

Course 1: Underground mine fires: prevention, control and emergency response plans

Juan Pablo Hurtado, Professor, Universidad de Santiago de Chile

WHEN

Thursday, August, 27th

LANGUAGE

Spanish

LENGTH

2,5 hours

DESCRIPTION

An underground mine fire is the most dangerous emergency that mine personnel may face due to the contamination of the air and the rapid spread of smoke and toxic gases through the mine ventilation system. This course reviews the causes and consequences of underground mine fires, as well as prevention strategies, emergency response procedures, fire control techniques, and the essential components of emergency response plans that underground mining operations should have in place to effectively manage these incidents.

GENERAL OBJETIVES

1. Objectives 1: Raise awareness among participants about the consequences of underground mine fires and the factors that may cause them.
2. Objectives 2: Review the main response and fire control strategies applicable to underground mining operations.
3. Objectives 3: Present the development and implementation of an effective underground mine emergency response plan.

CONTENT AND PROGRAME (UTC-4 CHILE TIME)

Module 1

- Introduction
- Historical Review and Statistics
- Causes of Underground Mine Fires
- Mining Regulations and Legislation

Module 2

- Fire Response and Control Strategies
- Mine Rescue Teams
- Emergency Response Plans

10:00 - 10:50	Module 1	Juan Pablo Hurtado
10:50 - 11:00	Questions and discussion Module 1	
11:00 - 11:10	Break 1	
11:10 - 12:00	Module 2	Juan Pablo Hurtado
12:00 - 12:10	Questions and discussion Module 2	
12:10 - 12:20	Break 2	
12:20 - 13:10	Module 3	Juan Pablo Hurtado
13:10 - 13:20	Questions and discussion Module 3	
13:20 - 13:30	Conclusions and Closure of the Course	Juan Pablo Hurtado

LECTURER(S) BIO

Juan Pablo Hurtado Cruz is a Full Professor in the Department of Mining Engineering at the University of Santiago of Chile, with 29 years of professional experience. He holds a B.Sc. in Mining Engineering from the University of Santiago of Chile (USACH) and a Ph.D. in Fluid Mechanics from the University of Oviedo, Spain. Throughout his career, he has participated in numerous research studies and engineering projects in both academia and the mining industry. He has authored more than 20 papers published in leading international peer-reviewed journals, over 50 papers presented at national and international conferences, and has supervised more than 130 undergraduate and graduate theses.

He is the Organizer and General Coordinator of the **Ibero-American International Mine Ventilation Symposium**.

His research and professional interests include fragmentation assessment methods for caving mining methods, mine ventilation, mine drainage, and efficient water management. His work integrates computational fluid dynamics (CFD), ventilation network simulation using VentSim, laboratory experimental techniques, and field measurements to address complex mining engineering challenges.

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COURSE 2: Health, safety and sleep: implications for intermittent work at high and very high altitude

Dr. Marc Poulin and Dr. Steven Roy, Professors, University of Calgary

Dr. Matiram Pun, Research Associate, University of Calgary

Dr. Rosella Camere Colarossi, Specialist in TMJ, Orofacial Pain and Dental Sleep Medicine, Private Practice

WHEN

Thursday, August 27, 2026

LANGUAGE

English and Spanish

LENGTH

4 hours

DESCRIPTION

Dr. Matiram Pun will speak about the impact of acute, subacute and chronic high-altitude exposure on sleep and breathing. Sleep is a state of physiological and reversible unconsciousness which can be terminated by external stimuli. Sleep is essential for maintaining physiological homeostasis, restoration of energy and freshness, maintaining good health and processing various brain functions such as cognition. Insufficient sleep, sleep disturbance or sleep disorder will negatively impact an individual's daytime function, reduce productivity and compromise long-term health. High altitude exposure impairs sleep, as well as brain, heart and lung function. Sleep disturbance independently impacts brain, heart and lung function. Hence, measuring sleep and addressing sleep-related problems among individuals who work at high-altitude work stations such as mines and observatories is paramount. The impact of acute, subacute and chronic high-altitude exposure has differential impact on sleep architecture and increases risks of adverse health consequences. Therefore, a restorative sleep and appropriate management sleep disorders for the high-altitude workers is extremely important for their health and safety as well as productivity. Therefore, conducting sleep studies, especially gold-standard sleep studies with polysomnography, should be conducted to identify the full spectrum of sleep disorders. In this lecture, we will present a basic understanding of sleep, sleep disorders, as well as challenges and opportunities of conducting sleep studies at high altitudes.

