutional capacity needed to undertake this pilot SEA.

2. **TOR FOR THE SEA PROCESS**

The undertaking of this SEA is a first step in a longer process of dialogue and collaboration between the MDS and other Ministries, the private sector and affected people, both at centralised and decentralised level (national, departmental and local government) in relation to the Salar de Uyuni. This process will certainly continue beyond the time period of undertaking this SEA, which can be considered as a learning period for all stakeholders involved. The following scheme can be used to guide the SEA process. The vertical arrow represents the planning process. The 9 steps represent the SEA process.



The scope and thoroughness of the above 9 steps may differ, depending on the time and resources available; from 'quick and cheap' (2-3 months) to comprehensive (1-2 years).

There is another step (0) 'screening' which precedes this 9-step approach: the purpose of this step is to bring lead/competent authorities and environmental authorities together to decide on the need for SEA.

In Bolivia, the decision to introduce and develop SEA has been taken by the MDS in its Multi-annual Plan (2004-2007). This decision has been discussed with other sectors of government, private sector, NGOs, civil society and donors, mainly at national level. MDS decided also that in principle SEA will be undertaken for each plan/mega-project of national importance.

The decision to undertake an SEA for the Salar de Uyuni as a second pilot in the framework of the institutionalisation of SEA has been taken by the MDS solely. Therefore, the following paragraphs conclude with recommendations or ToR, mainly meant to guide MDS in creating broad support amongst important stakeholders for the undertaking of this SEA, and to support decision making on the planning process that will be subject to SEA.

As soon as the options on step 0-3 have been discussed and decisions have been taken, the ToR for the assessment itself (step 4) can be further fine-tuned. The Commission provides advisory ToR for this step in chapter 3.

2.1 Step 0) Define which planning process is subject to SEA

Ideally, SEA is undertaken as early as possible in the process of developing policies, plans or programmes. However, SEA can also be done during the implementation phase to either improve implementation or feed future decisions. SEA may even get the form of a sectoral assessment used to set the agenda for future policies and plans.

During the visit, the Commission tried to get insight in:

- which would be the 'leading' planning process in the region
- who is/are the responsible agency(ies) ('the owner/developer of the planning process')?
- which are the decisions to be taken in the planning process and when will these be made?

Referring to the 9 step SEA as presented in the above scheme, these questions should help define 'the arrow', which stands for the planning process for which the SEA will be undertaken.

The Commission noticed that several plans or strategies have been developed, or will be developed, like:

- Plan de Desarrollo Sur-Oeste de Potosí, by the Vice-Ministry of Planning of the Ministry of Sustainable Development (November 2004)
- Plan estratégico del Viceministerio de turismo 2004-2007, estrategia de turismo departamental Potosí
- Plan de aprovechamiento de recursos evaporíticos, a desarrollar por CI-RESU, Complejo Industrial de los Recursos Evaporíticos del Salar de Uyuni
- Preliminary proposals to declare the Salar de Uyuni a natural reserve (Prefectura Potosí, 2004).

The first plan is a Development Plan for the South Western part of Potosí. A Commission has been installed recently, with representatives of eg. the (Vice)Ministries of Defence, Foreign Affairs, Tourism, Economic Development, the Presidencia and the Prefectura de Potosí. The first steps undertaken by this Commission are the identification of the most important actors in the region and the forming of a group promoting development. The latter group consists of representatives of the government, universities, private sector, farmers union, and a few other sectors. The next step will be to make an analysis of the most important problems and opportunities in the region. This will be done in working groups, for example on agriculture, health, mining, tourism, and institutional administration. This Plan de Desarrollo Sur-Oeste de Potosí is planned to be ready mid 2005.

The second plan is a strategic plan on tourism. For the Salar de Uyuni and its surroundings the objective is a socio-economic growth through an increase from 50.000 to 500.000 visitors per year, the majority coming from abroad. In October 2004 the Bolivian Government organized an international promotion campaign for the Salar de Uyuni (and Lake Titicaca) to become a priority area for tourism.

