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Dr. Regina Hunter
Sandia National Laboratories
Division 6431
P. O. Box 5800
Albuquerque, NM 87185

Dear Dr. Hunter:

SUBJECT: RESPONSE TO NOVEMBER PROGRESS REPORT (FIN A-1165)

In response to the November progress report, I have the following comments.

Task 1: Your familiarization with the various performance methodologies is progressing satisfactorily.

As soon as they are received, I will be forwarding to you the four remaining Golder reports on engineered barriers.

Aerospace is expecting to have the waste package methodology available in draft form in late January. I tentatively am planning a meeting for late February/early March during which questions arising from the initial review will be addressed.

Task 2: As discussed in our phone conversation, please critically review (in accordance with the EA Review Plan) the following sections of the Death Smith, Richton Dome, Davis Canyon and BWIP Environmental Assessments:

- 6.3.1.1
- 6.3.2
- 6.4.2

Costs should be charged to this task and should not exceed \$40K. The following delivery dates for preliminary comments are requested:

- COB January 16 Death Smith, Richton Dome
- COB January 18 BWIP, Davis Canyon.

Task 3: I have received the proposed list of experts with the accompanying resumes and have set up a group from DWM to review the resumes. I expect to have our suggestions for the panel of experts to you by the middle of February.

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I am enclosing the resume of Dr. Gregory Baecher for consideration among the panelists. I would like to discuss with you the applicability of his background and expertise to this project.

Task 4: Please provide an individual to assist in reviewing the hydrogeologic aspects of performance assessment in the Salt Environmental Assessments. I request that the reviewer be present at NRC Headquarters on January 26 and 27 for a comment compilation period. Costs should be charged to this task and shall not exceed \$3.5K.

The actions resulting from this letter are considered to be within the scope of FIN A-1165. No changes to costs or delivery of other contracted products are authorized. Please advise me immediately if you feel that this letter would result in changes to costs or delivery of other contracted products.

Sincerely,

ORIGINAL SIGNED BY

Leslie A. Peeters
Repository Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure:
Resume for Dr. Gregory Baecher

OFC	:WMRP:mkg	:WMRP	:	:	:	:	:
NAME	:L.A. Peeters	:J. Linen	:	:	:	:	:
DATE	:85/01/11	:1/1/85	:	:	:	:	:

Gregory B. Baecher
Associate Professor of Civil Engineering,
and Head, Constructed Facilities Division
Massachusetts Institute of Technology

77 Massachusetts Avenue, Room 1.353, Cambridge MA 02139
617/253-8435

Citizenship: U.S.A.

Principal Field of Interest:

Engineering geology and rock mechanics. Statistical methods of site
characterization. Engineering risk assessment.

Education:

University of California, Berkeley,	BSCE	1968
Massachusetts Institute of Technology	MSc	1970
Massachusetts Institute of Technology	PhD	1972

Experience:

Massachusetts Institute of Technology	Associate Professor	7/80	---
Massachusetts Institute of Technology	Assistant Professor	7/76	6/80
Technische Universitat Munchen, Institut fur Massivbau	Visiting Researcher	9/79	9/80
U.S. Army Corps of Engineers, Missouri River Division Labs	Research Engineer	6/68	9/68
International Institute for Applied Systems Analysis	Research Scholar	10/74	10/75

Consulting Record:

Ardaman Associates; T.W. Lambe and Associates; Tonen Oil, Tokyo;
Geotechnical Engineers, Inc.; Arthur D. Little, Inc.; TERA,
Corporation; Lawrence Livermore Laboratories; Woodward-Clyde
Consultants, Inc.; Institut fuer Bautechnik, Berlin; Borden
Agricultural Chemical; Soil and Rock Instrumentation, Inc.; Ideal
Products Company; Societe Electricite de Baie James; U.S. Bureau of
Mines; U.S. Army Engineers, Waterways Experiment Station; U.S.
Department of Transportation, Federal Highways Administration; Haley
and Aldrich, Inc.; Bromwell and Carrier, Inc.

