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3001.4/JRP-TRIP REPORT

MEMORANDUM FOR: John T. Greeves, Chief
Engineering Branch, WM

FROM: Jerome R. Pearring
Engineering Branch, WM

SUBJECT: ATTENDANCE AT THE 1985 RAPID EXCAVATION AND TUNNELING CONFERENCE

I attended the 1985 Rapid Excavation and Tunneling Conference from June 16-20, 1985 in New York, New York. The conference provided a forum for the exchange of international, professional and technical experience dealing with subject matter pertinent to Waste Management activities. The conference included 17 sessions and 71 presentations on subjects which covered the gamut of rapid excavation and tunneling technology. A copy of the conference program is attached.

While many of the papers presented at the conference had at least some significance to the high-level waste repository program, the papers presented in the session identified below were directly relevant:

1) Design, construction, and support of large underground openings,

2) Geotechnical data for underground projects,

3) Current shaft lining techniques,

4) Seismic design for underground structures,

5) Groundwater control in shafts and mine openings, and

6) Tunneling in gassy ground.

Abstracts of a few of the more relevant papers follow.

1) "Earthquake Engineering of Tunnels-Revisited," S. N. Owen and R. E. Scholl.

In 1979 these authors presented a paper on an evaluation and design procedure used in a study of a proposed nuclear waste repository. This paper revealed the progress in earthquake engineering of tunnels over the past 5 years and identified areas that were considered to need research and development activities.

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2) "Applicable Analytical Tools for a Seismic Design of Underground Excavations," C. M. St. John and T. F. Zahroh.

This paper briefly reviewed empirical and analytical tools available for design of subsurface excavations and underground structures. Summarized evidence was presented which indicated that the response of excavations in both continuous and discontinuous media can be adequately treated as pseudostatic using simple analytical tools appropriate for design under static conditions providing allowance for the additional loads which are defined in terms of stress for continuous media and acceleration for discontinuous media. For internal underground structure and for liners, a conservative approach would assume the structure must be designed to withstand the full free field ground strains. The paper also presented a brief description of several numerical codes for investigating wave propagation and ground/structure interaction. The authors believe that SHAKE will continue to be very important for defining free field ground motion to which subsurface excavations and underground structures will be subjects because limits in site media characterization lessen the importance of more sophisticated soil/structure interaction codes.

3) "Seismic Design of Underground Structures," L. L. Merritt, J. E. Monseas, and A. J. Hendron, Jr.

The seismic design proposed by this paper recommends that the earthquake induced distortions should be added to the normal static loading conditions for the underground structure. This design approach recognizes that the effect of the earthquake on underground structures is the imposition of a deformation which generally cannot be changed by strengthening the structure. The design goal is therefore one of providing sufficient ductility to absorb the imposed deformation without losing the capacity to carry static loads. Preliminary finite element analyses indicate this approach is valid and conservative.

4) "Design and Construction of the Sondan 2 Detector Laboratory," C. R. Nelson, et. al.

This paper presents design and construction details of a laboratory cavern 713 meters below ground in northeastern Minnesota. The cavern is 13.9m wide, 11.6m high and 71.8m long. The hostrock is basically metamorphosed, greenish colored chlorite. At the 40% construction completion point, one major fault has been encountered having been

traced about 45 meters and may extend an additional 60 meters. A series of joints and sheer zones essentially parallel to it both above and below have caused roof falls. The fault is strongly slickensided along dip and has up to 2cm of quartz and pyrite infilling. Rockbolts spaced 1.5 to 2.0m on center plus chain link mesh reinforced shotcrete are being installed.

5) "Ground Freezing for Soft Ground Shaft Sinking," J. A. Shuster

This paper presents 6 case histories for shafts ranging in diameter from 6' to 40' and to depths of 230' in overburden for which the Poetsch process of ground freezing was employed to provide temporary ground support for groundwater control during sinking. The Poetsch process involves the circulation of a chilled coolant through a closed system of refrigeration pipes embedded in the ground. The coolant is chilled and circulated by a stationary above ground refrigeration plant. Pipes are generally installed within thirteen pipe diameters of one another to assure timely freezing. Some factors that bear on the relative ease and cost of ground freezing include: 1) the geology of the site must be suitable for freezing, 2) the groundwater must be relatively static, i.e., velocity controllable to less than 2m/day, 3) sufficient pipes must be driven to a controlled configuration, i.e., to form a cylinder about the shaft, 5) the refrigerant must be of low temperature design and of sufficient capacity to ensure timely freezing, 6) the chilled coolant must have safe physical properties, 7) adequate monitoring instrumentation is required and 8) contingency planning is required in advance of unexpected or unfortunate circumstances.

A copy of the proceedings of the conference is available for review in my office (Room 488, extension x74648).

If you have any questions regarding the trip or any of the papers presented please contact me at you convenience.

/s/

Jerome R. Pearring
Engineering Branch
Division of Waste Management

Attachment:
As stated

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