

JUL 05 1984

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MEMORANDUM FOR: Mysore S. Nataraja, Section Leader
Engineering Branch
Division of Waste Management

FROM: John T. Buckley
Engineering Branch
Division of Waste Management

SUBJECT: TRIP REPORT COVERING THE ROCK MECHANICS
SYMPOSIUM ON JUNE 25-27, 1984

The 25th U.S. Symposium on Rock Mechanics was held at Northwestern University in Evanston, Illinois on June 25-27, 1984. Technical papers were presented in 24 major areas. The program which outlines the speakers, authors, and presentation topics can be seen as Attachment 1 to this memo.

Wednesday morning and afternoon presentations dealt with the topic of Nuclear Waste Isolation. The morning session consisted predominantly of technical presentations dealing with the rock mechanics aspects of repository design. Papers presented in the afternoon session dealt primarily with an overview of the rock mechanics effort to date and the role of in-situ testing in the design of a nuclear waste repository (see Attachment 1 for the authors and topics of presentations).

Following the seven presentations on Nuclear Waste Isolation on Wednesday afternoon, the speakers gathered on stage as a panel to answer questions from the audience and to discuss opposing points of view. The NRC was represented on the panel by John T. Greeves. Many of the questions from the audience were directed at John and dealt with the NRC position concerning the role of in-situ testing prior to granting a construction authorization. The audience responded favorably to the dialogue between panel members.

A list of symposium attendees is presented with this memo as Attachment 2. Late registrants to the symposium are not listed in Attachment 2. All registered attendees of the symposium were given a hard cover copy of the proceedings. A copy can be found in my office (room 483).

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PDR WASTE
WM-1 PDR

OFC	:	WMEG	:	:	:	:	:	:
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If you have any questions regarding the contents of this memo or would like any further information about the symposium, please call me at ext. 7-4544.

ORIGINAL SIGNED BY

John T. Buckley
Engineering Branch
Division of Waste Management

Attachments:
As stated

DISTRIBUTION:

WM FILE 459 ✓
WMEG r/f
NMSS r/f
REBrowning
MJBell
JTGreeves
LBarrett
HMiller
JBuckley
JOBunting
LBHigginbotham

OFC	:	WMEG <i>JB</i>	:	:	:	:	:	:	:
NAME	:	JBuckley/cj	:	:	:	:	:	:	:
DATE	:	84/05/07	:	:	:	:	:	:	:

Monday Morning II
10:30-12:30

Machine-Rock Interaction
Lecture Room 2

Chairmen: David A. Summers
Univ. of Missouri

Priscilla Nelson
Univ. of Texas

A Rational Approach to Practical Performance Assessment for Rapid Excavation Using Boom-Type Tunneling Machines

Simon T. Johnson
University of Newcastle upon Tyne, UK
(co-author: R.J. Fowell)
10:30-10:50

Cutting Trials with a Water-Jet-Assisted In-Seam Tester

H.J. Handewith
U.S. Bureau of Mines
(co-authors: R. J. Evans, M. Hood)
10:50-11:10

Experimental Assessment of Borehole Drilling Damage in Basaltic Rocks

Kittip Fuenkajorn
Univ. of Arizona
(co-author: J. K. Daemen)
11:10-11:30

Crater and Crack Formation in Rock from Impact of High Velocity Ceramic Projectiles

David C. Holloway
Univ. of Maryland
(co-authors: W. Wilson, D.B. Barker, A. Shukla)
11:30-11:50

Finite Element Simulation of Rock Cutting: A Fracture Mechanics Approach

Victor E. Saouma
Univ. of Pittsburgh
(co-author: M.J.J. Kleinovsky)
11:50-12:10

Fracture Mechanics-Theory

Lecture Room 3

Chairmen: Surendra P. Shah
Northwestern Univ.

