ERDENET COPPER-MOLYBDENUM MINE AND MILL COMPLEX: AN INTRODUCTION CONTAINNG AERIAL IMAGERY AND SELECTIONS FROM RECENT TECHNICAL LITERATURE -

A BRIEFING PAPER COMPILED FOR INTERNATIONAL MINING AND THE ENVIRONMENT EXCHANGE PROGRAM – AUGUST 2014

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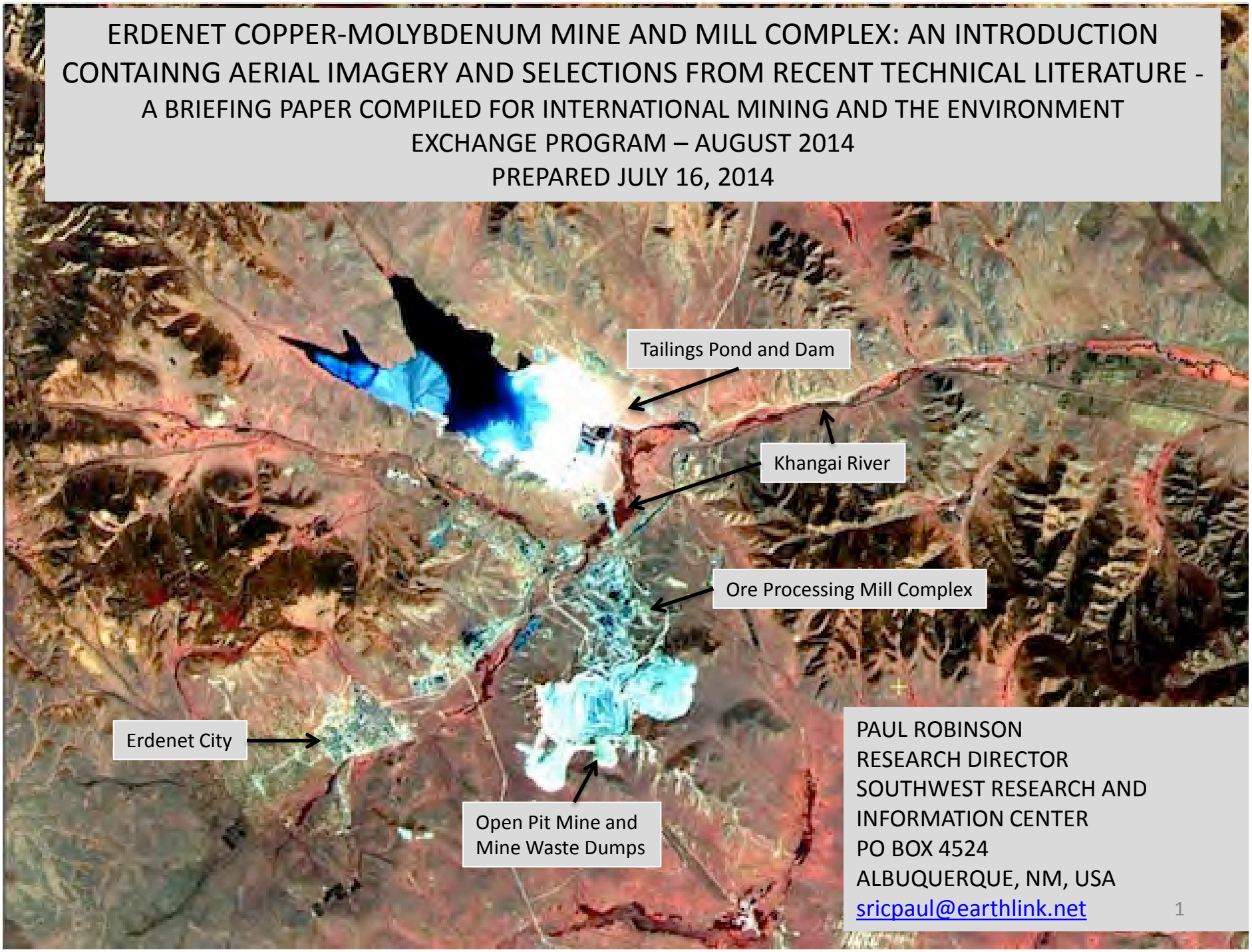

