

# TECHNICAL COURSES BEFORE THE CONFERENCE

COURSES ARE FREE OF CHARGE FOR REGISTERED PARTICIPANTS

## TECHNICAL COURSE 1 (ENGLISH WITH INTERPRETATION AVAILABLE)

Thursday, August 26

14:00 – 18:00

**Fundamentals of Tailings Geotechnics**

Conducted by TAILENG, USA



**Presenters:**

**Jorge Macedo**, Assistant Professor, Georgia Institute of Technology, USA

**Chris Bareither**, Associate Professor, Colorado State University, USA

**Jonathan Bray**, Professor, University of California Berkeley, USA

**Scott Olson**, Professor, University of Illinois at Urbana Champaign, USA

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## TECHNICAL COURSE 2 (SPANISH WITH INTERPRETATION AVAILABLE)

Monday, August 30

09:00 – 13:00

**Integrating Seismic Hazard, Performance and Monitoring of  
Tailings Deposits**

Conducted by Advanced Mining Technology Center (AMTC), Universidad de Chile



**Presenters:**

**Diana Comte**, Professor, AMTC, Universidad de Chile

**César Pastén**, Professor, AMTC, Universidad de Chile

**Roberto Gesche**, Professor, AMTC, Universidad de Chile

## TECHNICAL COURSE 3 (ENGLISH WITH INTERPRETATION AVAILABLE)

Tuesday, August 31

10:00 – 13:00



### Myths and Realities of Tailings Dewatering

Conducted by the Norman B. Keevil Institute of Mining Engineering, The University of British Columbia, Canada

**Moderator: Caius Priscu, Adjunct Professor, Norman B. Keevil Institute of Mining Engineering, The University of British Columbia, Canada**

#### Presenters:

**Kate Patterson**, Associate, Tailings and Water Resources Engineer, Klohn Crippen Berger, Canada

**Rachel Jensen**, Senior Process Engineer, Paterson & Cooke, USA

**Guillaume Tremblay**, Tailings & Dam Engineer, Rio Tinto, Canada

**Michael Davies**, Senior Advisor, Teck Resources, Canada

**John Lupu**, Senior Director, Newmont Mining, USA

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## TECHNICAL COURSE 1 (ENGLISH WITH INTERPRETATION AVAILABLE)

**Thursday, August 26**

14:00 – 18:00

### Fundamentals of Tailings Geotechnics

Conducted by TAILENG, USA



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**When:** Thursday August, 26<sup>th</sup> 2.00pm-6.00pm EDT

**Presenter(s):** Jorge Macedo, Assistant Professor, Georgia Institute of Technology

Chris Bareither, Associate Professor, Colorado State University

Jonathan Bray, Professor, University of California Berkeley

Scott Olson, Professor, University of Illinois at Urbana Champaign

**Language:** English (The talk by Dr. Jorge Macedo can be in Spanish if needed).

**Length:** 4 hours (Expected)

**Description:** This course discusses fundamental and applied concepts of tailings geotechnics, emphasizing their role in the design, construction, and operation of tailings storage facilities. The course will discuss general aspects of tailings engineering, fundamentals of static liquefaction, characterization of mine tailings at different scales (i.e., laboratory, field), and seismic design aspects of tailings storage facilities. The course aims to provide the participants with fundamental tailings geotechnics concepts needed to engage in conversations, projects, and subsequent learning opportunities on mine tailings geotechnics. This course is expected to be beneficial for civil and environmental engineers, geological engineers, geotechnical engineers, tailings engineers, mining engineers, risk managers, and other consulting engineers with interest in mine tailing.

**CONTENT AND PROGRAMME**

13:45 - 14:00	Welcome and Introduction to the Course	Course Coordinator
14:00 - 14:50	Introduction to tailings engineering	Chris Bareither
14:50 - 15:00	Questions and discussion Lecture 1	
15:00 - 15:50	Fundamentals of static liquefaction in tailings storage facilities	Jorge Macedo
15:50 - 16:00	Questions and discussion Lecture 2	
16:00 - 16:50	Field and laboratory assessment of undrained behavior of tailings	Scott Olson
16:50 - 17:00	Questions and discussion Lecture 3	
17:00-17:50	Seismic response of tailings storage facilities	Jonathan Bray
17:50:18:00	Questions and discussion Lecture 4	
18:00 - 18:10	Conclusions and Closure of the Course	Course Coordinator

**TECHNICAL BACKGROUND**

A general background in geotechnical engineering.

