

TECHNICAL PROGRAM

Live Streaming

Live sessions at Time Zone Santiago, Chile. GMT -4. English-Spanish interpretation available.

THURSDAY, AUGUST 26

Technical Course

14:00 **Fundamentals of Tailings Geotechnics**

- Conducted by **TAILENG, USA**

18:00

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

MONDAY, AUGUST 30

Technical Course

09:00 **Integrating Seismic Hazard, Performance and Monitoring of Tailings Deposits**

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

13:00

TUESDAY, AUGUST 31

Technical Course

10:00 **Myths and Realities of Tailings Dewatering**

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

12:30

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 Lupo, Senior Director, Newmont Mining, USA

WEDNESDAY, SEPTEMBER 1**Inauguration Ceremony****11:00 Words of Welcome****Mimy Mackenzie**, Conference Manager, Gecamin, Chile**César Pastén**, Tailings 2021 Co-organizer; Academic, Academic, AMTC, Universidad de Chile**Caius Priscu**, Tailings 2021 Co-organizer; Adjunct Professor, Norman B. Keevil Institute of Mining Engineering, The University of British Columbia, Canada**Michael Henderson**, Tailings 2021 Co-organizer; Director, Tailings Center of Excellence, Colorado School of Mines, USA**Jorge Macedo**, Tailings 2021 Co-organizer; Chair of TALENG, USA**Tamara Johndrow**, Tailings 2021 Chair, Director Tailings & Water, Freeport-McMoRan, USA**Plenary Session 1 (AM)**Moderator: **Johan Boshoff**, Group Head of Tailings, Gold Fields, Australia**11:30 Freeport's Tailings Stewardship and Management Program 16-Year Evolution and Path to Aligning with the Tailings Standard's Requirements****Tamara Johndrow**, Tailings 2021 Chair, Director Tailings & Water, Freeport-McMoRan, USA**12:00 Teck Resources' Tailings Governance Program - Roots, Formation, Journey of Incorporating External Expectations, and Teck's View of Defining Roles and Responsibilities and Maintaining Key Resources****Michael Davies**, Senior Advisor, Teck Resources, Canada**12:30 Discussion Pannel****Panelists:**

Briana Gunn, Newmont Mining, USA

Chris Anderson, Manager Tailings & Mine Waste, Teck Resources, Canada (TBC)

Ursula Weber, Social Development and Communities Manager, Anglo American, Chile

13:00 Virtual Welcome Reception (networking)**Plenary Session 2 (PM)**

Moderator: TBC

16:00 Alternatives Analysis to Aid Operators in Decision Making**Charles Dumaresq**, Vice President, Science and Environmental Management, Mining Association of Canada

16:45 **Incorporating Risk and Uncertainty Analysis in Design, Construction, and Operational Decision Making and Communicating Performance Outcomes Effectively**
Angela Kupper, Director and Principal Geotechnical Engineer, BGC Engineering, Canada

17:30 **Virtual Coffee Break**

THURSDAY, SEPTEMBER 2

Discussion Panel

11:00 **Tailings Professionals' Capacity: Quantifying and Addressing the Supply - Demand Gap**
Moderator: Michael Davies, Senior Advisor, Teck Resources, Canada

Introductory Presentation

Aidan Davy, Chief Operating Officer at ICMM, UK

Panelists:

Katie Kruger, Senior Tailings Engineer, Freeport-McMoRan, USA

John Wates, Non Executive Chairman, Fraser Alexander, South Africa

Caius Priscu, Adjunct Professor at UBC and Consultant, Canada

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

David Machin, Antamina, Peru

12:30 **Virtual Coffee Break**

FRIDAY, SEPTEMBER 3

Plenary Session 3

Moderator: **Sergio Barrera**, Tailings Management Consultant and Manager, Delfing Ingeniería, Chile (TBC)

11:30 **Implementing 248 in Chile**
Eduardo Zuñiga, Jefe Departamento de Gestión de Proyectos, Ministerio de Minería, Chile

11:50 **Implementing 248 and GISTM in Codelco Chile**
René Orellana, Gerente Corporativo Relaves, Codelco, Chile

12:10 **Changes to Chilean TSF design + Operation Over the Years**
Luis Valenzuela, Consulting Engineer, Chile

12:30 **Short Discussion - Questions and Answers for the Plenaries speakers**

12:50 **Congress Balance and Final Comments**

RECEIVED ABSTRACTS

(83 abstracts as of July 23)

