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MEMORANDUM FOR: Robert E. Browning, Director
Division of Waste Management

FROM: Philip Justus, Acting Chief
Geotechnical Branch
Division of Waste Management

SUBJECT: STATUS OF REVISIONS TO GROUNDWATER TRAVEL TIME AND DISTURBED ZONE TECHNICAL POSITIONS

The official comment period for the draft Generic Technical Positions on Groundwater Travel Time (GWTT) and the Disturbed Zone (DZ) expired on October 1, 1986. We have received comments from five parties. Notably lacking are any comments from the Department of Energy. A letter has been sent to DOE soliciting comments even though the comment period has passed. We have received informal comments from several DOE contractors who have worked on the formal comment package for DOE, so we expect a substantial set of comments imminently.

Comments received to date are summarized and grouped, where applicable, in the attachment to this memorandum. Among the most difficult comments to address are those dealing with the questions on the effects of uncertainty and spatial variability in the geologic media on groundwater travel time. Other notable comments deal with the difficulty of determining pre-emplacement paths of radionuclide travel and the uncertainty that pre-emplacement conditions outside of the disturbed zone adequately characterize the site.

These and other comments generated by the staff and our consultants have caused us to delay from October 31, 1986 to February 1, 1987 the next Operational Plan commitment, which was to produce the scheduled milestones for publishing the two Generic Technical positions in final form. This delay was made in order to allow the DOE comments to be received and plan for our Technical Assistance contractors, Williams and Associates, and Nuclear Waste Consultants, to address certain fundamental issues on the staff's interpretation of GWTT and DZ. The meeting with our contractors took place the week of November 3 - 7, 1986. Four generic work items were identified for the contractors in the area of uncertainty:

a. Sources of uncertainty;
b. Treatment of uncertainty;
c. Identification of uncertainty through hydrologic testing;
d. Uncertainty of groundwater flow.

The date for completion of the four generic work items has been tentatively set to be the end of May, 1987. Public comments already received were given to the contractors so that they can help us to address the specific points raised. Suggestions for revising the GWTT position have already been made by Williams and Associates. Comments specific to the disturbed zone have also been given to the Engineering Branch for their evaluation.

We would be happy to brief you further on the status of these GTP at your convenience.

ORIGINAL SIGNED BY
PHILIP S. JUSTUS

Philip Justus, Acting Chief
Geotechnical Branch
Division of Waste Management

Enclosures:
As stated

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

MEMORANDUM FOR: Robert E. Browning, Director, WM

FROM: Philip S. Justus, Acting Chief, WMGT/WM

SUBJECT: STATUS OF REVISIONS TO GROUNDWATER TRAVEL TIME AND DISTURBED ZONE TECHNCIAL POSITIONS

DATE: DEC 0 1 1986

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CONCURRENCES

ORGANIZATION/CONCUREE	INITIALS	DATE CONCURRED
WMGT: RCodell	RC	86/11/26
WMGT: MFliegel	MF	86/11/26
WMGT: PJustus	PJ	86/12/01

File note: Richard Codell discussed this memorandum with Seth Coplan on 12/1/86. Dr. Coplan is aware of its contents, and agreed that the memorandum should go foward.

COMMENTS ON DRAFT GENERIC TECHNICAL POSITION ON GROUNDWATER TRAVEL TIME

A. Classification of Comments

1. Dispersion, diffusion and matrix diffusion
   N1, N3, N4, N6, T2, Y9, Y16

2. Modelability and representativeness of field data
   N2, N3, N6, N10, N11, Y3, Y11

3. Uncertainty and Spatial Variability
   N5, Y2, N17, N18, Y8, Y10, Y15, Y17, Y18, P1, P2

4. Determination of fastest path
   N7, N8, N9

5. Special considerations for unsaturated media
   N9, N12

6. Colloid transport
   Y1, Y5

7. Use of natural tracers
   N3, N6

8. Alternative definitions for GWTT rule
   N13, N14, N15

9. Typographical errors
   N5, Y2

10. Miscellaneous and clarity
    N16, Y4, Y6, Y7, Y12, Y13, Y14, T1

B. Brief Synopsis of Comments Received by November 17, 1986

State of Nevada

N1. Language on average pore velocity is inappropriately weak. Should not even allow for the possibility of matrix diffusion.

N2. Feasibility of developing representative field data that would allow confident deterministic model development has not been demonstrated.

N3. Adequacy of the equivalent porous media concept (EPM) for fractured rock is doubtful. Age dating should be used wherever possible.

N4. Treatment of dispersion is inappropriate without first establishing a more rigorous technical position on advective transport. GTP places excessive emphasis on matrix diffusion.

