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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

WM DOCKET CONTROL
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WM Record File
101

WM Project 10
Docket No. _____
PDR ☒
LPCR ☒ (2)

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(Return to WM, 623-SS)

December 8, 1986

MEMORANDUM: Robert E. Browning, Director
Division of Waste Management

FROM: F. Robert Cook, Senior On-Site License
Representative, Basalt Waste Isolation
Project (BWIP)

SUBJECT: OBSERVATIONS, COMMENTS AND RECOMMENDATIONS
FOR THE PERIOD SEPTEMBER 29 TO NOVEMBER 14, 1986

TECHNICAL ITEMS

1. Waste Package--

a. Attachment A contains a summary of both near term (December through February) and long term (about two years hence) actions in the area of waste package design.

b. DOE continues to develop the licensing strategy for the engineered system for BWIP. This includes a definition of "substantially complete" containment which assumes a 5% failure of individual waste package containers. Also a portion of the natural rock surrounding the waste package boundary is included in the engineered system for the purposes of achieving the controlled release rate performance objective. Neither of these assumptions appear consistent with current Staff positions concerning these items.

c. Alternate waste package materials and room emplacement schemes are actively being investigated by BWIP. One such emplacement scheme which has been considered in the past and is currently receiving renewed attention is emplacement of waste packages in a trench in the floor of the storage rooms. However, in the reference design (side wall emplacement) the primary function of the container and packing remain containment and gradual release respectively.

d. As noted in my previous report, R&D testing on the waste package materials continues without apparent influence of the DOE policy associated with the stop work order for site characterization actions. It appears that DOE does not consider the R&D associated with the engineered system within the grouping of activities defined as site characterization, even though the

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activities are listed in 60.11(a)(8), which addresses the content of the SCP. This observation is substantiated by DOE's recent comments on the Staff's QA Review Plan concerning the Scope of that plan--which comments differentiate between site characterization and R&D associated with the engineered system for a given site (see Attachment B, comment #1).

Staff should recognize the distinction which DOE makes regarding the scope of "site characterization" and assure that future rule changes and staff positions take this into account to avoid additional confusion in this area.

2. Repository Engineering--

a. Attachment C contains a summary of both near term (December through February) and long term (about two years hence) actions in the area of repository engineering.

b. The project is preparing for a National Academy of Science review of rock mechanics starting about January 7, 1987. The review will involve about 11 experts from the NAS. As part of this preparation, RHO/DOE during the week of November 16, 1986 plans to consult with a panel of four outside experts to obtain comments on BWIP plans for rock mechanics testing and the overall strategy for resolving rock mechanics issues relative to repository design and performance assessment. Comments on this panel's observations and comments will be forwarded to Staff by telecon and by separate correspondence.

c. Attachment D contains a list of recent accomplishments by KE/PB, as well as expected accomplishments in the near future.

d. My general assessment of the repository engineering area for BWIP is that analyses are gradually being identified which will drive the design. Analyses involving rock mechanics for performance assessments relative to questions of isolation are not progressing in the same manner as those related to design. The responsibilities within RHO for rock mechanics issues in performance assessment are not well established and may contribute to this situation. In a related manner the synergistic effects of natural and man induced seismic activity with construction, operation and post closure related repository conditions on pertinent rock mechanics is not receiving attention in the BWIP planning and issue resolution licensing strategy to my knowledge. These areas should be reviewed with BWIP at the first possible opportunity, considering their potential impact on site characterization and engineering systems R&D.

e. Attachment E contains a summary of both near term (December through January) and long term (about two years hence) actions in the area of exploratory shaft work.

3. Geology--

a. Attachment F contains a summary of both near term (December through February) and long term (about two years hence) actions in the area of geotechnical work. Some of the items in this attachment relate to geology.

b. In my last report of October 1, 1986 I noted MR. Canard evaluation of the RSH-1 geologic data. In further discussion with Mr. Canard and other geologists familiar with the data from this well, it appeared warranted to review information in BNWL 776 concerning this well indicating that the coal deposits between various basalt flows are older than the basalt flows are considered to be. In this regard I forwarded the BNWL 776 report to Estalla Leopold at the University of Washington for her review. (Ms. Leopold is knowledgeable on the age dating of geologic strata through assessment of pollen assemblages.) Such assemblages were recorded in the said report for various coal bearing strata. Upon her completing the review I will forward her evaluation for Staff's information.

The information is important in understanding the thickness of the basalts as well as the nature of the faulting in the Rattlesnake Mountain.

c. I learned that RHO had obtained chip samples from the driller of RSH-1 in about 1980 and has performed XRF testing on the samples to the bottom of this well. Upon obtaining the analyses and the location key to the XRF samples I will forward same to Staff for their information. Rockwell believes that the rock samples all the way to the bottom of this hole are Columbia River Basalts. This is in contrast to the assessment provided in the BNWL 776 report, which concluded that the lower rock strata are andesite deposits from a volcano(s) to the West of the Site in the Cascades. It appears warranted for Staff to review the chemistry of the various zones in RSH-1 with comparison to known rock chemistry to independently assess the origin of these strata.

d. Attachment G is data on the Benson Ranch well, apparently drilled for oil and gas. This well is within the controlled area for the Reference Repository Location at Hanford. The reported show of oil in the attachment is of interest. This information is pertinent to Mr. Canard's assessment of the source of the gas found on the east slope of Rattlesnake Mountain in the past. Additional information on this well is available at RHO. I have requested this data and will forward it to the Staff upon its receipt. However the data reveals that the well is open from about 1300 feet to 2000 feet. (I was verbally informed that Rockwell has plans to re-enter this well upon resumption of site activities.)

4. Performance Assessment--

a. Comments 2d and 7a herein concern the incorporation of rock mechanics analyses into the repository performance assessment and hydrologic testing, both being pertinent to performance assessment.

b. Relative to comment 2a, the determination of the disturbed zone regarding the pre-emplacement groundwater travel time siting criteria could be significantly influenced by the consideration of the rock mechanics resulting from various repository construction and operation induced loadings, including loadings which induce seismic activity. I am not aware of actions at DOE or RHO to devise testing or analyses to assess this concern relative to disturbed zone determination during site characterization.

b. Licensing strategies, including the allocation of specific barrier performance objectives, are not being devised to address the EPA standard for individual exposure during the first 1000 years of the repository's existence, 40CFR191.15, to my knowledge. Considerations as to how to achieve compliance with these individual protection requirements should be reviewed with DOE in future meetings on performance assessment.

5. Geochemistry--

a. Attachment H is a summary of an article appearing in the Washington Geologic Newsletter for November, 1986.

b. Since the middle of September, DOE has been attempting to get PNL to issue radioisotope data in the confined aquifers on and around the Hanford Reservation, including iodine 129 data. The latest estimate of the date that DOE identified to me for PNL to complete their work is December 16, 1986. I have requested this information upon its release. I believe the PNL release will contain information which is in addition to that the Staff has already reviewed. For example, data collected after 1974 should be included in this release.

I recommend that NRC (Coleman) complete his evaluation of the data, including evaluation of any additional more recent data, and forward it to DOE for their information.

c. Item 4d above concerning the Benson Ranch well, see Attachment G, contains information pertinent to the geochemistry of the site. In particular note the reference to salty water which corroded the drillers tools. Item 7d contains information concerning the hydrochemical/radiochemical test program direction at BWIP.

