



Department of Energy

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WBS 1.2.5
QA: N/A

NOV 14 1990

Dr. Philip S. Justus, Section Leader
Geology-Geophysics Section
Geosciences and Systems Performance Branch, HLWM
U.S. Nuclear Regulatory Commission
MAIL STOP 4-H-3
Washington, DC 20555

Dear Phil:

TRANSMITTAL OF HARD COPY OF PAPER PRESENTED AT THE GEOLOGICAL SOCIETY OF AMERICA MEETING, NOVEMBER 1990, ENTITLED, "COMPLIANCE WITH 1,000 AND 10,000 YEAR PERFORMANCE REQUIREMENTS"

Enclosed are hard copies of the 35 millimeter slides which I used at the Geological Society of America meeting in Dallas, Texas, on October 31, 1990. We are prepared to begin putting text to the slides as soon as you let us know what format we should use and any restrictions in the content of the paper.

Sincerely,

Maxwell Blanchard
Maxwell B. Blanchard
Acting Deputy Project Manager
Yucca Mountain Project Office

YMP:MBB-751

Enclosure:
Hard Copies of 35mm Slides

11/1
102
WM-11
NH03

ABSTRACT FORM FOR ALL GSA MEETINGS IN 1990

Complete all sections 1 through 9 below.

TYPE ABSTRACT COMPLETELY WITHIN THE BLUE LINES BELOW.

No 11158

2. CHECK ONE CATEGORY below in which reviewers will be best qualified to evaluate abstract. Check "Other" if you want the program chair to choose for you.

COMPLIANCE WITH 1,000 AND 10,000-YEAR PERFORMANCE REQUIREMENTS - WHAT WILL IT TAKE TO LICENSE A GEOLOGIC REPOSITORY?

YOUNKER, J. L., VOEGELE, M.D., SAIC, 101 Convention Center Dr., Las Vegas, NV 89109; BLANCHARD, M.B., DOBSON, D.C., Yucca Mountain Project Office, U.S. Dept. of Energy, Las Vegas, NV 89109

Under currently existing regulations promulgated by the U.S. Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency, licensing of a geologic repository will require predictions of ground-water flow times and radionuclide transport times for 1,000 and 10,000 years, respectively. The appropriate use of geotechnical information in evaluations of compliance with criteria covering such time frames presents a challenging opportunity to geoscientists involved in such evaluations.

The DOE made preliminary evaluations of compliance with long-term performance criteria in 1984-1986 when potential repository sites were compared and screened to select sites for characterization. The siting criteria utilized (10 CFR Part 960) were based upon the long-term performance requirements established by the NRC. This experience provided useful insight into the uncertainties inherent in long-term predictions and also provided an indication of the relative importance of qualitative and quantitative information in evaluations of compliance. As site characterization continues at Yucca Mountain, our understanding of site processes and conditions is expected to improve. Site models will become more mature and confidence will be gained that the models correctly simulate site behavior. In parallel, the statistical quality of the data base representing three-dimensional rock properties will improve, leading to increased confidence that modeling results are broadly representative of the site. However, it is the manner in which improved knowledge of site processes and conditions translates into improved confidence in performance predictions that will allow an answer to be given to the question posed in the title of this abstract.

- 1 archaeological geology
- 2 coal geology
- 3 computers
- 4 economic geology
- 5 engineering geology
- 6 environmental geology
- 7 geochemistry
- 8 geology education
- 9 geomorphology
- 10 geophysics/tectonogeophysics
- 11 geoscience information
- 12 global geoscience
- 13 history of geology
- 14 hydrogeology
- 15 marine geology
- 16 micropaleontology
- 17 mineralogy/crystallography
- 18 paleoceanography/paleoclimatology
- 19 paleontology/paleobotany
- 20 petroleum geology
- 21 petrology, experimental
- 22 petrology, igneous
- 23 petrology, metamorphic
- 24 petrology, sedimentary
- 25 planetary geology
- 26 Precambrian geology
- 27 Quaternary geology
- 28 remote sensing
- 29 sedimentology
- 30 stratigraphy
- 31 structural geology
- 32 tectonics
- 33 volcanology
- 34 OTHER

SELECT ONE FORMAT

INVITED FOR SYMPOSIUM NUMBER: _____
(first five words of title)

VOLUNTEERED FOR A DISCIPLINE SESSION

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Regulatory Geology: Site and Performance
(first five words of title)

SELECT ONE MODE (Be aware that some sessions may have been designated specifically as either "poster" or "oral.")