Dr. Rosella Camere Colarossi will speak about innovations in the treatment of sleep-disordered breathing using mandibular advancement devices (MADs), with emphasis on their potential application in high-altitude workers. Sleep-disordered breathing and obstructive sleep apnea may negatively impact fatigue, cognitive performance, cardiovascular health, and occupational safety, particularly in remote and high-altitude environments such as mining operations. Mandibular advancement devices have emerged as a portable, comfortable, and increasingly technological alternative for selected patients with obstructive sleep apnea, especially in individuals who may have difficulties tolerating continuous positive airway pressure (CPAP) therapy in remote or shift-work settings. This lecture will review how MADs work, current advances in digital dentistry and CAD/CAM technologies, patient selection, comparison with CPAP therapy, and the role of oral appliance therapy in improving adherence and accessibility of treatment. Emerging innovations in continuous physiologic monitoring integrated into oral appliance therapy, including pulse oximetry and

treatment tracking technologies, will also be discussed as potential tools for improving follow-up and long-term management.

Dr. Roy will speak about the high-altitude illnesses. These will include the most common altitude related disease, the two life-threatening acute illnesses, and chronic altitude sickness. Attendees will learn what causes altitude illness, how it affects work at high altitude, how to recognize the most important diseases, and basics on how they can be prevented and treated.

GENERAL OBJECTIVES

- **Objective 1:** Learn about the importance of sleep in productivity, health, and safety of high altitude workers
- **Objective 2:** Learn about the medical risks of high altitude work and how to mitigate them.
- **Objective 3:** Learn about advances in medical device technology that aim to provide continuous monitoring during sleep.

CONTENT AND PROGRAME (UTC-4 CHILE TIME)

14:00 – 14:05	Introduction	Dr. Marc J. Poulin
14:05 - 14:55	Module 1: <i>Opportunities and Challenges of Conducting Polysomnographic Sleep Studies at High Altitude</i>	Dr. Matiram Pun
14:55 - 15:05	Questions and discussion Module 1	
15:05 - 15:15	Break 1	
15:15 - 16:35	Module 2: <i>High Altitude Illnesses (signs, symptoms, treatments)</i>	Dr. Steven Roy
16:35 - 16:45	Questions and discussion Module 2	
16:45 - 16:55	Break 2	
16:55 - 17:40	Module 3: <i>Innovations in the Treatment of Sleep-Disordered Breathing: The Role of Oral Appliance Therapy</i>	Dr. Rosella Camere Colarossi
17:40 - 17:50	Questions and discussion Module 3	

17:50 - 18:00

Conclusions and Closure of the Course

Dr. Marc J. Poulin

LECTURER(S) BIO

Dr. Matiram Pun: Matiram Pun is a post-doctoral fellow in Mountain Medicine and High Altitude Physiology at the University of Calgary. Mati studies sleep-disordered breathing, primarily obstructive sleep apnea, with intermittent hypoxia in a controlled laboratory environment in Calgary, and also at high altitude in shift workers at The Atacama Large Millimeter/submillimeter Array (ALMA) in northern Chile. Some of Mati's previous research examined the effects of acute, subacute, and chronic exposure to very high altitudes in the Nepal Himalayas and the South American Andes. Currently, Mati has been focusing on the effects of aging, shift work, extreme environment (high altitude) and comorbidities such as kidney failure on sleep architecture and sleep-disordered breathing.