**GENERAL OBJECTIVES**

- Introduce attendees to general aspects of tailings engineering with a focus on the geotechnical aspects.
- Introduce attendees to the mechanical characterization of mine tailings to evaluate phenomena such as static liquefaction.
- Introduce attendees to the characterization of mine tailings at different scales (Laboratory, field))
- Introduce attendees to the practices to assess the seismic performance of tailings storage facilities
- Illustrate the role of tailings geotechnics in the design, management, and closure of tailings storage facilities.

**LECTURER(S) BIO****Jorge Macedo**

Jorge Macedo, Ph.D., P.E. is an Assistant Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology in Atlanta, Georgia, USA. Dr. Macedo received B.S (2007) and M.S (2011) degrees in civil engineering and soil mechanics, respectively, from the Peruvian National University of Engineering and M.S. and Ph.D. degrees in Geoengineering in 2014 and 2017 from the Department of Civil & Environmental Engineering at the University of California Berkeley. Before joining UC Berkeley, Dr. Macedo practiced for six years as a geotechnical engineer working on a range of challenging geotechnical and geo-environmental multi-disciplinary projects for the mining sector. He worked on major mining projects in Peru, Argentina, and Brazil, from conception to detailed engineering design.

Dr. Macedo has expertise in the areas of Mining Geotechnics, Geotechnical earthquake engineering, advanced numerical modeling of geotechnical systems, performance-based design and risk assessment, and assessment and mitigation of seismically-induced hazards. Dr. Macedo's research combines performance-based engineering and data science tools with advanced numerical modeling (e.g., FEM, FDM, MPM) to support the implementation of risk and hazard assessment in geo-hazards engineering, which can lead to a more sustainable design of geotechnical systems.

**Christopher Bareither**

Dr. Bareither is an Associate Professor of Civil and Environmental Engineering at Colorado State University. His expertise is in Geotechnical and Geoenvironmental Engineering. His education is all within the field of Geological Engineering; he received a BS from University of Idaho (2004) and MS (2006) and PhD (2010) from University of Wisconsin-Madison.

Dr. Bareither conducts research and teaches undergraduate and graduate courses in Geotechnical and Geoenvironmental Engineering. In addition, he is faculty adviser to the CSU chapter of Engineers Without Borders that is actively engaged in engineering challenges for developing communities, and is a licensed Professional Engineer in the state of Colorado.

**Jonathan Bray**

Jonathan Bray is the Faculty Chair in Earthquake Engineering Excellence at the University of California, Berkeley. He earned engineering degrees from West Point, Stanford, and Berkeley. Dr. Bray is a registered professional civil engineer and has served as a consultant on several important engineering projects and peer review panels. He has authored more than 350 research publications. His expertise includes the seismic performance of earth structures, seismic site response, liquefaction and ground failure and its effects on structures, earthquake fault rupture propagation, and post-event reconnaissance. Dr. Bray was elected into the US National Academy of Engineering and is a Fellow in ASCE. He has received several other honors, including the Terzaghi Award, Ishihara Lecture, Peck Award, Joyner Lecture, Prakash Award, Huber Research Prize, Packard Foundation Fellowship, and NSF Presidential Young Investigator Award.

**Scott Olson**

Scott M. Olson, Ph.D., P.E. is a Professor and Faculty Excellence Scholar in the Civil & Environmental Engineering Department at the University of Illinois, where he joined the faculty in 2004. Prior to joining the University of Illinois, Scott worked in practice for nearly 8 years for Woodward-Clyde Consultants and URS Corporation on infrastructure, energy, and mining projects worldwide. Prof. Olson has researched static and seismic liquefaction for over 25 years, and has been involved in dozens of research and consulting projects involving geotechnical earthquake engineering; tailings dam engineering; in situ, laboratory, and centrifuge testing, soil-foundation-structure interaction; and paleoliquefaction and geohazards analysis. From these activities, Scott has published over 150 journal papers, conference articles, and reports and has received numerous awards, including the ASCE Walter L. Huber Civil Engineering Research Prize and the Canadian Geotechnical Society R.M. Quigley Award. Prof. Olson serves in various capacities for the Geo-Institute, USUCGER, EERI, the Transportation Research Board (TRB), and the Geotechnical Extreme Event Reconnaissance (GEER) Association. Most recently, he became a founding member of the U.S.-based Tailings and Industrial Waste Engineering (TAILENG) Center.