Harmut Spetzler
Univ. of Colorado

A Criterion for Quasibrittle Crack Growth

Len G. Margolin
Los Alamos National Laboratory
(co-author: B.W. Smith)
10:30-10:50

Mathematical Modeling of Progressive Cracking and Fracture of Rock

Zdenek P. Bazant
Northwestern Univ.
10:50-11:10

Mixed Mode Fracture Mechanics with Emphasis on Transversely Isotropic Rocks

Patricia L. Lavery
U.S. Army Corps of Engineers, Omaha NE
(co-authors: K.P. Chong, M.D. Kuruppu)
11:10-11:30

Compression-Induced Micro-Crack Growth

S. Nemat-Nasser
Northwestern Univ.
(co-author: H. Horii)
11:30-11:50

Development of Fracture Regions in Brittle Materials

Luis E. Vallejo
Univ. of Pittsburgh
(co-author: E. Pramono)
11:50-12:10

The Microcracking of Rock and the Prediction of Fracture and Failure

Alvin M. Strauss
Vanderbilt Univ.
12:10-12:30

In-Situ Stress
Auditorium

Chairmen: Bernard Amadei
Univ. of Colorado

Kunsoo Kim
Rockwell Hanford Operations

Using a Sonic Technique to Estimate In Situ Stresses

N. Mao
Lawrence Livermore Laboratory
(co-authors: J. Sweeney, J. Hanson, M. Constantino)
10:30-10:50

Determination of In Situ Stress from Anelastic Strain Recovery Measurements of Oriented Core: Comparison to Hydraulic Fracture Stress Measurements in the Rollins Sandstone, Piceance Basin, Colorado

Lawrence W. Teufel
Sandia National Laboratories
(co-author: N.R. Warpinski)
10:50-11:10

In Situ Stress by Pulse Velocity Monitoring of Induced Fractures

J.M. Pitt
Iowa State Univ.
(co-author: L. A. Klosternann)
11:10-11:30

Development of a Wireline Hydrofracturing Technique and Its Use at a Site of Induced Seismicity

Bezael C. Haimson
Univ. of Wisconsin
(co-author: M.Y. Lee)
11:30-11:50

Mining-Induced Stress Measurement with Hydraulic Borehole Pressure Cells

Paul H. Lu
U.S. Bureau of Mines
11:50-12:10

Analysis of Borehole Inclusion Stress Measurement Concepts Proposed for Use in the Waste Isolation Pilot Plant (WIPP)

Harold S. Morgan
Sandia National Laboratories
12:10-12:30

**Monday Afternoon
2:00-4:00**

Analytical Techniques Auditorium

Chairmen: Francois E. Heuze
Lawrence Livermore National
Laboratory
Ashraf M. Mahtab
Columbia Univ.

Numerical Modelling of the Stress and Displacement Fields Around Two- and Three-Dimensional Cracks

John. H. Curran
Univ. of Toronto
(co-author: L. Vandamme)
2:00-2:20

An Analysis of Ground Support Through Fully Grouted Rockbolts

D. E. Van Dillen
Agbabian Associates
(co-author: C.M. St. John)
2:20-2:40

Coupled Deformation/Flow Analysis with the Distinct Element Method

John Kafritsas
Massachusetts Institute of Technology
(co-author: H.H. Einstein)
2:40-3:00

Thermoviscoelastic Finite Element Model Simulations Associated with Underground Coal Conversion

S.C. Lee
Ohio State Univ.
(co-authors: S.H. Advani, J.K. Lee)
3:00-3:20

The Validity of Equivalent Rock Mass Models

K. C. Lau
Univ. of Toronto
(co-authors: K. Smith, A.M. Crawford)
3:20-3:40

Discontinuous Deformation Analysis

Gen-Hua Shi
Univ. of California, Berkeley
(co-author: R.E. Goodman)
3:40-4:00

Ground Control In Coal Mining Lecture Room 2

Chairmen: Syd S. Peng
West Virginia Univ.

Z.T. Bieniawski
Penn State Univ.