Government Committees, Service, etc.:

Independent Review Panel on Nuclear Waste Disposal, Office of Science and Technology Policy; U.S. Water Resources Council, Expert consultant on dam safety risk; National Flood Insurance Program, Workshop on Levee Safety; U.S. Corps of Engineers, Waterways Experiment Station, Program review for research on probabilistic methods in geotechnics; National Science Foundation, Proposal review panel, Policy Research and Analysis Division.

Awards:

Chi Epsilon; National Science Foundation Graduate Traineeship; National Science Foundation Graduate Fellowship; Rockefeller Foundation, Conflict in International Relations Fellowship.

Current Organizational Membership:

American Society of Civil Engineers [Committee on Geotechnical Reliability, Chairman; Committee on Offshore Reliability, Committee on Publications, Geotechnical Engineering Division]; Boston Society of Civil Engineers; International Society for Rock Mechanics [Organizing Committee, 22nd U.S. Symposium on Rock Mechanics; Organizing Committee 25th U.S. Symposium on Rock Mechanics]; International Association for Mathematical Geology American Statistical Association; The Institute of Management Sciences; Society for Risk Analysis.

Teaching Experience:

Massachusetts Institute of Technology

1.159	Judgement, Prediction, and Risk in Engineering Planning
1.103	Geotechnical Engineering Laboratory
1.08	Geotechnology
1.38s	Recent Developments in Rock Engineering
1.38	Engineering Geology
1.962	Special Studies in Geotechnical Reliability
1.381	Rock Mechanics
1.364	Foundations Engineering
1.34	Geotechnical Reliability
1.311	Geotechnical Engineering
1.03	Civil Engineering Systems Analysis II

Short Courses

- Risk and Reliability in Geotechnical Engineering (with R. Rackwitz, Technical University Munich), Southampton, 1980.
- Probabilistic and Statistical Methods in Geotechnical Engineering (with D. Veneziano, MIT), Bergamo, 1981.
- Probabilistic and Statistical Methods in Rock Engineering (with H.H. Einstein, MIT), Cambridge, 1981.
- Geotechnical Exploration for Offshore Structures--Statistical methods in data analysis (with C.C. Ladd and A.S. Azzouz, MIT), Houston, 1981.

Publications**Refereed Journals:**

1. Baecher, G.B. (1974). "Discussion on 'Uncertainty, safety and decision in soil engineering' by T.H. Wu", Journal of the Geotechnical Division, ASCE, 100(GT10).
2. Baecher, G.B. (1976). "Sampling for Group Utility", Journal Environment Systems, 5(4): 299-314.
3. Labreche, D.A., H.H. Einstein, M.J. Markow and G.B. Baecher (1978). "Decision analysis applied to rock tunnel exploration", Engineering Geology, V. 12(2): 143-161.
4. Baecher, G.B., E.M. Pate and R. de Neufville (1979). "Dam failure in benefit/cost analysis", Journal of the Geotechnical Division, ASCE, 106 (GT1): 101-105.
5. Baecher, G.B., E.M. Pate and R. de Neufville (1979). "Risk of dam failure in benefit/cost analysis", Water Resources Research, V. 16(3): 449-456.
6. Baecher, G.B., (1980). "Progressively censored sampling of rock joint traces", Journal of the International Association of Mathematical Geologists, V. 12(1): 33-40.
7. Baecher, G.B. (1981). "Optimal estimators of soil properties", Journal of the Geotechnical Division, ASCE, 107 (GT5): 649-653.
8. Baecher, G.B. and T.S. Ingra (1981). "Stochastic FEM in settlement predictions", Journal of the Geotechnical Division, ASCE, 107 (GT4): 449-463.
9. Baecher, G.B. and H.H. Einstein (1981). "Size effect in rock testing", Geophysical Research Letters, 8(7): 671-674.
10. Einstein, H.H. and G.B. Baecher. "Probabilistic and Statistical methods in engineering geology", Journal of Rock Mechanics, Suppl. 12: 47-61..
11. Baecher, G.B. and R. Rackwitz. "Factors of safety and pile load tests", Journal of Numerical and Analytical Methods in Geomechanics, 6: 409-424.
2. Baecher, G.B., "Sampling with decomposed variance", Journal of the Engineering Mechanics Division, ASCE, 108(EM5): 1013-1017.
13. Baecher, G.B. and R.L. Keeney, "A statistical analysis of induced seismicity", Bulletin of the Seismological Society of America, 72(2): 553-569.