Dr. Steven Roy: Steven Roy is an intensive care physician and mountain medicine specialist. In addition to residencies in Internal Medicine and Critical Care Medicine, he holds four international diplomas in Mountain and Expedition Medicine. He is faculty for the Canadian Diploma in Mountain Medicine, co-program director of the Wilderness MD/McGill University Resident Physician Elective in Wilderness Medicine, and program director of the Diploma in Wilderness & Expedition Medicine. He is a Fellow of the Royal College of Physicians & Surgeons of Canada, the Academy of Wilderness Medicine, the Royal Geographical Society, and the Royal Aeronautical Society. He is co-author of the chapters on High Altitude Illness in several textbooks including Mountain Emergency Medicine and Harrison's Principles of Internal Medicine. He sits on international committees related to remote and high-altitude medicine including the Executive Committee of the International Society for Mountain Medicine (ISMM), the Medical Commission of the International Commission of Alpine Rescue (ICAR), the Medical Commission of the International Climbing and Mountaineering Federation (UIAA), the Lake Louise Acute Mountain Sickness Score Consensus Committee, the Post-Graduate Medical Education Committee of the Wilderness Medical Society (WMS), and the Education & Training Committee of the Aerospace Medical Association (AsMA).

Dr. Rosella Camere Colarossi: Rosella Camere is a specialist in Oral Rehabilitation, Temporomandibular Disorders (TMD), Orofacial Pain, and Dental Sleep Medicine based in Lima, Peru. She holds a Master's Degree in Higher Education and serves as a Postgraduate Professor in the Oral Rehabilitation Program at Universidad Peruana de Ciencias Aplicadas (UPC). She is a Founding Member of the Peruvian Society of Temporomandibular Disorders and Orofacial Pain (APTDO). In addition to her private clinical practice, she collaborates with sleep medicine centers in Lima as a Dental Sleep Medicine specialist, with a focus on the interdisciplinary management of sleep-disordered breathing, oral appliance therapy, and the integration of advanced digital dental technologies into patient care.

Dr. Marc Poulin: Marc Poulin is Professor of Physiology in the Cumming School of Medicine (Departments of Physiology & Pharmacology, and Clinical Neurosciences) and the Faculty of Kinesiology. He is a member of the Hotchkiss Brain Institute, the Libin Cardiovascular Institute of Alberta, and the O'Brien Institute of Public Health. He also holds the Brenda Strafford Foundation (Endowed) Chair in Alzheimer Research. Dr. Poulin leads a graduate training specialization program in Mountain Medicine and High-Altitude Physiology at the University of Calgary. Since 2010, he has been interacting with mining companies to better understand

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the challenges imposed on miners who work at high altitude in South America. He currently serves on the scientific advisory board of the International Hypoxia Symposia Conference series and served as Editor for the journal Experimental Physiology (Physiological Society, UK; 2013-2017). Dr. Poulin is Director of the NSERC BRAIN CREATE Interdisciplinary Training Program for New Neurotechnologies (2019-2027).



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COURSE 3: Immersive Technologies, Data and Human Factors for Mining Safety

Gonzalo Aspillaga Trehwela, HSE and Operational Management Leader, SMI Chile

WHEN

Friday, August 28, 2026

LANGUAGE

Spanish

LENGTH

2,5 hours

DESCRIPTION

This course explores how immersive technologies, data analytics, and human factors can be integrated to improve safety performance and critical risk management in mining operations.

GENERAL OBJECTIVES

- **Objective 1:** Provide an overview of mining accident trends, with a particular focus on vehicle-person interactions using up-to-date statistical data.
- **Objective 2:** Analyze human factors, organizational error, and control failures as fundamental causes of mining accidents.
- **Objective 3:** Design a realistic Virtual Reality (VR) / Augmented Reality (AR) scenario linked to critical controls, BowTie analysis, and operational performance data.
- **Objective 4:** Develop a data structure, leading indicators, and decision-support dashboards for supervisors and management.
- **Objective 5:** Define a pilot implementation roadmap applicable to any mining operation.