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**TECHNICAL COURSE 2 (SPANISH WITH INTERPRETATION AVAILABLE)****Monday, August 30**

09:00 – 13:00

**Integrating Seismic Hazard, Performance and Monitoring of Tailings Deposits**

Conducted by Advanced Mining Technology Center (AMTC), Universidad de Chile

**Presenters:****Diana Comte**, Professor, AMTC, Universidad de Chile**César Pastén**, Professor, AMTC, Universidad de Chile**Roberto Gesche**, Professor, AMTC, Universidad de Chile

## INTEGRANDO EL PELIGRO SÍSMICO, DESEMPEÑO Y MONITOREO DE DEPÓSITOS DE RELAVES

**Cuándo:** Lunes 30 agosto de 2021

**Instructor(es):** Diana Comte S., Profesora Titular Departamento de Geofísica e Investigadora Titular AMTC, Universidad de Chile

César Pastén P., Profesor Asistente Departamento de Ingeniería Civil e Investigador Asociado AMTC, Universidad de Chile

Roberto Gesche S., Profesor Adjunto Departamento de Ingeniería Civil e Investigador Asociado AMTC, Universidad de Chile

**Idioma:** Español

**Duración:** 4 horas

**Descripción:** Este curso organizado por el Centro Avanzado de Tecnología para la Minería (AMTC) de la Universidad de Chile presenta los principales aspectos a considerar en el diseño sísmico de depósitos de relaves, considerando la estimación del peligro sísmico, la respuesta sísmica de estas geo-estructuras y el monitoreo requerido para evaluar su adecuado desempeño sísmico.

### CONTENIDO Y PROGRAMA

08:45 - 09:00	Bienvenida e Introducción al Curso	Coordinador(a) del Curso
09:00 - 09:50	Módulo 1: Peligro sísmico aplicado de Depósitos de Relaves	Diana Comte S.
09:50 - 10:00	Preguntas y discusión Módulo 1	
10:00 - 10:20	Break 1	

10:20 - 11:10	Módulo 2: Respuesta sísmica de depósitos de relaves	César Pastén P.
11:10 - 11:20	Preguntas y Discusión Módulo 2	
11:20 - 11:40	Break 2	
11:40 - 12:30	Módulo 3: Instrumentación	Roberto Gesche S.
12:30 - 12:40	Preguntas y Discusión Módulo 3	
12:40 - 13:00	Conclusiones y Cierre del Curso	Coordinador(a) del Curso

### PÚBLICO OBJETIVO

Este curso está orientado a profesionales involucrados(as) en diseño y operación de depósitos de relaves.

### METODOLOGÍA Y MATERIALES

El curso se realizará en forma sincrónica a través de la plataforma ZOOM (descargable desde [www.zoom.us](http://www.zoom.us)). Los participantes tendrán acceso a las presentaciones en formato PDF de cada uno de los tres módulos.

### OBJETIVOS GENERALES

- Analizar las principales herramientas para caracterizar el peligro sísmico al que están expuestos los depósitos de relaves en Chile. Además, se analizan los procedimientos para acceder a datos de redes sismológicas nacionales e internacionales, para la determinación del peligro sísmico de un sitio específico y comprender los procesos asociados a dicha determinación, principalmente sus alcances y limitaciones.
- Revisar los principales aspectos de la respuesta sísmica de depósitos de relaves y cómo se pueden incorporar en el diseño y en los métodos de análisis, considerando la caracterización y comportamiento dinámico de los materiales con métodos de terreno y laboratorio y la demanda sísmica, entre otros factores.
- Mostrar el valor de la instrumentación y monitoreo geotécnico como herramienta para entender el comportamiento estructural de un depósito de relaves frente a una amenaza sísmica. Se explicarán los mecanismos de falla que un sismo puede gatillar y se presentarán las variables de monitoreo que permiten hacer seguimiento al desarrollo de estos posibles mecanismos de falla.

**CÁPSULA BIOGRAFICA DE LOS INSTRUCTORES**

**Diana Comte S.** es sismóloga y profesor titular del Departamento de Geofísica de la Universidad de Chile, donde dicta los cursos asociados a terremotos y a peligro sísmico. Posee un magíster de la Universidad de Chile y un doctorado de la Universidad Nacional Autónoma de México. Es investigadora titular del Centro Avanzado de Tecnología para la Minería (AMTC) de la Universidad de Chile, donde participa en la línea de investigación de Relaves aplicando técnicas e instrumentación geofísica para caracterizar los depósitos de relaves.