14. Galzi, J-L. and G.B. Baecher, "Intersections with Fisher distributed planes", International Journal of the Association of Mathematical Geologists, accepted subject to revision.
15. Baecher, G.B., and H.H. Einstein (1983), Probabilistic and Statistical Methods in Engineering Geology, Part I: Exploration, " Rock Mechanics and Rock Engineering, 16, 39-72.
16. Ingra, T.S. and G.B. Baecher, "Uncertainty in bearing capacity on sands," Journal of the Geotechnical Engineering Division, ASCE, 109, GT4.
17. Baecher, G.B., "First order geotechnical reliability," International Journal of Numerical and Analytical Methods in Geomechanics, (Accepted for publication).
18. Einstein, H.H., D. Veneziano, G.B. Baecher, and K. O'Reilly, "Joint persistence," International Journal of Rock Mechanics and Mining Science, (accepted for publication).
19. Baecher, G.B., "Statistical analysis of rock mass fracturing," International Journal of the Association of Mathematical Geologists, 15(2): 333-352, 1983.

Conferences:

1. Einstein, H.H., G.B. Baecher and R.C. Hirschfeld, "Statistical size effect in brittle fracture of rock", Second International Congress on Rock Mechanics, Belgrade, 1970.
2. Baecher, G.B., "Subjective sampling in resource estimation", IIASA Conference on Estimation of Energy Resources, 1975. Invited.
3. Baecher, G.B. and J.G. Bros, "Extrapolating trending geological bodies", IIASA Conference on Estimation of Energy Resources, 1975.
4. Baecher, G.B., N.A. Lanney and H.H. Einstein, "Statistical description of rock properties and sampling", 18th U.S. Symposium on Rock Mechanics, 1977.
5. Baecher, G.B. and N.A. Lanney, "Trace Length Biases in Joint Sampling", 19th U.S. National Symposium on Rock Mechanics, 1978.
6. Baecher, G.B., "Modeling for Decision Analysis", ORSA Spring Meeting, 1979. Invited.
7. Baecher, G.B., "The current state of exploration modeling", ASCE National Convention, Boston, Geotechnical Reliability Specialty Session, 1979. Invited.
8. Baecher, G.B. and T.S. Ingra, "Equivalent properties for stochastic soil profiles", ASCE Specialty Conference on Structural and Geotechnical Engineering, 1979.
9. Baecher, G.B., "Search theory in geotechnical exploration", 3rd International Conference on Probability and Statistics in Structural and Geotechnical Engineering, 1979.
10. Baecher, G.B., H.H. Einstein and W. Dershowitz, "Statistical Modeling of rock deformability", 4th International Congress on Rock Mechanics, 1979.
11. Baecher, G.B. and H.H. Einstein, "Reliability modeling for pit slopes", 16th International conference on Applications of Computers and Operations Research to the Mineral Industries, 1979.