6. Site/Environmental--

a. PNL for DOE/RL has prepared a comprehensive plan for the collection of environmental data during site characterization relative to environmental effects associated with site characterization. (Plans for collection of data necessary to support an environmental impact statement (EIS) for the repository itself has not been prepared.) Portions of the comprehensive plan will be included in the BWIP environmental monitoring and mitigation plan (EMMP) scheduled for release in December, 1986. The decision to limit the scope of the plans in the EMMP stems from policy determined by DOE/HQ and is apparently the same for all three projects. I do not know the basis for this decision.

It is my understanding that the scope of the environmental monitoring to be identified in connection with the EMMP constitutes a small part of the total environmental monitoring considered necessary by DOE/RL to support an EIS for a repository. The rest of the monitoring and information gathering will be factored into the site activities at some later unspecified time pending direction from DOE/HQ.

7. Hydrology--

a. RHO is gradually becoming aware of and/or identifying significant vertical conductivity in the geologic setting along with other geologic structures and their unique hydrologic characteristics. This understanding as it is incorporated into hydrologic models may suggest that the large scale pump tests currently planned will generate data that is hard to interpret, other than to indicate the complexity of the site. In any case it will be prudent for staff to allot time to evaluate the analytical basis for any future hydrologic test strategy, presented in connection with a readiness review, to verify that anticipated geologic structures and their associated hydrologic characteristics identified by RHO are consistent with obtaining meaningful data from the large scale pump tests, assuming they are retained in the test strategy.

b. To my knowledge no new hydrologic data has been collected with the exception of the ongoing baseline monitoring. Work at DC-18 has stopped with the collection of physical hydrologic and hydrochemical data in the Ginkgo Flow.

c. The Westbay piezometer installation in RRL-14 began to fail earlier this year and is in the process of being removed from the hole. It was reported that failure was first deduced in June. Apparently the plastic packers used in the installation leaked.

d. Actions to devise a strategy for the hydrologic test program continue. The analytic basis for the test plans has not been identified as yet. However, it appears that hydrochemistry investigations will not be integrated into the drill and test program for physical hydrology determinations. Plans currently

call for obtaining hydrochemistry from other wells drilled at some later time. I have been informed that the reason that the hydrochemistry has been eliminated from the drill and test plan is to expedite the collection of the hydrologic data. In summary it appears emphasis on the collection of hydrochemical and radiochemical data has been greatly reduced as a result of non-technical objectives, input by DOE management as determinant test objectives.

At this time I do not understand how the hydrochemistry information to characterize baseline conditions can be collected after the large scale pumping begins. The current strategy appears inconsistent with the conclusions drawn by the Staff in December 1985 and in prior evaluations regarding the need to obtain baseline hydrochemical and radiochemical data at any given pumping location to help evaluate the data obtained during and following pumping. Staff should, as soon as possible, review with DOE/RHO the rationale for for this change in test strategy. As identified in Attachment I, a review of the strategy with the NRC Staff is being considered to be accomplished in January 1987.

8. Quality Assurance--

a. Rockwell conducted appraisals of various aspects of the quality assurance program during the subject period. In addition appraisals of major participants, except for the Boeing computer activities (BCSR) were conducted. Upon obtaining the reports of these appraisals I will forward them for Staff information.

b. Most aspects of the QA program are gradually being implemented at RHO. It is not apparent to me that adequate design control is being applied or planned within the DOE/RL organization itself. Accurate documentation of meetings where technical design decisions are discussed and verbal directions given is typically not accomplished to my knowledge. In addition the records of reviewers' comments on technical submittals along with management directions and comments are not being incorporated into a central records control system at DOE in any consistent fashion and in any prescribed time frame. It appears that final documents are the records that are best controlled.

The state of the design control described above is consistent with a general policy at DOE that the records associated with design work are not necessary to keep as evidence of the adequacy of the respective design activity. This leaves the Staff with only the alternative of overchecking the quality of a design product by independent design activities of their own. As I have indicated in the past I consider such independent design work outside the scope of Staff's capabilities as a result of their limited manpower. It is therefore important to identify the design control issue at DOE as soon as possible to expedite early implementation of requirements to achieve and provide evidence of adequate design control.

I recommend that Staff incorporate consideration of the design control and document control being implemented at DOE/RL in planning for participation in readiness reviews for BWIP in the future.

c. The program of developing a QA grading for activities subject to the QA requirements in 10CFR60 has resulted in one level of requirements being applied to all such activities for BWIP. Other activities which are assigned level II or level III within the BWIP quality assurance plan are not considered pertinent to potential licensing review, and, hence, they would not necessarily comply with the requirements of 10CFR60.

This single grade allows no priority in the activities subject to licensing review. As a result, activities which are most important may not be recognized by the workers and/or undue attention applied to activities which are of minor consequence at the expense of the more important activities. In addition the grading activity itself is biased to the assignment of level II or level III to activities which are actually pertinent to the licensing review in order to practically reflect the actual importance of the activity.

I do not know of any significant project, for which a quality assurance program was required, to have specified one set of requirements for all actions.

I consider that the policy of DOE's is creating a condition in which the project participants do not accept the usefulness/practicality of the quality assurance actions, particularly the need for documenting evidence of verification activities, costly and time consuming controls on procurement actions, etc. Mundane activities of low importance are verified to the same degree as the important activities. A concept that "QA is costly and has no practical effect" may be the result. A general lack of commitment to adhere to quality assurance principles and requirements may follow with actual degradation of the quality of activities.

Staff acceptance of the adequacy of one level of activity is, from my observations, not a conservative position to take in contrast to what might be concluded. I recommend that this issue be addressed in the GTP associated with the grading of QA activities.

MISCELLANEOUS ITEMS

a. During the subject period I was interviewed by L. Stephens of Congressman Sinar's committee. She asked about environmental issues associated with the Hanford Reservation including radiochemical contamination of the groundwater. A representative of the NRC's Office of Congressional Affairs audited the interview. Congressional Affairs was thereby appraised of the

items discussed during the interview. I related other issues discussed during the interview to WM Staff by separate correspondence.

b. During the period, following my return from leave the occurrences reported in Attachment J happened. These related to my interaction with BWIP participants per DOE/NRC agreements of Appendix 7. Subsequently, I wrote the elaboration of the issues as I perceived them for consideration in training for RHO personnel per DOE request. Attachment K and Attachment L are my comments and DOE (Mecca's) comments on my comments, respectively. Both sets of comments are self explanatory. I have attempted to expedite resolution of the differences apparent in reviewing Attachments K and L with no success to date. There is no action to accomplish the training committed to by DOE. In fact the only instruction planned by RHO to discuss OR interactions with BWIP staff was cancelled shortly after Attachment J appeared when I indicated with DOE concurrence that I wanted to attend.

In addition more comments were generated by the General Counsel for PNL and former NRC ELD after apparently receiving my comments from Mr. Carter, the person in charge of RHO's training for interaction with the On-site Representative and attorney cognizant of BWIP activities, or from a DOE source. These comments regarding this controversy and a marked up copy of Attachment K containing Mr. Carters marginal comments are enclosed as Attachment M.

I consider Mr. Cunningham's concern raised in Attachment M unfounded, considering my faithful reporting of issues which I perceive in meetings which I attend. Such attendance at meetings, including many associated with licensing strategy, has occurred since the beginning of my tour of duty over three years ago with no apparent concern from the public, the States or the Indian nations interested in this site. In fact it is my own observation that the State and Indians do not mistrust the OR's interactions with DOE and other participants. And, furthermore, I do not consider there is a danger that such a perception will develop. In short I discount Mr. Cunningham's concern and voice my own concern that the issue he has raised not act as a red herring distracting the NRC from pursuing an effective overview of DOE activities, including all aspects of their technical licensing strategies.

