DISCUSSION

F. Schmednecht[1] *(written discussion)*—What is Christopher Jepsen's field knowledge of vibrated beam technology? Does he know the phenomenon of the path of least resistance and passive earth strength? Also, why have there been so few field pumping tests of soil-bentonite walls?

C. Jepsen and M. Place (authors' closure)—The authors' paper represents primarily a literature search of the two cutoff wall construction methods. However, the authors also drew upon their joint experience and knowledge in the areas of soil sealing, cutoff wall design, and slurry properties testing to write the paper.

The phenomenon of a path of least resistance was recognized by the authors as being valid in rather ideal homogeneous conditions; however, numerous factors can readily nullify "the least resistance effect," such as (1) sudden changes in geology, (2) beam deflection caused by rocks, (3) successive nonplumb beam penetrations, (4) a necking in or collapse of previous beam imprints, and (5) insufficient beam overlap.

In short, a path of least resistance for the beam may not be always necessarily along the imprint of the previous beam penetration given all the internal and external factors that come into the picture.

The excellent performance of soil-bentonite cutoff walls in various dewatering projects throughout the country in the past 25 years has more or less obviated the need to "test" the soil-bentonite cutoff wall method with field pumping tests.

Y. B. Acar[2] *(written discussion)*—The author implies that slurry walls could be used in the containment of toxic wastes. Slurry walls are constructed of highly active clays. I would like to pose this question: Active clays are more susceptible to structural changes due to variations in pore-fluid chemistry. Does the author have an activity criteria in the use of such slurries for the containment of toxic wastes?

C. P. Jepsen and M. Place (authors' closure)—It is true that sodium bentonite is a very active clay and is susceptible to structural changes; however, as pointed out in this paper, the conventional soil-bentonite slurry wall should have at least 15 to 20% fines in it to assist the sodium bentonite in achieving the desired coefficient of permeability of the cutoff wall. Thus, any activity

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criteria for a soil-bentonite cutoff wall should be based on the specific backfill mixture proposed for a specific project.

For the VBI method in which specific predesigned self-hardening slurries are used, general activity criteria could obviously be determined to serve as guidelines for specific types of wastes.

The authors have not established an activity criteria for the use of slurries for waste containment; however, a survey of the performance of existing cutoff walls in use would be the most practical way of determining the long-term stability of cutoff walls against various types of wastes and leachates.

J. Evans[3] *(written discussion)*—The necking of thin cutoff walls was noted for U.S. Corps of Engineers test sections. Have the results of these test sections been published? Where? What are the conclusions from these Corps studies?

C. P. Jepsen and M. Place (authors' closure)—The authors are aware of at least two test installation sites. One test was done quite recently and, as of the date of presentation of this paper, the report was not published. The earlier test site was at "Lock E" of the Tennessee-Tomhigbee Waterway. The two reports generated from the earlier test are as follows:

1. Mobile, Alabama District Army Corps of Engineers "Lock E" Test Program, Tennessee-Tomhigbee Waterway, Mobile District, Dec. 1978.
2. Mobile, Alabama District Army Corps of Engineers "Design Memorandum No. 31, "Lock "E," Lock, Slurry Wall and Earthwork, Tennessee-Tomhigbee Waterway, Mobile District, July 1979.

To the best of the authors' knowledge, the results of the Corps studies are interpreted solely in the context of the specific conditions (geological or otherwise) under which the tests were conducted.

G. A. Leonards[4] *(additional closure)*—Necking of a vibrated beam wall was noted only at the Sunny Point test cell. It was caused by vibrations at 90° across a wall that had not yet set to its final consistency. In this case, a new bentonite-fly ash slurry was being tested for salt water resistance. A report on the Corps' study of the vibrated beam was due out in August 1984.

B. S. Beattie[5] *(written discussion)*—Why are polymer-treated clays more resistant to chemical leachate degradation than untreated clays, since the polymers used (sodium polyacrylates) are biodegradable, water soluble in nature, and have a shelf life of four to five years at best?

C. Jepsen and M. Place (authors' closure)—To the authors' knowledge, there is only one technical paper that discusses this question![6] In that paper, the results of only one permeameter column are presented. Thus, sweeping

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[5]Federal Bentonite, Montgomery, IL 60538.
[6]Alther, G. B., "The Role of Bentonite in Soil Sealing Applications," International Minerals & Chemicals Corp., Des Plaines, IL 60016.

conclusions cannot be made regarding the effectiveness of polymer-treated bentonites.

Data generated by the American Colloid Co. indicate that, in fact, polymer-treated bentonites are not more resistant to chemical leachate degradation. However, the author's company has determined that bentonite treated with inorganic dispersants do significantly improve contaminant resistance. Such specially treated products enjoy patent protection and have been available for the past seven to ten years.

Anonymous (written discussion)—The question of vibrated beam verticality and windows was raised pertaining to the Corps of Engineers test cells.

F. Schmednecht (closure)—Concerning vibrated beams versus open trench slurry wall methods, the only full-scale comparison known to me is at Wheatfield, Indiana, where both methods were used under the same conditions.

In 1975, five and one-half miles of vibratory beam wall was installed from on top of a dike with depths ranging from 11.6 to 13.7 m (38 to 45 ft). The slurry material was bentonite and cement. An in-place test cell yielded an average permeability of 8×10^{-8} cm/s. There has been no noticeable leakage to date.

In 1982, less than two miles of open-trench soil bentonite was installed from on top of the dike with depths averaging about 12.2 m (40 ft). It was installed with a backhoe and clamshell. To date, 214 lineal m of wall has been repaired because of piping and boils, and the problem still exists.

The preceding direct comparison under field conditions shows the relative quality of the two techniques applied to the same conditions.