Represented Countries (20): Argentina, Australia, Brazil, Canada, Chile, Colombia, Finland, France, Germany, Iran, Italy, Mexico, Netherlands, Peru, South Africa, Spain, Sweden, Turkey, UK and USA

Geotechnics and Dam Safety

(24 abstracts)

(A03) Static Liquefaction Behaviour of Oil Sand Tailings

Grytan Sarkar and Abouzar Sadrekarimi, Western University, Canada

(A04) Influence of Energy Flux on the Spectral Adjustment for the Dynamic Analysis of a Tailings Dam

Cristian Erazo, Frank Pérez, Pedro Mendoza and Jéssica Rodríguez, Ausenco, Peru

(A05) Comparison of Static and Dynamic Behavior of Centre Line and Downstream Raise Cyclone Sand Dams

Cristian Erazo and Frank Pérez, Ausenco, Peru

(A06) Stabilization of Tailings Dams: Soil Mixing For Ground Improvement

Peter Banzhaf, BAUER Spezialtiefbau, Germany

(A12) Earth Filled Dams Contact with Water and/or Fine Tailings versus Non Segregated Tailings – Risk Analysis

Juan Rayo and Freddy Flórez, JRI, Chile; and María Zandarin, Glencore Pachón, Argentina

(A21) Tailings Dam with Reinforced Earth Walls

Nicolás González and Rodrigo Ossandón, Tierra Armada, Chile

(A22) Evaluation of Theoretical Liquefaction of Compacted Tailings Piles Based on the State Parameter Approach: A Case Study

Eduardo Muguet and R. Silva, Statum Geotecnia, Brazil

(A28) Geotechnical characterization of an old copper tailings impoundment by using the Cone Penetration Test and Laboratory Testing

Camilo Morales, Emilia Castillo and Jean Paul Posch, SRK Consulting, Chile

(A39) Realistic Tailings Dam Flood Modeling using a Variable Density, Viscosity, and Yield Stress Two-Dimensional Model

Reinaldo García, Hydronia, USA; Sergio Martínez, Pilar García-Navarro and Javier Murillo Universidad Zaragoza, Spain; and Adolfo Correa, BrazilHydro, Brazil

(A40) Five Brazilian Tailings: From Laboratory and Field Data towards Safer Design Criteria

Paulo Cella and Flávia Padovani, BVP Engineering, Brazil

(A41) Simplified Dams Risk Assessments Need To Remain Meaningful

Franco Oboni and Cesar Oboni, Riskope, Canada

(A44) Comparison of CPTu Inversion Parameters Estimated Using the NorSand Widget

Kyle Smith, and Riccardo Fanni, Golder, Australia; and David Reid, The University of Western Australia, Australia

(A45) Static and Dynamic Liquefaction Numerical Analysis Using the Field State Parameter

Alfredo Arenas, Golder, Australia; and Johan Boshoff, Gold Fields, Australia

(A48) Residual Strength of a Silty Sand Soil Foundation: a Critical State Soil Mechanics Application

José Ccotohuanca, H. Barriga and J. Sanchez, Klohn Crippen Berger, Peru

(A50) Dam Safety Review: Lessons and Opportunities

Ignacio Atucha, Claudio Román, Marcelo Mussé and Gabriel Cuevas, Ausenco, Chile

(A70) Fault Tree Analysis as a Tool for Preventing the Developing of Failure Modes in Tailings Dams

César Pastén, Diana Comte, Christian Ihle and Samuel Rojas, Universidad de Chile; and Felipe Campos and José Campaña, Arcadis, Chile

(A71) TSF's Risk Management in Chile: A Preventive or Reactive View?

Gail Riddell, Emilio López, Manuel Cortés and Ignacio Pizarro, Nava Consulting, Chile

(A72) Geotechnical Characterization of a Phosphate Ore Tailing Applying Critical State Concepts with Norsand

Ian Paes, DF+ Engineering, Brazil

(A73) A Comparison of Sampling Methods in a Compacted Underflow Sand Embankment

Zygi Zurakowski, Stantec, USA

(A86) Static Liquefaction Prediction of Sandy Tailings through a Generalized Plasticity Model

Jorge Cárdenas and Anderson Barreto, National University of Engineering, Peru; and Celso Romanel, Pontifical Catholic University of Rio de Janeiro, Brazil

(A90) A Modular Base Platen Assembly to Increase the Efficiency of Triaxial Critical State Testing

David Reid and Andy Fourie, The University of Western Australia, Australia; and Ivan Orea and Riccardo Fanni, Golder, Australia