- ORAL— Verbal presentation before a seated audience.
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COMPLIANCE WITH 1,000 AND 10,000-YEAR PERFORMANCE REQUIREMENTS - WHAT WILL IT TAKE TO LICENSE A GEOLOGIC REPOSITORY?

SPEAKER: MAXWELL B. BLANCHARD
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OVERVIEW OF PRESENTATION

- **REGULATORY BACKGROUND**
- **FEATURES AND CHARACTERISTICS OF THE POTENTIAL REPOSITORY SITE**
- **REDUCING UNCERTAINTY THROUGH SITE CHARACTERIZATION**

**REGULATORY BACKGROUND:
NUCLEAR WASTE POLICY ACT (NWPA)
(1982, 1987)**

**DEPARTMENT OF ENERGY: RESPONSIBLE FOR
RECOMMENDATION OF CANDIDATE SITES,
SITE CHARACTERIZATION, AND
MANAGEMENT OF GEOLOGIC REPOSITORIES**

REGULATORY BACKGROUND:

(CONTINUED)

and
NUCLEAR REGULATORY COMMISSION:
RESPONSIBLE FOR PREPARING REGULATIONS;
FOR ~~USE IN~~ APPROVING/DISAPPROVING
APPLICATIONS TO CONSTRUCT, RECEIVE
AND POSSESS RADIOACTIVE WASTES,
AND TO CLOSE AND DECOMMISSION REPOSITORIES

ENVIRONMENTAL PROTECTION AGENCY:
RESPONSIBLE FOR SETTING STANDARDS FOR
PROTECTION OF THE GENERAL ENVIRONMENT
FROM OFFSITE RELEASES FROM RADIOACTIVE
MATERIAL IN REPOSITORIES

STATUS OF A POTENTIAL REPOSITORY SITE- YUCCA MOUNTAIN, NEVADA

**ENVIRONMENTAL ASSESSMENT ISSUED IN
1986 RECOMMENDED CHARACTERIZATION AS
POTENTIAL REPOSITORY SITE**

**BASIS FOR EA RECOMMENDATIONS INCLUDED
>40,000' CORE, 182 DRILLHOLES AND 23
TRENCHES WITHIN 10 KM; 53 SEISMIC STATIONS
WITHIN 160 KM**

STATUS OF A POTENTIAL REPOSITORY SITE-

(CONTINUED)

BY DOE

**SITE CHARACTERIZATION PLAN ISSUED TO
NRC IN 1988 DESCRIBED ADDITIONAL SITE
DATA NEEDED TO EVALUATE SITE SUITABILITY
AND DEVELOP LICENSE APPLICATION**

**CURRENT SITE DATA COLLECTION IS BY MEANS
OF NON-SURFACE DISTURBING ACTIVITIES DUE
TO STATE OF NEVADA'S REFUSAL TO GRANT
AIR-QUALITY PERMITS**

*There have been several law suits of varying nature and complexity
In this case the DOE was the plaintiff in the 9th district court
against the state who refused to grant permits. Court ruled in favor of
DOE and the state is expected to appeal to the Supreme Court.*