Stress Control Method Applied to Stabilization of Underground Coal Mine Openings

Shosei Serata
Serata Geomechanics, Inc.
(co-author: F. Carr)
2:00-2:20

Optimum Mining Plan for Multiple Seam Mining

Wen H. Su
West Virginia Univ.
(co-author: S.S. Peng, H.S. Hsiung)
2:20-2:40

An Investigation of the Causes of Cutter Roof in a Central Pennsylvania Coal Mine: A Case Study

John L. Hill
U.S. Bureau of Mines
(co-author: E.R. Bauer)
2:40-3:00

Methods of Designing Mechanical Roof Bolting in Horizontally Bedded Strata

D.H.Y. Tang
West Virginia Univ.
(co-author: S.S. Peng)
3:00-3:20

Rock Bursts in Hunan Collieries

Guangping Cui
Xiangtan Institute of Mining Technology, China
3:20-3:40

Constraint—The Missing Variable in the Coal Burst Problem

C. Babcock
U.S. Bureau of Mines
(co-author: D. Bickel)
3:40-4:00

ASTM Workshop on Testing Standards Lecture Room 3

Chairman: Howard J. Pincus
Univ. of Wisconsin, Milwaukee

Representatives from industry, government and academia will give informal presentations on the status of rock mechanics testing standards. A summary report of the workshop will be published in the ASTM Geotechnical Testing Journal.

Tuesday Morning I
8:00-10:00

Fracture Mechanics- Experimental Auditorium

Chairmen: Hammut Spetzler
Univ. of Colorado

Surendra P. Shah
Northwestern Univ.

**Ultrasonic Probing of the Fracture Process
Zone In Rock using Surface Waves**
Peter L. Swanson
Univ. of Colorado
8:00-8:20

**Fracture Analysis of Subsize Charcoal
Granite Specimens**
Joseph F. Labuz
Northwestern Univ.
(co-authors: S.P. Shah, C.H. Dowding)
8:20-8:40

**Strain Localization During Deformation of
Westerly Granite**
N. Brodsky
Univ. of Colorado
8:40-9:00

**Laboratory Hydraulic Fracturing Stress
Measurements in Salt**
Glenn M. Boyce
Univ. of California, Berkeley
(co-authors: T.W. Doe, E. Majer)
9:00-9:20

**Study of Fracture Mechanisms in Coal
Subjected to Various Types of Surface
Tensions Using Holographic Interferometry**
A. Wahab Khair
West Virginia Univ.
9:20-9:40

Longwall Mining Ground Control Lecture Room 2

Chairmen: Z.T. Bieniawski
Penn State Univ.

Syd. S. Peng
West Virginia Univ.

**Prediction of Inter-Strata Movements Above
Longwall Faces**
Neil Styler
Univ. of Pittsburgh
8:00-8:20

**Controlled Load Development at Longwall
Coalfaces**
A.K. Isaac
Univ. College, Cardiff, U.K.
(co-author: T. J. Bradbury, C.J. Holland)
8:20-8:40

**Technique to Measure Resultant Load
Vector on Shield Supports**
Thomas M. Barczak
U.S. Bureau of Mines
(co-author: R.C. Garson)
8:40-9:00

**An Improved Technique of In-Situ
Measurement of Fracture Zones
Surrounding Coalmine Gateroads**
B.G.D. Smart
Univ. College, Cardiff, U.K.
(co-authors: P.K. Nicholas, A.K. Isaac)
9:00-9:20

**Displacement Discontinuity Method for
Three-Dimensional Stress Analysis of
Tabular Excavations in Non-Homogeneous
Rock**
L.J. Wardle
CSIRO, Australia
9:20-9:40

**The Comprehensive Observation Research
on the Mechanism of Water-Eruptions
From the Floor**
Z.G. Jing
Shandong Mining College, China
(co-authors: B.Y. Li, Z.P. Sun, Z.A. Wang)
9:40-10:00

Characterization Studies Lecture Room 3

Chairmen: Don C. Banks
USAE Waterways Experiment
Station

George A. Kiersch
Cornell Univ./consultant Tucson

**Fractures and Physical Properties of the
Mount Waldo Granite Pluton, Maine**
Fitzhugh T. Lee
U.S. Geological Survey
(co-authors: S.F. Diehl, D.R. Miller)
8:00-8:20

**Characterization of the Precambrian
Granite in Northwestern Illinois**
Mary S. Coates
Harza Engineering Co.
8:20-8:40

**Site Characterization Studies of a Volcanic
Cap Rock**
Henri S. Swolfs
U.S. Geological Survey
(co-author: W.Z. Savage)
8:40-9:00