(A91) Not In My Dam: South32's Approach to Minimizing the Production of Contractant Tailings

Peter DiDonna, South32, Australia

(A93) Trends for the Monotonic Response of Mine Tailings Under Critical State Soil Mechanics

Jorge Macedo and Luis Vergaray, Georgia Institute of Technology, USA

(A99) Effect of Non-Plastic Fines in the Undrained Response of a Tailings Sand Under High Pressures

Diego Silva, Skava Consulting, Chile; and Felipe Ochoa, Universidad de Chile

Hydraulics and Transportation

(2 abstracts)

(A09) TSF Reclamation: Integrated Solutions for Tailings Re-Handling By Means of Slurry Transportation

Stefan Groenheide and T. de Boer, IHC Mining Advisory Services, Netherlands; and Guido Villamil, IHC Mining Advisory Services, Colombia

(A103) Flow Control Applied In Two-Phase Flow in Long Distance Pipes

Maycon Alves, Vale, Brazil

Seepage and Water Management

(6 abstracts)

(A11) Seepage Analyses in a Dam with Inverted Flow

Víctor Bretas, Leonardo Agripino, Vinicius Pereira, Renata Damas, Daniela Amorim and Mauro Lima Filho, Mineração Paragominas, Brazil; and Breno Castilho, Norsk Hydro, Brazil

(A58) Numerical-Experimental Analysis of the Galego Dam Internal Drain Flow, Using Laboratory and Field Data

Fabiano Mendanha and Sabrina Rocha, Vale, Brazil

(A65) Numerical Modelling of Unsaturated Flow in Dry Stack Tailings

Erick Rógenes, Luciano Souza, Stefania Oliveira, Elisa Silveira, Aline Marques and André Coelho, DF+ Engineering, Brazil

(A96) Influence of the Foundation Permeability and the Stacking Rate on the Filtered Tailings Heap Stability

Gino Calderón, Vale, Brazil

(A97) Leveraging Hydrogeophysics for In-Situ Monitoring of Tailings Facilities

Raul Mollehuara, Elena Kozlovskaya and Juha Lunkka, University of Oulu, Finland; and Daniele Pedretti, Università degli Studi di Milano, Italy

(A102) Flood Management in Tailings Storage Facilities (TSF)

Gustavo Calle, María Hernández and Mauricio Abdallah, Wood, Chile; and Matías Martínez, Minera Los Pelambres, Antofagasta Minerals, Chile

Rheological and Chemical Aspects

(7 abstracts)

(A10) A Geotechnical and Rheological Characterization of Bauxite Mining Tailings

Víctor Bretas, Leonardo Agripino, Vinicius Pereira, Renata Damas, Daniela Amorim and Mauro Lima Filho, Mineração Paragominas, Brazil; and Breno Castilho, Norsk Hydro, Brazil

(A49) Microbially Induced Calcite Precipitation as Tool to Improve the Mine Waste Management

Héctor Zúñiga, Javiera Toledo, Lorena Jorquera and David Jeison, Pontificia Universidad Católica de Valparaíso, Chile

(A66) Estimation of Tailings Flow Runout Distance from Rheology Approach

Álvaro Vergara and Sergio Palma, Universidad Técnica Federico Santa María, Chile; Alejandra Álvarez, JRI Ingeniería, Chile; and María Zandarín, Glencore Pachón, Argentina

(A75) Rheological Behavior of Different Types of Tailings for Dam Break Analysis

Micheline Perdigão, Paulo dos Santos, Brenda Vale, Laura Leite, Thiago Oliveira and Guilherme Ribeiro, DF+ Engineering, Brazil

(A76) Tailings Rheology Considerations for Dam Breach Analysis

Claudio Román, Francisco Scheihing and Jorge Martínez, Ausenco, Chile

(A88) Determination of the Rheology of Liquefied Bauxite Residue Using a Pilot-Scale Dam Break Test

Roxana Ugaz and Gordon McPhail, Water, Waste and Land, Australia

(A89) Rheological Characterization of a Filtered Bauxite Residue Deposit from Northern Brazil

Débora Chácara, Stefani Oliveira, Ronaldo Pantoja and Yuuki Miura, Hydro Alunorte, Brazil; and Breno Castilho, Paschoal Cataldi, Norsk Hydro, Brazil

Innovations in Conventional Tailings Design and Studies**(3 abstracts)****(A32) Improving Tailings Geotechnical Behaviour Using Bio-Additives for Large Scale Applications**

