14th U.S./North American Mine Ventilation Symposium

June 17-20, 2012
Salt Lake City, Utah

Organized and Hosted by the

THE UNIVERSITY OF UTAH
MINING ENGINEERING DEPARTMENT

with support from

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VALE
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About the Symposium

This symposium is organized by the Underground Ventilation Committee (UVC) of the Society of Mining Engineers (SME) and sponsored by these companies: Barrick Gold North America, Freeport McMoRan, Vale, REI Drilling and MVS, Inc. Since the first meeting in 1982, the vision of the UVC has been to provide ventilation engineers with the needed literature in the field and to promote the exchange of ideas and research results in different areas including monitoring of air contaminants, determining fresh air requirements, and producing power efficient ventilation and cooling systems.

The 14th U.S./North American Mine Ventilation Symposium is the result of considerable effort on the part of the symposium committee, practitioners and ventilation engineers, academics, and research scientists.

A total of 116 abstracts were received as a result of the call for papers, and 80 of these are presented in the proceedings. These were selected because they reflect the most pressing issues that ventilation professionals are dealing with today. The proceedings are divided into twelve topics:

- Numerical Modeling
- Coal Mine Ventilation
- Metal/Non-metal Mine Ventilation
- Diesel Emissions Control
- Mine Gases and Dusts
- Heat and Humidity
- Mine Fires
- Spontaneous Combustion
- Main and Booster Fans
- Ventilation Monitoring and Control
- Ventilacion en Español
Of these topics three are covered extensively: diesel emissions control, ventilation monitoring & control, and numerical modeling using computational fluid dynamics (CFD). Extended coverage of the first topic is the result of the increased use of diesel units in underground mines and the need to meet new regulations. For the second topic, the high level of interest results from the persistence of environmental hazards such as mine gases and dust in underground mines—particularly in coal mines. Finally, the rapid development of personal computers that can process complex fluid dynamic models quickly and efficiently has led to a rapid increase in research in this area. Currently, problems such as spontaneous combustion and air leakage through caved areas are being investigated using this tool.

In addition to the main technical part of the symposium, an equipment exhibit, five short courses, and three field trips to nearby mines in Utah, Nevada, and Wyoming have been organized to give every opportunity for the participants to make the most of their time in Salt Lake City area.

Felipe Calizaya, Associate Professor
Michael G. Nelson, Chair & Associate Professor
Mining Engineering Department
WELCOME to the UNIVERSITY of UTAH

The University of Utah, located in Salt Lake City in the foothills of the Wasatch Mountains, is the flagship institution of higher learning in Utah. Founded in 1850, it serves over 31,000 students from across the U.S. and the world. Known for its proximity to seven world-class ski resorts within 40 minutes of campus, the U encourages an active, holistic lifestyle, innovation, and collaborative thinking to engage students, faculty and business leaders.

The College of Mines and Earth Science

Instruction in mining was first given at the University of Utah in 1891 and the School of Mines was formally established at the University of Utah in 1901 by an Act of the Utah State Legislature. The college now occupies the Browning and Sutton Buildings on campus.

The College of Mines and Earth Sciences' location in a mineral and energy-rich geographical area provides a study and research environment that extends far beyond campus boundaries. The college consists of four academic departments that offer six majors and four baccalaureate and graduate degrees. Because of Utah's mineral resources, the college is pivotal in developing a region increasingly vital to the nation's mining and energy future.
SME Underground Ventilation Committee

The purpose of the Underground Ventilation Committee (UVC) is to promote engineering interest and technological progress in the ventilation of mines, tunnels and other subsurface openings. The UVC accomplishes its purpose by conducting technical sessions at SME-AIME meetings, sponsoring the North American Mine Ventilation Symposium with host universities and other organizations, and soliciting papers for publication in *Mining Engineering* and the *SME Transactions* and proceedings. The UVC offers an affiliation home for SME members engaged in the practice of underground ventilation. In these ways the UVC seeks to encourage research, education, publications, and technology transfer in the field of underground ventilation.

Miners at Tintic

**Organizing Committee**

John Kelleher  
Schauenburg Flexadux Corp.