PEREQ5Z/10-30-80

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PLANS FOR CHARACTERIZING THE YUCCA MOUNTAIN SITE

3 areas of major focus during site characterization and

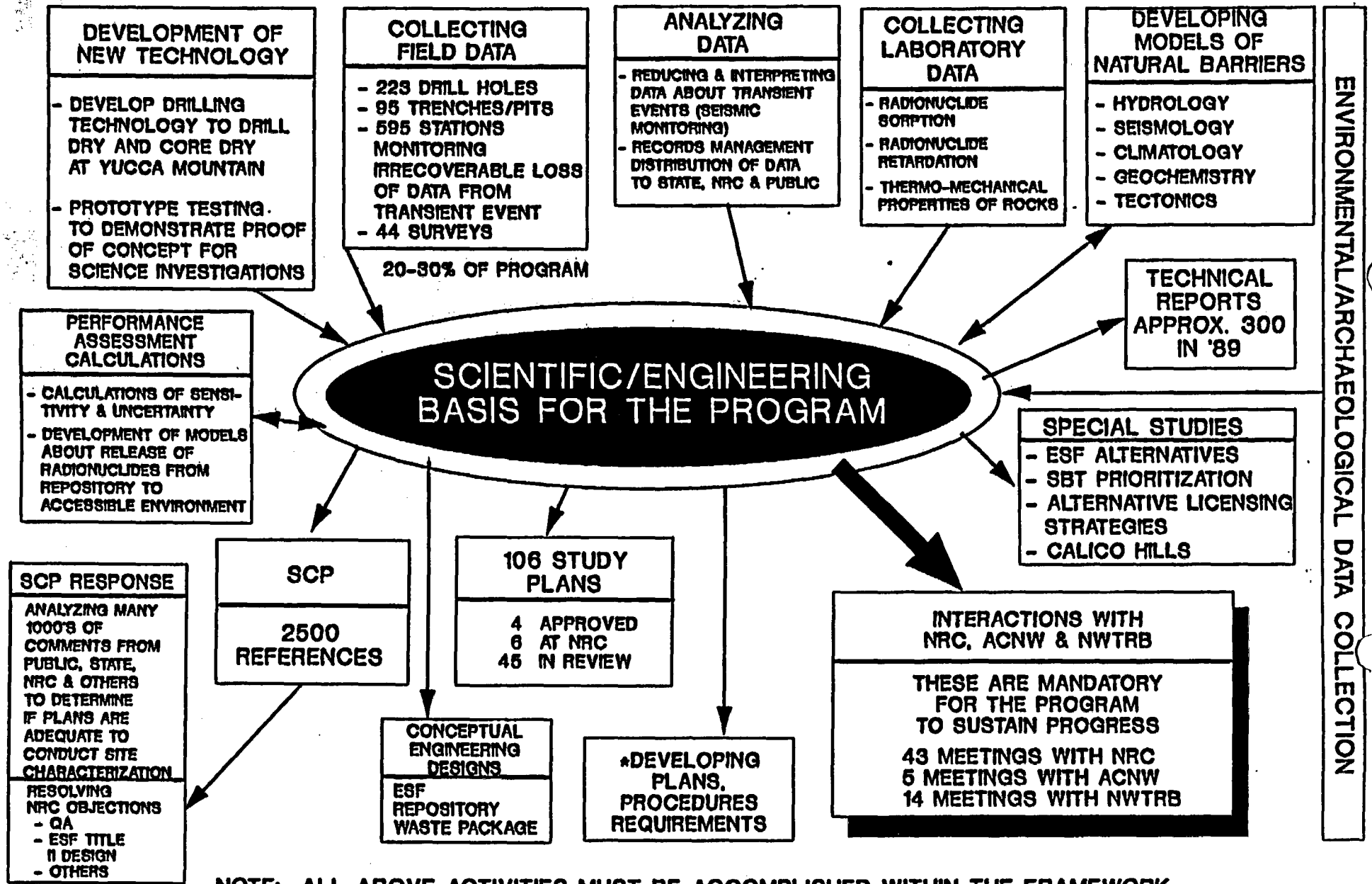
- **STUDIES TO DEVELOP/IMPROVE FLUID TRANSPORT MODELS UNDER THE RANGE OF CONDITIONS EXPECTED IN THE NEXT 10,000 YEARS**
- **FIELD SAMPLING PROGRAM TO IMPROVE DATABASE FOR DISTRIBUTION OF ZEOLITES ALONG POTENTIAL FLOW PATHS**
- **STUDIES TO DETERMINE PROBABILITIES AND CONSEQUENCES OF POTENTIALLY DISRUPTIVE EVENTS (e.g. VOLCANIC INTRUSION, FAULT RUPTURES OF WASTE CANISTERS)**