PAUL ROBINSON
RESEARCH DIRECTOR
SOUTHWEST RESEARCH AND INFORMATION CENTER
PO BOX 4524
ALBUQUERQUE, NM, USA
sricpaul@earthlink.net

Erdenet Mine and Mill Complex Overview 2014

Erdenet Mine and Mill Complex Overview

2003

2014

“Contamination of water and soil by the Erdenet copper–molybdenum mine in Mongolia,” 2014

Batbold Battogtokh, Jae M. Lee, Nam Woo,

Environ Earth Sci (2014) 71:3363–3374

Available at http://link.springer.com/article/10.1007%2Fs12665-013-2727-y and http://bk21eaa.yonsei.ac.kr/res_paper/1201

Abstract

As one of the largest copper–molybdenum (Cu–Mo) mines in the world, the Erdenet Mine in Mongolia has been active since 1978 and is expected to continue operations for at least another 30 years.

In this study, the potential impacts of mining activities on the soil and water environments have been evaluated. Water samples showed high concentrations of sulfate, calcium, magnesium, molybdenum, and arsenic, and high pH values in the order of high to low as follows: tailing water > Khangal River > groundwater.

Statistical analysis and the [change in] H^2 and O^{18} values of water samples indicate that the tailing water directly affects the stream water and indirectly affects groundwater through recharge processes.

Soil and stream sediments are highly contaminated with Cu and Mo, which are major elements of ore minerals. Based on the contamination factor (CF), the pollution load index (PLI), and the degree of contamination (Cd), soil appears to be less contaminated than stream sediments.

The soil particle size is similar to that of tailing materials, but stream sediments have much coarser particles, implying that the materials have different origins. Contamination levels in stream sediments display a tendency to decrease with distance from the mine, but no such changes are found in soil. Consequently, soil contamination by metals is attributable to wind-blown dusts from the tailing materials, and stream sediment contamination is caused by discharges from un- contained subgrade ore stock materials.

Considering the evident impact on the soil and water environment, and the human health risk from the Erdenet Mine, measures to mitigate its environmental impact should be taken immediately including source control, the establishment of a systematic and continuous monitoring system, and a comprehensive risk assessment.

Erdenet Mine – Overview 2014

2004

Erdenet Mine – Overview

2014

Erdenet Mill Tailings Pond 2014

2004

Erdenet
Mill Tailings
Pond

2014

Erdenet Mine – Southeast Mine Waste Dumps

2014

2009

Erdenet Mine – Southeast Mine Waste Dumps

2014

Erdenet Mine – Southwest Mine Waste Dumps 2014

2009

Erdenet Mine – Southwest
Mine Waste Dumps

2014

2004

Erdenet Mill Tailings Dam 2014

Erdenet Mill Tailings Dam

2004

2014

Offsite Impacts of Erdenet Copper Molybdenum Mine Tailings, North Central Mongolia, 2009

Charles Jason Tinant, Oglala Lakota College (OLC), USA Gerald Giraud, OLC, Bruce Berdanier, South Dakota State University, USA Don Belile, OLC, Devon Wilford, OLC, Helene Gaddie, OLC
Corresponding Author, charlesjasontinant@gmail.com
Available at: http://www.olc.edu/departments/math-sci-tech/publications.htm

Abstract

Sediment samples from stream and terrace deposits were collected in 2008 at six locations in north central Mongolia along the Erdenet-Khangal River from the Erdenet copper-molybdenum mine filter pond and from wetlands below the filter pond.

Mine tailings also were sampled at the outfall of the mine tailings pond. Metals in the sediment samples were analyzed by atomic absorption (AA) flame and graphite furnace after a hot nitric acid digestion technique following U.S. Environmental Protection Agency Method 3050. Metals in the sediment samples also were analyzed by x-ray florescence. Chromium (Cr) from 0.1 to 7.1 mg/kg, arsenic (As) from 1.8 to 5.1 mg/kg, lead (Pb) from 0.1 to 0.9 mg/kg, and copper (Cu) from 2.7 to 58.7 mg/kg were detected in stream and terrace deposit sediment samples. Chromium (Cr) from 6.9 to 13.1 mg/kg, arsenic (As) from 9.3 to 10.7 mg/kg, lead (Pb) from 0.2 to 2.3 mg/kg, and copper (Cu) from 61.4 to 96.1 mg/kg were detected in tailings and filtration pond sediment samples.