Hernán Cifuentes, ATC Williams, Australia; and David Williams, The University of Queensland, Australia

(A35) Water Recovery from Tailings Dewatering Circuits vs Make-up Water from Desalination Plant

Cristian Zamorano, Sergio Ramírez and Cristian Garrido, Fluor, Chile

(A42) Prediction of Initial Settled Density for Copper Tailings based on the Basic Properties

Arash Roshdieh and Keith Seddon, ATC Williams, Australia

Thickened and Paste Tailings**(6 abstracts)****(A02) Paste-type Thickener Critical Design Features**

Jerold Johnson and Brad Bentley, WesTech Engineering, USA

(A14) Flocculation and Dewatering of Oil Sands Tailings with a Novel Functionalized Polyolefin Flocculant

Zahra Rostami and João Soares, University of Alberta, Canada

(A27) Tailings Deposition Technologies Applied in a Region with Equatorial Climate

Filipe Guimarães, Wellington de Oliveira and Matheus Pedrosa, Equinox Gold, Brazil

(A51) Quantification of the Impact of Clay Presence in the Solid-Liquid Separation Stage of Copper Sulphide Tailings, In Continental and Sea Water

Catalina López-Espejo and Christian Ihle, Universidad de Chile

(A87) Descriptive and Prescriptive Analyses of Thickeners: Experimental and Operational Data Approach

Pamela Garrido, William Montes-Quiroz, Klebber Andrade and Patricia Fernández, Centro de Investigación Minería Sustentable JRI, Chile

(A101) Variation of Solid Concentration for High Thickened Tailings Flows during Deposition: A Field Study and Model

Fabián Olea and Tomás Errázuriz, Universidad de Chile

Filtered and Centrifuged Tailings Design and Studies

(7 abstracts)

(A08) Design and Geotechnical Studies of a Filtered-Tailings Stack

Breno Castilho, Norsk Hydro, Brazil; and Débora Chácara, Stefani Oliveira, Yuuki Miura and Ronaldo Pantoja, Hydro Alunorte, Brazil

(A19) Comparison of Two Filtering Techniques Applied To Bauxite Residue

Breno Castilho, Paschoal Cataldi, Norsk Hydro, Brazil; and Stefani Oliveira, Débora Chácara, Ronaldo Pantoja, Yuuki Miura, André Ramos and Alexandre Freitas, Hydro Alunorte, Brazil

(A34) Filter Aids to Improve Iron Ore Tailings Filtration

Nathalia Costa, Leandro Bicalho, Pierre Fernandes, Wagner Silva, Clariant, Brazil; and Rodolfo Moreira and Vinicius Seering, Vale, Brazil

(A37) Filtered Tailings Deposit Design: A Sustainable Alternative to Modern Mining

Édgar Quiroz, Stantec, Peru

(A53) Filtered Tailings Dry Stack Quality Control: Efficacy Study for Nuclear Densimeter Test Application

Matheus Muniz, Vale, Brazil

(A60) Dewatering of Tailings and Paste with Modern Vacuum Disc Filters

Jürgen Hahn, Bokela, Germany

(A64) Filtered Tailings and Mine Waste Dumps in Brazil: Challenges and Opportunities

Luciano Souza, Erick Rogenes, Stefania Oliveira, Elisa Silveira, Aline Marques and André Coelho, DF+ Engineering, Brazil

Technologies and Instrumentation for Monitoring and Surveillance

(13 abstracts)

(A01) Using Ambient Seismic Noise Interferometry to Image and Monitor Tailings Dams

Tjaart de Wit and Gerrit Olivier, Institute of Mine Seismology, Australia

(A07) InSAR Monitoring of Tailing Dams in Almalyk Mining and Metallurgical Complex (AMMC), Uzbekistan

Gokhan Aslan, BRGM-French Geological Survey, France; and Ziyadin Cakir, Istanbul Technical University, Turkey

(A16) G.Re.T.A. Solution to Monitor the Integrity of Tailings Dams

Greta Tresoldi, LSI Lastem, Italy; Luigi Zanzi, Politecnico di Milano, Italy; and Azadeh Hojat, Shahid Bahonar University of Kerman, Iran

(A18) Advanced Tailings Dam Monitoring and Response system based on IoT

Pedro Leite, Ricardo Telles and Luis Almeida, Mosaic Fertilizantes do Brasil; Bruno Rezende, Leonardo Santana, Tetra Tech América do Sul, Brazil; and Denis Guihot, Andrea Bartoli, Xavi Vilajosana, Leonardo Vidigal and Fernando Pérez, Worldsensing SL, Spain

