

Environmental impact assessment of illegal gold mining in the Amazon region

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Problem

Intensive gold exploration activities started in Brazil in the 1980s in the Amazon region. Ever since that time, awareness of the dangers of environmental contamination posed by the disposal of the metallic mercury used for the extraction of gold by amalgamation has been increasing among the general public and the authorities [1]. It is estimated that around 2000 t of mercury have been released in the Amazon in the last 20 years as a consequence of these mining activities. Several studies have been conducted by researchers from Brazil and other countries of the environmental impact of mercury pollution in the Amazon basin and of the health effects on the riverine populations, but much work remains to be done. On the basis of a comprehensive evaluation of many published scientific papers concerning the presence of mercury in several compartments of the Amazon region, it can be concluded that, instead of acute signs of contamination, the main impact of the gold mining activities will be to increase the general background of mercury in the soils, sediments and biota of the region, with long term consequences for the local population and for the fauna that are not yet known.

Why nuclear analytical techniques?

In the framework of a project developed in the Radiochemistry Division of the Instituto de Pesquisas Energéticas e Nucleares, Brazilian Nuclear Energy Commission (IPEN/CNEN-SP), and with support from the IAEA, a nuclear analytical technique, instrumental neutron activation analysis (INAA), was applied to the study of mercury contamination in Brazilian Indian populations living in the Xingu Park Indian Reservation, located in the Amazon region. Hair samples from the Indians and from a control population were analysed for total mercury, and very high concentrations of mercury were found in the Indians, with means of up to about 20 times that of the control population [2, 3]. The advantage of



INAA is that this method is non-destructive, avoids the need for chemical treatment of the samples, and is very accurate and sensitive, allowing determination of many other elements, such as aluminium, antimony, arsenic, cadmium, chromium and selenium, in these hair samples [4].

**How to
solve the
problem?**

Following this work on analysis of hair samples of Brazilian Indians, where the application of a nuclear technique allowed the analysis of mercury in about 400 samples, it is necessary to make a more complete study of this area, analysing samples of fish and other foodstuffs consumed by the Indians, as well as soils and sediments of the region, in order to assess the sources of contamination. In this project the hair samples of the Indians have also been analysed for methylmercury, a very toxic compound of mercury that is able to pass through biological barriers like the placenta and cause severe damage to the nervous system of the foetus. With the collaboration of the Jožef Stefan Institute, Ljubljana, Slovenia, methylmercury was analysed in many of the hair samples using another technique, cold vapour atomic absorption spectroscopy, and it was concluded that most of the mercury in the hair was present as methylmercury. It is already known that the most probable source of methylmercury for humans is fish, owing to the fact that fish can concentrate methylmercury to very high levels. Since the Amazon Indians consume fish on a daily basis, this could be the reason for the presence of very high

amounts of mercury in their hair and also in their blood, as shown by other studies.

This project will continue, with analysis of fish samples from the region of the Xingu Park, as well as of soils and sediments, in order to better understand the cycle of mercury in this region. INAA will be utilized throughout the project.

References

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