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Short Communication

# Impact of tailings on environments: Example of elemental transfers from spoil tips in the North of the France

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## ABSTRACT

The North of the France was the scene of an active past coal mining activity, whose wastes form about 300 spoil tips. Although these materials are considered as sterile, spoil tips are colonized by pioneer species, which contribute to the weathering of parent geological material and the formation of a neo-soil. Due to their composition and weathering processes, spoil tips – and neo-soils on its - can be at the origin of elemental transfers in the environment (pollutants as trace elements, sulfur, organic compounds. These transfers must be strongly understood and quantified to manage spoil tips and minimize their impacts.

To qualify the spoil tip/environment interactions, we have characterized the parent geological material and alteration processes, we have studied the neo-soil and its role in elemental transfers, and we have determined transfers, through field measurements and laboratory leaching tests. We selected one spoil tip made of black schists (quartz, clays, pyrites, oxides, coal residues), partially covered by a forest at the origin of a neo-soil, and surrounded by ponds. The spoil tip shows an unexpected neo-soil including three distinct horizons, corresponding to different degrees of parent material weathering (variation of mineralogy and oxidation state) and of organic matter incorporation. The mineralogical characterization (XRD, SEM, TEM) shows a S-rich alteration front at the schist surface, coupled to mineralogical transformations, and the formation of jarosite and Fe-oxides.

Ponds at the bottom of this spoil tip present various chemical and biological characteristics. Especially, the heavy metal concentrations measured in pond water are very variable from one pond to another. These analyses coupled to lixiviation test from each neo-soil horizon allow quantifying elemental transfers from black schist spoil tip and informing about the extent of the area of spoil tip influence.

## INTRODUCTION

Mining has been one of the key sectors for industrialisation of the world for centuries. As the mining activities enlarge, the amount of waste materials readily increases. Storage of waste materials or tailings disposal has become a serious matter for the mining industry due to its enlargement especially for the last 30 years. During the beneficiation of valuable metals and industrial minerals from their ores, large volumes of waste materials or tailings may be produced and these tailings may be harmful to the environment. It is now necessary to design and build tailings dams to store these waste materials for the modern mining industry. In this paper, the tailings dams and their possible environmental impacts are investigated by considering the design parameters, the possible dam failures and the stabilisation of the waste materials. On a global scale demand for the products of the extractive industries is ever increasing. Extraction of the targeted resource results in the concurrent production of a significant volume of waste material, including tailings, which are mixtures of crushed rock and processing fluids from mills, washeries or concentrators that remain after the extraction of economic metals, minerals, mineral fuels or coal. The volume of tailings is normally far in excess of the liberated resource, and the tailings often contain potentially hazardous contaminants. A priority for a reasonable and responsible mining organization must be to proactively isolate the tailings so as to forestall them from entering groundwaters, rivers, lakes and the wind. There is ample evidence that, should such tailings enter these environments they may contaminate food chains and drinking water. Furthermore, the tailings undergo physical and chemical change after they have been deposited. The chemical changes are most often a function of exposure to atmospheric oxidation and tends to make previously, perhaps safely held contaminants mobile and available. If the tailings are stored under water, contact with the atmosphere is substantially reduced, thereby forestalling oxygen-mediated chemical change. It is therefore accepted practice for tailings to be stored in isolated impoundments under water and behind dams. However, these dams frequently fail, releasing enormous quantities of tailings into river catchments. These accidents pose a serious threat to animal and human health and are of concern for extractive industries and the wider community. It is therefore of importance to understand the nature of the material held within these dams, what best safety practice is for these structures and, should the worst happen, what adverse effects such accidents might have on the wider environment

and how these might be mitigated. This paper reviews these factors, covering the characteristics, types and magnitudes, environmental impacts, and remediation of mine tailings dam failures.

## Conclusion:

Environmental impacts of mining can occur at local, regional, and global scales through direct and indirect mining practices. Impacts can result in erosion, sinkholes, loss of biodiversity, or the contamination of soil, groundwater, and surface water by the chemicals emitted from mining processes. These processes also have an impact on the atmosphere from the emissions of carbon which have effect on the quality of human health and biodiversity. Some mining methods may have such significant environmental and public health effects that mining companies in some countries are required to follow strict environmental and rehabilitation codes to ensure that the mined area returns to its original state. With open cast mining the overburden, which may be covered in forest, must be removed before the mining can commence. Although the deforestation due to mining may be small compared to the total amount it may lead to species extinction if there is a high level of local endemism. The lifecycle of mining coal is one of the filthiest cycles that causes deforestation due to the amount of toxins, and heavy metals that are released soil and water environment. Although the effects of coal mining take a long time to impact the environment the burning of coals and fires which can burn up to decades can release flying ash and increase the greenhouse gasses. Specifically strip mining that can destroy landscapes, forests, and wildlife habitats that are near the sites. Trees, plants and topsoil are cleared from the mining area and this can lead to destruction of agricultural land. Furthermore, when rainfall occurs the ashes and other materials are washed into streams that can hurt fish. These impacts can still occur after the mining site is completed which disturbs the presences of the land and restoration of the deforestation takes longer than usual because the quality of the land is degraded.