The Plan for the use of mineral resources by CIRESU consists of several elements. CIRESU recently has been reactivated and has started a survey on existing (legal and illegal) mining concessions, mainly in the Rio Grande delta, south of the Salar itself. At the moment it is in the process of seeing to it that existing concessions function according to law. For 2005-2006 CIRESU plans to develop a strategy for the exploration and exploitation of the minerals, possibly allowing international concessions as well.

The last plan prepared by the Prefectura de Potosí, together with SERNAP (National Service for Protected Areas), proposes the Salar the Uyuni as a possible new conservation area (out of 9 for the Potosí department). But so far Bolivia has not identified yet the priorities for biological conservation at a national scale (on top of the already existing protected areas).

The Commission is of the opinion that the Plan de Desarrollo del Sur-Oeste de Potosí would most probably be the leading plan for development. In the Comisión de Desarrollo, formed to develop this plan, all relevant sectors are represented. The 'owner' of this planning process would most probably be the Prefectura de Potosí, who oversees all developments taking place in the region of the Salar de Uyuni.

Additional arguments for selecting this Plan to be subject to SEA are:

- administratively: it is one of the regions in which the department of Potosí is divided and it is the planning unit of the Vice-Ministry of Planning
- ecologically/hydrologically: the functioning of the Salar de Uyuni cannot be seen independent of what happens in the watershed, which is totally contained in the Region Sur-Oeste. All discharge of the rivers end up in the Salar, so also the contamination from settlements, industries and sediments caused by erosion.
- operationally/functionally: many of the activities in the Salar the Uyuni have relations with the surrounding area. F.i. mining activities need infrastructure, energy; tourism needs infrastructure, hotels etc.

■ The Commission **recommends** that the Vice Ministry of Natural Resources and Environment, the Vice Ministry of Planning (both of MDS) and the Prefectura de Potosí agree that the planning process for the development of the South Eastern Part of Potosí will be subject to SEA. Decisions have to be taken subsequently on time frame: when must SEA results be available in order to facilitate decision making? What is the status of decisions that will be based on the outcomes of the SEA? Who will take these decisions? This may require the MDS and the Prefectura taking a joint decision on issues like who runs this SEA/plan process and commitments for uptake of the SEA results.

2.2 Step 1) Find the stakeholders and announce the start of the process

The activities undertaken during the visit of the Commission (see appendix 5) can be considered as a first (mini-)SEA already. The most important stakeholders in the process have been brought together, the MDS has been able to announce its plans in relation to SEA and a first introduction on the objectives and possible benefits of SEA has been given. A site visit has been paid to the most important activities in relation to mining and tourism. Unfortunately, a meeting which was organized to consult and discuss with representatives of municipalities and local organizations in Uyuni was not as well attended as planned due to communication problems. However, there will be other opportunities during the undertaking of the SEA.

■ The Commission **recommends** that the main findings of the stakeholder meetings, both in terms of process and contents are well documented to enhance transparency and are distributed to all relevant stakeholders to show appreciation for participating in the process. Formal decisions as a result of step 0) and 1) should be published (and publication should continue each time as decision-making on next steps has taken place).

2.3 Step 2) Develop a shared vision on problems/objectives and alternatives

During its site visit, the Commission gained insight in the existing problems and opportunities in the Salar de Uyuni and its surroundings. The Commission will elaborate further on these problems, objectives and alternatives in chapter 3.

- Based on this first assessment in chapter 3, the Commission **recommends** to decide together with the stakeholders identified in 2.1 and 2.2 whether these are indeed the most important problems, objectives and alternatives the plan has to address.

2.4 Step 3) Consistency analysis

The purpose of this step is to check the consistency of the plan for which the SEA will be undertaken with existing policies, plans and programmes, through interagency co-operation.

This requires an inventory (both public and private) at international, national, regional and local level of a number of development sectors to ensure that plans are compatible with each other.