Kirk H McDaniel  
Rio Tinto Group

Jürgen Brune  
Colorado School of Mines

Pierre Mousset Jones  
University of Nevada, Reno

Brian Prosser  
Mine Ventilation Services, Inc.

Yoginder P. Chugh  
SIU Carbondale, Illinois

Joe Stachulak  
Vale, Canada

George Gamble  
Clarage, Twin City Fan Co.
Manuscript Review Committee

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Pritchard, Christopher  NIOSH
John R. Marks   J.R. Marks Engineering, Inc.
Ian Duckworth  PT Freeport
Ian Loomis  PT Freeport Indonesia
John Grubb  Colorado School of Mines
Brian Prosser  Mine Ventilation Services, Inc.
Dan Brunner  REI Drilling, Inc.
Jordi Puig Mengual  Consultant, Andalucía, España
Enrique I. Acuña  CODELCO, Santiago, Chile
Kirk H McDaniel  Rio Tinto
Stephen Hardcastle  CANMET, Canada
Duncan Chalmers  UNSW, Sydney, Australia
Lihong (Lilly) Zhou  NIOSH
Paul Meisburger  Climax-Henderson Operations
Yoginder P. Chugh  SIU, Carbondale, Illinois

Undergraduate Field Trip at Skyline Mine
Symposium Sponsors

The 14th U.S./North American Mine Ventilation Symposium is made possible by generous sponsors and exhibitors from Industry. The Symposium coordinators would like to thank these professionals, corporations and organizations for their support in making this conference a success.

Gold Level Sponsors

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Silver Level Sponsors

VALE BARRICK

Session Sponsors

REI DRILLING

Mine Ventilation Services, Inc.

UTAH MINING ENGINEERING
Symposium Exhibitors

Exhibitor Booths will be open during the regular symposium schedule beginning Sunday, June 17 at 5:00pm in the Officers Club. Please stop by and meet the representatives of these companies.

ABC Industries, Inc. awisis@abc-industries.net
Accutron Instruments Inc. jamie@accutroninstruments.com
ACI-Canefo pterkovics@aci-ca.com
Chasm Consulting – Ventsim craig@ventsim.com
CFT-Compact Filter Technic dhowll@usminingsolutions.com
DU Tech tslaughter@dutechnologies.com
Flowcare, Engineering, Inc. ver.martin@flowcare.com
Howden North America Inc. bott@howdenbuffalo.com
Maestro Ventilation michael.gribbons@maestroventilation.com
Mine Ventilation Services, Inc. support@mvsengineering.com
PNR America tsnider@pnramerica.com
REI Drilling jspade@reidrilling.com
Robinson Fans, Inc. tricia.stable@robinsonfans.com
Schauenburg Flexadux Corp Kelleher@schauenburg-us.com
Shaft Drillers International tbruner@shaftdrillers.com
Simsmart Technologies Inc. sdufresne@simsmart.com
Spendrup Fan Company tsendrup@spendrupfanco.com
Terramin(Pty)Ltd mvs@terramin.co.za
TLT-Babcock Process Fan Group mhyduk@tltbabcock.com
Twin City Clarage, Inc. ggamble@clarage.com

EXHIBIT HALL MAP
NOTES...
Symposium Schedule
Officer’s Club
University Guest House-UGH

Saturday, June 16, 2012
7:30-9:30 a.m.  Registration/Workshop Check-in
                 Officer’s Club

8:30 a.m.-5p.m. Workshop: Psychrometry and Mine Heat Loads
                 Officer’s Club – Room A

                 Workshop: Fan Technology for Mine Ventilation Applications
                 Officer’s Club – Room B

Sunday, June 17, 2012
7:30-9:30 a.m.  Registration/Workshop Check-in
                 Officer’s Club

8:30 a.m.-5p.m. Workshop: Guidelines for Selecting Equipment in Cooling Systems
                 Officer’s Club – Room A

                 Workshop: Diesel Emissions Control
                 UGH East Ballroom

                 Workshop: Investigation into Ventilation Modeling Mistakes, Missteps and Results
                 UGH West Ballroom

2pm  Exhibitor Set Up—Officer’s Club

3-7 p.m.  Symposium Registration/Check-in
           UGH Ballroom Lobby

5:30-7 p.m. Welcome Reception
            UGH Ballroom Lobby
(Open to all participants and guests)

