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January 7, 1993

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NUCLEAR WASTE PROJECT OFFICE

Mr. Carl Johnson
Nuclear Waste Project Office
Capitol Complex, Suite 252
Carson City, NV 89710

Dear Carl,

There are several comments which I have prepared in review of the Total System Performance Assessments document entitled TSPA 1991: An Initial Total-System Performance Assessment for Yucca Mountain, SAND-91-2795. I realize that since this is not an official DOE document the state will not be submitting written comments to DOE. However, I was asked by Dr. Mel Siborberg to please document my verbal comments, presented at the December 15 NRC/DOE Technical Exchange Meeting. So with your permission I have done so.

The first area of comment lies in the conceptual model category. One potential conceptual model is that significant recharge occurs directly to the Topopah Springs Unit through the Solitario Canyon Fault Zone, Figure 1 (Lehman, 1992). Though graphics presented by Dr. Dockery (Figures 2 & 3) indicate this potential model is in fact acceptable to SNLA, all the models, SNLA's, PNL's, and NRC's assume a no-flow western boundary condition which prohibits this transfer of water into the Topopah Springs Unit.

We have made a preliminary attempt to quantify the volume of water which could enter the Solitario Canyon by applying a model (Nieber, et al, in Press) developed at the University of Minnesota Agricultural Hydrology Department which is designed to calculate "focused" recharge through a soil horizon, taking into account ET, catchment area to recharge area ratios, and actual climatic data from government operated weather stations. We used climate data from Tonopah, NV located approximately 90 miles to the northwest. At this station actual climate data including measurements of precipitation, solar radiation and storm characteristics were available and were used to simulate 20 years of weather using the program CLIGEN. This simulation along with geologic information was then used by Nieber's model to calculate the fate of water entering the catchment, including recharge, runoff and evaporation/transpiration. The average annual rainfall at Tonopah is actually somewhat lower than at Yucca Mountain, i.e. 130 mm/yr vs. 150-160 mm/yr, and should give conservative precipitation estimates. Our initial results indicate that between 12-30 cm/yr of recharge could penetrate through the alluvium in the canyon bottom. Hokett, et al, 1991, measured approximately 5 cm/yr percolating to 1.5 meters (limit of measurement) in a rainfall simulator plot with no run on or plant activity. Also the USGS Hydrologic Atlas maps

