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Dr. Robert M. Cranwell
Sandia National Laboratories
Division 6431
P. O. Box 5800
Albuquerque, New Mexico 87185

Dear Dr. Cranwell:

22 MARCH 1984 MEETING

Bruce Crane and I thank you for hosting us at your very productive 22 March 1984 meeting regarding reliability and risk assessment of basalt nuclear waste packages and repository. We are pleased that your Nuclear Regulatory Commission (NRC) Project Monitor, Robert Shepard, proposed this meeting. Aerospace looks forward to continued exchanges of information as our works with NRC move along and complement each other.

The discussions we had have proved valuable to us here at Aerospace in stimulating further thought for and direction of our work. The modeling work presented by Margaret Chu is very interesting. This model and others used at Sandia National Laboratories will be keenly studied and assessed for their application to our waste package modeling efforts.

I am enclosing a copy of the NRC Statement of Work (SOW) for Aerospace, the Program Plan, dated 30 September 1983, for this SOW and a copy of the briefing by Bruce Crane. These three items, in addition to the Aerospace draft Fault Tree (December 1983) and draft Event Tree (January 1984) reports which you already have, are the documents we have produced that are of interest to you.

Call me or Bruce if further discussion is desired.

Very truly yours,

Lawrence P. Boesch

Lawrence P. Boesch
Technology Impacts Directorate
Eastern Technical Division

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A-4165 PDR

LPB/gbf
Enclosures
cc: N. Ortiz, Sandia
R. Shepard, NRC
K. Chang, NRC
N. Eisenberg, NRC

PREPARATION OF ENGINEERING ANALYSIS
FOR
HIGH-LEVEL WASTE PACKAGES IN GEOLOGIC REPOSITORIES
(FIN A-4165-3)

BRIEFING TO

SANDIA NATIONAL LABORATORIES
ALBUQUERQUE

22 MARCH 1984

The Aerospace Corporation

THE AEROSPACE ROLE

- SUPPORT OVERALL NRC LICENSING BY PERFORMING ENGINEERING ANALYSIS OF WASTE PACKAGES

- TASKS

  1. EVALUATE METHODOLOGIES USED BY DOE AND OTHERS TO ASSESS WASTE PACKAGE PERFORMANCE

  2. DEVELOP FAULT TREES/EVENT TREES DEPICTING PACKAGE FAILURES AND RELEASE OF RADIONUCLIDES

  3. ASSESS PERFORMANCE OF DOE WASTE PACKAGE DESIGNS

  4. PERFORM GENERAL TECHNICAL ASSISTANCE

- 3-YEAR PROJECT

  - BASALT
  - SALT
  - TUFF

WORK DONE SO FAR

- FAULT TREE DESCRIPTION OF WASTE PACKAGE FAILURE
  - SEE DECEMBER 1983 DELIVERABLE TO NRC
  - TREE NOT YET QUANTIFIED BY ASSIGNING EVENT PROBABILITIES

- EVENT TREE DESCRIPTION OF FAILURE SCENARIOS
  - ONLY THE MOST LIKELY SCENARIOS HAVE BEEN DONE
  - SCENARIO PROBABILITIES HAVE NOT YET BEEN QUANTIFIED
  - SEE JANUARY 1984 DELIVERABLE TO NRC

CHALLENGES IN APPLICATION OF FAULT TREE METHODS

- STATISTICAL DEPENDENCE IN EVENT PROBABILITIES
- TIME DEPENDENCY OF EVENT PROBABILITIES
  - TIME LAGS BETWEEN INITIATION OF DEGRADATION PROCESSES
- REPRESENTATION OF CONTINUOUS PROCESSES AS DISCRETE STATES
- REPRESENTATION OF COMBINED EFFECTS OF SEPARATE PROCESSES
- QUANTIFICATION OF RADIONUCLIDE RELEASE RATES
- DATA REQUIREMENTS - NEED PROBABILITY DISTRIBUTIONS OF FAILURE TIMES

STATISTICAL DEPENDENCE OF EVENTS

- FAULT TREE QUANTIFICATION BY COMPUTER ASSUMES INDEPENDENCE OF PRIMARY EVENTS

- MANY PRIMARY EVENTS ARE JUST CROSSINGS OF THRESHOLD VALUES OF ENVIRONMENTAL VARIABLES

  E.G., TEMPERATURE, ION CONCENTRATIONS, PRESENCE OF WATER

- ENVIRONMENTAL VARIABLES ARE INTERRELATED - SHOULD BE MODELED AS A SYSTEM OF EQUATIONS

- ENVIRONMENTAL VARIABLES CAN BE INFLUENCED BY DEGRADATION OF WASTE PACKAGE GENERATING A FEEDBACK RELATIONSHIP (WAPPA MODEL)

TIME DEPENDENCY OF FAILURE PROBABILITIES

- FAULT TREES HAVING SIMPLE TIME DEPENDENCIES CAN BE QUANTIFIED
  - USE KINETIC TREE PROGRAMS BY VESELY

- PROTECTION BY OUTER BARRIERS AFFECTS FAILURE TIME PROBABILITY DISTRIBUTIONS FOR INNER BARRIERS
  - KINETIC TREES DO NOT ADDRESS THIS PROBLEM
  - SEE APPENDIX B OF EVENT TREE REPORT

EXAMINE OTHER EXISTING ASSESSMENT METHODS

- IDENTIFY THE MOST PROMISING CANDIDATES
  - ETD Is Identifying Those Under Consideration By DOE
- EVALUATE TECHNICAL MERIT OF MODELS
  - El Segundo Expertise Is Needed
  - Focus On Equations And Parameters Describing Physical Processes
  - Do Not Need To Benchmark Computer Codes

DEVELOP RECOMMENDATIONS FOR NEW APPROACHES

- SYNTHESIZE BEST FEATURES OF EXISTING METHODS WITH NEW IDEAS

- DEVELOP PRACTICAL METHODS FOR GENERATING INPUTS FOR PROBABILISTIC RISK ASSESSMENT FROM PHYSICAL PROCESS MODELS

TEST FAULT TREE APPROACH

- DEVELOP SAMPLE INPUT PROBABILITY DISTRIBUTION FOR PRIMARY EVENTS
- USE FAULT TREE LOGIC TO COMPUTE PROBABILITY OF PACKAGE FAILURE
- ASSESS APPROPRIATENESS OF FAULT TREE APPROACH