N5. Retardation - Typographical error in definition of R_d. GTP didn't address the vagaries of retardation in fractured media.

N6. Average seepage velocity is intractable in fractured rock terrane. Natural tracers are most reliable dating method.

N7. Using the entire DZ as the starting point for the GWTT calulations violates the fastest path concept. The cumulative distribution function (CDF) should be constructed only from the fastest path determined from site characterization. Don't consider multiple particle trajectories.

N8. Zero percentile of CDF should be used as the fastest GWTT.

N9. It isn't adequate to estimate probability of path created because of a large recharge event in unsaturated flow. If it does occur, it is the fastest path.

N10. GTP should describe acceptable experiments for determining U and n_e.

N11. Basically same as comment N10. NRC should comment on usefulness of field tests to determine GWTT.

N12. GTP should take the transient water table into account in GWTT definition.

N13. Choice of the word "aquifer" is poor for low permeability media.

N14. Should distinguish between bias and precision in definition of GWTT uncertainty.

N15. Suggests alternative definition of GWTT. CDF in terms of distribution of mass along a line after 1000 years.

N16. Suggests "hydrogeologic features" be added to "units".

N17. Suggests that correlations between parameters deserves more attention.

N18. Methods such as Monte Carlo and stochastic, realistically cannot be expected to be applicable to licensing proceedings.

YAKIMA NATION

Y1. Discussion of colloidal transport is oversimplified. Colloidal particles tend to travel along the fastest conduits.

Y2. There is a typographical error in the equation for computing groundwater travel time.

Y3. Discussion of the term "immobile water" is ambiguous. The theory relating adsorption and decay to transport has not yet been developed.

Y4. Equations 5 and 6 do not follow from equations 3, 4, and 5. Definitions of the terms G and C are missing.

Y5. Radiocolloids may travel in regions of higher than average fluid velocities.

Y6. Description on page 7 of Cathles experiment does not follow from preceding text.

Y7. Page 7, paragraph 3 - Distinction between self-diffusion of water molecules and tracers is artificial. Water movement cannot be traced without a tracer.

Y8. Uncertainty in estimation of parameters which characterize the probability distribution is ignored.

Y9. Definition of mechanical dispersion applies only to pore-scale nonuniformities.

Y10. Literature on stochastic modeling much larger than implied.

Y11. There is no analytical solution available for GWTT in 2 or 3 dimensions.

Y12. A better method for tracing particles is suggested.

Y13. Clifton and Neuman, and others have not employed conditional simulation for GWTT calculations. Only hydraulic heads were studied.

Y14. Other ways of generating multivariate random numbers are available in standard computer math packages.

Y15. There is no need for the correlation scales to be infinite.

Y16. Monte Carlo methods have not yet been applied to three dimensional flow situations. Clifton's method doesn't account for dispersion and diffusion, especially at scales smaller than the grid size.

Y17. Boundary condition uncertainty has not been explored.

Y18. The GTP overemphasizes a particular method for determining GWTT, and gives the erroneous impression that the method is without problems.

State of Texas

T1. Guidance is too prescriptive. It is not proper for NRC to prescribe how GWTT should be determined. GTP should identify criteria for GWTT.

T2. GTP should not allow matrix diffusion. Present position discourages it, but leaves open the possibility.

Nelson (Pacific Northwest Laboratories)

P1. Grouping uncertainty into CDF is confusing or incorrect.

P2. Reference percentile (e.g., 15th percentile) of CDF should be used, rather than leaving it to the discretion of the investigators.

COMMENTS ON DISTURBED ZONE

State of Nevada

N1. Cover letter - Site specific GTP's should be developed, one for each site.

N2. Basically the same as Yakima Comment 1 on 48FR28210, June 21, 1986. Makes it clear that GWTT was intended to reflect post-emplacement conditions and must not reflect effect of heat. The disturbed zone must encompass zone of thermal buoyancy.

N3. Same as Yakima comment 3. A smaller accessible environment is a poor justification for a smaller disturbed zone.

State of Texas

T1. Guidance is too prescriptive. It is not the purpose of a GTP to specify the size of the disturbed zone. The NRC should identify the significant criteria for determining the size of the disturbed zone.

Yakima Nation comments on proposed amendments to 10 CFR 60

Y1. In 1983, NRC did intend to include buoyancy effects. The NRC did not distinguish between rock and fluid effects. The original disturbed zone was envisioned to be on the scale of kilometers. (July 8, 1986).

Y2. The statement in the FR notice that disturbed zone effects are now modelable is in doubt.

Y3. A nearer accessible environment (5 vs 10 km.) is an inappropriate basis to liberalize the size of the disturbed zone.

Hanford REACH Project

H1. The Disturbed Zone should be extended to include shafts and boreholes.