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ALTERNATIVE CONCEPTUAL MODEL UTILIZING FOCUSED RECHARGE

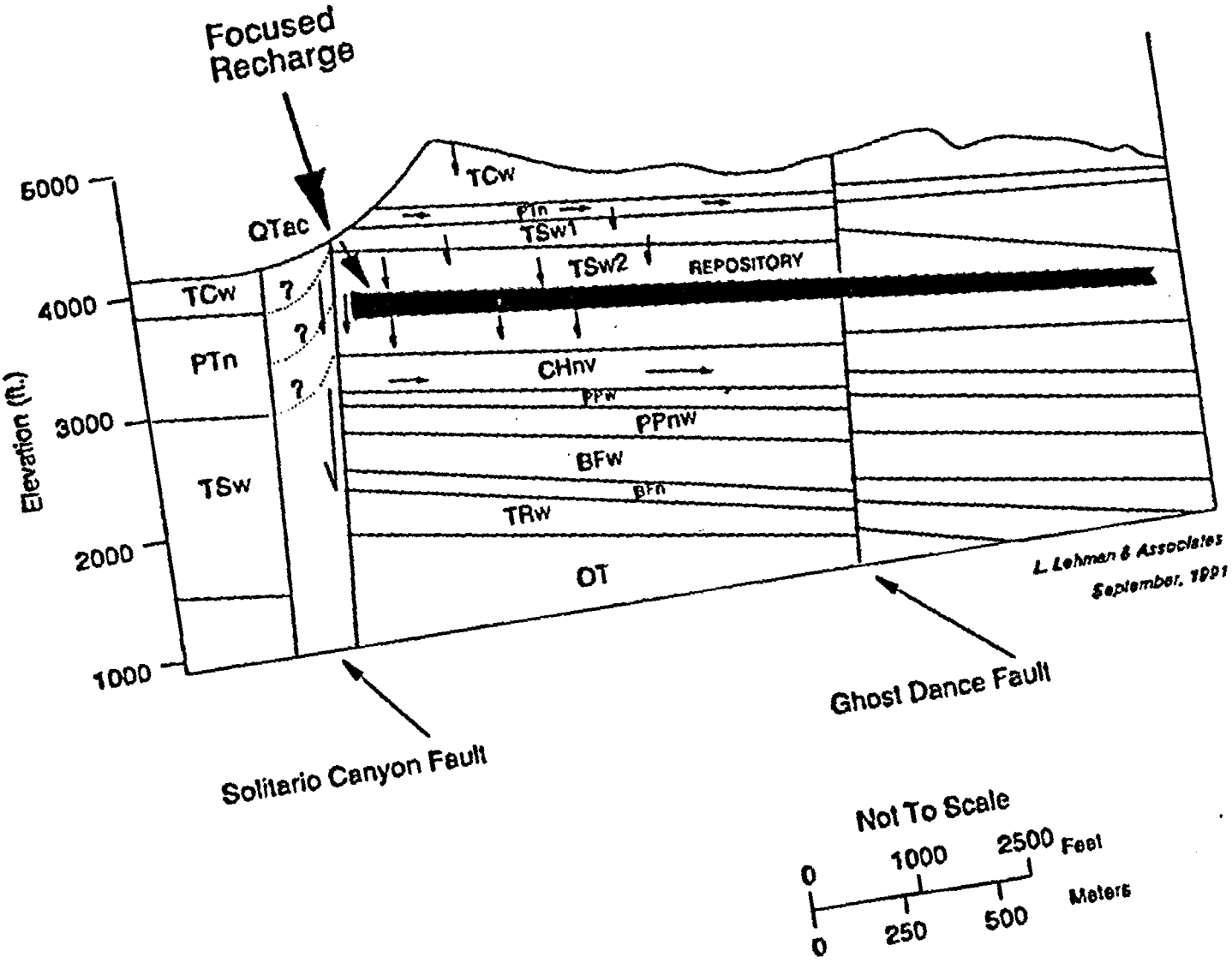

FIGURE 1

COMPOSITE-POROSITY MODEL

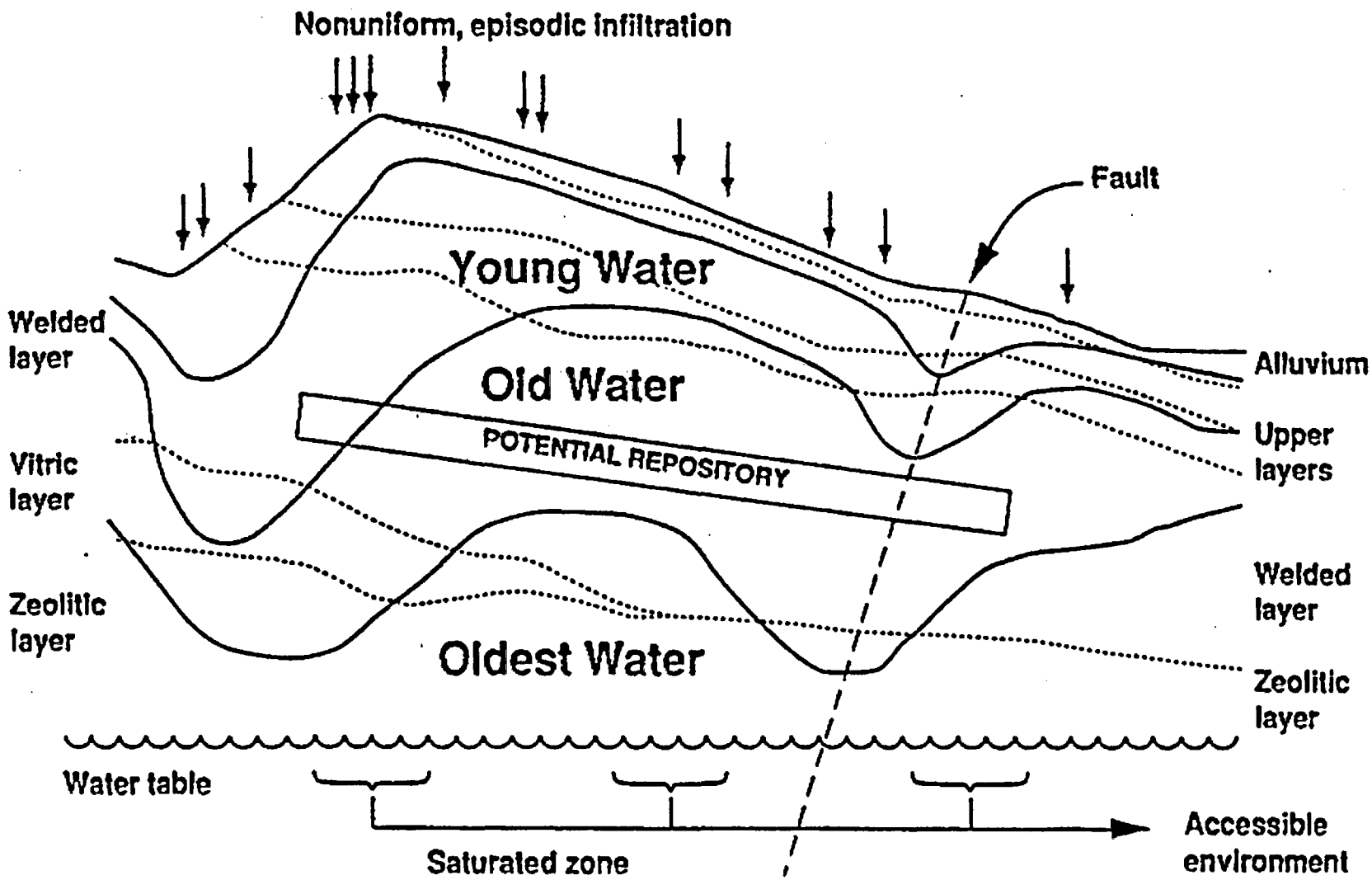

FIGURE 2

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WEEPS MODEL

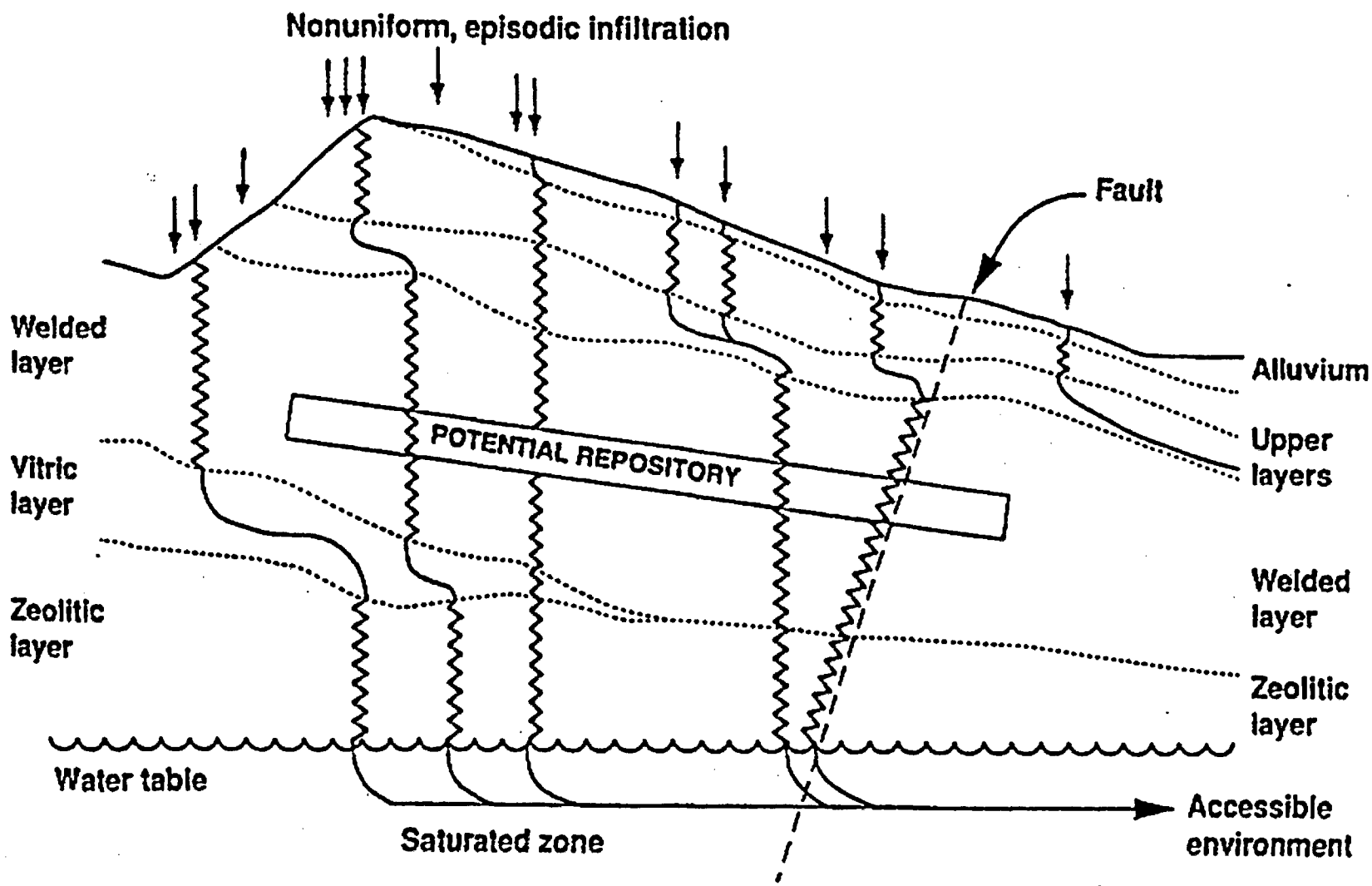

FIGURE 3

TSPAFBG15.125.ACNW/12-16-92

for the Great Basin Area (Harrill, 1988) have roughly estimated that a uniformly distributed 0.6 mm/yr recharge would be likely over the Yucca Mountain area, which if focused to 10% of the surface area by topography or fault zones, should give about 6 mm/yr available along the Solitario Canyon.

Regarding the SNLA estimates of infiltration, the estimates of .01 - 1 mm per year are simply derived by inverse modeling. In other words, using a matrix flow only, porous media model, the most you can push through the tuff units are these low fluxes. SNLA or DOE must take some steps to justify the use of this lower range of flux other than inverse modeling, preferably by collecting some data.

