

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Professional Development: *American Rock Mechanics Association (ARMA)*
Short Course on "Rock Mechanics for Practitioners"
Charge No. 20.06002.01.011

DATE/PLACE: August 4–8, 2003; Boulder, Colorado

AUTHOR: Kevin J. Smart

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PERSONS PRESENT: Kevin J. Smart

BACKGROUND AND PURPOSE OF TRIP:

With support from the CNWRA Professional Development Program, I attended a 4.5-day short course on *Rock Mechanics for Practitioners* offered by the American Rock Mechanics Association (ARMA). The short course was held on the University of Colorado campus in Boulder. The goal of the short course was to "provide a working overview of rock mechanics for practitioners who need to interact with geological engineers or to participate in rock engineering projects."

The course instructors, who all have considerable practical experience and have lectured extensively on applied, theoretical, and experimental rock mechanics, were:

1. Dr. Bernard Amadei, Professor of Civil Engineering at the University of Colorado, Boulder.
2. Dr. Francois Heuze, Leader of Geotechnical Programs at the Lawrence Livermore National Laboratory.
3. Dennis Lachel, President of Lachel Associates in Golden, Colorado.
4. Dr. John Tinucci, President of PanTechnica Corporation in Chaska, Minnesota.

The course participants included engineers (primarily civil, but some geological and mining) but also some geologists and geophysicists. Approximately one-half of the participants are employed by the U.S. Government (Los Alamos National Laboratory, Defense Threat Reduction Agency, Bureau of Reclamation) with the remainder coming from private industry.

SUMMARY OF PERTINENT POINTS:

The major topics covered by the short course included:

1. Rock masses, structures in rocks, and geological exploration.
2. Elasticity, stresses and strains.
3. Mechanical properties of rock materials and rock discontinuities.
4. *In-situ* measurement of deformations and stresses.
5. *In-situ* measurements of rock mass strength and deformation, scale effects, rock mass strength criteria.
6. Rock mass classification, support of rock structures.
7. Stereographic projection, analysis of rock wedge stability for the surface and underground.

SUMMARY OF ACTIVITIES:

I arrived in Boulder on Sunday evening, August 3, 2003. The short course met from 9:00 AM to 5:00 PM on Monday through Thursday (August 4–7) and from 9:00 AM to Noon on Friday (August 8). I returned to San Antonio on Friday evening.

The main format for the short course was lectures by the instructors interspersed with discussion (question/answer periods). Course materials were provided to all participants on CD-ROM along with some hard-copy handouts. Some of the lecture topics (e.g., rock mass classification, rock wedge stability) were supplemented by in-class exercises.

In addition to the primary lectures that covered applied, theoretical, and experimental rock mechanics, the instructors also included numerous case studies that illustrated the successes and failures of rock engineering projects.

CONCLUSIONS:

Two points were emphasized repeatedly by all the instructors:

1. The two most important aspects of all problems in rock mechanics are the *effect of scale* and the *role of discontinuities*.
2. A solid understanding of the *geology* of an area is crucial to a successful rock engineering project.

PROBLEMS ENCOUNTERED:

It was recommended that all participants bring a laptop computer to the short course. As such, I checked out one from IMS. Unfortunately, one software package provided by the instructors could not be loaded onto the machine since it required "administrator" privileges. This was a problem for many of the participants. As a result, some of the rock wedge stability exercises could not be interactively done during the course. Course instructors were made aware of this

problem so that other arrangements can be made in the future (either providing software in advance or arranging on-site computer access).


PENDING ACTIONS:

None

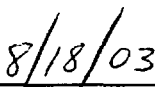
RECOMMENDATIONS:

This was a very useful course for someone with a traditional geology/geophysics background, and little or no experience in rock mechanics. This course along with future ARMA short courses on more specialized or advanced topics are highly recommended for current and future CNWRA personnel who will interact with engineers on problems that involve rock mechanics (e.g., tunnels or other underground structures, slope stability).

SIGNATURES:

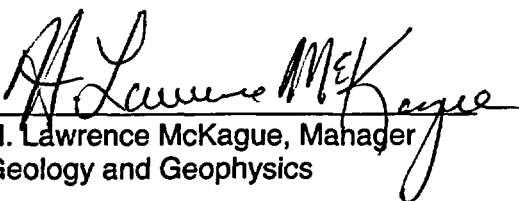


Kevin J. Smart
Research Scientist



Date

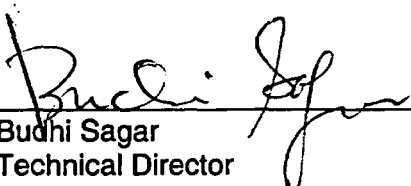
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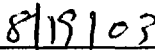
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Date



Budhi Sagar
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Date

KJS/slo