**Engineering Properties of Maquoketa Shale
in Northwestern Illinois**
Terje Preber
Dames & Moore
9:00-9:20

**Fracture Toughness of Sandstones and
Shales**
P.E. Senseney
RE/SPEC Inc.
(co-author: T.W. Pfeifle)
9:20-9:40

**The Relationship of Point-Load and
Moisture Content Indices of Highly
Anisotropic Sediments of the Illinois Basin**
Robert A. Bauer
Illinois State Geological Survey
9:40-10:00

Tuesday Morning II
10:30-12:30

Mining Induced Subsidence

Auditorium

Chairmen: Edward J. Cording
Univ. of Illinois

Michael Karmis
Virginia Polytechnic Institute and State Univ.

Recent Developments in Subsidence Prediction and Control for the Eastern U.S. Coalfields

Michael Karmis
Virginia Polytechnic Institute and State Univ.
(co-authors: T. Triplett, P. Schilizzi)
10:30-10:50

A Method for Assessing the Potential of Mine Subsidence at Abandoned Mine Sites Through the Assistance of Finite Element Modeling

R. Bischke
International Exploration, Inc.
(co-author: P. S. Getty)
10:50-11:10

Ground Movements Associated with Pillar Extraction Coal Mining in Northern West Virginia

Robert W. Bruhn
GAI Consultants, Inc.
(co-author: R.C. Speck)
11:10-11:30

Application of Time Domain Reflectometry to Mining

Kevin O'Conner
Northwestern Univ.
(co-author: C.H. Dowding)
11:30-11:50

Proposed Criteria for Subsidence Damage to Buildings

S. Bhattacharya
Engineers International
(co-authors: M.M. Singh, C.Y. Chen)
11:50-12:10

Construction of Residential Structures Above Abandoned Illinois Coal Mines

Jim Mahar
Univ. of Illinois
12:10-12:30

Protective Structure Design

Lecture Room 2

Chairmen: Christopher St. John
Agbabian Associates

Donald Linger
Defense Nuclear Agency

Dynamic Rock-Liner Interaction in Tunnels

T. Krauthammer
Univ. of Minnesota
(co-author: P.A. Cundall)
10:30-10:50

Testing and Modelling of Joints and Interfaces Under Static and Cyclic Loading

C.S. Desai
Univ. of Arizona
(co-authors: E.C. Drumm, K. Fishman)
10:50-11:10

CAVS/STEALTH Simulations of Tunnel Response in Jointed Rock

M.B. Gross
Science Applications, Inc.
(co-authors: G. Yee, D.E. Maxwell)
11:10-11:30

Scale Model Experiments Investigating the Response of Protective Structures to Nuclear Attack Loading

C. Michael Dickinson
SRI International
(co-author: H.E. Lindberg)
11:30-11:50

History of Protective Structures Development

Donald Linger
Defense Nuclear Agency
11:50-12:10

Characterization Studies - In-Situ

Lecture Room 3

Chairmen: Don Banks
USAE Waterways Experiment Station

G.B. Baecher
Massachusetts Institute of Technology

Successful Prediction of In Situ Fracture Permeability and Stiffness Characteristics Through Statistical Rock Mass Characterization

Paul R. La Pointe
ARCO Oil & Gas Company
(co-author: H.C. Ganow)
10:30-10:50

Poisson's Ratio as a Parameter for Determination of Elastic Modulus

David M. Cregger
Stone & Webster Engineering Corp.
(co-author: T.J. Lamb)
10:50-11:10

Rapid Assessment of Shear Strength and Its Variability

J.M. Pitt
Iowa State Univ.
(co-author: J.R. Rohde)
11:10-11:30

Performance Testing of the Doorstopper Biaxial Strain Cell

Randall G. Stickney
RE/SPEC Inc.
(co-authors: P.E. Senseny, E.C. Gregory)
11:30-11:50

Characterization of Rock Conditions for the Deep Tunnel Project in Milwaukee.

