

# Mine Closure 2018

## Proceedings of the 12th International Conference on Mine Closure

(Digital Version)

**3 – 7 September 2018, Leipzig, Germany**

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Cover design: Medienzentrum of Technical University Bergakademie Freiberg

Cover photos: Copyright LMBV photographer Peter Radke and  
TU Bergakademie Freiberg, André Simon

Production team: Juliane Günther, Stefanie Walter, Carsten Drebenstedt and André Simon,  
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Digital version (29.08.2018)

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## Review

The dedicated efforts of the peer reviewers have resulted in the high quality of the technical programme and the papers compiled for this publication. The editors thank the technical reviewers (page 6) who contributed their time and expertise as reviewers of manuscripts for the proceedings of the 12th International Conference on Mine Closure held in Leipzig, Germany. A technical and critical review of most paper was undertaken by a minimum of two reviewers for the production of this volume.

# Preface

The Bergakademie Freiberg, as the host of the Mine Closure 2018 in Leipzig, is pleased to welcome many experts from authorities, planning companies, universities as well as companies active in mining and reclamation. In addition to the presentations and posters, the conference presents numerous opportunities for professional exchange and insights into successful mining and reclamation in Germany. Our conference themes are:

1. Legal, financial, socio-economical and organizational aspects
2. Planning, modelling and monitoring
3. Case studies for mine closure
4. Mine closure and mining infrastructure
5. Mine flooding, balancing of groundwater deficits and pit lakes
6. Hydrogeochemistry, acid mine drainage and treatments
7. Geotechnical aspects
8. Biodiversity and ecological aspects
9. Handling of contamination and soil formation
10. Aftercare, marketing, reorganization of land, geotourism

Past International Conferences on Mine Closure were held:

2006	1st Seminar	13-15 September 2006	Perth	Australia
2007	2nd Seminar	16-19 October 2007	Santiago	Chile
2008	3rd Seminar	14-17 October 2008	Johannesburg	South Africa
2009	4th Conference	9-11 September 2009	Perth	Australia
2010	5th Conference	23-26 November 2010	Viña del Mar	Chile
2011	6th Conference	18-21 September 2011	Alberta	Canada
2012	7th Conference	25-27 September 2012	Brisbane	Australia
2013	8th Conference	18-20 September 2013	Cornwall	England
2014	9th Conference	1-3 October 2014	Johannesburg	South Africa
2015	10th Conference	1-3 June 2015	Vancouver	Canada
2016	11th Conference	15-17 March 2016	Perth	Australia
<b>2018</b>	<b>12th Conference</b>	<b>3-7 September 2018</b>	<b>Leipzig</b>	<b>Germany</b>

With kind regards and Glückauf!

**Professor Carsten Drebenstedt**  
Professor of Surface Mining  
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# Long-term Effects of Trace Element Contamination and Tree Species on Soil Microbial Biomass and Enzyme Activities

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## Abstract

*Phytostabilisation technology in post-closure metal-mine industry may be a feasible reclamation solution to avoid the transfer of trace elements to adjacent systems and to provide long-term benefits increasing the functionality of the reclaimed ecosystem. In a contaminated and remediated area in SW Spain, we determined the long-term effects of different tree species on soil functionality. After the Aznalcóllar mine-spill, a large-scale phytostabilisation plan was launched including sludge and soil removal, amendment addition and native tree species afforestation. We selected two areas in the Guadiamar Green Corridor, the North and South fields, due to their different soil properties and contamination levels. Both fields were affected by the spill and were afforested by a mixed plantation pattern with specimens of the same age. Three native tree species were selected for this study: white poplar (*Populus alba*), stone pine (*Pinus pinea*) and wild olive (*Olea europaea*), and compared with adjacent treeless areas.*

*Nineteen years after the phytostabilisation implementation, we measured soil physical-chemical parameters and available and total trace element concentrations. For functional measurements, we analysed the microbial biomass C and N as well as a varied enzyme activities to measure the hydrolysis of assimilated products of C, N and P. A long-term marked contamination effect was still significant along the Guadiamar Green Corridor. The North field, closer to the mine tailings, presented contamination concentrations above the Lower Guideline Values for total As, Cu, Pb and Zn. Tree afforestation was found to be positive for the increase of soil fertility and microbial biomass on trace element contaminated soils. The studied tree species were found to affect differently the soil chemistry and microbial communities. White poplar and stone pine were the tree species with the greatest effects on soil. Soils under white poplar presented less acidification and more N content, while soils under stone pine were acidified and presented the highest C:N ratio. Regarding microbial biomass, stone pine was found to reduce the biomass growth. Regarding enzyme activities, tree species had different effects depending on the specific enzyme; however soil acidification and contamination were the main factors affecting them. In conclusion, our study demonstrates the importance of properly planning the post-closure reclamation according to the nature of the mining activity and the local conditions and properties of the mine location. When phytostabilisation technology is selected, the effects of tree species should be taken into account to improve reclamation success and develop a self-sustaining ecosystem.*

**Keywords:** *Aznalcóllar mine-spill, functional ecosystem, phytostabilisation, post-closure, species-specific effect*