An additional comment is that the distribution of flux being considered is much biased toward the lower end (Figure 4). This lacks any support and is probably not very realistic given our above preliminary estimates of flux and the fact that it could enter directly into the Topopah Springs member. While a 39 mm per year flux is the maximum value considered by SNLA (approaching our order of magnitude), it is calculated as highly improbable. This distribution must be reconsidered.

Some rethinking of the SNLA fracture model (WEEPS) should be done given the potential 700 ft. fracture zone of the Ghost Dance Fault which runs directly through the repository and occupies a non-trivial volume. The WEEPS model assumes a uniform distribution of fractures carry a 1 mm/yr infiltration averaged over the repository area (with no focusing). They assume 50% die out and a few succeed to the repository where they initiate the release term only when a weep intersects a canister. In the SNLA base case, only 3.42 canisters are intersected. These calculations are interesting and provide insights into the magnitude of operational processes. However, given the potential focused fracture pathways provided by the Ghost Dance or the Solitario Faults, the functions controlling these releases, like the .00421 probability of canister/weep intersection, must be reconsidered. Also, higher fluxes directly affect the volume of water considered here and subsequently the number of water bearing fractures and ultimately the number of canisters involved in a release.

With respect to releases, they are not considered to initiate until after the repository re-wets, although I never found in the report exactly what that timeframe was. (This may have simply been an oversight on my part.) However, I think it will probably be on the order of the heat pulse or somewhere between 300 - 1,000 years after emplacement. This seems to imply "totally complete" containment for this time period. Why shouldn't some releases be considered probable during the drying out process?

The WEEPS model doesn't consider any "repository effect" from excavation induced stress changes, as were found at Stripa. This effect may influence the number of connected fractures around the excavation and potentially could direct flow into the tunnels as well. Some consideration of this effect should be attempted in WEEPS.