R.C. Isley
D'Appolonia Consulting Engineers, Inc.
(co-authors: S. Fradkin, J.M. McBee)
11:50-12:10

Tuesday Afternoon I
2:00-4:00

Mining Ground Control

Lecture Room 2

Chairmen: John F. Abel
Colorado School of Mines

W.G. Pariseau
Univ. of Utah

Instrumentation and Monitoring for Pillar Extraction in A Deep, Faulted Uranium Mine

Thomas R. Scotese
Tudor Engineering Co.
2:00-2:20

Reinforcement of Large Pillars by Bolting

S.J. Mitchell
Agapito & Associates
(co-authors: J.F.T. Agapito, L.A. Weakly)
2:20-2:40

Pressure Measurements in Gob

H.N. Maleki
Agapito & Associates
(co-authors: W. Hustrulid, D. Johnson)
2:40-3:00

Determination of Solution Cavern Spacing in Deep Salt Deposit

D.Z. Mraz
Chevron Canada Resources Limited
(co-authors: M.B. Crowe, M.B. Dusseault)
3:00-3:20

Leached Salt Cavern Design Using a Fracture Criterion for Rock Salt

D.S. Preece
Sandia National Laboratories
(co-author: W.R. Wawersik)
3:20-3:40

Numerical Modeling of "Stiff" Backfill in the Coeur d'Alene Mining District

Ed Van Eeckhout
Montana College of Mineral Science and Technology
3:40-4:00

Foundations And Slopes

Auditorium

Chairmen: C. William Lovell
Purdue Univ.

Fred H. Kulhawy
Cornell Univ.

Load Transfer for Drilled Shafts in Weak and Porous Limestone

T.J. Logan
Dames & Moore
(co-authors: J.R. O'Brian, C.P. Cupton)
2:00-2:15

Behavior of Rock Anchors and Sockets

Kent A. Pease
CH2M-Hill
(co-author: F.H. Kulhawy)
2:15-2:30

Stability of Slopes in Discontinuously Jointed Rocks

Thomas M. Tharp
Purdue Univ.
2:30-2:45

Groutability Ratio for Filter Blocking of Joints in Rocks

A.M. Crawford
Univ. of Toronto
(co-author: G. Groskopf)
2:45-3:00

A Case History of the Effect of Mine Subsidence on a Concrete Arch Bridge in Northern West Virginia

Roger B. Alke
West Virginia Dept. of Highways
(co-author: B.L. Thompson)
3:00-3:15

Catastrophic Failure of a Tied-Back Wall on the Interstate in Charleston, West Virginia

Berke L. Thompson
West Virginia Dept. of Highways
(co-author: D.C. Martin)
3:15-3:30

Foundation Studies for a Roller Compacted Concrete Gravity Dam

Gregg A. Scott
U.S. Bureau of Reclamation
3:30-3:45

Properties and Characteristics of Discontinuous Media

Lecture Room 3

Chairmen: Gregory B. Baecher
Massachusetts Institute of Technology

Fitzhugh T. Lee
U.S. Geological Survey

Large Scale Static and Dynamic Friction Experiments

Khosrow Bakhtar
Terra Tek Engineering
(co-author: N. Barton)
2:00-2:20

Frictional Sliding and Fracture Behavior of Some Nevada Test Site Tuffs

C.A. Morrow
U.S. Geological Survey
(co-author: J. Byerlee)
2:20-2:40

The Quantification of Power Law Indices for Discontinuity Shear Strength Prediction

B. Denby
McGill Univ.
(co-author: M.J. Scoble)
2:40-3:00

Application of Artificial Intelligence to Problems of Rock Mechanics

William S. Dershowitz
Massachusetts Institute of Technology
(co-author: H.H. Einstein)
3:00-3:20

A Similarity Test for Groping Orientation Data in Rock Mechanics

M. Ashraf Mahtab
Columbia Univ.
(co-author: T.M. Yeguialp)
3:20-3:40

Interpretation of Fracturing in Drill Cores

Louis A. Panek
U.S. Bureau of Mines
3:40-4:00

Wednesday Morning I
8:00-10:00

Behavior Under Special Conditions

Auditorium

Chairmen: Wolfgang R. Wawersik
Sandia National Laboratory
Zdenek Bazant
Northwestern Univ.