The effects of wind direction and distance from the mine tailings on copper concentration were analyzed by fitting these data to linear, exponential, and curvilinear models. The linear model for copper concentration as a function of distance fit the observed data with a Pearson's correlation coefficient (R2) of 0.77. The correlation of the data was only slightly improved by adding wind direction as a second variable and fitting a curvilinear model to the observed data. The linear distance model predicted that metal concentrations return to baseline levels at a distance of 6.4 km from the mine tailings dam.

Preliminary Water Quality Results for the Erdenet - Khangal River near Erdenet Copper Molybdenum Mine in North Central Mongolia, 2009

Charles Jason Tinant, Oglala Lakota College (OLC), USA Gerald Giraud, OLC, Bruce Berdanier, South Dakota State University, USA Don Belile, OLC, Devon Wilford, OLC, Helene Gaddie, OLC
Corresponding Author, charlesjasontinant@gmail.com
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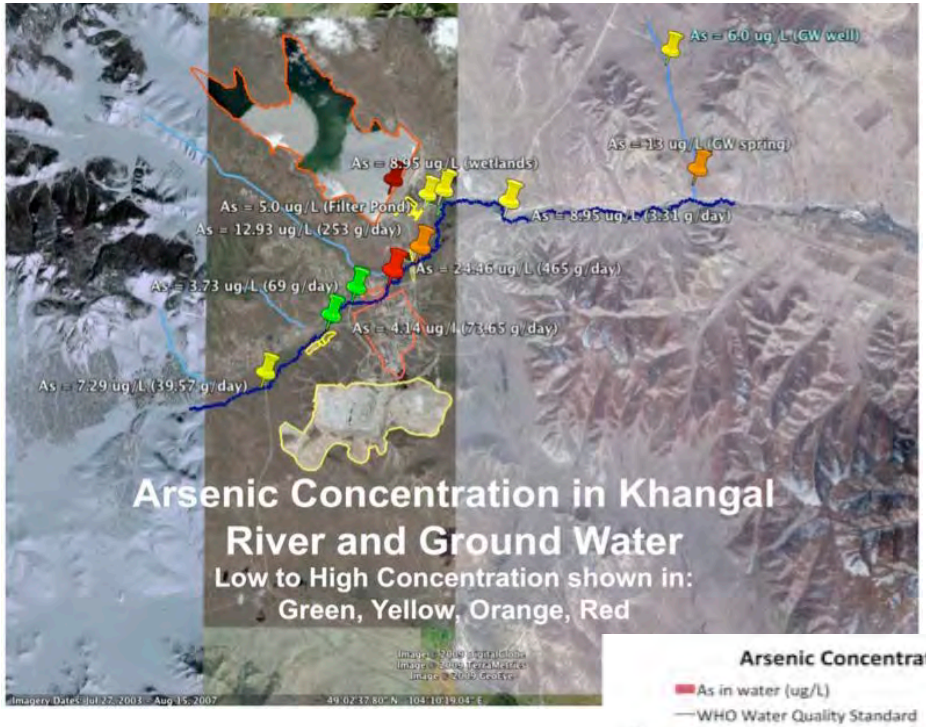
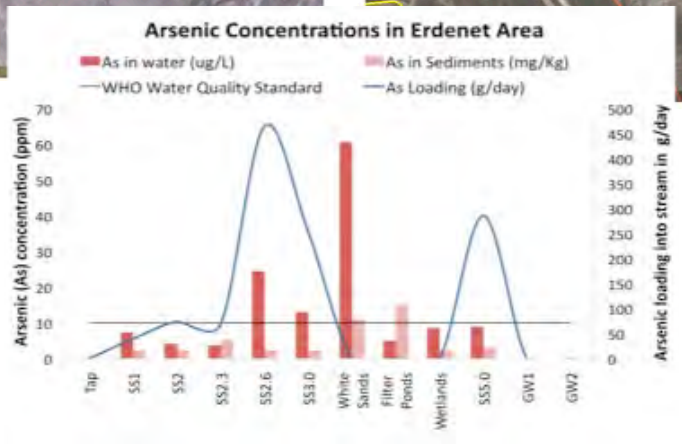
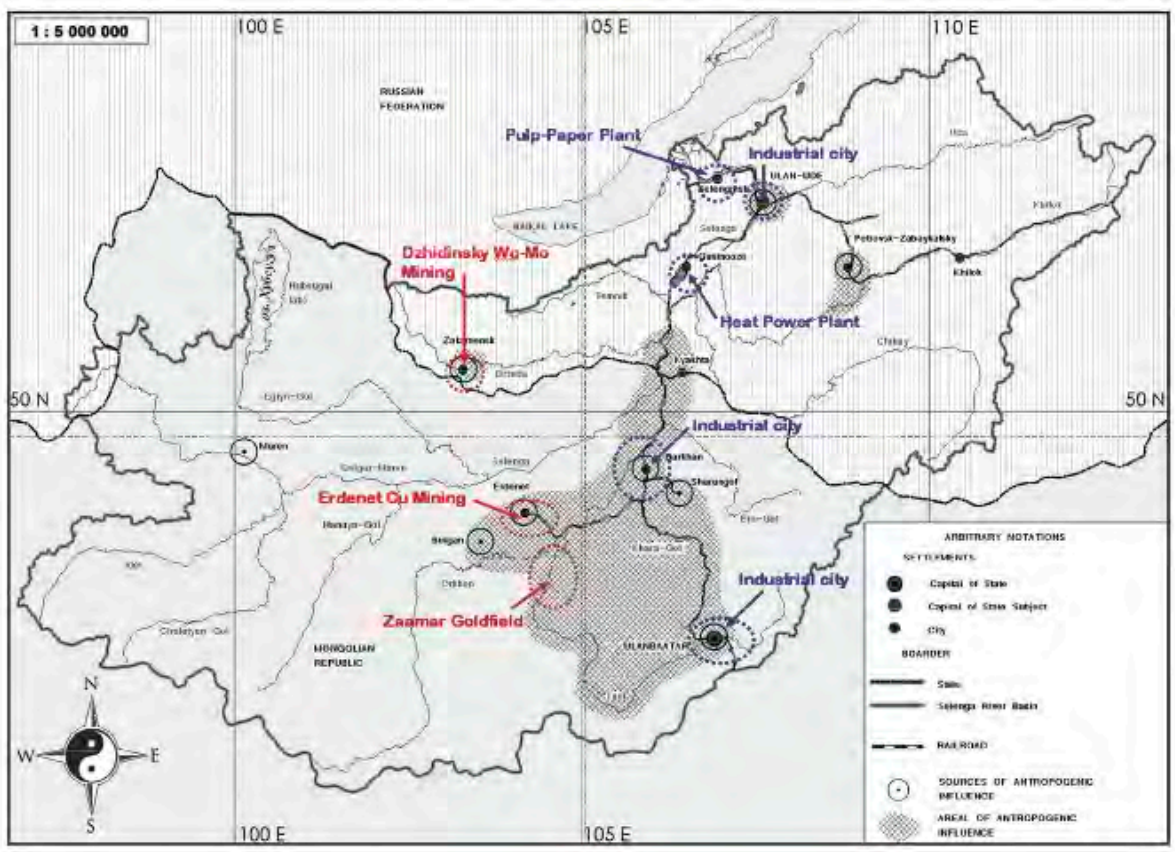




Integrated Water Management Model on the Selenge River Basin - Development and Evaluation of the IWMM on the SRB (Phase 3), 2010