- The Commission **recommends** that as part of the SEA an overview is made of all plans and programmes of different sectors (eg mining, tourism, environment) that have a link with or set conditions for the 'leading' planning process. An analysis should be made of:

- which policies/plans/programs support the new plan for the Development of South Western Potosí
- which ones have the potential to conflict with the new plan and how these conflicts can be solved (which plans are negotiable and which are not)

3. TOR FOR THE SEA CONTENTS

Steps 1 to 3 have determined the 'leading' planning process. The next step is to define which type of decisions are taken in this planning process. Generally spoken, several levels of strategic decision-making can be distinguished:

- **Why** do something? (Refers to the need and/or purpose, long term objectives)
- **What** to do? (Refers to methods, technologies and capacities)
- **Where** to do it? (Refers to locations on interventions)
- **How** to do it? (Refers to a concrete project design, including possible mitigation and compensation measures)

SEA is applied for the why, what and where questions. These questions will be dealt with in the next paragraphs for the Salar de Uyuni. At the end of each paragraph, the Commission will give ToR (or recommendations) for the information that has to be provided in the SEA. These advisory ToR however should be discussed and fine-tuned with all relevant stakeholders before starting the execution of the SEA (see also 2.2).

3.1 **Why** is development of the South-Western part of Potosí needed?

An area with a relatively poor population combined with a sensitive environment with high natural and geological values asks for careful and well in-

formed planning and decision making. The regional development plan for SW-Potosí will address the development problems and opportunities of the area, mainly related to tourism, mining, nature (and scenery) conservation and social development. The purpose of the SEA for the regional development plan for SW-Potosí would be to identify the most sustainable development scenario.

■ The Commission **recommends** the 'scenario' approach for the SEA. Four scenarios for the long term future development of the region could be developed, each from a different perspective:

- the first one concentrating on economic development (e.g. mining and large scale tourism)
- the second one focussing on maintaining the existing identity of the area (small scale tourism and relatively undisturbed natural values).
- a third one focussing on income generation for local population (social development)
- and a fourth one giving priority to nature conservation

Each of these scenarios can be built up out of several alternatives. The next paragraphs provide options already. These alternative scenarios should be discussed with relevant stakeholders involved during the undertaking of the SEA. The four mentioned scenarios are not necessarily exclusive. It could be possible to combine elements of the four of them into one or two alternative scenarios for decision making.

The SEA should ultimately lead to:

- a comparison of alternatives from an economic, social and environmental viewpoint with the aim of providing guidelines for development of the region (trends, magnitude, potential, feasibility and sustainability of planned developments). In order to compare alternative scenarios, criteria have to be established on beforehand. Use can be made of multi-criteria analysis.
- a transparent planning process, based on quality information including a participative debate on costs and benefits (in terms of economic, environmental, social and cultural arguments).

3.2 **What** are options for the development of SW-Potosí?

Present and future land use and activities in the region are listed below.

- Conservation of the biodiversity and landscapes of the dry Puna ecosystems
- Wildlife utilization, conservation and use of the vicuña for its wool
- Tourism. A type of tourism based on the natural beauty of the Salar and its surroundings. If possible combined with cultural and archaeological phenomena
- Traditional agriculture. Livestock production based on grazing of llama of the natural pastures and the cultivation of mainly quinoa
- Traditional salt extraction of the Salar
- Mining of minerals from the evaporates in the Salar
- Mining of minerals from the area surrounding and outside the Salar (e.g. San Cristóbal)
- Urban settlements

For each of these activities the present situation including potential impacts will be described in brief. The Commission subsequently gives ToR for alternative options to be elaborated in the SEA. The SEA should then try to formulate the most sustainable option per land use/activity, taking into account

zoning (see 3.3). These options can then be combined to several development scenarios as meant under 3.1. In summary:

- first think what is your aim
- then look what you are doing at the moment
- investigate how you could improve present activities/land uses
- and finally making logical combinations that serve different goals ('making money' (scenario 1), 'maintaining what is there' (scenario 2), 'poverty alleviation for local people' (scenario 3) and 'focus on nature' (scenario 4).

Each of these activities (and alternatives) will need infrastructure, energy and water. The Commission will include a description of the current situation for infrastructure, energy and water and provide ToR for alternatives, potentially leading to an integrated planning of these related activities.