Ambient Temperature Testing of the G-Tunnel Heated Block

Roger M. Zimmerman
Sandia National Laboratories
(co-authors: M.P. Board, E.L. Hardin, M.D. Voegelé)
8:00-8:20

Laboratory Permeability Measurements in Support of an Aquifer Thermal Energy Storage Site in Minnesota

S.C. Blair
Pacific Northwest Laboratory
(co-authors: W.J. Deutsch, L.D. Kannberg)
8:20-8:40

The Effect of Discontinuities, Stress Level, and Discontinuity Roughness on the Thermal Conductivity of a Maine Granite

Thomas C. Sandford
Univ. of Maine
(co-authors: E.B. Decker, K.H. Maxwell)
8:40-9:00

The Effect of Pore Pressure and Heating Time on the Strength and Sliding Stability of Serpentine Gouge

Diane E. Moore
U.S. Geological Survey
(co-authors: M. Jin, R. Summers, J.D. Byerlee)
9:00-9:20

Time-Dependent Behavior of Joints in Shale

R.K. Bowden
Univ. of Toronto
(co-author: J.H. Curran)
9:20-9:40

Strength of Indiana Limestone in True Biaxial Loading Conditions

B. Amadei
Univ. of Colorado
(co-authors: V. Janoo, M. Robinson, R. Kuberan)
9:40-10:00

Tunnel Support Requirements

Lecture Room 2

Chairmen: James Monsees
Parsons Brinckerhoff Quade & Douglass

Harvey W. Parker
Shannon Wilson, Inc.

Ground Support and Related Requirements

Jan Patricio
Rockwell International
8:00-8:20

Rock Support of the Jones Island Pump Station, Milwaukee, Wisconsin

Tim Smirnoff
Howard Needles Tamman and Smirnoff
8:20-8:40

Design Charts for a Deep Circular Tunnel Under Non-Hydrostatic Loading

Christopher M. St. John
Agbabian Associates
(co-authors: E. Detournay, C. Fairhurst)
8:40-9:00

Estimating Support Requirements from Simulation of Key Blocks

Lap-yan Chan
Woodward-Clyde Consultants
9:00-9:20

Rock Mechanics Studies at the Calumet Pumping Station, Chicago, Illinois

Frank S. Shurtliff
Foundation Sciences, Inc.
(co-author: H.S. Kelsay)
9:20-9:40

Excavation Through Highly Fractured and Sheared Host Rock, Pacheco Pumping Plant

R.S. Sinha
U.S. Bureau of Reclamation
(co-authors: P.F. Carlson, G.O. Bnggs, S.R. Barden)
9:40-10:00

Blast Fragmentation Lecture Room 3

Chairmen: Robert G. Lundquist
Ohio State Univ.

Alfred J. Hendron
Univ. of Illinois

Studies on Explosively Driven Cracks Under Confining In-Situ Stresses

K.R.Y. Simha
Univ. of Maryland
(co-authors: W.L. Fournay, R.D. Dick)
8:00-8:20

Primary Mechanism for Breaking Rock with Explosives

Robert R. Britton
Ohio State Univ.
(co-authors: C.J. Konya, D.R. Skidmore)
8:20-8:40

A Study of Fracture Pressurization as a Result of Explosive Detonation

William L. Fournay
Univ. of Maryland
(co-authors: K.R.Y. Simha, R.D. Dick)
8:40-9:00

Time Histories of Principal Strains Generated in Rock by Cylindrical Explosive Charges

Douglas A. Anderson
Martin Manetta Laboratories
(co-authors: S.R. Winzer, A.P. Ritter)
9:00-9:20

Methods for Predicting Rubble Motion During Blasting

J.T. Schamaun
Sandia National Laboratories
9:20-9:40

Shock Wave-Induced Fragmentation of Copper Porphyries

Catherine T. Aimone
New Mexico Institute of Mining and Technology
(co-authors: M.A. Meyers, N. Mojtabai)
9:40-10:00

Wednesday Morning II
10:30-12:30

Nuclear Waste Isolation: Some Rock Mechanics Considerations

Auditorium

Chairmen: Francis S. Kendorski
Terraform Engineers, Inc.

