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ScienceDirect

Procedia Technology 22 (2016) 440 – 444

Procedia Technology

9th International Conference Interdisciplinarity in Engineering, INTER-ENG 2015, 8-9 October 2015, Tirgu-Mures, Romania

A Performant State-of-Art Tool to Assess Cross-Border Impact of Industrial Activities. A Transboundary Air Pollution Case Study.

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Abstract

The paper focus is on the air pollution episode generated by a closed mining tailings dump located on Danube banks in historical Banat region, between Romania and Serbia. In this paper a new generation Gaussian plume air dispersion model was used, based on the hypothesis that the atmospheric boundary layer properties are characterized by the boundary layer depth and the Monin-Obukhov length rather than in terms of the single parameter Pasquill-Gifford class. The case-study focuses on a sensible case of Romania-Serbia cross-border case generated by the lack of maintenance of a closed mining tailings dump and the evaluation of an area type pollution source on the surrounding environment.

Peer-review under responsibility of the "Petru Maior" University of Tirgu Mures, Faculty of Engineering

Keywords: Air pollution; ADMS 5; Monin-Obukhov length; cross-border air pollution; air quality modeling.

1. Introduction

Models have become a primary tool for air quality analysis in most air quality assessments mainly for the several reasons, mainly because an assessment of the air quality in a large area can be obtained, while the air quality measurements are restricted to limited spatial coverage. The impact of emissions on air quality can be revealed by modelling, a very important aspect for supporting air quality management. Models and model applications can be distinguished on the basis of many criteria, such as the temporal and spatial scale, type of source, type of component,

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Peer-review under responsibility of the "Petru Maior" University of Tirgu Mures, Faculty of Engineering
doi:10.1016/j.protcy.2016.01.082

a.o. The most relevant are the macro-, micro- and mesoscale models, describing the dispersion and transport of air pollutants mainly on a spatial scale, but also temporal, transport equation, chemistry, a.o. sub-model are included.
Mining industry is a major atmospheric, soil and water polluter due to its specific effects: massive landscape modifications, large areas of land occupied by mining facilities, ground and underground waters chemical pollution, soil pollution, negative impact on local flora and fauna, a.m. Today we assist at a different and more dangerous new environmental risks caused by an increasing volumes of sterile dumps and, more dramatically, closed mining tailings dumps left unattended after closing of mining companies due to mineral deposits depletions. In 2006, the flotation tailing sterile material exceeded in Romania 5 million tones and the volume of polluted water discharged in receiving rivers, at national level, exceeded 50 million m^3. [1] The copper mining in Moldova-Noua was one of the oldest in Romania, with an historical sources dating before Roman Empire. However, the intensive industrialization of the copper mining in Moldova-Noua started in 1970 – 1980, being the largest copper exploitation, at its time, in Romania. The Moldomin, Moldova-Noua flotation tailing dumps covers 130 hectares in 3 tailing dumps with an average heights of 22 meters and a total content of sterile sands of approximately 30 million m^3. The technology used to fix the flotation sterile sands in the tailing dumps was a simple one, just a coverage of tailing dumps with a layer of water, constantly supplied on the dump surface. Starting with 2009, when the Moldomin Mining Company has been declared insolvent and its production stopped, the water supply to cover the flotation tailing dumps was also stopped. In this conditions, the main flotation tailing dump, no.3 with a surface of 86 hectares, dry out completely exposing the sterile sands to environmental elements. A view of the effect of closing and drying the Moldomin tailing pond (also named Bosneag) is presented in figure 1.

Fig. 1. (a) A view of closed Moldomin mining company flotation tailing dump no.3, in windy conditions.

The environmental situation caused by the Moldova-Noua tailing pond drying and lack of maintenance is well known and in October 2012 the European Commission opened the infringement proceedings against Romania. Romanian government agreed that the tailing pond is a source of pollution during windy periods and recognized the need for actions to solve the environmental problem. However, as the tailing pond remained in a state of almost complete abandonment, in 2014 the European Commission take Romania to Court for a failure to comply with EU legislation on mining wastes. [2]

The environmental impact of the copper mining wastes tailing ponds in Moldova-Noua are of significant concern as it affect not only the Romanian city of Moldova-Noua and nearby villages, but also the touristic city of Veliko Gradiste, in Serbia, giving the pollution phenomena an cross-border character.

2. Research problem and applied method

When it comes to PM10 (airborne particles with an equivalent diameter under 10 µg) worldwide, three techniques are mainly used to establish a PM10 emission factor for a specific site:

- A division of source activity in specific source components (e.g. wind erosion, included industrial roads) and then the available emission factors for each component are combined into a single emission factor for the entire source;
- The development of a new emission factor from applicable related factors and specific data;