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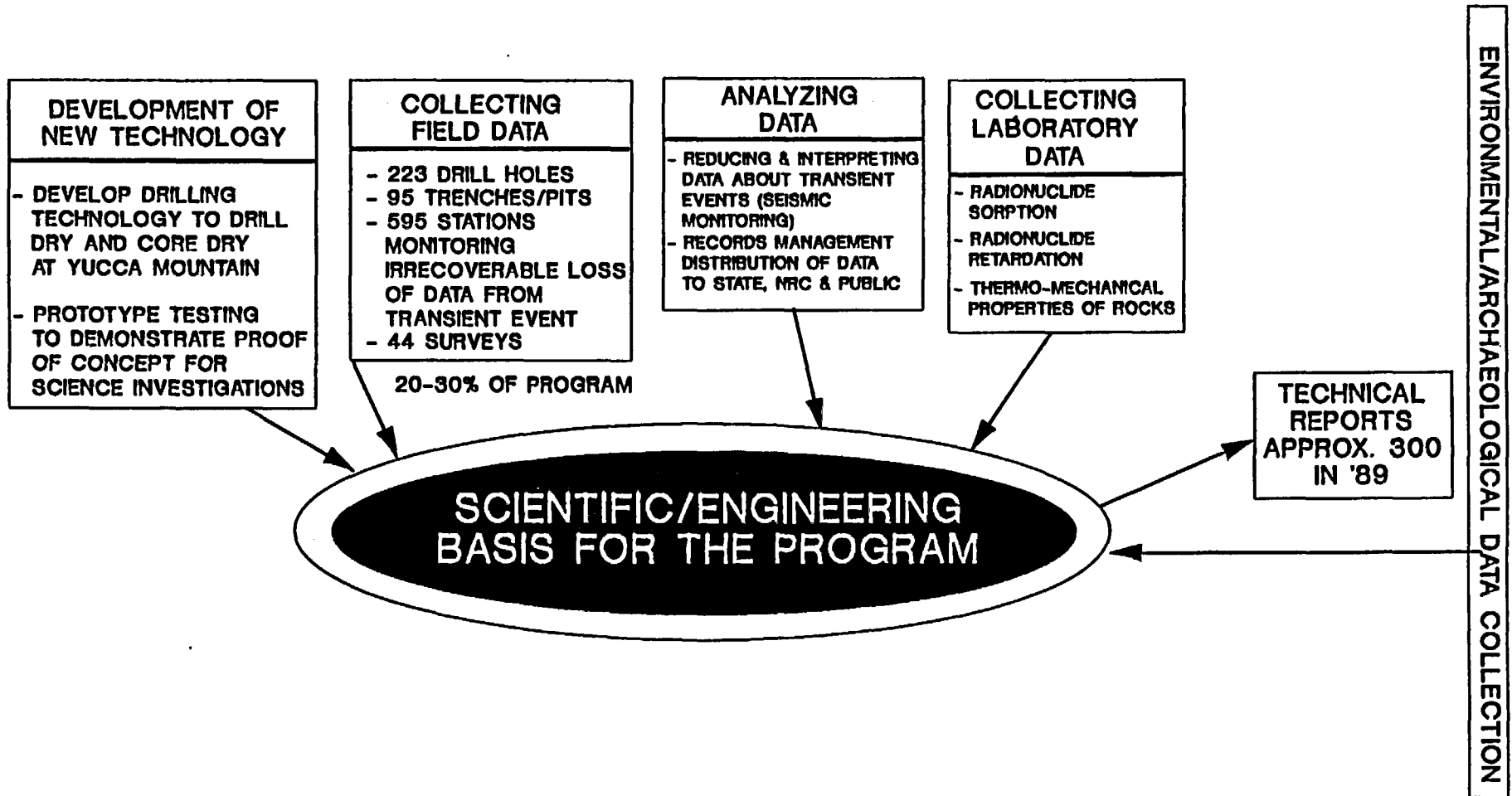
What are we doing, which these legal battles on or in court? A lot