William R. Judd
Purdue Univ.

Rock Support for Nuclear Waste Repositories

Lee W. Abramson
Parsons Brinckerhoff Quade & Douglas
(co-author: B. Schmidt)
10:30-10:50

Prediction of Long Term Creep Closure in Salt

Jeff W. Nelson
United Engineers and Constructors, Inc.
(co-author: P.C. Kelsall)
10:50-11:10

Design of a Salt Repository Based on Field Verification

John F. Abel Jr.
Colorado School of Mines
(co-author: F. Djahanguiri)
11:10-11:30

Rock Mechanics Aspects of Volume Changes in Calcium Sulfate Bearing Rocks Due to Geochemical Phase Transitions

Caner Zambak
South Dakota School of Mines and Technology
(co-author: R. Arthur)
11:30-11:50

Geomechanics Characterization of a Proposed Nuclear Waste Repository Site in Basalt

K. Kim
Rockwell International
(co-author: W.M. McCabe)
11:50-12:10

Deep Tunnel and Reservoir TARP Orientation

Lecture Room 2

10:30 and 11:30

The films and question and answer session are designed for those going on the field trip on Thursday. Others are welcome who do not have the opportunity to go on the trip but are interested in learning about the multi-billion dollar construction project.

Blasting Case Histories

Lecture Room 3

Chairmen: Alfred J. Hendron
Univ. of Illinois

Robert G. Lundquist
Ohio State Univ.

Results From Some Oil Shale Fragmentation Experiments Conducted at the Anvil Points Mine, Colorado

Richard D. Dick
Los Alamos National Laboratory
10:30-10:50

Rock Engineering for the Tyee Lake Tap

John Cogan
International Engineering Company, Inc.
(co-author: F. Kintzer)
10:50-11:10

Lake Thistle Draining Project

Randall J. Essex
Woodward-Clyde Consultants
(co-author: L.L. Oriard)
11:10-11:30

Microcomputer Simulation of Rock Blasting to Predict Fragmentation

C. Dinis da Gama
Instituto de Pesquisas Tecnologicas, Brazil
11:30-11:45

Prototype Sheathed Explosive Rock- Breaker Charge for Open Shooting in Flammable Atmospheres

R.J. Maniero
U.S. Bureau of Mines
(co-author: J.E. Hay)
11:45-12:00

Probabilistic Analysis of Blasting Impact on Open Pit Stability

Dae S. Young
Michigan Technological Univ.
12:00-12:15

Study of Blasting Mechanics and Its Application

Sundar S. Saluja
Univ. of North Dakota
12:15-12:30

**Wednesday Afternoon
2:00-4:00**

Nuclear Waste Isolation: Status of Rock Mechanics Considerations

Auditorium

Chairmen: William R. Judd
Purdue Univ.

Francis S. Kendorski
Terraform Engineers, Inc.

An Overview of the OCRWM Program Efforts

J. Fiore
U.S. Dept. of Energy
(co-authors: V. Der, V. Montenyohl)
2:00-2:20

Exploration
David L. Pentz
Golder Associates
2:20-2:40

**Laboratory Testing For Repository
Characterization**
James E. Russell
Texas A&M Univ.
(co-authors: J. Handin, N. Carter)
2:40-3:00

**Field Testing Policy Questions Related to
the Role of Field Testing in the
Establishment of a Radioactive Waste
Repository**
W.A. Hustrulid
RE/SPEC Inc.
(co-author: W.F. McClain)
3:00-3:20

**Hydrogeologic Overview of the Nuclear
Waste Isolation Program**
Irwin Remson
Stanford Univ.
3:20-3:40

**A Geologic High Level Nuclear Waste
Repository Considered as an Underground
Facility Design Problem**
Francis S. Kendorski
Terraform Engineers, Inc.
3:40-4:00

**Panel Discussion on Nuclear Waste
Isolation**
Above authors will be panel members
4:00-4:30

Fracture Modeling and Field Verification For Gas Extraction

Lecture Room 2

Chairmen: Jean-Claude Roegiers
Dowell Inc.

