

TAILINGS AND MINE WASTE '08 VAIL, COLORADO

www.tailingsandminewaste.org



At left: Vail Clock Tower. Photo courtesy of Jack Affleck. Above left: Vail Cascade Resort pools. Photo courtesy of Karl Newman. Above right: Vail Cascade Resort sanctuary. Spa photos courtesy of Ron Coppock.

Objective

The objective of Tailings and Mine Waste '08 is to provide a forum for presenting the state-of-the-art with respect to mill tailings and mine waste current practice, and to discuss current and future issues facing the mining and environmental communities.

Background

Tailings and Mine Waste '08 is a continuum of a series of symposia on mill tailings management that originally started at Colorado State University in 1978 and subsequently progressed as the annual Tailings and Mine Waste Conferences 1994 through 2004. The primary purpose of the Conference is to provide a forum and meeting place for members of the mining community, engineers and scientists serving the mining industry, regulatory groups and other interest groups concerned with environmental issues related to tailings and mine waste management. Topics related to the engineering and management of tailings and mine waste will be covered, including case histories, design, operation, and disposal for mine waste management, geotechnical considerations, liners, covers and barriers for waste control, reclamation and remediation of mine impacted sites, surface water and groundwater management and geochemistry, and policies, procedures and public safety.

Who Should Attend

Mine and mill managers, engineers involved with tailings management and reclamation, environmental and geotechnical engineers, geoenvironmental engineers, regulatory personnel, consulting engineers, researchers, and other interested groups have found the Tailings and Mine Waste Conference to be an exciting place to present ideas, learn of new developments, make contacts in their professional fields, and discuss issues of mutual interest.

Honorary Conference Chair

John D. Nelson, Engineering Analytics, Colorado State University, Fort Collins, Colorado

Organizing Committee

Daniel D. Overton, Committee Chair, Engineering Analytics, Fort Collins, Colorado

Larry Cope, SRK Consulting, Inc., Fort Collins, Colorado

Christopher Hatton, URS Corporation, Denver, Colorado

Michael Henderson, Tetra Tech, Golden, Colorado

Linda Hinshaw, Colorado State University, Fort Collins, Colorado

Andrew Robertson, Robertson GeoConsultants, Inc., Vancouver, British Columbia

Charles D. Shackelford, Colorado State University, Fort Collins, Colorado

Clint Strachan, MWH Americas, Inc., Fort Collins, Colorado

William Thompson, Golder Associates, Inc., Denver, Colorado

Bryan F. Ulrich, Knight Piésold and Co., Elko, Nevada

Conference Affiliate

International Mine Water Association (IMWA), Germany

Exhibitor Space

The Organizing Committee invites your participation in presenting an exhibit. Exhibition of services, equipment, and technologies meets one of the Conference goals, which is to exchange ideas about issues facing the mining and environmental communities. If you would like to display an exhibit, please contact Linda Hinshaw.

Venue

The Conference will be held at the Vail Cascade Resort Hotel in Vail, Colorado www.vailcascade.com. The Resort sits at the base of Vail Mountain at an altitude of 8150 feet. Vail is an internationally acclaimed ski resort, located 90 miles west of Denver. The major airport to use is Denver International Airport. Vail enjoys a clear, dry

climate year-round. While sunny skies are the norm at this time of year, please keep in mind that in October, a sudden snowstorm may occur, so plan your dress and travel time accordingly. We encourage you to use your time in Colorado for recreation as well as technical learning.

Transportation

Travel from Denver International Airport (DIA) to Vail can be by rental car, bus or limousine. Vail is about a two-hour drive from Denver via Interstate I-70. **Colorado Mountain Express** offers a shuttle service from DIA to Vail. When making a reservation mention “Tailings and Mine Waste” to get a discounted rate of \$75.60 one-way. They have a regular scheduled route to and from Vail and DIA. You may call them at 1-800-334-7433 or use their Web site: www.resort-express.com.