**César Pastén P.** es ingeniero geotécnico y profesor asistente del Departamento de Ingeniería Civil de la Universidad de Chile, donde dicta los cursos de mecánica y dinámica de suelos. Posee un magister y doctorado en ingeniería civil del Georgia Institute of Technology. Es coordinador académico del Diploma de Postítulo en Ingeniería de Relaves, investigador asociado del AMTC y director del Laboratorio de Sólidos y Medios Particulados de la Facultad de Ciencias Físicas y Matemáticas.



**Roberto Gesche S.** es Ingeniero Civil en Estructuras y Construcción de la Universidad de Chile, con un Magíster (M.Sc.) en Geotecnia e Infraestructura de la Universidad de Hannover, Alemania. Cuenta con 19 años de experiencia laboral en construcción de obras, diseño, y planificación de infraestructura. Roberto ha participado de proyectos en el Reino Unido, Alemania, España, Argentina y Chile, en sectores como la minería, energía, obras portuarias, y edificación. Desde el año 2012 se desempeña como docente part-time en la Escuela de Ingeniería de la Universidad de Chile.

## TECHNICAL COURSE 3 (ENGLISH WITH INTERPRETATION AVAILABLE)

Tuesday, August 31

10:00 – 13:00



### Myths and Realities of Tailings Dewatering

Conducted by the Norman B. Keevil Institute of Mining Engineering, The University of British Columbia, Canada

**When:** Tuesday, 31 August 2021 @7AM Vancouver; 8AM Denver, 10AM Santiago

**Presenter(s):** Kate Patterson, KCB; Rachel Jensen, Paterson & Cooke; Guillaume Tremblay, Rio Tinto; Michael Davies, Teck Resources Ltd., John Lupo, Newmont; Caius Priscu, UBC (Moderator)

**Language:** English, with live Spanish interpreters

**Length:** 2.5 hrs

**Description:** This live technical workshop, **organized by the Norman B. Keevil Institute of Mining Engineering at the University of British Columbia**, will discuss the latest trends and practices on the topic of tailings dewatering and sustainable tailings management. Myths will be debunked, and realities will be uncovered by five specialists from around the world, related to tailings dewatering systems and processes. Speakers represent well established and respected consulting engineering firms, owners and operators of tailings storage facilities, and the academia. Several case studies will form the basis of the discussion as they relate to tailings dewatering challenges and opportunities, what works and what doesn't, success stories and mishaps. Above all, the workshop will reveal some difficult but practical solutions considered when the realities of field implementation do not really align with the original design intent, and how we can learn and continuously improve in this field of practice.

### TECHNICAL BACKGROUND

This workshop will dive into the technical challenges of tailings dewatering from many angles, including civil, geotechnical, mineral processing, and metallurgical engineering, optimized mine waste management plans, and sustainable tailings management practices.

## PARTICIPANTS

This workshop is designed specifically for the practitioners, engineers and scientists alike, in the field of mine waste management, and for those who have interest in gaining practical knowledge and willing to learn from the success stories and the challenges the industry faces when considering tailings dewatering in their projects or at their operations. Students, engineers and geoscientists in training are particularly encouraged to attend this workshop.

## CONTENT AND PROGRAM

Time (Chile local time)	Activity / Presentation Title	Presenter
10:00 – 10:10	Welcome, Introductions and Safety Share	Caius Priscu
10:10 – 10:30	Strategies and alternative analyses for dewatering tailings	Kate Patterson
10:50 – 11:10	Thickened and paste tailings dewatering – The key ingredients	Rachel Jansen
11:40 – 12:00	Filtered tailings: Lemon or Lemonade?	John Lupo
11:10 – 11:20	Coffee break	
10:30 – 10:50	Planning and implementing dewatering transition - Operational challenges	Guillaume Tremblay
11:20 – 11:40	Dry stacking in cold regions – What works and what doesn't	Michael Davies
12:00 – 12:30	Q&A – open discussion forum, and closing	Caius Priscu

## RESULTS FROM ATTENDING THE WORKSHOP

At the end of the workshop, participants will learn from experienced practitioners on the topic of tailings dewatering technologies, the pros and cons of available methods, and how tailings dewatering – if properly implemented, could lead to successful tailings management projects with multiple benefits, including safer facilities, improved water recovery, and lower risks.