Our review was somewhat frustrated because we were unable to obtain the documents which had most of the hydrology details. The reports which we requested were:

DISTRIBUTION OF PERCOLATION FLUXES AT REPOSITORY

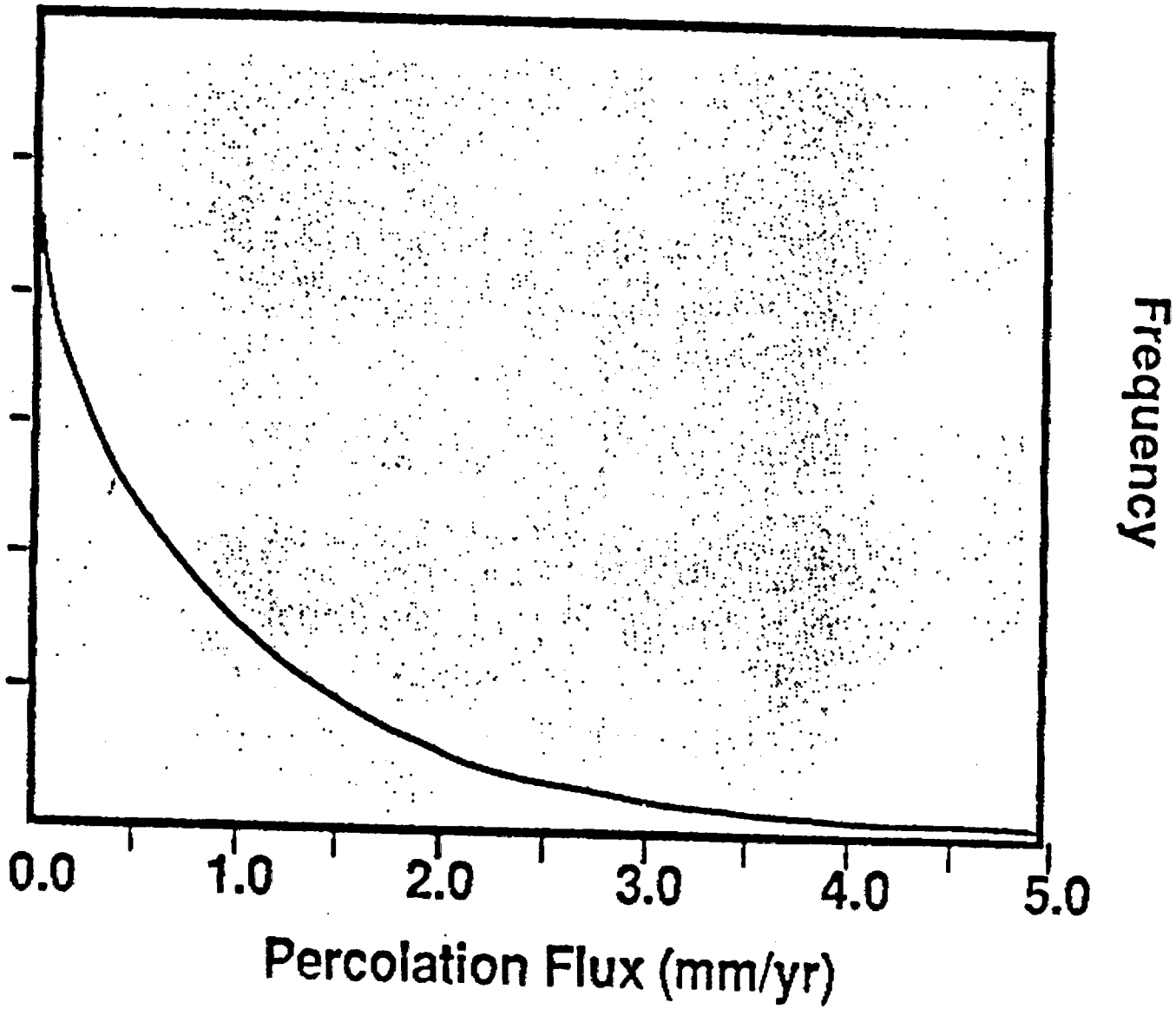

FIGURE 4

TSPA91HD16P.125.ACNW/12-16-92

Barnard, R.W., and H.A. Dockery, editors, 1991, "Technical Summary of the Performance Assessment Calculational Exercises for 1990 (PACE-90), Vol. 1: "Nominal Configuration" Hydrogeologic Parameters and Calculational Results", SAND90-2726, Sandia National Laboratories, Albuquerque, NM (NNA.910523.001)

Eslinger, P.W., and B.Sagar, 1988, "EPASTAT", A Computer Model for Estimating Releases at the Accessbile Environment Boundary of a High-Level Nuclear Waste Repository-Mathematical Model and Numerical Methods, "SD-BWI-TA-022, Rev. 1, Westinghouse Hanford Co., Richland, WA (NNA.920521.0050)

Gainer, G., P.G. Kaplan, A.S. Schenker, and H.A. Dockery, 1992, "Model Domains and Hydrogeologic Data Base to support Earling Site Suitability and Total-System Performance Assessment Models, :SAND92-0799, Sandia National Laboratories, Albuquerque, NM (NNA.920630.0035)

Carl Gertz's response to this request is attached as Figure 5.