Contact

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Registration Information

Contact

Conference Services
Colorado State University
8037 Campus Delivery
Fort Collins, CO 80523-8037
(970) 491-7501
FAX (970) 491-7747
E-mail: ocsreg@lamar.colostate.edu

SHORT COURSE

In conjunction with this conference, we are pleased to be able to offer the following short course to be held on **Sunday, October 19, 2008**. The course will be held at the Vail Cascade Resort, Centennial Room E-F, Registration 8:00 am, Course Duration: 8:30 am to 4:30 p.m.

Slope Stability and Seepage Modeling of Mine Tailings and Waste Rock – Application of New Technologies

Presented by:

Murray Fredlund, PhD, PEng, President/CEO,
SoilVision Systems Ltd.
Dirk van Zyl, PhD, PE, Professor, University of British Columbia.

OVERVIEW

This course covers advances in both the theoretical and practical application of probability theory to slope stability and seepage geotechnical problems. Special focus will be paid to creating numerical models of tailings and waste rock facilities. Case studies will also be examined which illustrate the complexity of back-analysis of classic slides such as the Lodalen slide by both 2D and 3D slope stability numerical methods. Application of statistical principles to seepage analysis will also be covered. In particular the following questions will be addressed:

SLOPE STABILITY

- When is probability theory applicable to a certain application?
- Can probability theory be applied to practical problems?
- What are acceptable probabilistic safety indicators?
- How should spatial variation of soil properties be assessed?
- How much data is acceptable for a probabilistic slope stability analysis?
- What Poisson's ratio is appropriate to use in a particular analysis (and what is its effect on a slope stability analysis)?

SEEPAGE

- How does mesh density affect my answers?
- What is the effect of mesh density on cover design analysis?
- What is the effect of mesh density on earth dam analysis?
- How does draw-down affect both pore-water pressures and stability?
- What are methods of checking for model “correctness”?
- What are advanced methods for solving “unsolvable” models?
- Why do many climatic models produce wrong results?
- How do climatic events affect slope stability?
- In what applications is automatic mesh refinement beneficial?

The course will also cover advances in the area of slope stability analysis in applying stochastic principles both materially and spatially to numerical models. A combination of classic limit equilibrium as well as more advances stress-based numerical models will be covered in terms of their applicability to practical problems. In addition, the applications of automatic mesh refinement techniques to practical problems in order to improve convergence and improve the accuracy of calculations will be discussed.

FEE

The course fee is \$550 per person; \$150 for students. On-site registration will be on a space available basis. Minimum number of registrants is 12. The registration fee includes course notes and refreshment breaks.

TAILINGS AND MINE WASTE '08 CONFERENCE PROGRAM

Preregistration and Reception (Cash Bar)

Vail Cascade Resort – Main Centennial Foyer

October 19, 2008

6:30 p.m. - 8:30 p.m.

Day One – Monday, October 20, 2008

7:00 - 10:30 a.m. Registration – Main Centennial Foyer

7:30 - 8:30 a.m. Authors' Breakfast – Blue Spruce Room

Introductions

8:30 - 9:00 a.m. Welcome and Introductions

Keynote Speaker Andy Fourie, Professor, University of Western Australia

9:00 - 10:00 a.m. Centennial D

Topic: Future Tailings Management Strategies – High Time We Took the High Road

10:00 - 10:30 a.m. Break – Exhibit Hall
Rocky Mountain Ballroom

Session 1 Case Histories

10:30 a.m. - Noon Centennial Ballroom D

- Tailings Closure at BHP Billiton's San Manuel Operation Design and Closure Construction San Manuel, Arizona
D. Ortman

- Case Study: Site-wide Water Balance of the Pierina Gold Mine, Peru
L. George

- Reclamation of the Panna Maria Mill Site and Tailings Impoundment: A 2008 Update
C.L. Strachan and K.L. Raabe

- Mining Impacts: A Case Study
R.K. Will

- Design and Construction of an Evaporation Pond at a Historic Uranium Mining Facility
T.A. Chapel, C. Woodward, and R. Jolley

