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OCT 21 1983

MEMORANDUM FOR: Edward O'Donnell
Earth Sciences Branch
Division of Health, Siting
and Waste Management, RES

FROM: Mark J. Logsdon
Repository Projects Branch
Division of Waste Management

SUBJECT: REVIEW OF USE OF KRIGING IN "BOREHOLE ASSESSMENT NEEDS PLAN" BY S.G. OSTON AND J.I. SCOTT (THE ANALYTIC SCIENCES CORPORATION, REPORT TR-3677)

Per the discussion of 7/29/83 between you, Dr. Robert Wright and me concerning kriging of hydraulic conductivity values at BWIP, I am transmitting to you a copy of "Borehole Assessment Needs Plan" by Oston and Scott of the Analytic Science Corporation (TASC). The TASC report relies on a statistical analysis of borehole data, primarily kriging techniques, to evaluate BWIP repository performance for selected scenarios. On the basis of the analysis, of which the kriging is an important part, TASC concluded that "new boreholes beyond the current drilling program are not needed..." (p. PS-10) and that "... the present borehole program is adequate to justify safe system performance given sufficient credit for well designed engineered features" (p. PS-11). Because of the strongly worded nature of these broad conclusions, the TASC report is a particularly significant document.

WMRP would appreciate comments on the TASC document by your PNL contractors, particularly with respect to the broad conclusions of the study, cited above. Do the reviewers concur with the TASC conclusions, and what is the technical basis for their concurrence or non-concurrence? In responding to these major questions, the WMRP staff requests that the PNL review address the following points:

1. Is kriging an appropriate statistical technique for integrating point values of permeability (hydraulic conductivity) and hydraulic head into two-or three-dimensional distributions of

values for use in numerical modeling? Has kriging been applied to deep, low-permeability systems on the scale of a proposed HLW geologic repository in studies other than the TASC project?

2. Is the application of kriging in the TASC report appropriate?

   a. Are the basic assumptions of the theory of regionalized variables stated completely and accurately?

   b. Are the assumptions made by TASC supportable for the Hanford site on the basis of the data presented? If not, are the methods used sufficiently robust to be used reliably in a study such as this?

   c. Is there a sufficient data base of permeability (hydraulic conductivity) values to develop reliable variograms (e.g., Figure 2.3-1, p. 2-8, which is based on only 6 measurements in the Umtanum)?

   d. Given that the remainder of the study depends on the "acceptable fit" of this "linear" variogram form, is the use of a linear least-squares fit that is constrained to pass through (0, 0) appropriate? Are the conclusions that there are no sills and no nugget effect defensible? Is the medium demonstrably isotropic?

   e. Is the evaluation methodology of Section 2.4 rigorous?

   f. Given that there are no data points shown in Figures 2.5-1 and 2.5-2 for any of the area of the figures west of DC-1/2 and DC-12 (in particular, across the RRL), what is the basis for containing the isopleths of log "k" or log "k" in the western third of these maps? That is, while kriging provides an exact <u>interpolation</u>, how robust is kriging for <u>extrapolation</u>?

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WMRP anticipates that a preliminary review by PNL addressing these questions would require a modest level of effort. If you have questions about this request, please contact me. Thank you for your assistance in this matter.

"ORIGINAL SIGNED BY"

Mark J. Logsdon, Project Manager
Repository Projects Branch
Division of Waste Management

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