As a final comment, I would like to urge the NRC to look at what the key data needs are now, based on this modeling exercise to date. They should determine what parameters are important (like fracture properties) and areas where no data exist. NRC must get these requests into DOE early. The very long turn around times in acquiring data may preclude its collection if it isn't asked for prior to approval of Study Plans or before site charatorization begins.

I hope these comments are useful to you. If you have any questions, please feel free to call.

Sincerely,

L. LEHMAN & ASSOCIATES, INC.

Linda Lehman

Linda L. Lehman
President

LLL:as

TB
EN Y

Department of Energy
Yucca Mountain Site Characterization
Project Office
P. O. Box 98608
Las Vegas, NV 89193-8608

WBS 1.2.5.2
QA: N/A

File Nevada Incoming

OCT 29 1992

Carl A. Johnson
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Agency for Nuclear Projects
State of Nevada
Evergreen Center, Suite 252
1802 North Carson Street
Carson City, NV 89710

RESPONSE TO REQUEST FOR REFERENCES

In a letter dated October 19, 1992, you requested three references pertaining to the Yucca Mountain Site Characterization Project. All three of these documents are in draft form and have not been reviewed and approved by the U.S. Department of Energy (DOE). The requested references will be sent to you as soon as they have been approved by the DOE.

If you have any questions, please contact Jeanne L. Cooper at (702) 794-7930.

Carl P. Gertz
Project Manager

RSED:JLC-640

cc:
M. B. Blanchard, YMP, NV
A. C. Robison, YMP, NV
J. R. Dyer, YMP, NV
S. B. Jones, YMP, NV
J. M. Boak, YMP, NV

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FIGURE 5

REFERENCES:

Barnard, R.W., and H.A. Dockery, editors., 1991, "Technical Summary of the Performance Assessment Calculational Exercises for 1990 (PACE-90), Vol. 1: "Nominal Configuration" Hydrogeologic Parameters and Calculational Results," SAND90-2726, Sandia National Laboratories, Albuquerque, NM. (NNA.910523.0001)

Eslinger, P.W., and B. Sagar, 1988, "EPASTAT" A Computer Model for Estimating Releases at the Accessible Environment Boundary of a High-Level Nuclear Waste Repository-Mathematical Model and Numerical Methods," SD-BWI-TA-022, Rev. 1, Westinghouse Hanford Co., Richland, WA. (NNA.920521.0050)

Gainer, G., P.G. Kaplan, A.S. Schenker, and H.A. Dockery, 1992, "Model Domains and Hydrogeologic Data Base To support Early Site Suitability and Total-System Performance Assessment Models," SAND92-0799, Sandia National Laboratories, Albuquerque, NM. (NNA.920630.0035)

Harrill, J.R., Gates, J.S., Thomas, J.M., 1988, Major Ground-Water Flow Systems in the Great Basin Region of Nevada, Utah, and Adjacent States, USGS Atlas HA-674-C.

Hokett, S.L., G.F. Cochran, and S.D. Smith, 1991, Shallow Vadose Zone Response to a Simulated Pluvial Climate at a Field Site near Yucca Mountain, Nevada. Submitted for publication in the "Special Issue of Radioactive Waste Management and the Nuclear Fuel Cycle on the Yucca Mountain Project".

Lehman, Linda L., 1992. Alternate Conceptual Model of Ground Water Flow at Yucca Mountain, Proceedings of High Level Radioactive Waste Management, April 12-16.

Nicks, Arlin, 1989. CLIGEN Version 1.0, WEEP Water Erosion Project, Durant, OK.

Nieber, J.L., Tosomeen, C.A.S., and B.N. Wilson. In Press A Stochastic-Mechanistic Model of Depression Focused Recharge, Second USA/CIS (formerly USSR) Conference on Environmental Geology and Hydrology, Washington D.C., May 15-21.