(A25) Integration of the Monitoring of Variables Associated With Physical Stability to the Safety Management System for Tailings Storage Facilities

Jasna Zúñiga and Gonzalo Suazo, Universidad Técnica Federico Santa María, Chile

(A52) Integrity Monitoring of Tailing Storage Facilities Using Distributed Sensing Fiber Optics

Sam Johansson, HydroResearch, Sweden; Michael Mondanos, Silixa, UK; and Zara Anderson, Silixa, Canada

(A59) Passive Seismic Ambient Noise Imaging and Monitoring of Earthen Dam walls using Fibre-Optic (DAS) dataRichard Lynch, Aurélien Mordret, Sophie Beauprêtre, Roméo Courbis¹, Anaïs Lavoué, Sisprobe, France; Sam Johansson, Hydro Research, Sweden; and Anna Stork, Michael Mondanos, Zara Anderson and Nicholas Arndt, Silixa, UK**(A61) Evaluation and Investigation of Anomalous Behavior of Instrumentation of the Pocilga Dam**

Fabiano Mendanha, Thais dos Santos, Felipe Leão and Roney Rodrigues, Vale, Brazil

(A62) Application of Modern Systems & Technologies for Better Managing Risks Posed By Tailings Storage Facilities

Kamal Mistry, Fraser Alexander, South Africa; and Juan Duarte, Fraser Alexander, Chile

(A85) Satellite InSAR for Assessing Deformation Processes of Tailing Dams: The Żelazny Most Case in Legnica Glogow Copper District (Poland)

Benedetta Antonielli, Sapienza Università di Roma, Italy; Francesca Bozzano, Stefano Scancelli, Paolo Mazzanti and Serena Moretto, NHAZCA, Italy; Alessandra Sciortino, Università degli Studi dell'Aquila, Italy

(A98) Towards the Development of an Effective Monitoring Program of Tailings Dams: The Vale Experience

Karla Pimentel, Isabela Vasconcelos, Beatriz Mapa, Diego Lage, Filipe Costa, Pamela Lisboa and Tercio Costa, Vale, Brazil; and Paolo Farina, Geoapp, Italy

(A106) Surveillance and Reporting Tools for TSF Management

Mark Schmelter, Freeport-McMoRan, USA

(A105) Automated Permanent Monitoring of Seepage for Tailings Dams Using a Customized ERT System

Leopoldo Córdova, Geosinergia Ingeniería y Medio Ambiente, Chile

Inclusion of Stakeholders in Tailings Planning

(2 abstracts)

(A13) Novel Interactive Web-Based Tool for Dam Breach Inundation Studies

Gemma Bullard, Patrick Grover, Robert Millar, Katie Tait and Matthew Lato, BGC Engineering, Canada

(A67) The Future of Abandoned Tailings Facilities in Chile

Manuel Cortés, Gail Riddell, Emilio López and Ignacio Pizarro, Nava Consulting, Chile

Governance and Operational Experiences

(9 abstracts)

(A63) Practical Steps to Global Industry Standards on Tailings Management Compliance for Operational TSFs

Siduduzo Dladla, Fraser Alexander, South Africa; and Juan Duarte, Fraser Alexander, Chile

(A69) Challenges in Chilean TSFs Global Standard Implementation

Emilio López, Gail Riddell, Manuel Cortés and Ignacio Pizarro, Nava Consulting, Chile

(A77) Dry Stacking of Filtered Tailings in High-Andean Region: Geotechnical Considerations

José Sierra and Jorge Chávez, Golder, Peru

(A80) Integrated Planning Procedures for Optimizing TSF Operations at the Peñasquito Mine

Rafael Dávila and Eduardo García, Newmont Mining, Mexico

(A81) Case Study: Rockfill Dam Construction at a Tailings Storage Facility

Ranjiv Gupta, Ayobami Alao, Amber Pehringer and Laura Nugent, Freeport McMoRan, USA; and Jason Hilgers, AECOM, USA

(A82) Systematic and Sustainable Tailings Storage Facility Dust Control

Ross Hunsaker, Evan Fonger and Ramón Arnaudez, Newmont Mining, Mexico

(A83) Practical Considerations for The Tailings Operating Manuals

Johan Boshoff and Louise McNab, Gold Fields, Australia

(A84) App Based Solutions to Benchmark Operations against the Global Industry Standard on Tailings Management