12. Baecher, G.B. and R.L. Keeney, "Factors contributing to reservoir induced seismicity", Geological Society of America, Annual Meeting, Los Angeles, 1979.
13. Einstein, H.H., W. Steiner and G.B. Baecher, "Assessment of empirical design methods for tunnels in rock", Rapid Excavation and Tunneling Conference, Atlanta, 1979.
14. Baecher, G.B. and A. Merritt, "Site Characterization: State of the art", 22nd U.S. National Symposium on Rock Mechanics, Cambridge, 1981. Invited State-of-the-Art.
15. Einstein, H.H. and G.B. Baecher, "Probabilistic methods in engineering geology: State of the art", 30th Geomechanics Colloquium (in honor of Professor F. Pacher), Salzburg, 1981 (unabridged version of entry 2.10). Invited State-of-the-Art.
16. Baecher, G.B., "Risks and uncertainties in geotechnical engineering", International Conference on Structural Safety and Reliability, Trondheim, 1981.
17. Baecher, G.B. and R. Rackwitz, "Factors of safety for pile load capacity", Joint Committee on Structural Safety, Comite Europeen du Beton, Annual Meeting, Lisbon, 1980.
18. Baecher, G.B., "Statistical analysis of in-situ test results", Updating Subsurface Sampling of Soils and Rocks and their In-situ Testing, Engineering Foundation, 1982. Invited.
19. Baecher, G.B., "Playing the odds in rock mechanics," 23rd U.S. National Symposium on Rock Mechanics, Berkeley, 1982. Invited Keynote.
20. Baecher, G.B., "Professional judgement and prior probabilities in engineering risk assessment," Proceedings, 4th International Conference on applications of Statistics and Probability to Structural and Geotechnical Engineering, Florence, 1983.
21. Baecher, G.B., "Systematic geotechnical risk assessment of a chemical refinery," Proceedings, Conference on risk analysis of large industrial facilities," NRC/LLL, San Francisco, 1983.
22. Baecher, G.B., "Just a few more tests and we'll be sure," in, Bowles, D. (Ed.) Probabilistic Models of Soil Properties, ASCE Specialty Session, Atlanta, 1984.

Other Major Publications:

1. Baecher, G.B., J.B. Gros and K. McCusker. "Balancing apples and oranges: Methodologies for facility siting decisions", in Policy Analysis, D. Bunn and H. Thomas (Eds.), 1976.
2. Baecher, G.B., "Analyzing exploration strategies", in C.H. Dowding (Ed.), Site Characterization and Exploration, ASCE, 1979.
3. Baecher, G.B., B. Peintinger and R. Rackwitz, "Basic notes on strength: Compacted soils", Joint Committee on Structural Safety, Comité Europeen du Beton, 1981.

4. Baecher, G.B., "Simplified geotechnical data analysis," in P. Thoft-Christensen (Ed.), Reliability theory and its application in Structural and Soil Engineering, NATO-ASI, D. Reidel Publishing Co., Holland, 1982.
5. Baecher, G.B., "Applied geotechnical reliability analysis," in P. Thoft-Christensen (Ed.), Reliability theory and its application in Structural and Soil Engineering, NATO-ASI, D. Reidel Publishing Co., Holland, 1982.
6. Baecher, G.B., (1982). "Simplified statistical methodology for evaluating rock mechanics exploration data," U.S.A.E. Waterways Experiment Station Report, 65pp.
7. Baecher, G.B., W.A. Marr, J.-S. Lin, and J. Consla (1983), "Critical parameters for mine tailings embankments," Report to U.S. Bureau of Mines under contract J0215028.

Internal Memoranda and Progress Reports:

1. Baecher, G.B., "Probability theory in geological exploration", IIASA Research Mem. 75-18, 1975.
2. Baecher, G.B., "Extensions of Roy's and Roadifer's subjective approach to oil resource estimation", IIASA WP 75-54, 1975.
3. Baecher, G.B., "Spatial process modeling for air pollution", IIASA WP 75-40, 1975.
4. Baecher, G.B., "Standard setting with uncertain utility functions", IIASA WP 75-65, 1975.
5. Baecher, G.B., "Decision objectives and attributes for the nuclear siting study", IIASA WP 75-165, 1975.
6. Baecher, G.B. and K. Twyford, "Land use capability mapping", Technical Report, Department of Civil Engineering, M.I.T. R78-17, 1978.
7. Baecher, G.B., "Search in Geotechnical Engineering", Technical Report, Department of Civil Engineering, M.I.T., 1978.
8. Baecher, G.B. and T. Ingra, "Foundation settlement using uncertain finite element analysis", Technical Report, Department of Civil Engineering, M.I.T. R78-13, 1978.
9. Baecher, G.B. and T.S. Ingra, "Uncertainties in Bearing Capacity Prediction for Sands", Technical Report, Department of Civil Engineering, M.I.T. R78-12, 1978.
10. Baecher, G.B. and T. Lee, "Models for settlement predictions", Technical Report, Department of Civil Engineering, M.I.T. R79-11, 1979.
11. Einstein, H.H., G.B. Baecher and D. Veneziano, "Reliability analysis of pit mine slopes", Technical Report, Department of Civil Engineering, M.I.T., R80-21, 1980.
12. Baecher, G.B. and H.H. Einstein, "Statistical analysis of joint orientation data", Notes for M.I.T. short course "Current Developments in Rock Engineering".
13. Baecher, G.B., "A summary of sampling theory for application to geotechnical engineering", Research Report, Department of Civil Engineering, M.I.T. R78-14, 1978.
14. Nucci, L.R. and G.B. Baecher, "Error Rates in Two-Color Maps", Research Report, Department of Civil Engineering, M.I.T. R78-11, 1979.
15. Leung, P. and G.B. Baecher, "Modeling Uncertainty in Geotechnical Engineering", Research Report, Department of Civil Engineering, M.I.T.

16. Baecher, G.B., "Probabilistic modeling of site exploration", Research Report, Department of Civil Engineering, M.I.T. R79-9, 1979.
17. Baecher, G.B., et al., "Geotechnical reliability of offshore gravity structures", Project Sea Grant Report, MIT SG 80-20, 1980.
18. Einstein, H.H., G.B. Baecher, J. Kafritsas and M. Cheng, "Combined stability-deformation analysis of rock slopes", Progress Report to the Office of Surface Mines, M.I.T., 1981.
19. Lee, L. and G.B. Baecher, "Acoustical information in offshore geotechnical site investigation," MIT Sea Grant Report, 1983.

Invited Lectures:

- November 1977. "Subjectivism in Geological Exploration", Department of Civil Engineering, Princeton University.
- November 1976. "Model Uncertainty in Geotechnical Prediction", Department of Civil Engineering, M.I.T., Seminar Series on Reliability Methods in Geotechnical Engineering.
- November 1978. "Probabilistic Geotechnical Analysis of Waste Repositories," Lawrence Livermore Laboratories.
- February 1979. "Model Uncertainty", Lawrence Livermore Laboratories.
- May 1979. "Statistical Analysis of Rock Joints", and "Uncertainty about Uncertainty", Department of Civil Engineering, University of California, Berkeley.
- April 1979. "Stochastic Models in Soil Mechanics", Technische Universitat Munchen.
- January 1980. "Level II Analysis in Geotechnical Design", Imperial College, University of London.
- April 1980. "Sources of Geotechnical Uncertainty", "Statistical Analysis of Site Exploration Data", and "The Second Moment Approach to Geotechnical Analysis", (three day lecture series). Norwegian Geotechnical Institute.
- May 1980. "Applied Uncertainty Analysis", The Technical University of Denmark and the Danish Engineering Academy.
- July 1980. "Reliability of Rock Slopes", E.T.H. Lausanne.
- December 1982. "Statistical analysis of in situ data," USAE Waterways Experiment Station, Vicksburg, MS.
- March 1983. "Reliability assessment of James Bay Dykes," Department of Civil Engineering, RPI, Troy, NY.
- Spring 1984. "Risk Analysis of an Oil Refinery Tank Farm," Stanford University.