3.2.1 Conservation of the biodiversity and landscapes of the dry Puna ecosystems

A study of the WWF/Worldbank gave the Central Andean Dry Puna (see also appendix 9) the highest conservation priority, amongst others because of the small area conserved and the biological distinctiveness. Also the Prefectura de Potosi has identified the Salar de Uyuni as a possible new conservation area.

- Because the area contains good examples of many of the ecosystems of the Central Andean Dry Puna Ecoregion, the Commission **recommends** that the SEA investigates the possibility to select a part of the area for strict conservation through a process of systematic conservation planning. Newly identified areas should complement the Parque Eduardo Avaroa, and together they could be incorporated in an UNESCO Man and Biosphere Reserve. Although the primary objective of the conservation areas is the preservation of the flora and fauna, they could be tourist attractions as well. In the design of the management of the conservation areas, the experiences of the Parque Eduardo Avaroa should be taken into account in terms of the determination of the carrying capacity, design of the tourist circuits, involvement of the local communities and the generation of income/investment.

3.2.2 Wildlife utilization, conservation and use of the vicuña for its wool

The vicuña is a wild relative of the llama and alpaca and is famous for the very high quality of its wool. Since historic times it is killed or caught for this wool. Nowadays it is recognized as a possible wildlife resource, that can be used in a sustainable way: MDS has an initiative for the management of vicuñas for its wool. Because there are still wild populations of vicuñas in the area, their management for wool production could be an alternative to increase the income of the rural population (see appendix 7 for reference).

- The Commission **recommends** that the SEA provides the following information:
 - where does the vicuña still occur ?
 - what is its habitat and which area contains that suitable habitat ?
 - which community is interested in this activity? The vicuña wool probably only gives an economically interesting return when it is processed. So the selected community should have the interest in this aspect also. It could also become part of a small local industry and related to tourism.

3.2.3

Tourism

One of the objectives of tourism development is income generation for the local people, including creation of (direct and indirect) employment. Optimizing the quality of services for tourism could also benefit the quality of life of the people in the area. However, during the site visit, the Commission noticed that the region is not yet prepared to receive an increasing amount of tourists, in terms of infrastructure, hotels of sufficient quality, water, energy and basic services. Moreover, growth in tourism will also generate an increasing pressure on the natural and cultural environment. Environmental/cultural problems that have been reported are:

- insufficient treatment of solid waste and lack of sanitation facilities, both in urban areas as in isolated sites of interest (eg. Isla Inca Huasi)
- spills of gasoline, grease and tires by the cars of tourist companies
- damage to the natural vegetation because cars search new routes each time causing soil erosion
- the tour operators often work without environmental licenses
- local communities do not receive any income from tourist activities
- local communities are not prepared to receive tourists
- Chilean tour operators include Uyuni and the Lagunas in their package, thus not generating income for Bolivia.

Although the Bolivian government has great plans with Uyuni and its surroundings, apparently a solid survey on the carrying capacity of the region (in terms of extensive traffic, damage to flora, fauna and landscape, waste) has not been carried out yet. Other points of attention are price developments of products, social/cultural impacts through mass tourism, influx of traders and opportunity seekers and social impacts thereof.

One of the first requirements in developing tourism is infrastructure to improve access to the area. This requirement coincides with the needs in other development activities like mining (see par. 3.2.9)

■ The Commission **recommends** to undertake as part of the SEA a study into ways to develop sustainable tourism with a planning horizon of 5-10-15 and 20 years. This will include a supply-demand analysis in terms of services, a carrying capacity analysis, regulation for access routes, environmental (and social) guidelines for tour operators, capacity building of local community and income generation through tourist activities to be used for improving services. Local communities should be involved in the SEA process to know their needs for services to improve their quality of life, but also to define their active participation in tourist activities. This could include traditional art crafting (salt, fabric), traditional food, guides, and small hotels based on the history and identity of the region. The SEA should also pay attention to the (upgrade of) the traditional railway network and related facilities as this could be regarded as a tourist attraction as well. Finally, strategies should be developed which include Uyuni and its surroundings in regional, national and international tours.