Johan Boshoff and Louise McNab, Gold Fields, Australia

(A104) Tailings Governance in Codelco: The Way Traveled and Next Challenges

Carlos Vilches and René Orellana, Codelco, Chile

Tailings Closure Management

(4 abstracts)

(A17) Coal TSF Closure Guidelines, Targeting a Consistent, Measurable and Sustainable Approach

Sally Moodie and Kim Ferguson, BHP, Australia; and D. Chad LePoudre, BHP, Canada

(A26) Geoquimic Stability of Tailings Dams at Closure

Osvaldo Aduvire, SRK Consulting, Peru

(A38) Management of the Post Closure Erosion of Sand Dam Embankments

Gordon McPhail, Nikolai Nazarov and Francisco García, Water, Waste and Land, Australia

(A74) Evaluation of Procedures for Tailings Dams Closure: International Guidelines Approach

Thiago Oliveira, Felipe Lanza, Laura Matoso Joao Costa and Mario Júnior, DF+ Engineering, Brazil

ABSTRACT DISTRIBUTION

Mining Companies

(25 abstracts)

BHP, Australia (1)
 BHP, Canada
 Codelco, Chile (1)
 El Pachón, Glencore, Argentina (2)
 Equinox Gold, Brazil (1)
 Freeport McMoRan, USA (1)
 Hydro Alunorte, Brazil (2)
 Los Pelambres, Antofagasta Minerals, Chile (1)
 Gold Fields, Australia (3)
 Mineração Paragominas, Brazil (2)
 Newmont Mining, Mexico (2)
 Norsk Hydro, Brazil (1)
 South32, Australia (1)
 Vale, Brazil (7)

Engineering and Consulting Companies

(38 abstracts)

Arcadis, Chile
 ATC Williams, Australia (2)
 Ausenco, Chile (2)
 Ausenco, Peru (2)
 BAUER Spezialtiefbau, Germany (1)
 BGC Engineering, Canada (1)
 BrazilHydro, Brazil
 BVP Engineering, Brazil (1)
 DF+ Engineering, Brazil (5)
 Fluor, Chile (1)
 Geoapp, Italy
 Geosinergia Ingeniería y Medio Ambiente, Chile (1)
 Golder, Australia (1)
 Golder, Peru (1)
 IHC Mining Advisory Services, Colombia
 IHC Mining Advisory Services, Netherlands (1)
 Hydronia, USA (1)
 HydroResearch, Sweden
 JRI Ingeniería, Chile
 Knight Piésold, Peru
 LSI Lastem, Italy (1)
 Nava Consulting, Chile (3)
 Riskope, Canada (1)
 Sisprobe, France (1)

Skava Consulting, Chile (1)
SRK Consulting, Chile (1)
SRK Consulting, Peru (1)
Stantec, Peru (1)
Stantec, USA (1)
Statum Geotecnia, Brazil (1)
Suncor Energy, Canada
Tetra Tech América do Sul, Brazil
Tierra Armada, Chile (1)
Water, Waste and Land, Australia (2)
WesTech Engineering, USA (1)
Wood, Chile
Worldsensing SL, Spain (1)

Supplier Companies**(5 abstract)**

Bokela, Germany (1)
Fraser Alexander, Chile (2)
Fraser Alexander, South Africa
Mosaic Fertilizantes do Brasil
Clariant, Brazil
Klohn Crippen Berger, Peru (1)
Silixa, Canada (1)
Silixa, UK

Universities and Research Centers**(14 abstracts)**

Institute of Mine Seismology, Australia (1)
Istanbul Technical University, Turkey
National University of Engineering, Peru (1)
NHAZCA, Italy (1)
Politecnico di Milano, Italy
Sapienza Università di Roma, Italy
Shahid Bahonar University of Kerman, Iran
Universidad de Chile (3)
Universidad de Valparaíso, Chile
Universidad Técnica Federico Santa María, Chile (1)
Università degli Studi dell'Aquila, Italy
Università degli Studi di Milano, Italy
University of Alberta, Canada (1)
University of Oulu, Finland (1)
University of Texas, USA
The University of Queensland, Australia
The University of Western Australia (1)
Western University, Canada (1)

Universidad de Zaragoza, Spain
Pontificia Universidad Católica de Valparaíso, Chile (1)
Pontifical Catholic University of Rio de Janeiro
Centro de Investigación Minería Sustentable JRI, Chile (1)
Georgia Institute of Technology, USA (1)

State-Owned Institutions, NGOs and Government Agencies

(1 abstracts)

BRGM-French Geological Survey, France (1)