Noon - 1:30 p.m. Lunch – Exhibit Hall
Rocky Mountain Ballroom

Session 2A Geotechnical Considerations

1:30 - 3:00 p.m. Centennial D

- Experimental Characterization of the Influence of Curing under Stress on the Hydromechanical and Geochemical Properties of Cemented Paste Backfill
E. Yilmaz, T. Belem, M. Benzaazoua, and B. Bussière

- A New Tailing Management Tool
J. Coffin, G. Gjerapic, and D. Znidarcic

- Guidelines for Stabilizing Historic Mine Workings
J. F. Lupo

- Landscape Design for Soft Tailings Deposits
G. McKenna and V. Cullen

Session 2B Water Management & Geochemistry – I

1:30 - 3:00 p.m. Centennial E-F

- Applying Numerical Hydrogeochemical Models as Decision Support Tools for Mine Closure Planning
L.E. Eary, J. Eshleman, R. Jakubowski, and A. Watson

- Arsenic Distribution & Arsenic Binding Forms in Uranium Tailings Material
T. Naoman

- Hydrological Flow through Waste Rock Piles
M. Fredlund and R. Thode

- Geochemical Characterization of Proposed Waste Dumps over Time and Space
L. Breckenridge, S. Poos, A. Hudson, and D. Thompson

3:00 - 3:30 p.m. Break – Exhibit Hall
Rocky Mountain Ballroom

Session 3A Reclamation and Remediation

3:30 - 5:00 p.m. Centennial Ballroom – D

- Past, Present and Future for Treating Selenium-Impacted Water
J. Gusek, K. Conroy, and T. Rutkowski

- Exploring the Limitations of Biochemical Reactors
P. Smart and J. Gusek

- Reclamation and Closure Cost Planning and Estimation and the Mining Life Cycle
L.E. Boxill and T.E. Martin

Session 3B Design, Operation, and Disposal – I

3:30 - 5:00 p.m. Centennial E-F

- Simple Mine Waste Management Planning for Successful Operations in the Canadian Low Arctic
P.M. Bedell and K.S. Willis

- James Creek Tailings Facility Relocation for the Gold Quarry Open Pit Expansion
J. Young and A. Boye

- Heat and Mass Balance Modeling of a Subaqueous Tailings Disposal Facility
G.R. Eykholt, J.B. Manchester, S.V. Bonohue, and J.C. Cherry

- Water Chemistry and Metal Cycling in a Subaqueous Tailings Disposal Facility
J.B. Manchester, G.R. Eykholt, S.V. Donohue, and J.C. Cherry

Day Two – Tuesday, October 21, 2008

7:00 - 10:00 a.m. Registration

7:30 - 8:30 a.m. Authors' Breakfast - Blue Spruce Room

Session 4A Design, Operation and Disposal – II

8:30 - 10:00 a.m. Centennial D

- Heap Leach Lixiviant Flow – Myth Versus Reality
J.R. Kunkel

- Challenges in Heap Leach Pad Design: Consideration of Thermal Conditions
A.L. Hudson and T. Meyer

- Antamina Tailings Dam – Seepage Remediation Project
R. Manrique, A. Haynes, and T. Eldridge
- Innovative Mine Waste Disposal in Two Distinctly Different Settings
I. Wislesky and A. Li

Session 4B Policies, Procedures, and Public Safety – I

8:30 - 10:00 a.m. Centennial E-F

- Uranium Tailings Facility Design and Permitting in the Modern Regulatory Environment
K. Morrison, J. Johnson, J. Elliott, and B. Monok
- Tailings Structure Closure for Economic Development in Ghana
M.B. Thorpe, F. Nyame, and B.A. Addo
- State of Practice of Tailings Thickening in the State of Nevada, USA
B.F. Ulrich
- Lessons Learned from Table Top Reviews of Emergency Action Plans for High Hazard Dams in West Virginia, USA
J.D. Quaranta, H.M. Childers, and P. Myles
- Marine Tailings Disposal in Papua New Guinea
N.S. Parate

