LPDR
WM-10 (2)

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101.0/NMC/86/12/30



MEMORANDUM FOR: Paul Hildenbrand, BWIP Project Manager
Repository Projects Branch
Division of Waste Management

FROM: Neil M. Coleman
Hydrology Section
Geotechnical Branch

SUBJECT: TRANSMITTAL OF REVIEW OF BWIP DOCUMENT

Enclosed is a review of RHO Computational Brief No. 550, "Probability Distribution of Horizontal Hydraulic Conductivity in Grande Ronde Basalt Flow Interiors." The results of the computational brief reportedly show that the conductivity data follow a log-normal probability distribution at the 0.95 level of confidence.

Based on this review it is observed that the conclusion reached in the computational brief is ambiguous due to the nature of the data and the manner in which the statistical test was interpreted. It is recommended that this review be forwarded to appropriate DOE management personnel because of its relevance to considerations of groundwater travel time at Hanford.

/s/

Neil M. Coleman
Hydrology Section
Geotechnical Branch

Enclosure: As stated

CC: M. Fliegel
T. Verma

WM Record File
101

WM Project 10
Docket No.
PDR ✓
LPDR ✓ (B)

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# WMGT DOCUMENT REVIEW

FILE NUMBER: 101.0

DOCUMENT: Eslinger, P. W., 1986. RHO Computational Brief No. 550, Probability Distribution of Horizontal Hydraulic Conductivity in Grande Ronde Basalt Flow Interiors, Rockwell Hanford Operations, Richland, Washington.

REVIEWER: Neil M. Coleman

DATE REVIEW COMPLETED: 86/12/30

## SIGNIFICANCE TO NRC WASTE MANAGEMENT PROGRAM:

The output from this brief was used to support Clifton, 1986 (Groundwater Travel Time Analysis for the RRL at the Hanford Site). Clifton (1986) is an important supporting document that was cited in the Final EA for Hanford.

## BRIEF SUMMARY OF DOCUMENT:

The computational brief presents the result of one goodness-of-fit test for log-normality on a set of 13 horizontal hydraulic conductivities from Grande Ronde Basalt flow interiors. A Minimum Hellinger Distance goodness-of-fit test was computed and analyzed. The results reportedly show that the data follow a log-normal probability distribution at the 0.95 level of confidence.

## PROBLEMS, DEFICIENCIES, OR LIMITATIONS OF REPORT:

On page 1 it is stated that "these [hydraulic conductivity] data follow a log-normal probability distribution at the 0.95 level of confidence." This statement may be misleading in that the results are actually ambiguous. The "goodness-of-fit" test was designed to evaluate a null hypothesis that the data distribution is log-normal. Because the computed test value was less than the critical value (alpha = 5%), the null hypothesis of log-normality could not be rejected. But "failure to reject" is not the same as "accepting" the hypothesis.

The results of the computational brief should have been described in a manner analogous to the following: "The null hypothesis of log-normality could not be rejected at the 95% confidence level. We may accept log-normality as a reasonable interpretation, but in doing so our chance of being wrong is unknown."

In other words, it was not appropriate for the author to imply that the data are log-normally distributed at the 95% confidence level. According to Davis (1973), failure to reject the null hypothesis contains an unassessed probability of error (i. e., Type II, or Beta, error). In one sense, statistical tests cannot tell a researcher what is, but only what is not.

It is emphasized that the overall data set is relatively small (n = 13), and that horizontal hydraulic conductivity data were collected from an ensemble of basalt flow interiors rather than from a single basalt flow. The variance of an ensemble data set would probably be greater than the variance of data derived from an individual basalt unit. This higher variance, along with the effect of a small data set, probably made it more difficult to reject the null hypothesis in this exercise. It is also noted that several different kinds of hydrologic tests were used to obtain the transmissivity values from which hydraulic conductivity values were derived. The scale of testing varies among the various types of hydrologic tests that were used. Thus, the sample set of conductivity values actually consists of several subsets when scale of testing is considered. Based on the above, it is noted that other equally valid hypotheses (i. e., that the data came from populations having normal, uniform, gamma or exponential distributions) may also have been difficult to reject based on the available data set.

ACTION TAKEN:

This review is being distributed to cognizant NRC staff members.

ACTION RECOMMENDED:

A copy of this review should be forwarded to appropriate DOE management personnel. The NRC staff should be made aware of DOE's inappropriate statement of conclusions in this computational brief. This should be considered in staff reviews of future DOE products that present summary statements about geoscience and engineering data.

REFERENCES:

Clifton, P. M., 1986. Groundwater Travel Time Analysis for the Reference Repository Location at the Hanford Site; SD-BWI-TI-303, Rockwell Hanford Operations, Richland, Washington.

Davis, J. C., 1973. Statistics and Data Analysis in Geology, John Wiley & Sons, Inc., New York, New York.

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

MEMORANDUM FOR: P. Hildenbrand

FROM: N. Coleman

SUBJECT: TRANSMITTAL OF REVIEW OF BWIP DOCUMENT

DATE: JAN 5 1987

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