CONTENT AND PROGRAMME (UTC-4 CHILE TIME)

10:00 – 10:10	Course Opening and Introduction: Overview of the course objectives, methodology, and the central case study: vehicle-person interaction in mining.	Course Coordinator / Instructor
10:10 - 10:40	Module 1: Mining Accident Trends and Critical Vehicle-Person Risk Objective: Understand current mining accident trends and the critical nature of vehicle-person interactions. Topics include global and Chilean accident statistics (2015–2024), blind spots, communication failures, operational pressure, exposure in open pit and underground mines, processing plants, workshops, transportation, contractors, and the influence of experience, seniority, fatigue, and shift work.	Gonzalo Aspillaga

	Methodology: Technical presentation with case analysis and guided discussion.	
10:40 - 10:50	Questions and discussion Module 1: Discussion of real operational experiences, field challenges, and common hazards associated with vehicle-person interaction.	
10:50 - 10:55	Break 1	
10:55 - 11:30	Module 2: Human Factors, BowTie Analysis and Critical Controls Objective: Examine how human error, organizational conditions, and weak controls contribute to critical incidents. Topics include human-organization-control causal models, risk perception, fatigue, cognitive workload, operational pressure, normalization of deviations, BowTie analysis for vehicle-person collisions, threats, top events, consequences, preventive and mitigating controls, and criteria for effective critical controls. Methodology: Applied BowTie analysis and technical discussion.	Gonzalo Aspillaga
11:30 - 11:40	Questions and discussion Module 2: Discussion on control effectiveness, field verification, supervision, and the gap between procedures and actual practice.	
11:40 - 11:45	Break 2	
11:45 - 12:20	Module 3: VR/AR, Preventive Data, Performance Indicators and Pilot Implementation Objective: Design an immersive solution linked to critical controls, data collection, and preventive decision-making. Topics include a VR/AR scenario involving a night shift, reduced visibility, missing spotter, decision points, reaction data, decision sequences, control failures, database design, leading and lagging indicators, dashboards, implementation requirements, a 90-day pilot roadmap, and ethical considerations in data management.	Gonzalo Aspillaga

	Methodology: Conceptual demonstration of the workflow from critical risk → VR/AR scenario → data collection → indicators → preventive decision-making.
12:20 – 12:30	Applied Exercise, Conclusions and Course Closing: Participants will identify a critical hazard, propose controls, design a VR/AR scenario, define three preventive data points, and develop a KPI, an alert, and a management action. Final technical conclusions and closing remarks.

LECTURER(S) BIO

Gonzalo Aspillaga Trehwela is a Risk Prevention Engineer and a Sernageomin Category B Certified Professional with more than 15 years of experience in occupational health and safety, HSEQ management, regulatory compliance, and critical risk management across mining, industrial, and highly regulated operations.

His professional experience includes major national and international mining projects and contracts involving companies such as BHP, Codelco, Anglo American, and Rio Tinto, where he has led initiatives in operational management, preventive leadership, auditing, technical training, executive reporting, and the implementation of internationally recognized management systems, including ISO 45001, ISO 31000, and Critical Risk Management frameworks.

He has received international training and certification in G-MIRM, Critical Control Management, catastrophic risk management, incident investigation, and methodologies for strengthening critical controls, supported by The University of Queensland, Australia.

His professional approach is aligned with the ICMM Critical Control Management Good Practice Guide, focusing on the identification, verification, and assurance of critical controls designed to prevent serious and fatal incidents.

He currently serves as HSE and Operational Management Leader at SMI Chile, where he promotes technical training and applied innovation initiatives, including a collaborative project with the Universidad del Desarrollo focused on the use of immersive technologies, augmented reality, data analytics, and simulation to strengthen preventive training, operational decision-making, and the proactive management of critical risks in mining.