3.2.4

Traditional agriculture

The Commission got the impression that the area is in general severely overgrazed. If that is the case, it probably creates accelerated erosion, generating high sediment load of the rivers and transport of sediment into the Salar. It also reduces the productivity of the vegetation and therefore the productivity of the livestock, mainly llamas.

- The Commission **recommends** to include in the SEA a study into the grazing management of the natural vegetation, in order to suggest alternatives for improvement.

3.2.5 **Traditional salt extraction of the Salar**

Traditional salt (halita) mining takes place in the area close to the village of Colchani. Its impact on the total Salar is restricted, and the localized mining of salt can attract tourists and allow the continuation of the local industry related to salt. The drying of the salt takes place presently in primitive ovens that use tola (a small native shrub *Baccharis*) as fuel. Although this species is the main component of the natural vegetation in this area, its collection as fuel may have a (local) negative impact.

- The Commission **recommends** that the SEA provides estimates on the quantification of the use of tola as fuel, the impact of its use on the vegetation and suggestions for alternatives (improved ovens, other type of fuel, etc). Other improvements and recommendations to the way of salt mining and salt industry of the Colchani region should be included in the SEA.

3.2.6 **Mining of minerals from the evaporates of the Salar**

The salt lake forms part of a Fiscal Reserve. The Bolivian institute CIRESU is surveying, and dealing with the concessions in the area. Within the Fiscal Reserve area itself, there are currently no concessions. It is not completely clear what the reason for this is, since there are enormous amounts of economical interesting minerals in this area. Apparently, the Bolivian government is planning to start with (international) concessions in this area by 2006.

Apart from the existing mining operations in the Rio Grande delta, where most of the mining is dedicated to Ulexite ($\text{NaCaB}_5\text{O}_6(\text{OH})_6.5(\text{H}_2\text{O})$), large amounts of K, Mg, B, Li and gypsum exist as secondary (placer) deposits within the salt cover of the lake. According to one study (Ostrom, appendix 7), the mineral resources of the first 6 meters are already huge. One deep borehole suggests the existence of more layers of salts (12?) related to older salt lakes (buried by the younger ones). Geophysical analyses of the borehole suggest the continuation of the above-mentioned elements to depth, although the highest concentrations exist in the upper 6 meters. The geological resources of the above-mentioned minerals, including others, such as normal salt, are therefore almost endless. In the restricted area close to the Rio Grande delta, the concentrations are such, that the mineral reserves are huge for all mentioned elements.

Gypsum, which could also be produced in the area, could be a viable mining element for the building industry.

There exists currently interest to extract especially K and B for mostly the Brazilian market. Li is economically very interesting, but the lithium market seems to be controlled by three foreign or international companies on which Bolivia does not have any influence or control.

- The Commission **recommends** to develop alternative options in the SEA concerning (i) the area for mining, (ii) cost effectiveness, (iii) mining techniques:

- i. **Area for mining:** Before making a strategic decision for the mining of the placer deposits in the salt lake, it is recommended to study the source of the deposit. This could lead to the finding of an economical viable primary ore deposit in one of the mountain areas to the south of the salt lake, probably somewhere in the volcanic rocks. The acquired knowledge will lead to a better decision about any mining activity in the area and could lead to a decision not to mine the placer deposits within the salt lake but rather the primary deposits. One or more Universities, either a Bolivian or a Bolivian and foreign University, could carry out such a study.
- ii. **Cost effectiveness:** It is recommended to study the possibility to mine K and B in one operation, making the whole operation more cost effective. Including Li into this operation allows the project to gain substantially more revenues, which can be used to improve the infrastructure, and water and energy supply, much needed when starting such a large mining operation. In fact, when only mining B and K it seems economically more difficult to allow such huge investments. Alternatively, mining the raw materials and transporting these to a city like Oruro for processing seems impossible, given the amounts of raw material to be transported. Adding the valuable Li to the minerals to be exploited can possibly make the difference to allow for the investments. Real calculations to these different opportunities or scenarios should be made, based on world market prices and mineable reserves. Further studies on gypsum production are also recommended. A recommendable tool for such calculations is Mining DSS of the Dutch geological survey (TNO-NITG).
- iii. **Mining techniques:** It is probably only economically viable to refine and purify the ore on-site, as costs to move large quantities by railway or truck will probably be too high. Purifying ore on-site requires the use of environmental pollutants, such as sulfur. Planning and monitoring of these chemical processes are essential, to avoid damage to the environment. The H₂SO₄ plant of the Fuerzas Armadas could be the provider of these chemicals. The SEA should provide information on the above mentioned aspects, including also how the local population can benefit from the mining and processing operations. Since there is general, explainable, resistance against international companies by local people, these people should be involved in the planning process to secure transparency and participation and get their support. A result of the process could include compensation (either in kind or in money) for damage inflicted on the local community.

