

JUN 8 1989

HLWM RES NEED

- 1 -

MEMORANDUM FOR: P. Justus, Section Leader
Geology-Geophysics Section, HLGP

D. Chery, Section Leader
Hydrologic-Transport Section, HLGP

S. Coplan, Section Leader
Systems Performance Section, HLGP

M. Nataraja, Section Leader
Geotechnical Engineering Section, HLEN

R. Weller, Section Leader
Engineering Section, HLEN

FROM: R. Ballard, Chief
Geosciences and Systems Performance Branch, HLWM

J. Bunting, Chief
Engineering Branch, HLWM

SUBJECT: SPECIFIC HLWM RESEARCH NEEDS

As a follow-up to the Division user-need memo of February 1989, and our request dated May 2, 1989, for specific topics to aid RES in their preparation of a five-year plan, we are attempting to establish a more formal structure for tracking research needs and their resolution. Such a system is needed to enable the Division to make full use of research program results and to systematically track the progress of each research project.

Enclosed is a list of ongoing projects managed by RES in support of the High-Level Waste Program (Enclosure 1). Also enclosed is a form that is to be completed for each research project identified in Enclosure 1 (Enclosure 2). You are requested to designate a lead individual for each project in your respective areas of responsibility and have the attached form completed by that individual. The lead individual should be encouraged to work closely with the RES counterpart for each research project to assure accuracy in completing the form.

Also enclosed is the list of specific research needs Dave Brooks prepared from staff responses to our May 2, 1989 note (Enclosure 3). This list is currently being used in draft form by RES in preparing their program plan. Because of the length of the list, you are requested to identify the three highest priority items in your area of responsibility and assign reviewers to expand on the

8906120064 890608
NMSS SUBJ
414.4 CDC

delete TR55 + CNWRA

*44.4
NHXR 1/1*

JUN 8 1989

HLWM RES NEED

- 2 -

identified specific need by completing the HLWM Research Needs form (Enclosure 4).

Our intent is to meet with RES during the next few weeks to discuss the identified specific research needs and factor them into the long-range research program. As selected tasks are incorporated into the RES program during the next fiscal year, forms such as those in Enclosure 2 are to be completed by assigned staff and periodically updated.

Dave Brooks has the lead for compiling the forms into a concise retrievable format. Your input is requested by June 14, 1989.

151

R. Ballard, Chief
Geosciences & Systems Performance Branch, HLWM

151

J. Bunting, Chief
Engineering Branch, HLWM

Enclosures:
As stated

cc: R. Browning, HLWM
J. Youngblood, HLWM
J. Linehan, HLPD
M. Silberberg, WMB/DE/RES
J. Funches, PMDA/NMSS

DISTRIBUTION:

Central Files ~~REBrowning, DHLWM~~ ~~BJYoungblood, DHLWM~~ RLBallard, HLGP
JOBunting, HLEN ~~JLinehan, HLPD~~ HLGP r/f NMSS r/f
DBrooks, HLGP

OFC :	HLGP	HLGP	HLEN	:	:	:
NAME :	DBrooks/cj	RLBallard	JOBunting	:	:	:
DATE :	6/6/89	6/7/89	6/7/89	:	:	:

HLWM FY 89/90 HLW RESEARCH SUPPORT

HYDROLOGY AND GEOCHEMISTRY

Hydrology

D1662	Unsaturated Flow (U od Az)	89
TBD/D1662 Cont.	Validation Exp. Unsat. Flow (U of Az)	90
G1112	Large Block Grant (U od Az)	89,90
B7096	Climatology of Recharge (CNWRA)	90
D1672	Char. Mod. Cont. Trans. (U of Az)	89,90

Geochemistry

B0462	Valence Effects/Adsorp. (ORNL)	89
B3040	Site Geochemistry (LBL)	89
B6644	Unsat. Mass Transport (CNWRA)	89,90
B6773	Lab Modeling of Sorption (CNWRA)	90
G1150	Hydrochemical Trans. Modeling (J.H.U)	89,90

MATERIALS AND ENGINEERING

Corrosion

D1670	Overpack/ Backfill (NIST)	89,90(?)
D1690	Metrology (NIST)	89,90(?)
D1692	Overpack Degradation (CorCo)	89,90(?)
B6663	Integrated Experiments (CNWRA)	89,90
TBD	Waste Container Sealing (CNWRA)	90