I note that it is the State's and Indian's intent to also attend the meetings which I have labeled licensing strategy meetings as soon as their own on-site presence is established. When such presence occurs, the open meeting policy suggested by Mr. Cunningham followed per his words "on the reactor licensing side

of the house" will be a reality. I recommend that NRC Staff formally urge DOE to invite the States and Indians to their licensing strategy sessions to assure the issue suggested by Mr. Cunningham is dead. I would hope Mr. Cunningham would advise the DOE in the same vane.

F. Robert Cook

F. Robert Cook,
Senior On-Site Licensing
Representative, Basalt
Waste Isolation Project
(BWIP)

Attachments as stated:
Att's N & O to NColeman only

cf:	JTBuckley	JOBunting	WLilley
JJLinehan	JMLibert	JMHoffman	SWasler
MRKnapp	PTPrestholt	JTGreeves	AHale
PHildenbrand	FRCook/rdg	PJustus	I&E
NColeman w/att N&O	FXCameron	DBrooks	HLefevre
KCChang			

DOE/RL/JAntonnen
UUIIN/WBurke
O.DOE/WDixon
O.DOE/MBlazic
DOE/JKnight
NP/RTHalf-Moon
Wash.DOE/THusseman
YIN/RJim

1.2

BASALT WASTE ISOLATION PROJECT

PLANNED ACCOMPLISHMENTS
90-DAY WINDOW

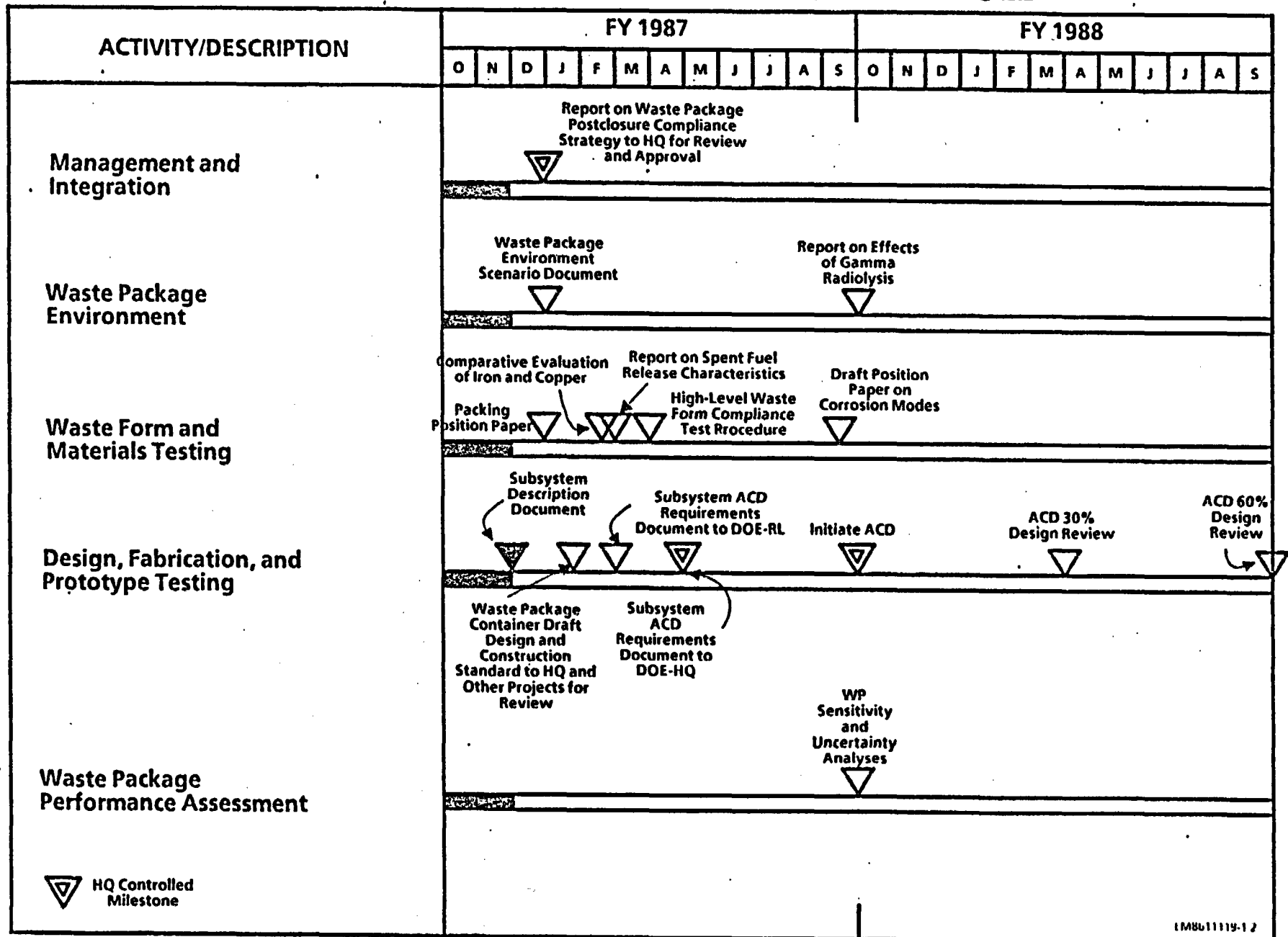
<u>TITLE</u>	<u>BASELINE</u>	<u>FORECAST</u>
<u>December</u>		
Complete Transfer of Packing Diffusion Studies to Pacific Northwest Laboratory	12/86	12/86
Initiate Parr Autoclave Long-Term Spent Fuel Waste Release Testing	12/86	01/87
** Report on Waste Package Postclosure Compliance Strategy to HQ for review and approval	12/86	12/86
* Packing Materials Position Paper	12/86	1/87
* Waste Package Environment Scenario Document	12/86	1/87
<u>January</u>		
* Waste Package Container Draft Design and Construction Standard to HQ and other Projects for review	1/87	1/87
Complete Redox Test Data/Results Report for FY 1984 - FY 1986	1/87	1/87
Place testing contracts with Rockwell Science Center, Temple University, and Argonne National Lab	Various	01/87
Complete Procedure/Initiate Preparation of Altered Packing Materials for Testing	01/87	01/87
<u>February</u>		
* Draft Waste Package Subsystem Requirements Document to DOE-RL	02/87	02/87
* Report on the comparative evaluation of Iron- and Copper-Base Container Materials	02/87	02/87
* Report Spent Fuel Radionuclide Release Characteristics	02/87	02/87

* RL-Controlled Milestone.
 ** HQ-Controlled Milestone.

Attachment A

encl. to Memo of 12/8/84
 to Browning from Cook
 rec'd 12/15/84
 101

1.2 WASTE PACKAGE END FUNCTION SCHEDULE



PROPOSED CHANGES/CLARIFICATIONS TO THE NRC REVIEW PLAN:
 "QUALITY ASSURANCE PROGRAMS FOR SITE CHARACTERIZATION
 OF HIGH LEVEL NUCLEAR WASTE REPOSITORIES"

Page 1 of 4

NRC Review Plan Requirement

DOE Comment

Proposed Change/Clarification

1. General

(a) The Title, Scope & Purpose of "Site Characterization" is inconsistent with the content, in that the review plan contains considerable criteria which is not applicable to site characterization, but is applicable to the engineered design and the components of the geologic repositories.