3.2.7 **Mining of minerals from the area surrounding and outside the Salar**

Some of the surroundings of the salt lake could also be made available for mining activities, including the ones that are already in operation, such as the Ulexite mining in the Rio Grande delta, the metallic primary ore deposits of San Cristóbal, and sulfur mining to the north of the Tunupa Volcano. There are concessions of iron ore mining given to Rio Tinto, a large international company. This suggests the existence of huge iron ore deposits to the south west of the salt lake. Improvement of the infrastructure could also facilitate the start of iron ore and other mining activities in the area, making infrastructure improvements even more viable. In addition, iron ore and other mining activities could facilitate infrastructural improvements.

Concessions for the surroundings are given to many companies. In the Rio Grande delta, concessions are apparently given to more than two organizations, but mining is restricted to two companies, COSSMIL and SOCOMIR.

The Commission is of the opinion that mining techniques, of especially the local Co-operations, should much be improved. Now mining is scattered and unorganized, leaving scars in the landscape. Part of the drying of the Ulexite is done in primitive ovens with yareta (*Azorella compacta*) as fuel. Yareta is a cushion plant with a large underground woody structure. Under these harsh environmental conditions it grows very slow, which means that large specimens are very old (they say up to more than 1000 years). Large scale harvesting of the yareta may have a negative impact.

■ The Commission therefore **recommends** to study in the SEA the present use of yareta and its impact on the population. As little is known about this species a study about the growth and reproduction may be necessary to evaluate the possible damage on its collection.

The mining co-operations should be supported in all their mining activities, including their logistical operations. Attention should be given to the abandonment techniques. Currently, refinement of the Ulexite is restricted to drying of the ore. If it is decided to refine the Ulexite on site, which will boost revenues, potential pollutant chemicals will be used. A planning and monitoring process of the chemical process and waste disposal is essential, to avoid damage to the environment. Again, the H₂SO₄ plant of the "Fuerzas Armadas" could be a provider for these chemicals. For the metallic mineral exploitation in the "San Cristóbal" area, preventing and monitoring the waste disposals into the surrounding rivers is also important, for the same reasons. The SEA should address these issues, again paying attention to local community involvement.

■ The Commission **recommends** that the SEA looks into the possibility that the volcano Tunupa, including the salt lake and surroundings qualify for a UNESCO "GeoPark". This will help the region to get wider attention for the lake, thus probably attracting more tourists. The whole South Western part of the Uyuni area, including the Laguna's Verde and Colorada, could be incorporated into a larger "Man and Biosphere" area (see also 3.2.2) with regions of allowed human activities such as mining and areas of protected status, with respect to ecology, archaeology, geology, etcetera. Of course, the Laguna Verde and Colorada regions are very important for tourism and nature protection, so mining should be prevented in these areas. The "Man and Biosphere" UNESCO status could be combined with the "GeoPark" status, and either possibility further studied.

3.2.8 Urban settlements

The many development opportunities of the area, and the existing plans and projects under preparation will undoubtedly lead to an increase in population. An increasing population requires planned expansion of living quarters, water supply, sewerage, waste disposal, health facilities, schools, etc.