REPRESENTATION OF KEY SCIENTIFIC INVESTIGATION ACTIVITIES

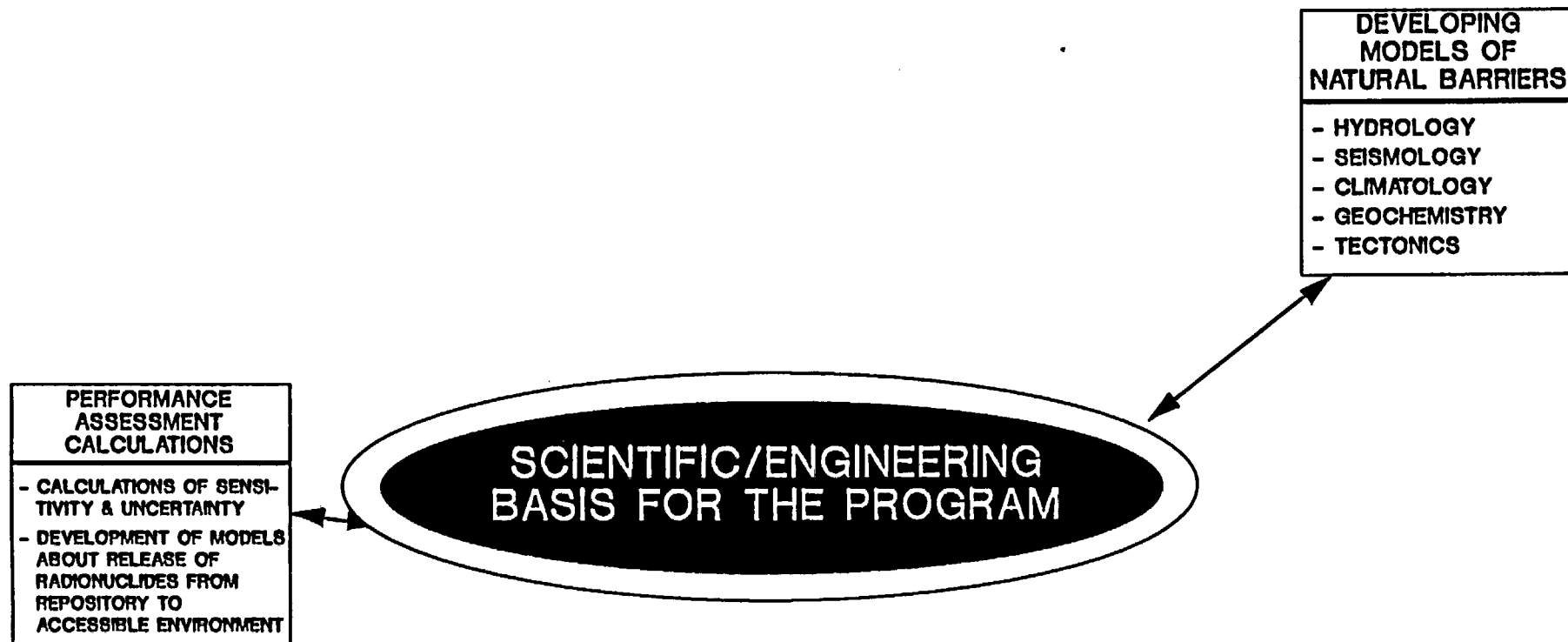


NOTE: ALL ABOVE ACTIVITIES MUST BE ACCOMPLISHED WITHIN THE FRAMEWORK OF A COMPREHENSIVE NRC ACCEPTED QUALITY ASSURANCE PROGRAM THAT WILL WITHSTAND THE CHALLENGES OF A LICENSING PROCESS

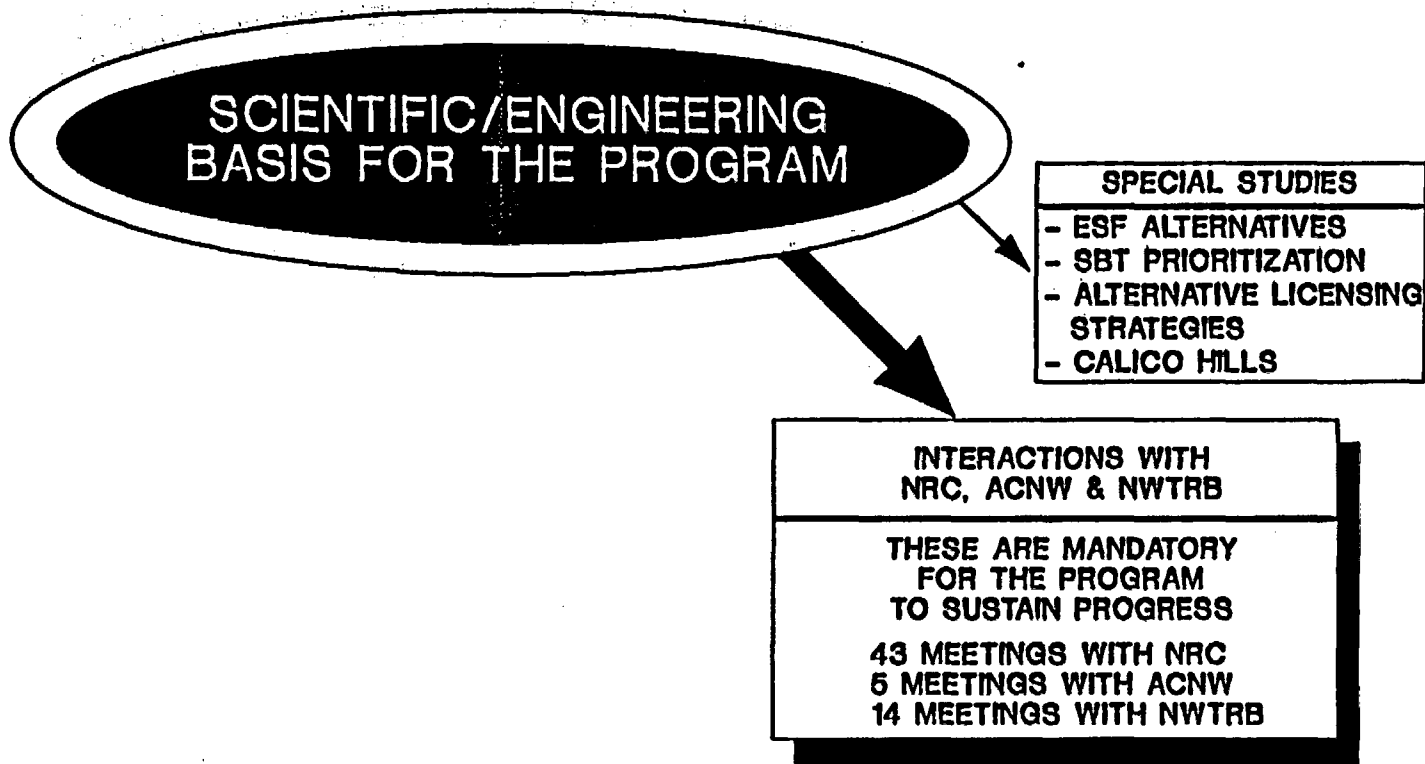
REPRESENTATION OF KEY SCIENTIFIC INVESTIGATION ACTIVITIES



REPRESENTATION OF KEY SCIENTIFIC INVESTIGATION ACTIVITIES

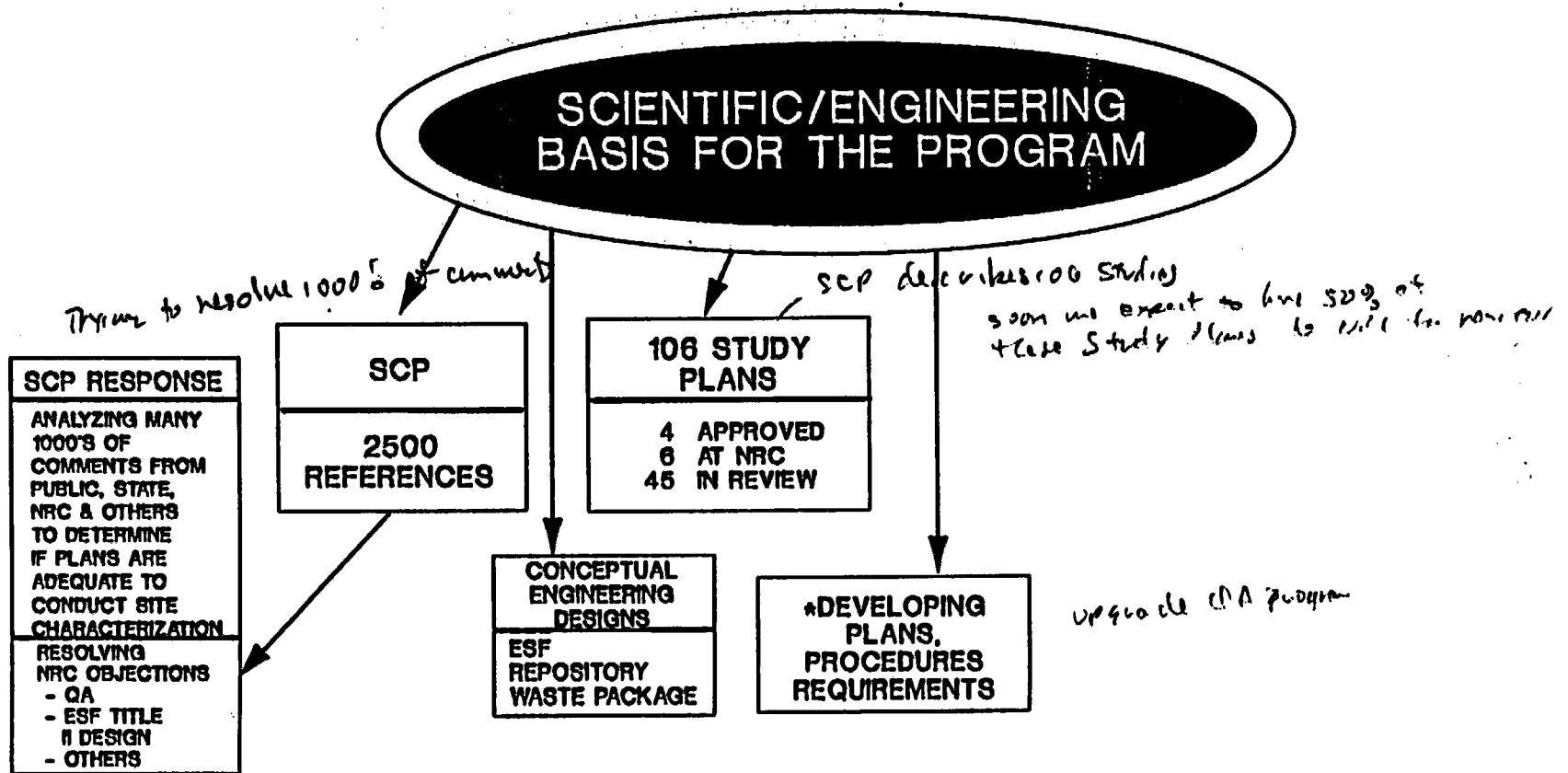


REPRESENTATION OF KEY SCIENTIFIC INVESTIGATION ACTIVITIES



107 9 meetings/yr were oversight groups
12

REPRESENTATION OF KEY SCIENTIFIC INVESTIGATION ACTIVITIES



"REST AVAILABLE C. 1"

WILL IMPROVED SITE DATABASE TRANSLATE INTO IMPROVED CONFIDENCE IN REPOSITORY PERFORMANCE?