10:00 - 10:30 a.m. Break – Exhibit Hall
Rocky Mountain Ballroom

Session 5A Liners, Covers, and Barriers

10:30 - noon Centennial D

- Liner System Design for Tailings Impoundments and Heap Leach Pads
J.F. Lupo
- Evaluation of Geomembrane Puncture Potential and Hydraulic Performance in Mining Applications
A. Kohlman, M. Henderson, J. Kaul, and C. Athanassopoulos
- Field Performance of Cover Systems
N.R. Amorim, R.F. Azevedo, O. Ferreira, and A.C. Ribeiro
- Capping the Tailings Impoundment at the Jamestown Mine
J.C. Isham

Session 5B Water Management & Geochemistry – II

10:30 - Noon Centennial E-F

- Stochastic Prediction of Mine Site Water Balance, Gilt Edge Mine Superfund Site, Lawrence County, South Dakota
M. Nelson
- Using Water Balance Tools for Site Design, Operation and Expansion Management
A. Trautwein
- Desiccation and Rheology in Cyclic Surface Disposal of Gold Paste Tailings
P. Simms, B. Fisseha, and J. Henriquez

12:00 - 1:30 p.m. Lunch – Exhibit Hall
Rocky Mountain Ballroom

Guest Speaker James Herron, Staff Historian, Division of Reclamation, Mining and Safety, Denver, CO

1:30 - 2:30 p.m. Centennial Ballroom D

Topic: *An Historical View of Mining in the Leadville Area*

Session 6A Design, Operation & Disposal – III

2:30 - 4:00 p.m. Centennial D

- Pipeline Design for Paste and Thickened Tailings Systems
R. Cooke
- Efficient Dewatering Solutions on Vibrating Screens
R. Heinrich
- High Pressure Washing Technology “Hydro-Clean”
S. Palombo
- Remote Monitoring of a High Hazard Coal Waste Impoundment in Mountainous Terrain Case Study
J.D. Quaranta, L.E. Banta, and J.A. Altobello

Session 6B Policies, Procedures, Public Safety – II

2:30 - 4:00 p.m. Centennial Ballroom – E-F

- Selection of Waste Dump Site in Open Pit Mines using Multi Attribute Decision-Making Techniques
M. Osanlooa, M. Golestanifar, and A. Aghajani-Bazazia
- Towards Responsible Management of Tailings Facilities
E. Gardiner
- Developments in the Safety and Security of Mining Industry Dams
J.W. Fredland
- Life Cycle Assessment Approach to Evaluate Tailings Management Options
D. Van Zyl

4:00 - 4:30 p.m. Break – Exhibit Hall
Rocky Mountain Ballroom

Session 7 Case Histories

4:30 - 6:00 p.m. Centennial D

- Gold Quarry North Waste Rock Facility Slide Investigation and Stabilization
R.J. Sheets and E.E. Bates
- An Overview of the Grouse Creek Mine Tailings Impoundment Closure
F. Moyer and S. Rogers
- Measurement of Radioactivity and Radon Exhalation Around One Uranium Mine and One Abundant Copper Mine, Jaduguda, Jharkhand, Eastern India
K.S. Banerjee, D. Sengupta, R. Kumar, A. Mahur, and R. Prasad
- Remediation of the Block P Tailings Site
J. Hunt and J. Carter
- Stabilized Upstream Tailings Dam and Converted into a Filtered Tailings Facility
M. Veillette, S.A. Larreta, and T. Martin

6:00 p.m. Gala Reception (Cash Bar) – Exhibit Hall
Rocky Mountain Ballroom

TAILINGS AND MINE WASTE '08



VAIL, COLORADO
October 19-22, 2008



TOUR

Day Three – Wednesday, October 22, 2008

The Climax Molybdenum Mine

8:30 a.m. - 1:30 p.m.

The Climax Mine is a world-class molybdenum mine located at high altitude in the Colorado mountains. The tour will visit the tailings impoundment and overview the mine facilities and ongoing reclamation activities.