7:30-9:30 p.m. Organizing Committee Dinner Meeting
                UGH West Ballroom
(Open to all Organizing Committee members and invited guests)
Monday, June 18, 2012

7:15 a.m.  Symposium Registration & Check-in  
           Ballroom Lobby

7:30-8:30 a.m.  Authors’ Coffee & Speaker Ready Room  
                 UGH East Ballroom  
                 (open to session chairs & presenters)

8:30 a.m.  Welcome and Announcements  
           UGH West Ballroom

   Michael G. Nelson, Moderator  
   Felipe Calizaya, Conf. Coordinator  
   John Kelleher, Exhibit Coordinator

8:45-9:30 a.m.  Plenary Keynote Addresses  
                 UGH West Ballroom

   Steve Bessinger  
   San Juan Coal Company, Farmington, NM

   Chris Pritchard  
   National Institute for Occupational Safety and Health (NIOSH)

   John Marks  
   J.R. Marks Engineering, Inc.

9:30-10 a.m.  Break—Exhibit Hall Officer’s Club

10:15-12 p.m.  Concurrent Sessions—Officer’s Club

Room A  Diesel emissions control—1  
        Chair: Ian J. Duckworth

        Ventilation Requirements for Modern Diesel Engines—R. A. Haney

        Tailpipe emissions and ambient concentrations of gaseous pollutants from diesel engines during in-use and isolated zone studies—E. G. Cauda

        Airflow Specification for Metal/nonmetal mines—J. R. Marks

        Toward Mine Aerosol and Ventilation Mapping through Computer Vision-Assisted Sensing—S. Janisko

        Live transmission of real-time engine, exhaust quality and ambient data from mobile diesels equipment—B. Rubeli
10:15-12p.m.  Concurrent Sessions—Officer’s Club

Room B  Ventilation Planning
Chair: B. Prosser

Ventilation system design for the CODELCO New Level Project
—K. G. Wallace

Barometric Resistance Surveys: “The times, they are a changing”
—J.A. Rowland

Harmonization and standardization of risk management of underground ventilation in Australia—M. A. Tuck

Comparison of Barometer Pressure Surveys with Other Measurement Techniques—R. A. Ruckman

A Case for Revision of Time-Honoured Mine Ventilation Design Parameters through Active Field Observations
—B. Belle

12:15-1:15 p.m.  UGH East Ballroom - Lunch
Sponsored by Robinson Fans, Inc.

1:20-2:40 p.m.  Concurrent Sessions—Officer’s Club

Room A  Coal Mine Ventilation
Chair: Y. Chugh

A Modeling Study on Longwall Tailgate Ventilation—J. F. Brune

An alternative solution to the problem of efficiently ventilating room and pillar headings—B. Leeming

Computational Fluid Dynamic Modeling of Sealed Longwall Gob in Underground Coal Mine—D. Worrall, J. Grubb

Ventilation on demand for a high productivity longwall mine project
—R. Ponce
1:20-2:40 p.m.

**Concurrent Sessions**—Officer’s Club

**Room B**

**Metal/ Non-metal Mine Ventilation**
Chair: C. Pritchard

**Fifteen Years of Resistance Data Collected at Freeport Indonesia**
—I. J. Duckworth

Series ventilation circuits in hard rock mines—can they be designed and operated safely? —D. J. Brake

**Ventilation Design for the Boleo project**—S. B. Patton

**Updating Leeuille mine ventilation system to support future growth**—S. Arya

**Planning and selection of the main fans for the Grasberg block cave mine**—I. M. Loomis

2:40-3:10 p.m.

**Break**—Exhibit Hall Officer’s Club

3:10-4:50 p.m.

