



# DETERMINING THE TOXICITY POTENTIAL OF MINE-WASTE PILES

Notes from a Workshop Presented at the Joint Conference of the  
Billings Land Reclamation Symposium and the Annual Meeting of the  
American Society of Mining and Reclamation,  
Billings, Montana, June 1, 2003

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by Kathleen S. Smith<sup>1</sup>, Thomas R. Wildeman<sup>2</sup>, LaDonna M. Choate<sup>1</sup>,  
Sharon F. Diehl<sup>1</sup>, David L. Fey<sup>1</sup>, Philip L. Hageman<sup>1</sup>, James F. Ranville<sup>2</sup>,  
Rosalia Rojas<sup>3</sup>, and Bruce D. Smith<sup>1</sup>

- 1 U.S. Geological Survey, Denver, Colorado
- 2 Rocky Mountain Regional Hazardous Substance Research Center and the Colorado School of Mines
- 3 Rocky Mountain Regional Hazardous Substance Research Center and Colorado State University

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This report consists of lectures from a workshop presented at the Joint Conference of the Billings Land Reclamation Symposium and the Annual Meeting of the American Society of Mining and Reclamation convened in Billings, Montana, June 1, 2003. The title of the workshop was *Assessing the Toxicity Potential of Mine-Waste Piles*. Slide-based presentations are included on the following topics.

## I. Introduction

- A. Scope of the workshop (*by Tom Wildeman*)
- B. Fundamentals of mine-drainage formation and chemistry (*by Kathy Smith and Tom Wildeman*)
- C. Mining wastes overview (*by Sharon Diehl and Kathy Smith*)

## II. Methods to Determine Bioaccessibility of Metals from Waste (*by LaDonna Choate and Jim Ranville*)

## III. Physical Characterization

- A. Physical characterization of mine-waste piles (*by Tom Wildeman*)
- B. Fate and transport of metals and sediment in surface water (*by Rosalia Rojas, Pierre Julien, and Mark Velleux*)

## IV. The Importance of Geology (*by Sharon Diehl*)

## V. Geophysical Applications to Mine-Waste Piles (*by Bruce Smith*)

## VI. Waste Pile and Water Sampling (*by Kathy Smith*)

## VII. Chemical Analysis of Solids, Waters, and Leachates (*by Kathy Smith*)

## VIII. Leaching Tests

- A. Leaching studies (*by Phil Hageman*)
- B. Assessing the toxicity of mine-waste piles: Chemical criteria (*by Tom Wildeman*)

## IX. Acid-Base Accounting (*by David Fey*)

## X. Using the Decision Tree (*by Tom Wildeman*)

## XI. References

# ASSESSING THE TOXICITY POTENTIAL OF MINE-WASTE PILES

Notes from a workshop presented by scientists from the  
U.S. Geological Survey, Denver, CO  
and the  
Rocky Mountain Regional Hazardous Substance Research Center,  
Colorado State University and the Colorado School of Mines

## ABSTRACT

When assessing the environmental impact from mining operations, an immediate question arises about potential impact and toxicity of mine-waste piles. This question is particularly difficult to assess for waste piles on abandoned mine lands in the western United States and coal-waste piles in the eastern United States. In many of these situations, there is no water in direct contact with the piles, except during meteorological events, yet it appears that the pile has caused significant ecological disturbance. For the past several years, scientists at the Colorado School of Mines and the U.S. Geological Survey have been studying the toxicity potential of waste-rock piles. Simple and practical methods have been developed for determining the potential of a waste-rock pile to cause significant contamination. For example, quick inexpensive field leaching tests have been developed that offer an evaluation of acid and trace-metal release from mine-waste material. Additionally, two-dimensional hydrologic and erosion models might be used to assess acid and metal sources and sinks. Such methods are presented for evaluating mine-waste piles from watershed scale, site scale, and microscopic scale, using geophysical, geochemical, and mineralogical methods. Current methods used to determine bioaccessibility and bioavailability of metals from wastes, such as extraction techniques, are described and assessed. Case studies with field and laboratory data illustrate these methods. These applications are used as the basis for a simple decision tree that has been developed to assess the potential impact of a waste-rock pile, and the scientific background that serves as the basis for decisions.

**Workshop Time:** 8:30 am – 4:00 pm, June 1, 2003

### **Workshop Organizers:**

Dr. Thomas R. Wildeman  
Dept. of Chemistry & Geochemistry  
Colorado School of Mines  
Golden, CO 80401  
Phone: 303-273-3642  
E mail: [twildema@mines.edu](mailto:twildema@mines.edu)

Dr. Kathleen S. Smith  
U.S. Geological Survey  
M.S. 973, Denver Federal Cntr.  
Denver, CO 80225-0046  
Phone: 303-236-5788  
E mail: [ksmith@usgs.gov](mailto:ksmith@usgs.gov)