Extended Abstract Journal of Coastal Zone Management 2019

Vol.22 No.2

Climate Change 2019: Recycling coal combustion by-products for mine site rehabilitation- Mehdi Azadi- The University of Queensland

Mehdi Azadi

The University of Queensland, Australia

The rehabilitation and closure of mines is often impeded by the presence of mine wastes (spoils, rejects, tailings) with undesirable chemical and physical properties that increase the risks of acid and metalliferous drainage, spontaneous combustion, salinity, dust generation, and erosion. At the same time, the various types of coal combustion by-products from power stations have unique chemical and physical properties such as an alkaline nature, pozzolanic binding effects, high water holding capacity, and particle size distributions which can be beneficial for mine rehabilitation. Many of the coal-fired power stations are located in close proximity to mines. The relatively short distance of coal mines and the power stations reduces the cost of coal transport. It also provides the opportunity to transport coal ash back to the mines at a low cost for the rehabilitation applications, including i) encapsulation and coating of the reactive materials (to prevent acid mine drainage and spontaneous combustion), ii) replacing of some of the costly soil amendment chemicals, iii) backfilling and stabilising final voids and underground workings, and iv) treatment of contaminated water. Our research aims to assess the effectiveness of the technology for improving physical and geochemical stability of mine wastes, and reducing any residual risks after mine closure, by testing the scenarios in which coal ash is reused.

In some circumstances and in some applications coal combustion by-products (CCBs) generated from coal-fired power plants was considered as alternatives for natural materials. This review focussed on the use of CCBs for mining sites. The alkaline pH of CCBs has been shown to play a neutralizing role in acid mine drainage and the consequent precipitation of metals, mainly as metal hydroxides, from solution. Coal combustion by-products have also been used for soil restoration, showing that one or more of the physical, chemical and biological properties of degraded soils have been improved, which in turn has led to improved revegetation results. Furthermore, fly ash has been used as one of the materials in engineered covers built to encapsulate and isolate potentially hazardous mine waste. The use of CCBs for mine void backfilling was seen as an opportunity for the use of CCBs in bulk. Backfilling of underground mine vacuums with these materials offers the potential to reduce acid mine drainage, reduce the risk of land subsidence and minimize and control mine fire probability. While proactive use of CCBs can eliminate or minimize the remaining environmental burden if separate storage or disposal of such otherwise 'waste' materials is needed, adverse side effects can occur as a result of these uses of CCBs, such as leaching of deleterious elements.

Thus, in the case of their use in mine backfilling, for example, possible environmental impacts must be assessed and monitored in the context of other variables during a test phase and used on a large scale before re-filling with such materials. There is still a lack of well-researched information on the practical use of CCBs and their potential environmental and health impacts, and effective guidelines and regulations are also limiting factors in their use for mine rehabilitation purposes Government regulations in most countries consider CCBs a waste but not a hazardous waste. However, given the high potential of CCBs in a number of roles and functions related to mine rehabilitation and mine closure, there is a need for more practical research and more government engagement. With the continued use of coal to generate electricity for the world's power needs, coal combustion by-products (CCPs) will be produced in greater quantities during the ensuing decades. About 130 million tons of CCPs are produced annually from the 600 coal-fired power plants currently operating in the USA, with estimates of 500 million tons produced worldwide. Five major types of CCPs exist: bottom ash; boiler slag; fly ash; fluidized bed ash; flue gas desulfurization ash. Bottom ash does not generally constitute a disposal problem because it is extensively used as aggregate fill material for construction projects, filler in construction materials (wall board and dry wall) and de-icing solids for roads. Boiler slag is used for similar purposes as bottom ash, but it can be used as a glassy grit material for sand blasting. Fly ashes constitute 70% of the by-products generated and these ashes are produced in several ways in a power plant depending on the boiler type and the emission control system employed at the power plant. These fine-textured ash materials may be dry fly ash from conventional coal-fired boilers, dry ashes collected in flue-gas desulfurization or other collection devices (bag houses or scrubber filters), or they may be collected in wet scrubber systems producing a fly ash slurry.

The use of CCBs for mine void backfilling has been seen as an opportunity for the use of CCBs in bulk. Backfilling of underground mine vacuums with such materials has the ability to reduce acid mine drainage, reduce the risk of land subsidence and mitigate and monitor the possibility of fire at mine. While the proactive use of CCBs can eliminate or reduce the remaining environmental burden if separate storage or disposal of these otherwise 'waste' materials is required, adverse side effects such as the leaching of deleterious elements may occur. Thus, in the case of their use in mine backfilling, for example, possible environmental impacts must be assessed and monitored in the context of other variables during a test phase and used on a large scale before re-filling with such materials.

This work is partly presented 6th World Conference on Climate Change September 02-03, 2019 held at Berlin, Germany

There is still a lack of well-researched information on the practical use of CCBs, and their potential environmental and health effects, and in their use for mine site rehabilitation purposes, effective guidelines and regulations are also limiting factors. Government regulations in most countries consider CCBs a waste but not a hazardous waste. However, given the high potential of CCBs in a number of roles and functions related to mine rehabilitation and mine closure, there is a need for more practical research and more government engagement.