CONFERENCE ACCOMMODATIONS

Block reservations have been made at the Vail Cascade Resort Hotel, 1300 Westhaven Drive, Vail CO 81657, www.vailcascade.com. Participants may make their reservations by calling (800) 420-2424, or by E-mail: vcr-groupres@destinationhotels.com. The rates are \$109.00 (U.S.) for single or double occupancy. Mention the “Conference on Tailings and Mine Waste '08” to obtain these special rates. The block reservations expire September 18, 2008.

Check-in

Check-in starts at 4:00 p.m. and checkout time is 12:00 noon; on Wednesday, October 22, checkout time for those taking the tour will either be extended to 2:00 p.m., or arrangements for storage of luggage will be made if late checkout is not possible.

Parking

Valet parking is \$25.00 (U.S.) per vehicle, per night. Self-parking is at a discounted rate of \$5.00 (U.S.) per night for Tailings and Mine Waste hotel registered guests. Day parking rates are charged for conference attendees that are staying off-site - \$5.00 (U.S.) per hour with a maximum of \$20.00 (U.S.)

Aria Spa and Club

The Aria Spa and Club are adjacent to the resort and include a 10,000 square-foot luxury spa and a 68,000 square-foot fitness center. Access to the fitness club is complimentary to guests of the resort and provides them with a variety of recreational facilities including indoor/outdoor tennis, racquetball, squash, basketball, aerobics, fitness and cardio equipment, steam rooms, whirlpools and an outdoor pool. Use of the spa facilities is NOT complimentary to our guests. Due to the demand for use of the spa facilities, those wishing to make appointments should do so in advance. You may call 1-888-824-5772 to make reservations. Please know that an 18 percent gratuity is added to the retail price of all spa services, and all charges/cancellations will be handled on an individual basis. Individuals will also be responsible for the 6% resort fee.

Authors' Breakfast

Authors who are presenting should come to the authors' breakfast on the day they are presenting to meet with their session chairman to discuss the format of their session and introduction of their papers.

CONFERENCE REGISTRATION INFORMATION

Authors' Registration: Authors' registration discounts pertain only to the author(s) presenting the paper at the conference. Registration fees for authors presenting papers will be discounted \$50.00 (U.S.) from the participant registration, which is \$795.00 and must be paid by 5:00 p.m. MDT September 17, 2008. The registration fee after September 17, 2008, or on site for an author presenting a paper is \$895.00

Participant Registration: There is an advance registration fee of \$845.00 (U.S.) if paid by 5 p.m. MDT, September 17, 2008. The registration fee after September 17, 2008 or on site is \$945.00 (U.S.). The author and participant registration package includes attendance at all sessions, one copy each of the Proceedings – available at the time of the Conference – refreshment breaks, lunches, and gala reception.

One-Day Registration: There is a one-day registration fee of \$645.00 (U.S.) per day for Monday (10/20/08), or Tuesday (10/21/08) if paid by 5 p.m. MDT, September 17, 2008. The one-day registration fee after September 17, 2008 or on site is \$745.00 (U.S.). There is no author discount for one-day registrations. The one-day registration package includes attendance at all sessions, refreshment breaks, lunches and gala reception. **It does not include a copy of the Proceedings. This may be purchased separately on site.**

Student Registration: Students fully enrolled at a university, college, or high-school may register for a fee of \$75.00 (U.S.) if paid by 5 p.m. MDT, September 17, 2008. The registration fee after September 17, 2008, or on site is \$95.00 (U.S.). Please provide an adviser letter or other verification of student status along with submission of registration form. The student registration package for the conference includes all items under the general package above **except for the Proceedings which may be purchased separately on site.** For those students who are also the presenting authors, please see Linda Hinshaw during the conference regarding the purchase of Proceedings.

All Registrations: Refunds, less a handling fee of \$25.00 (U.S.) will be made in the event of cancellation, provided the Office of Conference Services is notified by 5:00 p.m. MDT, October 1, 2008. Substitution of participants is permitted. There is a \$17.00 (U.S.) return check charge. Registration questions may be directed to the Office of Conference Services, Telephone (970) 491-7501 or Fax (970) 491-3568, or E-mail: ocsreg@lamar.colostate.edu.

CE Units: Colorado State University Division of Continuing Education will grant Continuing Education Units (CEUs) after successful completion of the conference. A recording fee of \$50.00 is required for those desiring to receive CEUs.

Group Rates: Company and governmental agency group rates for **four** people or more are available. Please contact Linda Hinshaw for information.

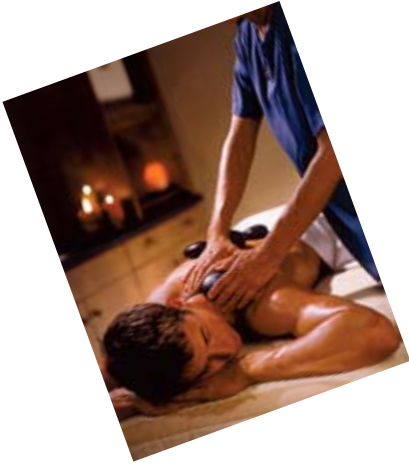
TAILINGS AND MINE WASTE '08



October 19-22, 2008

Colorado State University is an equal opportunity/affirmative action institution and complies with all Federal and Colorado State laws, regulations, and executive orders regarding affirmative action requirements in all programs. The Office of Equal Opportunity is located in 101 Student Services. In order to assist Colorado State University in meeting its affirmative action responsibilities, ethnic minorities, women, and other protected class members are encouraged to apply and to so identify themselves.

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TAILINGS AND MINE WASTE '08
 October 19-22, 2008, Vail, Colorado




REGISTRATION FORM

Name(s) as you want on name tag(s) _____
 Organization _____
 Address _____
 City _____ State _____ Zip/Postal Code _____
 Telephone (_____) _____ Fax (_____) _____
 Country _____ E-mail _____
 Special ADA Needs _____

Registration Fee for Conference

Author Postmarked by September 17, 2008.....# _____ @ \$795 = \$ _____
 Author Postmarked after September 17, 2008# _____ @ \$895 = \$ _____
 Participant Postmarked by September 17, 2008# _____ @ \$845 = \$ _____
 Participant Postmarked after September 17, 2008.....# _____ @ \$945 = \$ _____
 One-Day Registration Postmarked by September 17, 2008
 Mon.____ Tues.____# _____ @ \$645 = \$ _____
 One-Day Registration Postmarked after September 17, 2008
 Mon.____ Tues.____# _____ @ \$745 = \$ _____
 Student Postmarked by September 17, 2008.....# _____ @ \$75 = \$ _____
 Student Postmarked after September 17, 2008# _____ @ \$95 = \$ _____
 (Please include student status verification.)

Registration Fee for Short Course

Slope Stability and Seepage Modeling of Mine Tailings and Waste Rock – Application of New Technologies
 Regular.....# _____ @ \$650 = \$ _____
 Student.....# _____ @ \$150 = \$ _____

Tour

Climax Molybdenum Mine# _____ @ \$95 = \$ _____

Continuing Education Units @ \$50 = \$ _____

Total Registration Fees = \$ _____

Method of Payment

_____ Check [payable to Colorado State University in U.S. funds] _____ Purchase Order/Training Form [attached]
 _____ MasterCard Card# _____ Exp. Date _____
 _____ Visa Card# _____ Exp. Date _____
 Cardholder Name (Please Print) _____

Mail completed form [with payment] to Tailings and Mine Waste '08, Conference Services, Colorado State University, 8037 Campus Delivery, Fort Collins, CO 80523-8037, or Fax to (970) 491-7747.

You may register on-line. Go to www.tailingsandminewaste.org for link.

The Department of Civil and Environmental Engineering
Colorado State University in conjunction with the University of Alberta
and the University of British Columbia
present

TAILINGS AND MINE WASTE '08

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Program and Registration
October 19-22, 2008
Vail Cascade Resort & Spa
Vail, Colorado