**Concurrent Sessions**—Officer’s Club

**Room A**

**Ventilación en Español**—1
Chair: E. Acuña

**Utilizacion de ventiladores secundarios en Minas subterráneas**—F. Calizaya

**Caracterización numérica y experimental de pérdidas de carga en el nivel de producción en método Block Caving**
—J. P. Hurtado Cruz

**Optimización del sistema de ventilación en una mina de granitura, Compañía Minera Raura**
—N. Rueda, C.S. Toro

**Planeamiento de ventilación asistida para la U.P. San Cristobal, Cia Minera Volcan**
—J. Corimanya, R. Mendez

**Rutas de escape en casos de emergencia**—E. Perez
Room B  
**Mine Gases & Dust—1**  
Chair: J. Brune

**A Field Assessment of SIUC Innovative Spray System for Continuous Miners for Dust Control**—Y. Chugh

**A CFD Modeling study of spatial spray locations for continuous miner for efficient dust control**  
—V. Kollipara

**An Experimental study of approaches to minimize pressure loss within wet scrubber and its effect on coal and quartz dust control**—H. Gurley

**A CFD analysis of air flow patterns in the face area for continuous miner making a straight initial cut**  
—V. Kollipara

5:10-5:50p.m.  
**Underground Ventilation Committee**  
Ventilation Certification Meeting

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**Restaurants......close to campus**

- **Aristos Greek Restaurant & Café—Authentic Greek**  
  244 South 1300 East  
  Salt Lake City, UT 84102  
  (801) 581-0888

- **Market Street Broiler—Fresh Seafood & Steak**  
  260 South 1300 East, Salt Lake City, Utah 84102  
  (801) 583-8808

- **La Frontera—Mexican**  
  201 S. 1300 E., SLC, UT, 84102  
  (801) 582-0699

- **The Pie Pizzeria**  
  1320 E 200 S, Salt Lake City, UT 84102  
  (801) 582-0195

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**Tuesday, June 19, 2012**

7:30-8a.m.  
**Authors’ Coffee & Speaker Ready Room**  
UGH East Ballroom  
(open to session chairs & presenters)
8:10-9:45 a.m. Concurrent Sessions—Office’s Club

Room A  Diesel Emissions Control—2
Chair: J. Stachulak

Diesel particulate Matter (DPM) control strategies at Leeville mine
—T. Terrillion, S. Arya

Isolated zone evaluation of the Tier 4i diesel engine equipped with an SCR system—A. D. Bugarski

Pilot Study—Protection factor of closed cab equipment for Diesel Particulate Matter in an underground mine—J. Griffith

Simulation of hydrogen release behavior from an underground distribution system for hydrogen vehicle power application
—B. Angers, S. Hardcastle

Room B  Mine Gases & Dust—2
Chair: J. Tien

Model and experimental studies in the longwall goaf in the methane inflow conditions
—W. Dziurzynski, S. Wasilewski

A 2012 update on the world VAM oxidizer technology market
—J. Somers, C. Burklin

Dissipating the heat inside mine refuge chambers—J. F. Brune

Utilizing NetzCAD as a tool for predicting gas emissions and outbursts—E. Clausen, A. Agasty

Technical measures for dust control in the German coal mining for the prevention of “Black Lung” and silicosis diseases—K. Bartke
9:45-10:15 a.m.  Break—Exhibit Hall Officer’s Club

10:15 – 12 p.m.  Concurrent Sessions— Officer’s Club

Room A  Main and Booster Fans
Chair: M. G. Nelson

Booster fan applications for sections in longwall and room and pillar mining—C. Pritchard

Underground booster fans - current UK practice for safe installation and management —R. Leeming

Use of underground booster fans in foreign prominent coal mining countries compared with the situation on prohibition in the United States—S. Gillies

A Study of Recirculation in a Coal Mine Ventilation Model Main Fans—J. Wempen

Effect of booster fan in ventilation networks – Computational and experimental approaches —A. Habibi, S. Gillies

Room B  Mine Fires
Chair: D. Chalmers

MFIRE 3.0 - NIOSH brings MFIRE into 21st Century —A. C. Smith, A. F Glowacki

Simulation of Inertization for Underground Mine Fires —Y. Zhang, J. Tien

CoExperimental Investigation of the Effect of Ventilation on Underground Mine Fire Behavior under Different Conditions —X. Zhang, J. Tien

A preliminary full scale cutting test to find pre-cursor parameters of frictional ignition—E. Kim
12:15-1:15 p.m.  UGH Ballroom - Lunch
Sponsored by Robinson Fans, Inc.