In order to answer this question we will have to deal with uncertainty (in at least 2 different areas)

GEOLOGIC UNCERTAINTY: VS. REGULATORY UNCERTAINTY:

**WHAT ARE CURRENT
CONDITIONS AND WHAT
PROCESSES ACT TO
CHANGE THEM?**

**HOW CAN "REASONABLE
ASSURANCE" BE GAINED
ABOUT PREDICTIONS OF
LONG-TERM RADIONUCLIDE
RELEASES?**

these are
related questions

The answer to this question first
requires an answer from this question

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SITE CHARACTERIZATION

1st one some ways we have to reduce

- REDUCING GEOLOGIC UNCERTAINTY -

- BETTER DEFINITION OF SPATIAL VARIABILITY IN HYDROLOGIC AND MINERALOGIC PROPERTIES
- INCREASED CONFIDENCE IN GEOLOGIC AND HYDROLOGIC MODELS
- IMPROVED UNDERSTANDING OF PROCESSES THAT CAN CHANGE CURRENT CONDITIONS
- INCREASED CONFIDENCE IN PROBABILITIES AND CONSEQUENCES OF DISRUPTIVE EVENTS

These 3 things can lead to

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*Approaches
to be considered for*

REDUCING REGULATORY UNCERTAINTY

*Need to understand the
linkage between the
natural conditions and
transport/
retardation*

Try to Establish a clear

- **PLACE FOCUS ON LINK BETWEEN SITE CONDITIONS/PROCESSES AND PERFORMANCE OF BARRIERS RELIED ON FOR CONTAINING AND RETARDING RADIONUCLIDES**
- **INCREASED TECHNICAL CONSENSUS ABOUT SITE MODELS AND PROCESSES SHOULD REDUCE SOME REGULATORY UNCERTAINTIES**

with a broad tech consensus

REDUCING REGULATORY UNCERTAINTY

(CONTINUED)

- ^{between} **DISTINGUISHING SOURCES OF UNCERTAINTY IS LIKELY TO BE IMPORTANT IN GAINING "REASONABLE ASSURANCE"**
 - **REPOSITORY-INDUCED UNCERTAINTIES** *how will the repository be under conditions?*
 - **UNCERTAINTIES DUE TO COUPLED PROCESSES** *what will be the effects of coupled processes?*
 - **"UNKNOWN UNKNOWN"**
 - **PROJECTING HUMAN ACTIONS OVER 10,000 YEARS** *encompassing changing socioeconomic needs & technological innovations*
- ^{still} **SOME UNCERTAINTY IS LIKELY TO REMAIN IN LONG-TERM PREDICTIONS OF RADIONUCLIDE RELEASES - THIS UNCERTAINTY WILL BE DIFFICULT TO QUANTIFY** *Expert opinion may well be the only way to deal with this.*

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PERSPECTIVES ON UNCERTAINTIES IN PREDICTIONS OF REPOSITORY PERFORMANCE

LICENSEE - DOE

**WHAT LEVEL OF
UNCERTAINTY IS
ACCEPTABLE FOR DOE *to decide*
TO ^{prepare} SUBMIT A LICENSE
APPLICATION TO THE NRC?**

REGULATOR - NRC

**WHAT LEVEL OF
UNCERTAINTY ABOUT
CONTAINMENT AND ISOLATION
WILL ALLOW "REASONABLE
ASSURANCE" TO BE ACHIEVED?**

PEREQ16Z/10-30-90