Rock Mechanics

D1192	Sealing Boreholes in Tuff (U of Az)	89,90
B6643	Seismology (CNWRA)	89,90

PERFORMANCE ASSESSMENT MODELLING

Modelling

A1266	Perf. Assess. Meth. (SNL)	89,90
B7121	Climates of the Holocene (NSF)	89,90
B6667	Thermohydrologic Interactions (CNWRA)	89,90
B6664	Stochastic Techniques (CNWRA)	89,90
G1120	Contam. Trnspt. Modelling (NAS)	89,90
D2505	Non Linear 2 D Hydro Modelling (SBIR)	89,90
TBD	Perf. Ass. Modelling(CNWRA)	90

Model Validation Data Bases

D2012	Alligator Rivers (ANSTO/NEA)	89,90
A1824	Valles Caldera (SNL)	89,90
B6673	Geochemical Analogs (CNWRA)	89,90
TBD	Transport Analyses (CNWRA)	89,90

HLWM RESEARCH SUMMARY

FIN/TITLE: _____ / _____

CONTRACTOR: _____

BUDGET: FY89 _____ K, FY90 _____ K,
FY91 _____ K, FY92 _____ K

HLWM LEAD: _____

RES LEAD: _____

HLWM NEED FOR RESEARCH (LIST):

RESEARCH OBJECTIVES (LIST AND KEY TO HLWM NEED FOR RESEARCH):

STATUS OF RESEARCH TO DATE (LIST AND KEY TO RESEARCH OBJECTIVES):

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

PRELIMINARY ASSESSMENT OF SPECIFIC HLW RESEARCH NEEDS

A WASTE FORM AND PACKAGING

A1 Identification and Assessment of Potential failure Modes for Waste Packages

CONCERNS

- Degradation of waste package from the inside.
- Effects of waste type and origin on degradation mechanisms.
- Effects of wetting/drying on degradation mechanisms.
- Effects of welding on the degradation of materials
- Effects of carbon on stress corrosion cracking
- Effects of (surface) inhomogeneities on the degradation of materials
- Effects of coupled interactions
- Corrosion by microbial processes
- Extrapolation of lab and field data
- Model validation

A2 Evaluations of Interactions Between Waste Packages and the Repository Environment

CONCERNS

- Corrosion by microbial processes.
- Environment created by interaction with cannister, support plate, emplacement dolly, liner, rock bolt material.
- Effects of wetting/drying on interactions and environment.
- Effects of radiation
- Effects of heat
- Release of carbon-14.
- Effects of coupled interactions
- Extrapolation of lab and field data.
- Model validation

A3 Assessment of Corrosion Rates

CONCERNS

- Effects of wetting and drying
- Environment of corroded area Vs bulk repository environment
- Kinetics of corrosion
- Effects of microbial processes
- Factors that initiate localized corrosion
- Stress corrosion cracking (Intergranular Vs Transgranular)
- Coupled interactions
- Extrapolation of lab and field data.
- Model validation

A4 Analogs of Leaching and Migration

CONCERNS

- Comparison of lab sorption, mineral stability, leaching and kinetic data with observations of natural and anthropogenic analogs
- Changes in leaching rates with time
- Vapor/gas phase transport
- Effects of oxidation state on leaching and radionuclide release
- effects of wetting and drying
- Coupled interactions
- Extrapolation of data
- Model validation

B REPOSITORY DESIGN AND ROCK MECHANICS

B1 Rock-Mass Sealing

CONCERNS

- Effects of wetting and drying
- Free drainage concept
- Seals as a preferential pathway for gas/vapor/water
- Material properties under repository environment
- Sealing damaged area around drilled holes and blasted holes
- Coupled interactions
- Preferential pathway for carbon-14
- Seismic effects on seal performance
- Extrapolation of lab and field data
- Model validation

EARTH SCIENCES

C1 Analog Studies of Conditions/Processes/Environments

CONCERNS

- Natural and anthropogenic analogs for extrapolation of lab and field experimental sorption and mineral stability data
- Natural and anthropogenic analogs for extrapolation of experimental approaches/methods
- Air flow in unsaturated rock
- How effective is gas flow at depth.
- Quaternary volcanic-hydrothermal systems
- Approaches for mapping underground facilities.
- Quaternary age determinations
- Extrapolation of data
- Model validation

