

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: GulfRocks 2004: The 6th North American Rock Mechanics Symposium
Administrative Item 20.06002.01.101.400

DATE AND PLACE: June 6 through 9, 2004
Houston, Texas

AUTHOR: Amitava Ghosh

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PERSONS PRESENT:

219 people from various organizations (List attached)

BACKGROUND AND PURPOSE OF TRIP:

The purpose of this trip was to attend the 6th North American Rock Mechanics Symposium and a short course on wellbore stability offered as a part of the symposium. The rock mechanics symposium is held annually and attracts researchers from the universities, national laboratories, and different organizations involved with any aspect of rock mechanics discipline. This symposium provides an opportunity to be familiar with ongoing research studies at various institutions around the world and make personal contacts with investigators.

SUMMARY OF PERTINENT POINTS:

GulfRocks 2004

This was the 6th North American Rock Mechanics Symposium (NARMS) originally scheduled to be hosted by the La Sociedad Mexicana de Mecanica de Rocas at a location in Mexico. As La Sociedad Mexicana de Mecanica de Rocas was not able to host this symposium, the American Rock Mechanics Association took the responsibility to host it at Houston. Also La Sociedad Mexicana de Mecanica de Rocas has expressed inability to host the next North American Rock Mechanics Symposium in 2006. In view of this American Rock Mechanics Association Board has taken a decision to withdraw from the NARMS organization. Consequently, there will not be anymore NARMS. Future NARMS symposiums will be held in U.S.A. for two consecutive years [one year as U.S. Rock Mechanics Symposium followed by a symposium jointly hosted with Canadian Rock Mechanics Association (CARMA)]. CARMA will host a rock mechanics symposium in the third year in Canada jointly with ARMA. Next U.S. Rock Mechanics symposium will be held in Anchorage, Alaska, and will be hosted by the University of Alaska, Fairbanks.

GulfRocks 2004 was (June 7 through 9, 2004) attended by 219 participants from different organizations associated with the rock mechanics field, such as, Baker Hughes, Bureau of Economic Geology, CANMET, ChevronTexaco, ExxonMobile, CSIRO, Golder Associates, Montana Tech, Georgia Tech, New England Research, NIOSH, Shell, University of Arizona,

University of Minnesota, etc. There were three parallel sessions each day. Additionally, there was a poster session. Themes of the sessions include: Mining and Excavations; Salt Geomechanics; Property Characterization and Laboratory Measurements; Geotechnical Engineering; Hydraulic Fracturing; Rock Physics, Dynamics and Seismicity; Fractures and Faults—Flow and Fractures; In-Situ Stresses; Well Completions—Sand Production and Management; Constitutive Modeling—Soft Rocks; Foundations and Slope Stability; Pore Pressure and Seals; Deformation and Flow in Porous Media; Reservoir Geomechanics; and Drilling and Wellbore Stability. Professor Michael Economides spoke on price of oil and global politics to open the symposium. This was an interesting and thought-provoking presentation. The point he tried to convey is that the oil and gas prices are controlled by global politics. There were three keynote speakers: (1) Professor John Hadjigiorgiou presented on “Rock Mechanics Issues in Ore Pass Performance;” (2) Dr. Lew Watts presented on “Underbalanced Drilling—A Rock Mechanical Journey;” and (3) Dr. Stephen H. Hickman presented on “The San Andreas Fault Observatory at Depth: Testing Fundamental Theories of Earthquake Mechanics Through Drilling.” Each of these presentations was well received.

Professor Hadjigiorgiou spoke on the practices in ore pass design, especially in the context of Canadian mining practices. He also showed Particle Flow Code (PFC2D) based modeling approaches used to understand the mechanism of blockage of the overpass. This knowledge is used to design ore passes with minimum blockage. Underbalanced drilling is a specialized and novel way of drilling oil wells where the mud weight used is less than that required to balance the stresses at the Wellbore wall. He discussed about the design and cautions necessary for successful completion of the wells. Dr. Hickman presented the drilling project current ongoing through the San Andreas fault to verify several theories on earthquake generation. This hole will penetrate the fault and pass through a zone predicted to generate repeated earthquakes. He discussed the tests that will be conducted in this project.

Short Course on Wellbore Stability

This course was given by Dr. Gemma M. Keaney of Knowledge Systems. She is the Geomechanics Manager for the Drillworks computer program marketed by Knowledge Systems. A total of nine persons from oil and gas industries, DOE Geothermal program, and Center for Nuclear Waste Regulatory Analyses attended this short course. The course outline is as follows:

- Basic Rock Mechanics for wellbore stability analysis for drilling applications
- Earth stresses and strain
- Wellbore stresses and wellbore failure
- Rock strength: tension, compression, and shear
- Stress-strain behavior of real rocks (elastic, elastic-brittle, elastic-plastic)
- Prediction of failure
- Calibration of wellbore stability model

In wellbore stability application in oil and gas industries, one of the objectives is to control the mud weight (and thereby mud pressure) to minimize formation of new fractures or dilation of existing fractures because mud can be lost into these fractures leading to collapse of the hole. The course discussed the general methodologies to determine the safe operating window of mud weight taking into consideration measured or estimated *in-situ* stresses including pore pressure and estimated rock strength using rock failure model(s). In general, each oil or gas

field has some known characteristics of the in-situ stress distribution (K_0 , ratio of horizontal to vertical stresses, is 0.7 to 1.0 or more in Gulf of Mexico) and rock stress-strain behavior. Presence of shale complicates the strength estimation as it also depends on hydration/swelling and fluid transport properties due to chemical reaction of shale with the mud. A quick introduction to Drillworks code was given. This code is based on Microsoft Excel[®] and determines the safe mud weight for a project given stress and rock properties. A sensitivity of different parameters on the ultimate results can be evaluated for a given project quickly using this code.

CONCLUSIONS:

The emphasis of this symposium was on topics related to oil and gas industries; only some sessions were on rock mechanics areas related to other civil structures, such as tunneling, and mining industry. There were no papers and sessions devoted to low- and high-level waste disposal. American Rock Mechanics Association Board members in a general body meeting expressed concerns on this.

The short course on wellbore stability provided a good introduction and background on wellbore stability problems.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

None.

SIGNATURE:

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Amitava Ghosh
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Date

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MECHANICS SYMPOSIUM
JUNE 7 THROUGH 9, 2004
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