■ The Commission **recommends** that the SEA develops growth scenarios and required basic needs. The impacts of population growth should be described.

3.2.9 Water, energy and infrastructure

The mining activities, especially the refinement of the minerals on site, will require a large amount of energy and water, apart from an improved infrastructure. Also other activities like tourism, and (new) urban settlements will

need these facilities. At the moment only 10.7% of the local population has access to electricity and 38% to drinking water.

Presently, rain and surface waters are restricted, and therefore the water supply is a problem. Studies suggest the existence of some fossil water in aquifers, however the feasibility and sustainability of the use of fossil water in the area should be examined. Alternatively, water could be moved from other areas, such as Potosí or Oruro, but this is costly. Apparently there exists a new technique to extract water from gypsum, developed by a Dutch company (appendix 7 for reference). It is a fairly complicated technique that needs energy to heat the gypsum to at least 60 degrees. This possibility could be further studied, especially since heating of the gypsum can be done by solar or wind energy. If the process is properly operated, not only water is extracted for mining purposes, also high quality building material will result.

Energy supply is currently also a problem. The co-operation in Rio Grande uses a power generator for two hours a day running on diesel. Several alternatives to boost energy supply should be studied. One alternative is to expand the power network from Uyuni to Rio Grande; another is to expand the gas pipeline from Potosí to Uyuni and Rio Grande. Other alternatives are the development of a solar cell plant close to the salt lake, or the use of wind energy by windmills. However, negative environmental effects of these different supplies should be considered and looked at, such as the impact on the landscape when using windmills. In addition, the economic impact of each energy supply source and the technical difficulties for building, and especially maintenance of different techniques must be considered.

Another opportunity is to study the use of geothermal energy. This option is possibly best studied on a country level (and therefore beyond the scope of a regional plan), such that the best places for geothermal energy can be chosen. This will depend on the regional geology and the distance to the customers and regional electrical network. The latter will imply that the energy network should be expanded from Uyuni to Rio Grande, and that geothermal energy plants could be developed in other regions of the country.

The infrastructure is also facing problems at the moment. Close to the Rio Grande delta, COSSMIL is currently improving the road, since it cannot be used during the rainy season. A railway connects Rio Grande with Oruro. An old railway track connecting Rio Grande with Chile seems to exist, but is currently not used and probably not usable. The roads around Uyuni are all unpaved roads, and it is necessary to improve the road system to boost mining and other activities in the area. A first requirement should be the pavement of the Challapata to Uyuni road. This will allow for easier access to the area for both tourism and mining. For the movement of the concentrated B and Li, the railway or trucks can then be used to move it to Oruro and further on. If considering iron ore mining in the area, one could probably consider the upgrading of the railroad to Chile, since iron ore requires large amounts of ore to be moved to a harbor, otherwise large quantities could be moved by railroad to Oruro and further to Puerto Suárez and Brazil.

After the pavement of the Challapata-Uyuni road, increased activities can lead to the decision to start larger mining activities, which can attract the needed investments for the improvement of the energy, water and infrastructure in the area.

- The Commission **recommends** to examine the above mentioned water, energy and infrastructure alternative options in the SEA. An integrated plan combining the above recommendations with the needs in the area of tourism, ecology and of the people living in the area, allows for easier negotiations with private-public institutions for the needed investments. The SEA should indicate, on basis of a demand analysis, which are priorities in terms of location (access routes, entry point on the salt lake) and time planning (all year round, dry and rainy season options). As for infrastructure, the SEA should also set priorities for water and energy.

3.3 **Where** should interventions take place?

Because several of the actual or proposed uses of the area are not compatible with each other, it is thought that the only way to avoid and manage environmental/social and economic problems is to make a zoning for the whole area. In some cases a zone can be a combination, such as wildlife utilization and traditional agricultural. Tourism can be combined with other categories, but it can exist on its own as well. Mining could be restricted to the regions where large amounts of economically interesting deposits of B, K, (Mg) and Li occur, notably the southern part of the salt lake. The idea behind the zoning of the area is: do different things in different parts, giving the guarantee that everything receives its attention without creating negative effects for other activities. For the zoning of (part of) the area it may be useful to consider also the concepts of the Man and Biosphere Reserve or the GeoPark of UNESCO.

- The Commission **recommends** that, as part of the SEA, zoning of the area be developed to allow the formulation of development scenarios/alternatives that contribute maximally to a sustainable undertaking of the diverse economic activities.

4. **INSTITUTIONAL ARRANGEMENTS AND IMPLEMENTATION MODALITIES**

This chapter deals with the next steps of the 9 step SEA: 5) Do the assessment and document it and 6) Organise (independent) quality assurance.

4.1 Step 5) Do the assessment and document it

MDS has funds available for undertaking the SEA. It was agreed that the SEA could best be executed by Bolivian experts, thus generating SEA capacity and experience within the country. These experts should be recruited especially for this SEA but then operating in the offices of the Prefectura de Potosí. Criteria for the selection of experts are knowledge of EIA, preferably in combination with a background in (socio) economy, tourism, mining and nature conservation. The team should be headed by a Bolivian team leader, with basic knowledge of SEA. The tasks of this individual will be managing the SEA office and secretarial support, arranging contacts with relevant stakeholders, preparing monthly progress reports and overseeing and editing SEA report production. The Commission suggests that MDS (Vice ministries of Planning and Natural Resources and Environment) appoint, as owner of the planning process, the SEA process manager, who works closely together with the SEA team leader. This person will be responsible for involvement of all actors and building up mutual understanding for and ownership of the results. Another responsibility would be to watch over the timely availability of SEA results to influence decision making within the planning process. The SEA process

manager is operating within the SEA-unit which is being formed at the moment as part of MDS. The SEA process manager is also involved in the undertaking of the SEA for the Polo de Desarrollo (Sur-este) and thus guarantees a consistent approach.

The Commission also recommends to form a Steering Group for this SEA, in which representatives of the most important stakeholders have a seat (eg. at general directors level from MDS, Vice ministry of Tourism, Mining (CIRESU) and Prefectura de Potosí). This steering group meets once a month to guide the SEA process and review progress. This steering group is especially meant to guarantee the political back-up and support for undertaking this SEA. The SEA team leader and process manager will attend these meetings.

As this SEA pilot is the second of its kind in Bolivia, and as there is very limited SEA experience in the country itself, the Commission recommends to make use of international SEA experience. There are two alternative options. Either contracting an international SEA consultant, with experience in Latin America (and preferably Bolivia) who visits Bolivia regularly to guide and coach the team (eg. a few days each month). This is probably an expensive option. As an alternative to this option, the SEA team leader (and SEA process manager) could travel as and when required to receive coaching and training from an international SEA consultant who acts as a 'sparring partner' on a regular basis, especially focussing on the bottlenecks encountered during the execution of the SEA. The second option would probably contribute better to the objectives of 'training on the job' and capacity building and would to a greater extent enhance ownership of this SEA.

In relation to the accumulation of information for this pilot SEA, the Commission has noticed that there is a considerable amount of information available already, which is a good starting point for the process of gathering base line information (see appendix 7).

The Commission also recommends to open a web-site on this pilot SEA to enhance transparency and participation, but also to enlarge the learning effect (and other possible 'spin-off') of this pilot SEA.

4.2 Step 6) Organise (independent) quality assurance

It is up to MDS, in consultation with key stakeholders to design the undertaking of the SEA, depending on when SEA results have to be available to influence the planning process (see 2.2). On the basis of experience with other SEAs, the Commission is of the opinion that it may take well up to early 2005 to arrange the set-up and management of this SEA. This means that the assessment itself can probably start early 2005. Roughly estimated, the assessment will take 6 months. This however does not mean that quality assurance only takes place at the end of that period. As the process in SEA is just as important as the contents part, the quality assurance can be organised at regular intervals during the undertaking of the SEA, especially as this is a learning process for all parties involved. The Commission is willing to assist in this monitoring of quality assurance if requested by MDS and other key stakeholders.