1:20-2:40 p.m.  Concurrent Sessions-Officer's Club

Room A  Numerical Modeling—1
Chair: I. Loomis

CFD Modeling of Pollution Transport in Open Pit Mines under Arctic Air Inversion
—W. Collingwood

Integration of climate projections in ventilation network calculations—R. Beez, J. G. Swanson

Application of graph theory algorithms to detect multiple recirculation paths —E. Acuña

Choosing command and control for ventilation systems within the mine environment.
—S. Fredsti, P. Mousset-Jones

Room B  Heat and Humidity—1
Chair: K. Wallace

An overview of Canadian heat stress research related to mining—S. Hardcastle

CFD modeling of direct heat exchange with water spray systems
—A. Agasty, J.G. Swanson

Modeling of the Natural Heat Exchange Area at Creighton Mine for Operational Decision Support—L. Fava, B. Anderson

Development-end Cooling Study
—D. Bahrami, G. Danko

2:40-3:10 p.m.  Break—Exhibit Hall Officer’s Club

3:10-4:50 p.m.  Concurrent Sessions-Officer’s Club

Room A  Ventilación en Español—2
Chair: F. Calizaya

El beneficio de algoritmos genéticos sobre la optimización manual de redes de ventilación principal
—E. Acuna, R. Alvarez

Ventilación en Altura: Criterios de diseño de un sistema de ventilación principal—J. Puig Mengual
Evaluación del sistema de ventilación de Mina Colquechaquita
—J. L. Condori, L. Hidalgo

Estandarización del proceso de ventilación en minas de carbón—Caso Carbones del Caribe S.A.S. Colombia—C. S., Toro

Guía para Estimar el Requerimiento de Aire en Minas que Utilizan M étodos de Open Stopping
—E. Cordova, F. Calizaya

Room B Ventilation Monitoring—1
Chair: I. Duckworth

Developing ventilation management system at Leeville mine

SmartEXEC optimized mine ventilation on demand (VOD) at Xstrata’s Nickel Rim South
—H. Dello Sbarba, E. Bartsch

Gas sensor limitations for the qualitative control of ventilation on demand Systems—S. G. Hardcastle

A review of computer based intelligent control and monitoring systems for mining ventilation
—M. Devlin

5:10-5:50 Underground Ventilation Committee (UVC) Meeting
Open to all Room A

7-9:30 Banquet—UGH Ballroom
Announcement of location of the 15th Symposium
Brian Prosser, Chairman, Underground Ventilation Committee

SME 2012 Howard L. Hartman Nominee
For Outstanding Service in the Field of Mine Ventilation Engineering
By Dr. Ian Loomis, Technical Advisor, P.T.Freeport -Indonesia

Remarks by the nominee

Symposium Organizers
Felipe Calizaya and Michael G. Nelson

Entertainment: The Lightwood Duo
Mike Christiansen & Eric Nelson
Wednesday, June 20, 2012

7:30-8 a.m. Authors’ Coffee & Speaker Ready Room
Office’s Club Room A
(open to session chairs & presenters)

8:10-9:45 a.m. Concurrent Sessions—Officer’s Club Room A

Concurrent Sessions — Officer’s Club Room A

Spontaneous Combustion
Chair: J. Grubb

Applications of directionally drilled horizontal gob boreholes for methane drainage in Western Coal Mines — D. Brunner, F. Schumacher

A Mathematical Model of R70 Self-Heating Test for the Propensity of Coal Spontaneous Combustion — Y. Luo, X. Wang

Benchmarking coal self heating — B. Beamish

Quantifying spontaneous combustion inhibition of reactive coals — B. Beamish

Control of spontaneous combustion in a pillar using a flexible membrane — D. Chalmers

Ventilation Monitoring — 2
Chair: George Gamble

Assessing environmental changes and recognizing activity within a VOD system — S. Hardcastle

Comprehensive ventilation simulation of atmospheric monitoring sensors in underground coal mines — K. R. Griffin, K. D. Luxbacher


A comparative study on ventilation efficiency in dead spaces along airways based on laboratory model and mine measurement — G. Arpa, A. Widiatmojo
Mine Exhaust Fan Coupling Failures due to VFD Induced Torque Oscillations
—Vern Martin, Steve Kaufman