John C. Sharer
Gas Research Institute

**Finite Elements Modeling of the Interaction
Between Hydrofractures and Slanted
Interfaces in Non-Homogenous Rock**
R.J. Shaffer
Lawrence Livermore National Laboratory
(co-authors: R.K. Thorpe, A.R. Ingraffea, F.E.
Heuze)
1:30-1:50

**Growth of a Crack Through Interfacial
Boundary**
J.C. Lee
Northwestern Univ.
(co-author: L.M. Keen)
1:50-2:10

**Rock Mechanics Effects Observed
Subsequent to Multiple Fracturing of Well-
bores**
J.F. Cuderman
Sandia National Laboratories
2:10-2:30

**The Interaction of Geology, Mechanical
Properties and In-Situ Stresses in Hydraulic
Fracturing**
Jeffrey N. Schuyler
Dow Chemical
(co-author: J.D. McLennan)
2:30-2:50

**Gas Fracturing: Numerical Calculations
and Field Experiments**
Stewart K. Griffiths
Sandia National Laboratories
(co-authors: C.W. Smith, R.H. Nielsen)
2:50-3:10

Wave Propagation

Lecture Room 3

Chairmen: Arley G. Franklin
U.S. Army Corps of Engineers
Waterways Experiment Station

Earl P. Hoskins
Texas A&M Univ.

**Cross-hole Acoustic Measurements in
Basalt**
M.S. King
Lawrence Berkeley Laboratory
(co-authors: L.R. Myer, J.J. Rezwani)
1:30-1:50

**A Laboratory Study of Seismic Velocities
and Attenuation of Host Rocks for a
Nuclear Waste Repository**
Bjorn N.P. Paulsson
Univ. of California, Berkeley
1:50-2:10

**The Potential and Application of Sonic
Wave Methods in Engineering Rock
Characterization**
P. Schilizzi
Virginia Polytechnic Institute & State Univ.
(co-authors: M. Karmis, Z. Agoutantis)
2:10-2:30

**Site Characterization for Prediction and
Simulation of Dynamic Events**
Dwain K. Butler
U.S. Army Corps of Engineers' Waterways Ex-
periment Station
2:30-2:50

- REVISED AGENDA -

WEDNESDAY AFTERNOON - NUCLEAR WASTE ISOLATION: STATUS OF ROCK MECHANICS
CONSIDERATIONS

AUDITORIUM

Chairmen: William R. Judd, Purdue University
Francis S. Kendorski, Terraform Engineers, Inc.

- 2:00 - 2:20 "In Situ Testing Strategy for HLW Repositories"*
Jay Rhoderick, U.S. Department of Energy
- 2:20 - 2:40 "Repository Exploration"
David L. Pentz, Golder Associates
- 2:40 - 3:00 "Laboratory Testing for Repository Characterization:
James E. Russell, Neil L. Carter, John Handin,
Texas A & M University
- 3:00 - 3:20 "Hydrogeologic Overview of the Nuclear Waste Isolation Program"
Irwin Remson, Stanford University
- 3:20 - 3:40 "A Geologic High Level Nuclear Waste Repository Considered
as an Underground Facility Design Problem"
Francis S. Kendorski, Terraform Engineers, Inc.
- 3:40 - 4:00 BREAK
- 4:00 - 4:20 "Policy Questions Related to the Role of Field Testing in the
Establishment of a Radioactive Waste Repository"
William A. Hustrulid, Colorado School of Mines
William C. McClain, RE/SPEC, Inc.
- 4:20 - 4:40 "Reasonable Assurance and Its Relationship to In Situ Testing
for HLW Repositories"*
John T. Greeves and Robert J. Wright,
U.S. Nuclear Regulatory Commission
- 4:40 - 5:30 Panel Discussion on Nuclear Waste Isolation

*Papers available before session

25th U.S. SYMPOSIUM ON ROCK MECHANICS

June 25-27, 1984

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