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Perspective

Radioactive Contamination of the Environment in Abandoned Metallic Mines

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INTRODUCTION

In the 19th and 20th centuries, metal mining played a significant role in the extremadura region. But the vast majority of mines closed for various reasons, leaving many abandoned mining sites, the bulk of which had waste dumps on the premises. Metal extraction is regarded as a NORM activity even though it is not radioactive in and of itself. Three previous mining sites that extracted Pb-Ag, Pb-V-Zn-Ag and Pb-Zn were chosen for this study in order to evaluate the radiological influence on the environment and population. By figuring out the effective dosage and creating detailed isodose maps of the location, the external γ exposure was estimated. The effective dose over the surrounding background was elevated by the mining sites up to 0.41 mSv/y, which is less than the reference value of 1 mSv/y.

There was only one mining site where waste dumps had higher levels of uranium and radium activity than the nearby soil. In the absence of NORM activity, the soil to plant (wild grass) transfer factors matched other published values. Thus, no increased radionuclide transfer was noted. Using the tiered method created in the ERICA tool, the risk to non-human biota was used to evaluate the radiological impact on the environment. In the most cautious tier 1, the total risk quotient of all radionuclides under consideration was less than 1. Using tier 3, total dose rates were computed for a number of terrestrial Reference Animals and Plants (RAPs), yielding values less than 40 µGy/h. As such, the effect on non-human biota may be regarded as insignificant.

DESCRIPTION

Spain has always been a centre of metal mining, though the industry had a significant growth in the latter part of the 19th and early 20th centuries. But as of right now, the great majority of mines that were involved in the extraction of heavy metals like Cu, Ni, Zn, Pb, Ag, Fe, Sn, W have stopped operations for various reasons (such as the depletion or starvation of ore veins, changes in metal prices, etc.). It is easy to see how much of the metal mining industry in the extremadura region of Spain was shut down in the 21st century. Compared to more than 500 abandoned metal mines, extremadura had four inactive and one active metal mine as of 2008. The massive explosion of metal mining in Spain throughout the last century has left an unavoidable "legacy" of vast garbage dumps that remain to this day and the remains of buildings constructed to support the industry.

Old mining operations' leftovers, many of which have accumulated heavy metals in varying quantities and with varying degrees of mobility and/or availability, make up these waste dumps. It should be highlighted that many of these trash dumps were abandoned during a period and under laws when the safeguards in place to lessen their effects on the general public and the environment were obviously subpar compared to what is needed today. Due to this, neighbouring environments may become contaminated with heavy metals and other harmful chemicals like arsenic from abandoned metal mines and their waste dumps.

While the extraction of radioactive materials is not the primary goal of metal mining, the work activities involved in the process include handling, storing and producing waste that is not typically classified as radioactive but nevertheless contains naturally occurring radionuclides that could significantly increase worker and when appropriate, public exposure.

The impact of metal mining within the so-called NORM (Naturally occurring radioactive material) sectors is compiled globally in compilations like the IAEA's TRS419 (International Atomic Energy Agency) (IAEA, 2003). With the exception of uranium, virtually little information regarding the existence of naturally occurring radionuclides connected to the metal mining is found in the scientific

literature on a worldwide scale. According to another research, there was an increase in the concentration of naturally occurring radionuclides, primarily radium and uranium, in gold mine waste dumps compared to control regions. Uranium can be viewed as a by-product of gold mining, with low quality uranium ores (0.1%) being recovered as opposed to commercial grade (0.3-6%).

The usage of acid drainage results in a rise in uranium leachate from waste dumps. The leachate's transportation is dependent upon the various uranium species present, with U(VI) being mobile and U(IV) immobile, as well as the oxidation and reduction processes of Fe. The concentration of these radionuclides in the water bodies near the mining sites may increase as a result of their increased mobility. Increased uranium and thorium concentrations have also been recorded in waste dumps from other types of metallic mining, such as Sn or Ni.

CONCLUSION

By calculating the effective dose rate from external irradiation and creating isodose maps, the radiological impact on the population was evaluated. In order to ascertain the activity concentration and evaluate the radionuclide transfer from soil to plants, samples of wild grass and soil were also gathered. Since these mines are now abandoned, their structures are in ruins and there are no publically accessible underground amenities, the inhalation pathway was deemed insignificant. Thus, exposure from radon inhalation was likewise regarded as minimal. Since the mining locations contained no edible crops, the ingestion pathway was thus deemed insignificant. Since there was no body of water nearby, there was little thought given to interacting with it.