## SPECIFIC OBJECTIVES

- Objective 1: understand the opportunities of implementing tailings dewatering technologies
- Objective 2: understand advantages and disadvantages of the various dewatering technologies
- Objective 3: learn from the past mistakes in implementing dewatering projects
- Objective 4: be aware of the pitfalls of assumptions or poor implementation decisions, and
- Objective 5: have a confirmation that one size does not fit all that each site and location context is different, and solutions need to be looked at and evaluated based on their own merit.

## WORKSHOP METHODOLOGY

The workshop will take place in a synchronous mode, with live presentations, using the ZOOM platform. It will consist of five, 20 minute long presentations by five experienced professionals, followed by a Q&A session where participants can ask questions related to the presentations or general questions on the topics.

## WORKSHOP MATERIALS

Participants will receive a copy of the slides presented in PDF format, just prior to the workshop.

## PRESENTERS' BIO

### **Kate Patterson, M.Eng, P.Eng, P.E, KCB, Vancouver, BC, Canada**



Kate Patterson is a senior Civil Engineer and Associate at KCB with over 14 years of experience in mine waste management with a focus in tailings and water strategic planning and design. She has a keen interest in tailings alternatives assessments and decision analysis, recently leading and facilitating studies for several large, complex projects. Kate coordinated a review of tailings technologies (from 2015 to 2017) commissioned by the MEND project and supported by the Mining Association of Canada (MAC). This study includes an inventory of alternative tailings management technologies in Canada and a case study review of international alternative tailings technologies.

### **Rachel Jensen, M.Phil, Paterson & Cooke, Denver, CO, United States**



Rachel Jensen is a senior process engineer focusing on tailings management strategies and solutions within Paterson & Cooke's North American practice. Rachel is currently providing support to a major mining company in the development of long-term tailings strategies for their global operations. She has over 16 years of experience in mineral processing within various roles, including engineering, consulting, and project management. Rachel has field experience in South Africa, Turkey, Indonesia, Mexico, Brazil, and Australia. Her experience includes tailings dewatering, paste backfill, process design, feasibility studies, circuit mass balance, model building and simulation and surveys for plant optimization/auditing.

## **Guillaume Tremblay, Ing., Rio Tinto, Jonquiere, QC, Canada**



Guillaume Tremblay is a geotechnical engineer working for Rio Tinto Aluminum in Québec, Canada. Mr. Tremblay has more than ten years of experience, with a focus on geotechnical engineering, consulting and project management. Working with Rio Tinto for 7 years now, he recently joined the bauxite residue disposal area management team as the dam engineer. His focus is on the geotechnical aspects of the RDA while managing the operational transition between wet and dry disposal.

## **Michael Davies, PhD, P.Eng, Teck Resources Ltd., Vancouver, BC, Canada**



Dr. Michael Davies is a senior advisor for Teck Resources. Michael joined Teck in early 2012 as their Vice-President, Environment and in late 2017 transitioned as part of a phased retirement to a senior advisory role. His current role involves assisting in Teck's technical pursuits, providing internal review and leading Teck's tailings governance program, guiding specific input on mine waste research and development, and in developing talent. In addition to his corporate mining experience, prior to joining Teck Michael had over 25 years of consulting experience including several tailings/geotechnical

review boards.

## **John Lupo, PhD., P.E., Newmont, Denver, CO, United States**



Dr. Lupo is the Sr. Director of Geotechnical and Hydrology for Newmont. He has spent over thirty years in the mining industry playing in rock, soil, and water in projects across the world.

## **Caius Priscu, Ph.D, P.Eng, University of British Columbia, Vancouver, BC, Canada**



Dr. Priscu is an Adjunct Professor with the Norman B. Keevil Institute of Mining Engineering at the University of British Columbia, where, since January 2021, he enjoys mentoring students, sharing knowledge, and teaching Mine Waste Management, Safety and Risk Management of Tailings Storage Facilities. Dr. Priscu is also Co-Founder and Principal Geotechnical Engineer with Priscu and Associates Consulting Engineers Inc., based in West Vancouver, BC, Canada. He has over 30 years of experience in the field of geotechnical and geo-environmental engineering related to the mining and water resources industries across the world. He was involved in projects located in Canada, US, Australia, South Africa, Botswana, Zimbabwe, Tunisia, Chile, Peru, Brazil, Slovenia, Spain, Mongolia, Philippines, and Romania.