JangMin Chu, ChangHee Lee, Lunten Janchivdorj, Bair Oktyabrevich Gomboev, SangYoung Park, and HyunJoo Mun
(Project partners include: UN Environment Program, Korea Environmental Institute, K-Water Institute, Myongi University, Institute of Geoecology Mongolian Academy of Sciences, Baikal Institute of Nature Management, Siberian Branch , Russian Academy of Sciences)

available at: http://bic.iwlearn.org/en/documents/to-sort-over-the-folders/reports/integrated-water-management-model-on-the-selenge-river-basin/Integrated%20Water%20Management%20Model%20on%20the%20Selenge%20River%20Basin%20III%20-2010%20Full-1.pdf



Selected Eight Hotspots in the Selenge Project

Integrated Water Management Model on the Selenge River Basin - Development and Evaluation of the IWMM on the SRB (Phase 3), 2010 Statements regarding Erdenet include:

The Erdenet porphyry Copper and Molybdenum (Mo) deposit is one of the largest mines in Mongolia and is operated by a joint Mongol Russian company. The Erdenet mine has been operating since 1978 and annually yields approximately 20 million metric tons of Cu ore from which approximately 354,000 metric tons of copper concentrate and 3,500 tons of Molybdenum concentrate are produced annually. More than 90% of the Cu and Mo produced is exported to Russia. The copper concentration from Erdenet contains 27-35% of copper with trace amounts of selenium (50-60 g/T), silver (50-70 g/T), tellurium (8-9 g/T), and gold (0.3-0.5 g/T). The molybdenum concentration from Erdenet typically contains 47-54% of molybdenum with trace amounts of rhenium (450 g/T), selenium (90 g/T), and tellurium (15 g/T). On average, 124,000 metric tons of copper and 1,672 metric tons of molybdenum are produced annually from the Erdenet mine.

The Erdenetyn Ovoo copper ore deposit is located close to the town of Erdenet. Orkhon aiming is located in the north of Mongolia, in the territory of Burgan aimag, approximately 400 kilometers northwest of Ulaanbaatar. The deposit was discovered and explored between 1960 and 1972. In 1973, the Government of Mongolia, together with the former Soviet Union, set up the Erdenet Mining Corporation. When Erdenet city (Bayan Ondor soum) was first build the population was just over 7800. There were around 2500 head of livestock and 7 percent of total population was working in the industrial sector. During the last 30 years, the population has increased 10 fold, the head of livestock has increased by 55 times, and 33.8 thousand people work in over 1200 establishments. The population of Bayan Ondor soum is 78 thousand and 92.5% of the total population of Orkhon aimag.

Heap (2004) reported that the Erdenet copper mine is reportedly fined US $500,000 per year, and chalked it up as a cost of doing business rather than the more costly option of improving their processes' Enforcement of environmental standards is weak, and the nascent environmental elements of civil society are silent with few exceptions. In other words, a company does pretty much what it likes.

Integrated Water Management Model on the Selenge River Basin - Development and Evaluation of the IWMM on the SRB (Phase 3), 2010 Statements regarding Erdenet include:

The waste from the ore processing is pumped to a Tailings Management Facility (TMF), which is located approximately 4 km away from the plant. The TMF is basically a 5 km long tailing reservoir and Dam of standard design, of which 3 km are covered with water and 2 km are exposed tailing beaches. It contains 400 million tons of mine tailings, as well as 15 million m3 of supernatant water. To make room for more tailings, the dyke has increased in lifts of 6 to 10 meters; current plans call for the dyke to reach its final height in 2010. There is a critical need to strengthen the routine maintenance and monitoring of the dike's stability according to international standards to avoid and/or manage any seepage contamination problems resulting from the tailings turning acidic, as the ore contains copper sulfide minerals and pyrite, which cannot entirely be removed in the beneficiation process.

To date, only some $30,000 is being spent to put topsoil on the tailings. Since a possible date for the decommissioning of the operation is still to be set, there is no plan for environmental remediation after the mining operations cease, nor have funds been set aside from operating income for this purpose.

Blowing tailing dust is also one of the most serious environmental issues. With an open area of approximately 500 hectares of dry tailing beaches and a very fine-grained tailing material (80 percent <0.74 m), the wind has no trouble picking up dust. There is not much that can be done to mitigate the problem; stabilizing the surface with surfactants may help, but it is considered too costly since it has to be done on a regular basis due to new waste material continuously being pumped into the TMF.