9:45-10:15 a.m. Break - Exhibit Hall Officers Club

10:15 – 12 p.m. Concurrent Sessions—Officer’s Club

Room A Numerical Modeling—2
Chair: P. Mousset-Jones

Convective, diffusive and dispersive transport of gaseous constituents by ventilation—G. Danko

A technique for creating perfluoro-carbon tracer (PFT) calibration curves for tracer gas studies
—E. C. Jong, K. D. Luxbacher

Evaluation of mine size on turbulent effective diffusion from tracer gas measurement data and numerical simulation—A. Widiatmojo, K. Sasaki

Comparison of use of booster fans in US Coal Mines to alternative approaches for maintaining ventilation—A. Habibi

Room B Heat and Humidity—2
Chair: S. Hardcastle

Modular Thermal Transfer Unit (MTTU) - Portable Surface Ice Stope
—C. Allen, E. Rantanen

Factors that influence on the mine climate simulation—W. Yang, M. Inoue

Temperature variations in underground tunnels—G. Danko

Improved Design of Total Air Conditioning System in Underground Coal Mines - A Computational Fluid Dynamic Study
—J. C. Kurnia, A. Sasmito

~Symposium Closes~
The Howard L. Hartman Award

The Howard L. Hartman Award, established in 1989, recognizes distinguished contributions in the practice, teaching, or research in the field of underground ventilation engineering. The award is made every two years and will consist of a plaque engraved with the name of the award and the recipient. Election to this honor is by the Executive Committee of both divisions and the SME Board of Directors. Nominations are normally requested the autumn before the symposium with the announcement of the award made at the symposium. There are no limitations regarding the nationality, professional field, membership in the Institute, or otherwise.

Recipients of the Howard Hartman Award

1989    Howard L. Hartman
1991    Malcolm J. McPherson
1993    Y.J. Wang
1995    John R. Stevenson
1997    Raja V. Ramani
1999    Rudolf E. Greuer
        Fred N. Kissell (joint)
2002    Pierre Mousset-Jones
2004    Pramod C. Thakur
2006    Jan M. Mutmansky
2008    John R. Marks
2010    Andrzej Wala
Something to do close by.....

Explore the District  http://www.foothillcd.com
Experience Foothill's Museums, Parks, Zoos, and more.

Visit Foothill Cultural District—the heart of Salt Lake City's cultural life. With trails to hike, zoo animals to watch, trains to ride, dinosaur bones to dig, beds to sleep in, gardens to stroll, Olympic sports to remember, Buffalo Soldiers to visit, and fine art to enjoy, there's something for everyone. And it's all within two square miles in Salt Lake's foothills.

Check the website for special offers & transportation information.

Hogle Zoo  801-582-1631
This is The Place Heritage Park  801-582-1847
Red Butte Garden & Arboretum  801-581-IRIS
The Olympic Cauldron Park  801-581-8849
Utah Museum of Natural History  801-581-6927
Utah Museum of Fine Arts  801-582-1631
NOTES...
NOTES...
SPECIAL THANKS

The symposium organizers and the Underground Ventilation Committee of the SME wish to recognize those who helped make the 14th U.S./North American Mine Ventilation Symposium a success!

Symposium Participants & Guests
- Sponsors
- Exhibitors

Symposium Committees
- Exhibit Organizer
  John Kelleher

Field Trip Organizers & Participating Companies

- Mining Engineering Dept. Staff
  Pam Hofmann

- Mining Engineering Dept. Students
  Kirk Erickson, Mahesh Shriwas, Russel Spaulding

University Guest House Conferences

Field Trip Information
Field Trips require registration. For availability please contact Pam Hofmann 801-585-5176

Wednesday, June 20
1:30pm—Robinson Fans, Inc. Facility Tour
Load bus in parking lot return by 5pm

2pm—Nevada Meikle Mine Tour
Load bus in parking lot for travel to Elko, Nevada return Thursday by 6pm

Thursday, June 21
7am—Kennecott Utah Copper Tour
Load bus in parking lot return by 4pm
For Information during or after the Symposium
Call (801) 585-5176 or visit
http://web.utah.edu/14mineventsymposium/index.html