(a) Revise title, Scope and Purpose to include the Engineered Design and components of the geologic repositories.

(b) The HLW repository program is comprised of activities involving engineered design as well as scientific investigations. The Review Plan should reflect this in its format and content.

(b) The content should identify which criteria/requirements are applicable to both scientific investigations and engineered design, and which would be applicable to one or the other. Enclosed for your consideration is a strawman outline for such a review plan. It is based on the criteria and format of Appendix B (18 Criteria) for the engineered design, but identifies where there should be major differences for scientific investigation.

2. Section 1 - Organization

(a) Para. 1.10

DOE and its prime contractor identify a management position within each respective organization that retains overall authority and responsibility for the QA program. This position, occupied by an individual with appropriate management and QA knowledge and experience has the following characteristics:

(a) It is the position of DOE that the management position that retains overall authority and responsibility for the "QA Function" has no other duties or responsibilities unrelated to QA. However, the management position that retains overall authority and responsibility for the QA program, also has responsibility for line functions.

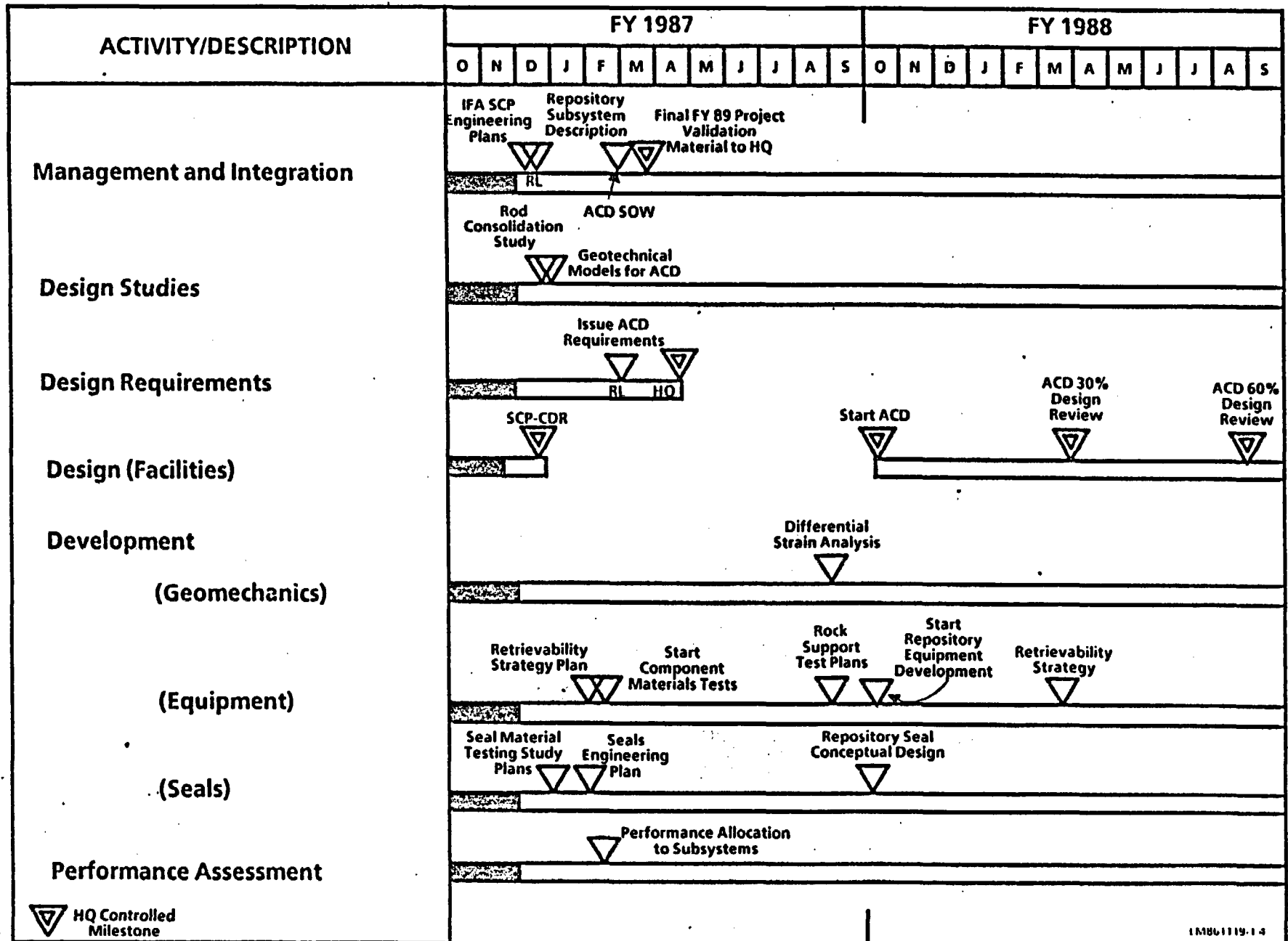
(a), (b) &

(c) Revise Section 1 of the review plan to recognize the verification of proper performance and conformance of the work as a line management responsibility, not the QA organization. The "QA Function" is responsible for overall assurance of QA program adequacy and implementation. The review plan should differentiate between responsibility for quality verification and the over-all assurance of quality.

d. Has no other duties or responsibilities unrelated to QA that would prevent full attention to QA matters.

1.4	BASALT WASTE ISOLATION PROJECT		
	PLANNED ACCOMPLISHMENTS 90-DAY WINDOW		
TITLE		BASELINE	FORECAST
<u>December</u>			
	Issue SCP Engineering Plans	12/86	12/86
	Issue Repository Subsystem Description to DOE-RL	12/86	12/86
*	Issue Rod Consolidation Study	12/86	12/86
**	Issue SCP Conceptual Design Report	12/86	01/87
	Seals Material Testing Study Plans	12/86	12/86
<u>January</u>			
*	Issue Retrieval Strategy Plan	01/87	01/87
	Seals Engineering Plan	01/87	01/87
	Geotechnical Models for Advanced Conceptual Design (ACD)	01/87	01/87
	Issue Borehole Analysis Supporting Document	01/87	01/87
<u>February</u>			
	Issue ACD Statement of Work to DOE-RL	02/87	02/87
	Performance Allocation to Subsystems	02/87	02/87
	Issue ACD Requirements to DOE-RL	02/87	02/87
	Start Component Materials Tests	02/87	02/87
*	RL-Controlled Milestone.		
**	HQ-Controlled Milestone.		

1.4 REPOSITORY END FUNCTION SCHEDULE



ACCOMPLISHMENTS

KAISER ENGINEERS / PARSONS BRINCKERHOFF

<u>Current Period</u>	<u>Schedule</u>	<u>Completed</u>
• BQARD Readiness	10/1/86	10/6/86
• Study II ES		
• Issue all Liner Specifications	10/24/86	10/24/86
<u>Planned Future (Next 90 Days)</u>	<u>Schedule</u>	<u>Forecast</u>
• Fuel Rod Consolidation Report (Final)	10/13/86	12/15/86
• Study 10 V & V <i>Validation & Verification</i>	10/15/86	11/28/86
• Design Methodology Report (IFA) <i>Study II</i>	10/24/86	12/19/86
• Rock Stress		
• ACD Criteria, Final Report	10/31/86	11/28/86
• Overall Strategy, Final Report	11/21/86	12/12/86
• Retrievability Mini-Report	11/30/86	12/19/86
• Start ESF Design	1/2/87	
• Start ACD (Waste Package)	1/2/87	
(Repository)	3/87	

Attachment D

BASALT WASTE ISOLATION PROJECT

1.6

ACCOMPLISHMENTS

<u>TITLE</u>	<u>BASELINE</u>	<u>ACTUAL</u>
Release KE/PB to initiate verification of as-built measurements of ES-1 Liner	9/86	9/86
Prepare Restart and FY 1987 Training Plan and Tracking System for the Exploratory Shaft Program	10/86	Deleted
* Prepare and submit to DOE change request for additions to the TEC for FY 1987 update	10/86	11/86
Begin preparation of TEC Revision	11/86	11/86

*RL-Controlled Milestone.

1.6

BASALT WASTE ISOLATION PROJECT

NOVEMBER 25, 1986

PLANNED ACCOMPLISHMENTS
90-DAY WINDOWTITLEBASLINEFORECASTDecember

Complete re-estimate of ES-II Conceptual Design

11/86

12/86

Complete design drawings for lower 560 feet of casing

11/86

12/86

Complete design specifications for new 72-inch casing

11/86

12/86

Completion of overall work plan for Study II

11/86

12/86

Start procurement of welding/grouting subcontractors

11/86

Unknown

Completion of casing Heat Treat Test Case

12/86

Unknown

Complete physical measurements of ES-I casing as part of Study II

12/86

3/87

*line methodology
Study.*January

Revision 0 of TEC update to DOE

1/87

1/87

Complete Design Basis Study

1/87

3/87

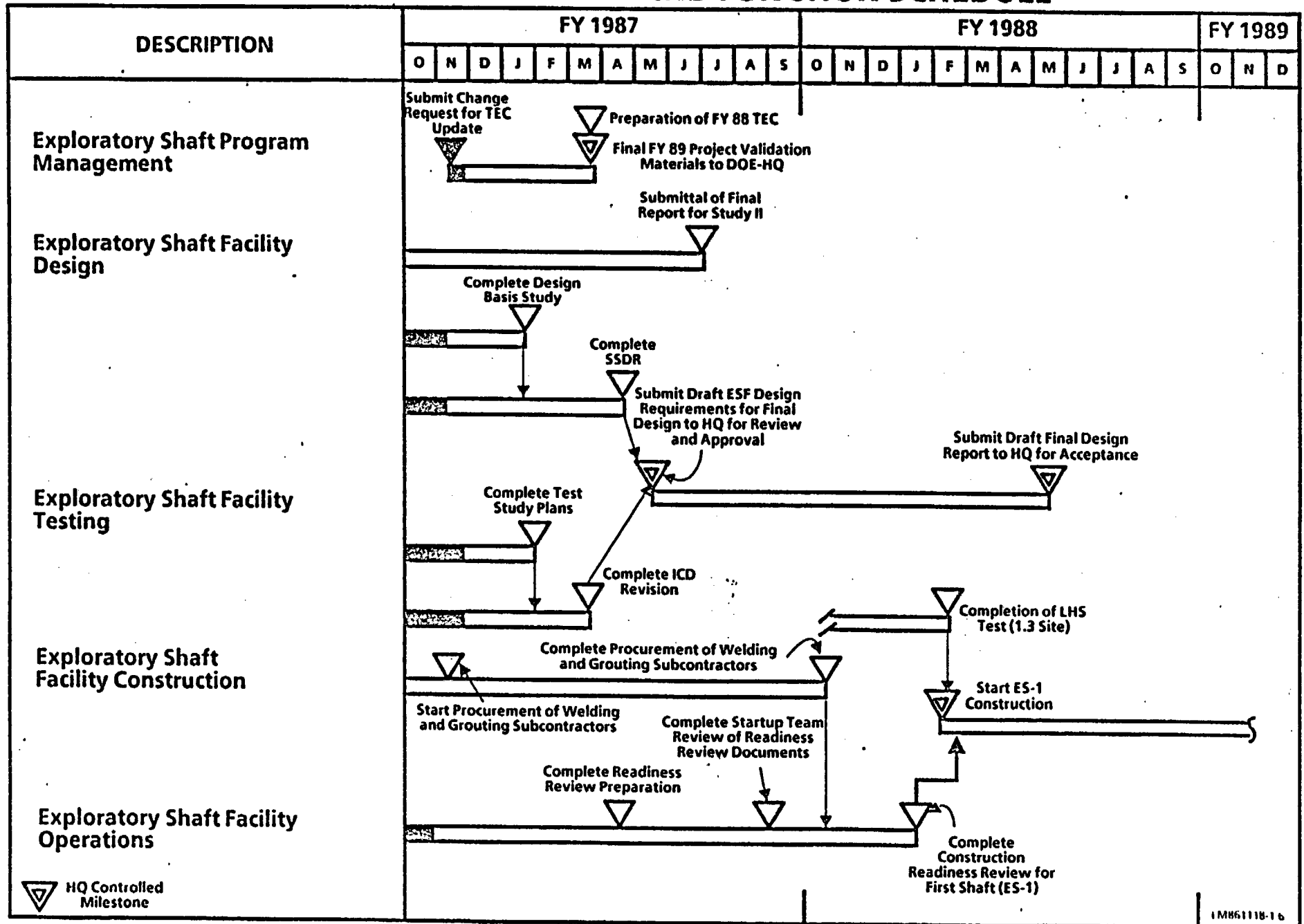
Complete Test Study Plans

1/87

1/87

February

1.6 EXPLORATORY SHAFT END FUNCTION SCHEDULE



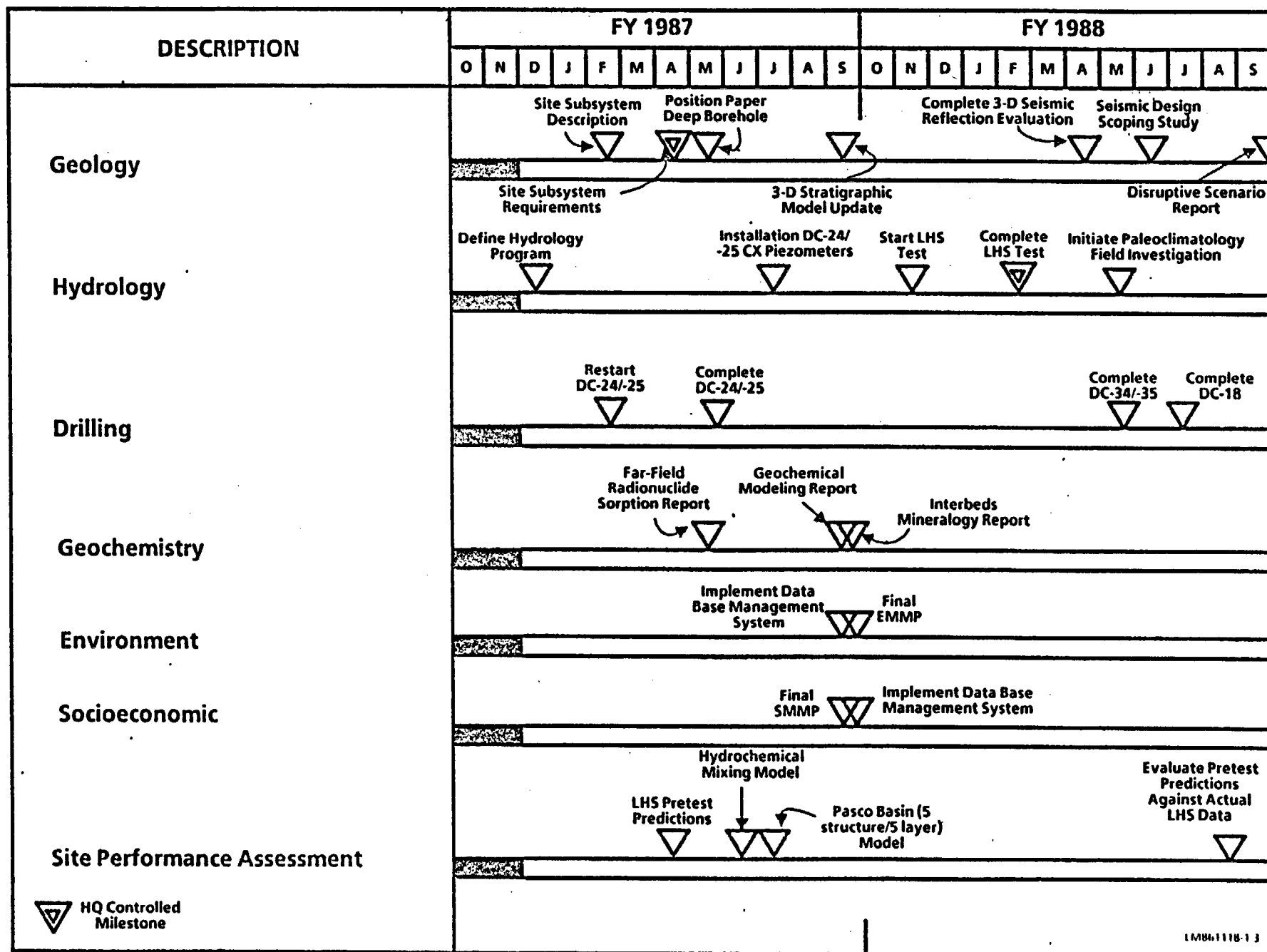
BASALT WASTE ISOLATION PROJECT

1.3

PLANNED ACCOMPLISHMENTS
90-DAY WINDOW

<u>TITLE</u>	<u>BASELINE</u>	<u>FORECAST</u>
<u>December</u>		
Complete Annual Regional Seismic Monitoring Report	N/A	12/86
Submit Expedited Special Case Restart for Boreholes DC-24/-25 to DOE	N/A	12/86
Complete programmatic plan for bringing Basalt Technical Data Systems into compliance with the Project Management Procedures Manual	N/A	12/86
Site selections for additional hydrologic monitoring wells to HQ for approval (define Hydrology Program)	12/86	12/86
<u>January</u>		
Complete drafts of nine geologic study plans	N/A	1/87
Complete transition plans for seismic monitoring and seismic reflections testing	N/A	1/87
Complete procurement of seismic data processor	N/A	1/87
Complete procedures required for restart of Boreholes DC-24/-25	N/A	1/87
<u>February</u>		
Restart Boreholes DC-24/-25	2/87	2/87
Site Subsystem Description	2/87	2/87

1.3 SITE END FUNCTION SCHEDULE



Shedd's well No. 11

Log of Spokane - Benton County Natural Gas Co. well.
Section 5-11 25 E.W.H.

Boulder Volcanic Ash & Gravel	18 feet	18 feet.
Fine sand.....	3 feet	20 feet.
Gravel.....	10 feet	30 feet.
Porous Basalt.....	50 feet	80 feet.
Yellow Sand with slight mixture of clay.....	23 feet	1103 feet.
Clay, Sand & Boulders.....	128 feet	230 feet.
Porous Basalt.....	50 feet	260 feet.
Basalt.....	138 feet	418 feet.
Clay.....	33 feet	465 feet.
Clay, Sand & Boulders.....	30 feet	485 feet.
Basalt (Very Hard).....	25 feet	510 feet.
Grey Basalt.....	30 feet.	540 feet.
Blue Shale.....	10 feet	550 feet.
Sand & Boulders.....	10 feet	560 feet.
Sand & Broken Basalt.....	20 feet	580 feet.
Hard Grey Basalt.....	150 feet	730 feet.
Hard Basalt.....	165 feet	895 feet.
Sand Rock.....	8 feet	801 feet.
Hard Basalt.....	94 feet	895 feet.
Slate.....	8	1003 feet.

A flow of gas was encountered with about 400 feet of water in the hole and was cased off. An oily gum was taken from the casing at the 800 foot level after a string of casing was removed. This is the deepest well with ten inch hole made in basalt.

LOGS OF BENTON COUNTY WELLS.

by

Herbert C. Harris

Sent by L. K. Armstrong 10/22/28

B-28

1310 ft. to 1314 ft. 4 ft. black basalt all formations
From 1201 to 1450 ft. carried natural salts of the earth
and rusted tools very quickly. Some fresh water at 1400 ft.
1310 ft. to 2000 ft. Gray & Black basalt

Cased with 8" to 314 ft. At 1438 ft. to 1450 --12 ft. rock
resembled fine sand stone. (12 hrs. to 6 ft. hole)
Sand so fine had to let it set in bucket to save any cutting
yet it carried enough oil to cover top of 12 qt. pail in
five to ten minutes after bringing to surface. Oil obtained
was paraffin base. The same was encountered again at 1540
to 1553' water was not cased out in either case and stood
at 210 ft. level.

(Copied from scrap paper - (1-2-24, 1925).
Record by Ch. Culver)

Benson Well

D1026-05

Surface Elev. 610' (B.M. Near by)
(10' = 50')



Soil - gravel - sand - 350'

Basalt 100'

White & Yellow Clay 25' ± 5'

Clay 4'

Basalt - Reddish

Sea level

Basalt - black or gray

1221' Depth

Soil gravel sand	to 350
Basalt	350 450
Wh & yel Clay	450 475 @ 480
Clay ?	
Basalt-reddish	541 550 ±
Basalt-black or gray to present bot on	
	1221 all basalt

D1026-05

Copied 10/8/37
P.A.K.

Benton Count

B-28

LOG OF BENSON WELL
Drilled by Geo. E. Scott,
March 1, 1929

see 26 (12-25E)

DC-1

6 ft. clay
 24 ft. dry loose sand
 17 ft. dirty sand
 11 ft. fine sand
 10 ft. coarse gravel
 6 ft. cement gravel
 5 ft. coarse loose gravel
 1 ft. dirty gravel
 5 ft. fine pea gravel
 41 ft. dirty gravel
 First water at 127 ft. raised to 100 ft. level
 23 ft. dirty gravel
 150 ft. to 300 ft. all dirty gravel
 150 ft. sand, Had to drive pipe to bottom all the time
 300 to 304 ft. 4 ft. gravel
 345 ft. blue clay 41 ft.
 Landed 12 $\frac{1}{2}$ " 50# AP.I. casing on basalt rock at 345 ft.
 345 ft. to 448 ft. 103 ft. black & gray basalt
 448 ft. to 460 ft. 12 ft. white sandy clay
 460 ft. to 471 ft. 11 ft. white sticky clay
 471 ft. to 537 ft. 66 ft. blue clay, sand & part sticky
 Cased with 10" 45 $\frac{1}{2}$ " API. seamless to 537 ft.
 537 ft. to 703 ft. 166 black & gray basalt
 Drilled 10" and later under-reamed to 12 $\frac{1}{2}$ " for 10" casing
 703 ft. to 855 ft. 152 ft. black & gray basalt
 855 ft. to 886 ft. 31 ft. blue shale & clay
 886 ft. to 893 ft. 7 ft. sand stone
 893 ft. to 924 ft. 31 ft. blue sandy shale
 Under-reamed to 12 $\frac{1}{2}$ " hole for 10" 45 $\frac{1}{2}$ " API. casing to 924 ft.
 Under-reamer lugs could not be tempered to cut most of
 the basalt stone, so had to build up with self hardening
 steel. I spent almost three months with all grades of
 steel before I found a mixture that would be hard enough
 to stand the blow without breaking. Had to use pull down
 Jacks on 10" pipe and the last 200 ft. the drive was pretty
 tough, went the limit with 8" oil country jack with 2000#
 pressure & drive down spear with long stroke jars & two
 stems, so had to use 12" plunge jack capacity 226 tons
 actually using 150 to 175 tons push down and spear at
 800 ft. with long stroke jars & two stems to move this
 casing. 10" casing to 924 ft.
 934 ft. to 1085 ft. 161 ft. black basalt
 1085 ft. to 1172 ft. 87 ft. gray basalt
 1172 ft. to 1201 ft. 29 ft. changeable basalt black, gray & reddish
 ✓ 1201 ft. to 1203 ft. 2 ft. yellow clay
 1203 ft. to 1249 ft. 46 ft. blue shale & trace of white sand
 1249 ft. to 1280 ft. 31 ft. blue shale
 1280 ft. to 1281 ft. 1 ft. brown shale
 1281 ft. to 1296 ft. 15 ft. blue shale
 1296 ft. to 1310 ft. 14 ft. greenish shale (sticky)

'ray' on PC disc

MINERALS IN FRACTURED BASALT--AN ISSUE

by
Raymond Lasmanis, State Geologist

The Cohasset Flow of the Columbia River Basalt Group has been selected by the U.S. Department of Energy (USDOE) as a potential storage site for the nation's high-level nuclear waste. A recurring issue raised by the public and earth scientists is the highly fractured nature of basalt flows. After all, most of the numerous basalt outcrops throughout eastern Washington are cliffs of basalt below which are large talus slopes of fractured and jointed rock. Some concerns about effects on fracture-filling minerals and the effectiveness of waste containment under the conditions created by the proposed repository were addressed in the Division's response to the USDOE draft Environmental Assessment and are described briefly in the paragraphs that follow.

USDOE claims that at a repository depth of 3,000 feet, the fractures are infilled and healed by minerals, thus effectively sealing adjacent aquifers from the repository. They state in the Environmental Assessment (USDOE, 1986) that fractures at depth in the Cohasset basalt flow are filled with clay minerals (89 percent), zeolites (7 percent), and silica (4 percent). In a USDOE-sponsored report (Ames, 1980), it is noted that sodium-containing nuclear wastes, if escaping from a canister, would come in contact with calcium-bearing nontronite clay, causing an exchange in the nontronite of calcium for sodium. (In nontronite, aluminum can be replaced by magnesium, which, in turn, can be replaced by calcium, sodium, and potassium.) As a result of the substitution, the clay would expand to close off the fracture, and thus block further flow of water along joints and cracks.

The complex minerals contained in basalt fractures under the Hanford area are listed, with their chemical formulas, in Table 1 (page). These minerals were identified in drill core from five holes drilled by Atlantic Richfield Hanford Company between 1969 and 1972. Of the clays, nontronite was the most common, and heulandite and gmelinite were the most abundant zeolites.

The effect of fractures and the mineralogy of their fillings on containment and protection of groundwater from nuclear waste can not be dismissed by a simplistic analysis. Once a repository is operational, the minerals in the fractures will be exposed to heat, differential hydrostatic and lithostatic pressure, air, and humidity. It is conceivable that, in time, the local environment of the canister storage area will be exposed to nuclear waste as well, should canisters fail.

USDOE reports that after waste emplacement, the basalt in the emplacement rooms will reach a temperature of 131[deg] C and that basalt surrounding the storage hole will reach a

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temperature of 224[deg] C (USDOE, 1982). Clays of the smectite group can experience considerable water loss upon heating between 100[deg] and 200[deg] C. The illite clays can contain appreciable amounts of water as interlayers between silicate sheets of the molecular structure. This water is also released after heating above 100[deg] C. Zeolites, too, will dehydrate and produce water in the fractures. The smectite-group clays experience contraction with initiation of heating, whereas the less abundant illite clays may expand.

The questions that need to be answered about clay and zeolite behavior in fractures require complex laboratory experiments. There is an urgent need to know the nature of fracture-filling materials and what they will produce after having been exposed to heat and air during the operation of the repository. It is possible that the purported integrity of the fractures will be compromised and that solutions resulting from dehydration of zeolites and clays could create new geotechnical and geochemical problems.

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Table in CPT accompanies this (fracture minerals in basalt).

(This article continues on page .)

**Table 1. Minerals in basalt fractures
at Hanford, Washington. Repository
depth is 3,000 ft below the surface;
clay formulas are simplified**

Surface to 1,300-foot depth

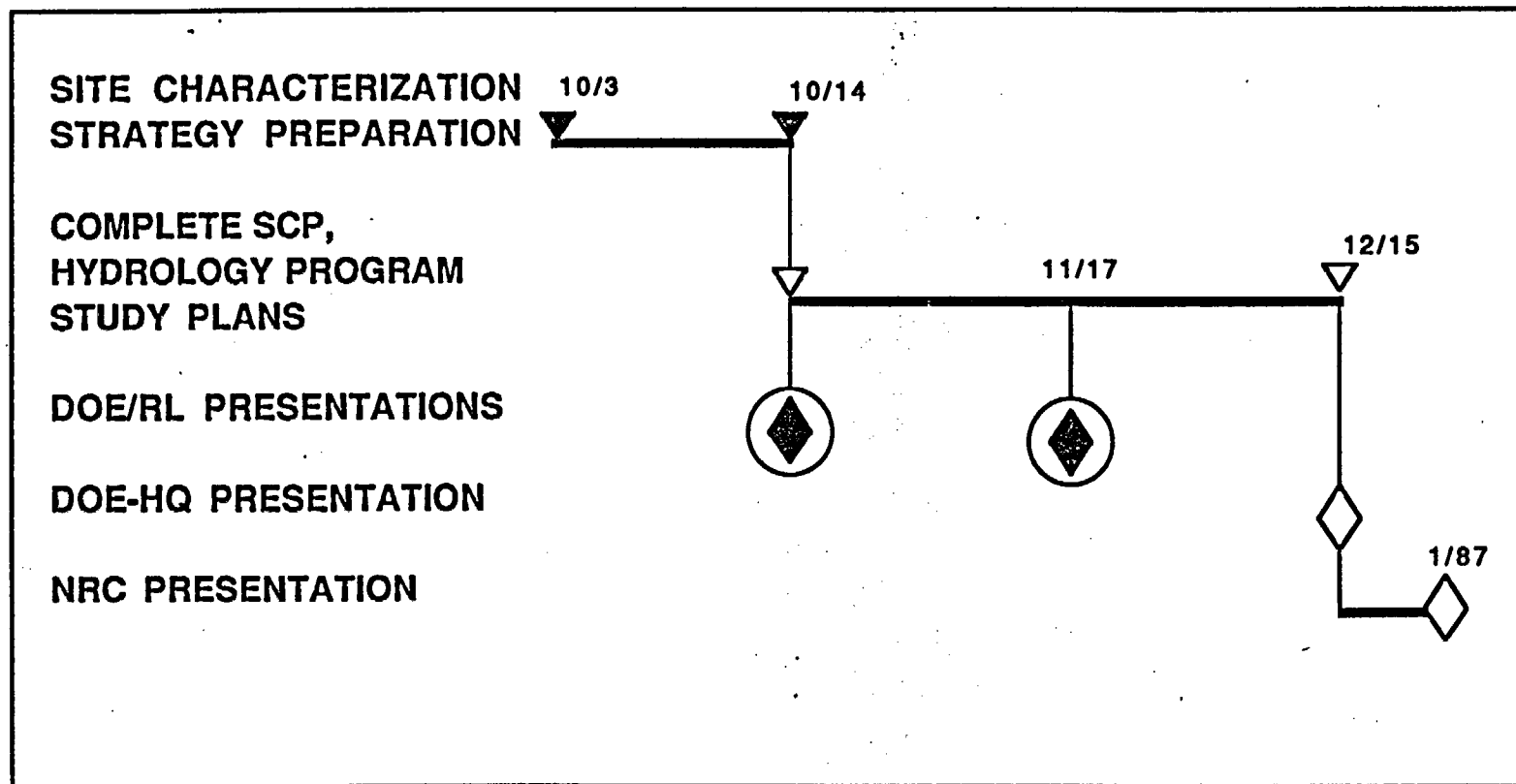
Quartz
Calcite (up to 7.06% MnO)
Smectite group clays
 nontronite
 montmorillonite

