MAR 2 0 1989

MEMORANDUM FOR: Richard Major, Acting Chief
Project Review Branch No. 1
Advisory Committee on Nuclear Waste

FROM: George Lear, Assistant Director
Special Issues Group

SUBJECT: RESPONSE TO ACNW REQUEST FOR THE KEY TECHNICAL TOPICS FOR THE YUCCA MOUNTAIN SITE DETAILED REVIEW GUIDES IN THE NRC SCP REVIEW PLAN

In a February 21, 1989 briefing to the ACNW on the SCP Review Plan, Robert Johnson agreed to give the ACNW a list of the key technical topics which are listed in each detailed review guide of the SCP Review Plan. I have enclosed the list of requested key technical topics.

ORIGINAL SIGNED BY

George Lear, Assistant Director
Special Issues Group

cc: Jack Parry

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LIST OF KEY TECHNICAL TOPICS FOR THE YUCCA MOUNTAIN SITE DETAILED REVIEW GUIDES IN THE NRC SCP REVIEW PLAN

Detailed Review Guide Number and Title

3.3.1 Geomorphology, Physiography and Topography

a. erosion
   (1) potential maximum rate of erosion in the vicinity of the exploratory shaft facility
   (2) potential maximum rate of erosion in the area of the waste handling facilities
   (3) potential maximum rate of erosion of repository overburden
   (4) potential maximum rate of erosion in adjacent or overlying wash areas

b. features resulting from geomorphic processes
   (1) locations and characteristics of paleo spring deposits
   (2) locations and characteristcs of landslide areas

c. paleoclimate
   (1) Pleistocene climatic variations
   (2) effect of variations on
      - effective precipitation,
      - water table
      - springs
      - carbonate deposition

3.3.2 Stratigraphy and Lithology

a. identification of stratigraphic features
   (1) degree of welding

(2) lithophysae content
(3) content of lithic fragments
(4) thinning and thickening of repository horizon
(5) porosity and permeability

b. amount of offset of stratigraphic units by faulting

3.3.3 Seismology

a. historic seismicity, including:
(1) representativeness of the historical pattern of seismicity in the vicinity of the site
(2) reconciliation of focal mechanisms for microearthquakes in vicinity of the site with apparent nature of tectonic activity

b. relationship of seismicity to geologic and tectonic structures, including:
(1) regions of uniform earthquake potential in the southern Great Basin including, but not limited to, regions encompassing:
(a) the Walker Lane
(b) Owens Valley
(c) Death Valley
(d) the Las Vegas Shear Zone
(e) the Southern Nevada East-West Seismic Belt
(2) potential for seismic activity on faults in the immediate vicinity of Yucca Mountain

c. earthquake generating potential of geologic structures and seismotectonic zones, including:
(1) faults in the Yucca Mountain vicinity
(2) maximum earthquake potentials

d. seismic wave transmission characterics, including:
(1) response at repository depth to nuclear tests and nearby natural earthquakes

e. vibratory ground motion including:
   (1) nature of vibratory motion at the site resulting from earthquakes on faults in the immediate vicinity of Yucca Mountain

f. seismically induced phenomena, including:
   (1) effect of earthquakes on ground water levels

3.3.4 Structural Geology and Tectonics

a. tectonic framework and tectonic history
   (1) role of pure and/or oblique extension in tectonic model

b. volcanic history in the vicinity of the site
   (1) volume of material associated with each cycle
   (2) duration and character of each cycle
   (3) interrelationships between faulting and volcanism

c. faulting history in the vicinity of the site
   (1) amount of vertical versus oblique displacement
   (2) effect of detachment faults on site stability
   (3) relationship between strike-slip, normal, and detachment faults

d. active stress field in the vicinity of the site
   (1) influence of nuclear tests on the state-of-stress
   (2) relationship to microseismicity

3.3.5 Natural Resources

a. the presence of mineral deposits and their association with
   (1) stratigraphic units of volcanic origin
   (2) veining
   (3) fault zones
   (4) alteration zones

(5) subsurface plutons

b. the association of hydrocarbon resources with
(1) Paleozoic stratigraphic units underlying the site
(2) trap rocks

3.3.6 Geophysics (methods used to characterize the following features)

a. volcanism
(1) potential magma chambers and magma sources

b. structure
(1) fault characteristics with emphasis on detachment surfaces, if present
(2) fracture characteristics

3.3.7 Natural Analogs

a. Natural Analogs
(1) use of analogs in the investigation of zeolite stability and in interpretation of the origin of the calcite-silica vein deposits

b. Related Field Tests
(1) use of data from the nuclear weapons tests at the Nevada Test site for investigating radionuclide migration in tuff

3.3.8 Effects of Post-closure Changes on site Geochemistry

a. Natural Changes
(1) climatic variations may affect the location of the unsaturated zone, and may result in changes in water chemistry and rock geochemistry

3.3.9 Geochemical concerns for Modeling

a. the ability of models chosen to predict chemical processes in the unsaturated zone

b. the appropriateness of solid solution models used in calculating the thermodynamic parameters of zeolites

3.3.10 Geochemical concerns for the Engineered Barrier System

a. Geochemical Concerns for Leaching
   (1) effects of successive wetting and drying cycles

b. Geochemical Concerns for Corrosion
   (1) effects of salt build-up, caused by the evaporation of infiltrating water

3.3.11 Geochemistry of the Host Rock

a. petrology of the calcite-silica veins
   (1) use of stable isotopes to determine temperature of formation

b. petrographic studies of geopetal structures to support geologic investigations of tectonism

c. formation and distribution of zeolites

3.3.12 Geochemistry of Groundwater

a. evaluate the effect of water sample collection method on unsaturated zone water chemistry

b. presence and effect of colloidal or particle-bound

radionuclides on matrix diffusion

3.3.13 Mineral and Glass Stability

a. effect of silica phase stability on zeolite stability

3.3.14 Radionuclide Retardation

a. Sorption of key radionuclides
   (1) sorption of radionuclides on zeolites
   (2) effect of wetting/drying cycles on sorption

b. Solubility/precipitation of key radionuclides
   (1) effects of successive wetting/drying cycles on radionuclide solubility

c. Dispersion, diffusion, advection of key radionuclides
   (1) effects of unsaturated conditions

d. Vapor-phase transport
   (1) consequences of vapor phase transport of gaseous radionuclides by-passing the unsaturated zone hydrologic barrier

3.3.15 Surface Water

a. potential for flooding of surface locations of shafts and ramps during the preoperational, operational and post-closure periods for floods up to and including the PMF

b. estimates of the potential for debris blockage of site ephemeral streams resulting in flooding

c. estimate of recharge to the unsaturated zone from potential

flooding of surface openings or ponding in the vicinity of surface access location

d. discussion of geomorphic changes which could affect drainage configurations

e. measurements necessary for water balance estimates

(1) meteorological parameters; e.g., solar radiation, wind speed, rainfall, air temperature, potential evapotranspiration
(2) characterization of infiltration potential, e.g. infiltrometers, rainfall simulators, direct rainfall/ runoff measurements in channnels

f. discussions of designs to preclude or minimize infilitration to the underground facility, particularly at shafts and ramps

3.3.16 Groundwater Flow

a. possible methodologies for characterizing flow in unsaturated, fractured tuff formations, including:
(1) thermocouple psychrometer tests
(2) tensiometer tests
(3) soil moisture block tests
(4) neutron log tests
(5) permeameter tests
(6) fractured rock infiltrometer tests
(7) packer tests of fracture permeability
(8) pore water extraction by core squeezing
(9) pore water extraction by centrifuge and displacement
(10) pore water samples by lysimeter
(11) vacuum collection of vapor-phase isotopes

3.3.17 Water Resources

None

3.3.18 Climatology and Meterology

None

3.3.19 Disturbed Zone

a. vibratory ground motion (underground nuclear explosions and earthquakes)

b. thermal decomposition of zeolites

3.3.20 Geomechanics Testing

a. geomechanics characteristics of lithophysal zone

b. feasibility testing of long horizontal emplacement technology

3.3.21 Borehole and Shaft Seals

a. sealing-design strategy
   (1) free drainage stragegy
      (a) reliability of free drainage for 10,000 years
      (b) site characterization investigations for free drainage

   (2) seal performance in unsaturated medium (geochemical)

b. sealing of major faults

c. sealing of excavation below the repository horizon

3.3.22 Retrievability

a. long horizontal holes emplacement option

3.3.23 Conceptional Design of the Repository

a. limits on vertical and lateral flexibility imposed by:
   (1) faulting
   (2) thickness of target horizon
   (3) heterogeneities such as lithophysae
   (4) overburden requirement

b. defense-related activities
   (1) effects of proximity to bombing range on surface facilities
   (2) effect of underground nuclear explosions on the repository
   (3) potential for aircraft crashes on surface facilities

c. long horizontal emplacement holes
   (1) retrieval (see "Retrievability" Review Guide 3.3.22)
   (2) deleterious rock movements
   (3) construction equipment technology

3.3.24 Substantially Complete Containment

a. the consequences of uncertainties on the analyses of waste package lifetime and radionuclide release rate

b. assumptions regarding waste package failure modes and the uncertainties associated with these assumptions

c. the susceptibility of the austenitic stainless steels to stress-assisted cracking in chloride/oxygen/water (steam) environments

3.3.25 Waste Package Design
None

3.3.26 Engineered Barrier System Release Rates
Same as 3.3.24