C2 Groundwater Chemistry

CONCERNS

- Concentration of solutes in groundwater due to evaporation
- Redox activity
- Evolution of groundwater chemistry (organic/inorganic/microbial)
- Representative sampling of Cl-36, Tc-99, and I-129 in vadose zone
- Zeolites as indicators of water composition
- Gas phase control of pH and oxidation state of groundwater
- The effect of climatic changes on groundwater chemistry
- Age determinations
- Nonequilibrium conditions
- Extrapolation of lab and field data
- Model validation

C3 Radionuclide Transport

CONCERNS

- The effects of inaccurate thermodynamic properties of key solid phases (zeolites) on modeling sorption
- Colloids as a transport mechanism
- Use of Kds to model sorption
- Source term
- Movement of carbon-14
- Vapor/gas phase transport
- Coupling of vapor/gas/liquid phase transport
- Presence of H-3, Tc-99, I-129, and Cl-36 as indicator of transport potential at site
- Coupled interactions
- The use of linear differential equations to model nonlinear transport chemistry
- Extrapolation of lab and field data
- Model validation

C4 Mineralogy

CONCERNS

- Stability of zeolites
- Dissolution of minerals causing increasing permeabilities
- Kinetics
- Age determinations
- Extrapolation of lab and field data
- Model validation

C5 Response of Groundwater Levels and Underground Openings to Strong Ground Motion

CONCERNS

- Impact of rock mineral stability on seismic response of openings
- Impact of ground motion on rock stability and its effect on waste package
- Groundwater response to seismic and or fault activities
- Extrapolation of lab and field data
- Model validation

C6 Groundwater Flow and Radionuclide Transport

CONCERNS

- Effects of excavation and waste emplacement on groundwater flow
- Effects of shaft and tunnels on air and moisture movement through rock
- The reliability of pneumatic tests in determining hydraulic parameters
- Accuracy of surface Vs subsurface based determinations of flux
- What constitutes a representative elementary volume for unsaturated fractured rock like that found at Yucca Mt.
- Geologic variations that effect flow and transport
- Source term
- Air/vapor/gas movement through Yucca Mt.
- Movement of carbon-14
- Mobile Vs immobile water
- Coupled interactions
- The use of linear approximations to evaluate and couple nonlinear flow and transport behavior
- Extrapolation of lab and field data
- Model validation

C7 Uncertainty in Probabilistic Seismic Hazard Assessment

CONCERNS

- The uncertainty created by the random occurrence of seismic events
- Effects of rock movement on waste packages
- Extrapolation of lab and field data (earthquakes to **10,000 yrs**)
- Model validation

C8 Climate Changes and Effects on Unsaturated Flow Conditions

CONCERNS

- Effects of increased rainfall on unsaturated flow
- Effects of groundwater withdrawal
- Extrapolation of lab and field data
- **Model validation**

C9 Coupled Interactions of Thermal-Mechanical-Hydrologic Systems

CONCERNS (ALSO SEE A1-4, B1, C3, and C6)

- Effects of coupled interactions on retrievability
- Uncertainties of linear modeling of nonlinear processes and events
- Extrapolation of lab and field data
- **Model validation**

D SYSTEMS PERFORMANCE

D1 Independent Systems Assessment Methodology for Evaluation of Total System Performance

CONCERNS

- The use of linear approximations to model non linear systems
- Source term
- Evaluation of human factors
- Extrapolation of lab and field data
- **Model validation**

D2 HLW Preclosure Safety Systems Analysis

CONCERNS

- Source term
- Evaluation of human factors
- Extrapolation of lab and field data
- **Model validation**

HLWM RESEARCH NEED

- 1 -

DATE: _____

HLWM BRANCH/SECTION: _____ / _____

STAFF LEAD: _____

STATEMENT OF RESEARCH NEED (ONE SENTENCE/ASSOCIATION TO 10 CFR 60 ASSUMED)

REASON FOR RESEARCH NEED:

REFERENCE TO NRC PROGRAMS (I.E., TP'S, RULES, MOU, SF&CG):

ASSOCIATED NRC RESEARCH:

ASSOCIATED DOE RESEARCH OR INVESTIGATIONS: