Mining Activity at the High Colorado River and the Saline Waste Problem

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Abstract

Though not in agreement with geographical reality, the Colorado River is habitually considered as the Patagonia northern boundary. It crosses an arid region shared among five provincial states from Argentina, a fact that has made the river into a very important resource with a delicate hydrological and ecological balance. Its salinity is nowadays a decisive factor for its agricultural use, and a strict limit – expressed in electrical conductance - of nearly 1,8 microsiemens has been fixed by law. In 2003, Río Tinto company bought the operation of a potassium mine located on the left margin of the high Colorado River, near the Andes. Exploitation of the potassium creates a waste problem. Mining is performed by means of hot water injection into deep layers (more than 1000 m), mining a product of which approximately half is common salt.

The company suggests waste storage near the mine, in the form of salt piles approximately 40 meters high. The salt storage location is 5 km from the river, 300 meters higher relative to it, and bordered by two big "dry rivers". The authorities fear that, due to eolian pollution (it is a zone of strong and frequent winds) or due to some of the violent storms typical in this arid region, salts may reach the river course and create an alteration or an ecological disaster downstream. Another negative possibility is that because of the piles' considerable weight, the floor may yield, causing infiltration that would reach the river valley.

The problem can be fully appreciated if this waste disposal is projected in space and time: after thirty years of exploitation, more than 200 hectares would be covered by salt. The basin authority has proposed salt re-injection as the safest solution, but the company has not so far accepted this, and an uncertain situation has arisen.

The mining implementation – not yet authorized - would create a remarkable economic reactivation in the region, but outdoor salt accumulation would cause a big potential risk for downstream cultivation that is constantly growing and projected to triple the surface presently irrigated.

Key words: river; Colorado; potassium; salts; reinjection; salinity; cultives.

Introduction

During the 1990's, laws highly favourable to capital development were enacted and brought in to Argentina many mining investments from transnational companies. Since these laws did not consider ecological aspects, serious problems have arisen in different parts of the country. A clear example of this is the installation of a potassium mine in Mendoza province, Malargüe department, next to the Colorado River high valley. This enterprise, once fully operational, would position the country as the fifth-ranked potassium producer worldwide, but would simultaneously unleash a pollution risk that would increase with time.

Methods.

The Colorado River in Argentina is habitually considered as the northern boundary of Patagonia, although this does not entirely fit with the geographical definition that extends the region 100 km further north. The river is approximately 1000 km long from its springs in the Andes mountain range to its mouth in the Atlantic Ocean. It has an average flow of 147 m^3/s where it exits the range, having no tributaries but being almost entirely snow-fed. Along its route, the river crosses a very arid region that comprises parts of five Argentinian provinces, where it can be used in several ways.

This multiple-use potential (population water supply, agriculture, energy production and, mainly, integration of the country by cutting the desert) has led to a harmonic use agreement signed between the five provinces and the nation, by means of which the first Argentinian Basin Organization was founded, one of the first such in South America.

The agreement is based on a river salinity limit fixed by law at 1,8 microsiemens of electrical conductance at the entry of the last irrigated zone, beyond which cultivation becomes impossible and uneconomic. Through this method, all the water-dependent activity is based on flow use that maintains the above-mentioned value. The water salinity is constantly monitored, and any change detected, whatever its origin, activates an alarm system.

At the time of writing, the problem of implementation of the potassium mine involves four aspects: **a**) high energy consumption needed by the extraction; **b**) saline waste due to the exploitation; **c**) waste volume and storage placement and **d**) difficulty and ecological risk in transporting the product to the loading port.

a) For the proper operation of the mine, Rio Tinto needs large amounts of energy – from gas and electricity – in the long term. Due to various circumstances, gas and electricity in Argentina have become scarce. The company estimates a yearly gas consumption of approximately 367 million -- an amount equivalent to the commercial, residencial and official consumption of the whole of Mendoza province, where the deposit is located. Such consumption would generate a daily heat emission of nearly nine thousand million kilocalories, capable of altering the environment.

As regards electricity, the requirement would be 78 MW, also a quite significant number for a country whose sources cannot cope with the demand.

Also, as part of the exploitation process, the mine will use 31 thousand Hm^3 of water extracted from influent reaches of the Colorado River, a volume that would then be lost for any other further use.

b) Extraction of the potassium from underground strata at approximately 1200 m depth will be performed through the hot water injection method (80 C), that will dissolve the mineral which will then pumped up to the surface as a mixture of water, potassium and waste. This process will certainly cause cave formation at the bottom as the extraction progresses.

Followng refinement of the mineral, it is estimated that for each ton of potassium produced some 1,1 tons of sodium chloride will be left behind. This salt will be stored on a site in the river valley. From 40 years of mining, an estimated volume of 83 million m^3 of sodium chloride will accumulate on a 210 ha surface covered with salt piles with heights up to 50 metres. It is estimated that the constant flow of wet mass will get compacted until a thick crust forms naturally, encasing the material and preventing its erosion.

c) The storage site is located approximately 4 km from the river, at an elevation of nearly 140 m relative to the river's bank. These values result in an average slope of 3 to 4 per cent, which very steep for any water drainage. Near the storage site there is a "dry river" feature capable of being activated with large, violent flows during seasonal storms with intense rainfall.

The main fears are as follows:

1.- Violent peak rainstorms will overcome the planned barriers and reach the "dry river" and through this the Colorado River.

2.- Wind erosion in this region of very strong frequent winds will disturb the constantly deposited waste flows, causing salt deposition on the fluvial valley surface.

3.- The plastic sheet barriers that protect the deposit's bottom and edges will yield to the accumulated high pressure of the salt, and as a result infiltration will occur that will be difficult to detect initially and will have unpredictable consequences.

d) The mining company has decided that the mineral will be transported by truck to a train terminal and thence by special trains to the loading port of Bahía Blanca, located 700 km from the mine source. The trucks' frequency and weight - 40 tons per unit - have led to refusal of this traffic through urban centres and on important routes for the local economy (irrigation, agriculture, and tourism). In addition, the estimated train traffic every 40 minutes in the major Black River fluvial valley, an area of intensive cultivation, will cause major town-planning problems.

Conclusion

The Colorado River basin organization (COIRCO) as well as ecological and governmental organizations from the provinces through which the river runs have categorically rejected the possibility of outdoor salt storage, asking instead for the reinjection of salt into the caves caused by the extraction. The company has not accepted this option, agreeing only to a very low reinjection percentage. Another option, storage on areas from which drainage does not go into the river valley (such as old volcanic craters) has not so far been considered.

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