From 1,300-to 8,000-foot depth

- Silica minerals (4%)
 - quartz SiO_2
 - opal (cristobalite) $\text{SiO}_2 \cdot n\text{H}_2\text{O}$
 - Zeolites (7%)
 - heulandite
 $\text{Ca}_4[\text{Al}_8\text{Si}_{28}\text{O}_{72}] \cdot 24\text{H}_2\text{O}$
 - clinoptilolite
 $\text{Na}_6[\text{Al}_6\text{Si}_{30}\text{O}_{72}] \cdot 24\text{H}_2\text{O}$
 - mordenite
 $\text{Na}_8[\text{Al}_8\text{Si}_{40}\text{O}_{96}] \cdot 24\text{H}_2\text{O}$
 - gmelinite
 $\text{Na}_8[\text{Al}_8\text{Si}_{16}\text{O}_{48}] \cdot 24\text{H}_2\text{O}$
 - phillipsite
 $(\text{Ca}_{0.5}, \text{Na}, \text{K})_6[\text{Al}_6\text{Si}_{10}\text{O}_{32}] \cdot 12\text{H}_2\text{O}$
 - chabazite
 $\text{Ca}_2[\text{Al}_4\text{Si}_8\text{O}_{24}] \cdot 13\text{H}_2\text{O}$
 - harmotome
 $\text{Ba}_2[\text{Al}_4\text{Si}_{12}\text{O}_{32}] \cdot 12\text{H}_2\text{O}$
 - Clay minerals (89%)
 - Smectite group
 - nontronite
 $(\text{OH})_4(\text{Si}_{7.34}\text{Al}_{0.66})\text{Fe}_4^{3+}\text{O}_{20}$
 - beidellite
 $(\text{OH})_4(\text{Si}_6\text{Al}_2)\text{Al}_{4.44}\text{O}_{20}$
 - montmorillonite
 $(\text{OH})_4\text{Si}_8(\text{Al}_{3.34}\text{Mg}_{0.66})\text{O}_{20}$
 - Illite - H_2O content 3.58-8.01%
-

Attachment I

HYDROLOGY CHARACTERIZATION PROGRAM DEVELOPMENT



Monday, October 27, 1986 Tri-City Herald

Repository efforts hampered by gap in communication

NRC criticizes DOE cooperation

By CHRIS SIVULA
Herald staff writer

Efforts to find a permanent solution to the nation's growing stockpile of high-level nuclear wastes are hampered by the Department of Energy's lack of cooperation, according to a Nuclear Regulatory Commission report.

NRC's review of work at Hanford to develop a container to safely house spent nuclear fuel "was only partially successful because of the lack of cooperation," according to a report prepared by the NRC's representative at Hanford.

Similarly, the NRC report calls its review of repository design work at Hanford "only marginally useful since DOE and (Rockwell Hanford) would not permit review of several key records."

Rockwell manages the Basalt Waste Isolation Project for DOE. Studies scheduled for BWIP are to determine Hanford's suitability as a underground storage site for high-level nuclear waste.

John Anttonen, DOE's assistant

manager at Hanford for commercial nuclear waste, calls the NRC criticism "an honest difference of opinion."

"We're trying to compromise. We want to cooperate with the NRC and we want their involvement," Anttonen said.

Disagreements between the two agencies led to some sharp words in the NRC's October report:

"The action on DOE's part to inhibit the free interaction and review of DOE activities by NRC personnel is inconsistent with the conditions NRC noted were necessary to expeditiously prepare and accomplish licensing activities."

Under the Nuclear Waste Policy Act, the NRC must issue a license before construction can begin on any high-level waste repository. The commission has on-site representatives at the three sites scheduled for additional repository studies.

Hanford, plus sites in Nevada and Texas, were selected in May for long-term studies, called site characterization.

The issue of cooperation with the NRC picked up a temporary, and apparently erroneous, head of steam in recent days when some Rockwell managers were told not to talk to Robert Cook, NRC's on-site representative for Hanford's repository studies.

Both DOE and Cook believe that the order was a misunderstanding. According to Mike Talbot, a DOE spokesman, the order followed a conversation between DOE and

Please see DOE, Page A2 ▶

Inside

Classified.....	C5
Comics.....	B3
Metro/Northwest.....	B1
Movies.....	A7
Obituaries.....	C5
Opinion.....	A4
People.....	A2
Sports.....	C1
TV log.....	C4
Weather.....	A3

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Rockwell managers assigned to BWIP.

"Our people restated the need for the contractor to be receptive to the NRC, and that DOE needed to be kept abreast of communications," Talbot said. "Somebody misinterpreted that to mean that they were not to cooperate without DOE authorization. That was wrong."

At any rate, Lee Olson, DOE's manager for the BWIP project, immediately took action to have the order corrected.

Neither DOE nor the NRC know exactly what precipitated the Rockwell order. Rockwell has declined to comment on the incident. "Bob (Cook) called Lee Olson. That's how we became aware of it," Anttonen said.

"When Lee heard of it he immediately picked up the telephone and talked to Rockwell, because that (the order not to talk to Cook) is not in accordance with our agreement," Anttonen added.

"I don't know how it happened. I talked to Rockwell and they don't know how it happened. I talked to Clark Gibbs, (Rockwell's BWIP director) and he doesn't know how it happened and he in turn talked to people underneath him and they

can't explain how it happened."

The order also puzzled Cook. "Why it came up I'm not sure. I think it has something to do with my latest report, but that's just a surmise," he said.

Cook's October report includes, in addition to complaints about DOE cooperation, two internal Rockwell documents on traces of iodine-129 found in ground water at the Hanford site.

NRC obtained the documents from an anonymous source, rather than through DOE channels. Cook believes that including the documents in the October report may have sparked the conversations between DOE and Rockwell that lead to the misunderstanding.

While the traces of radioactive iodine are at levels too minute to cause a health concern, the NRC believes data collected on the isotope could be useful in understanding Hanford ground water movement.

One possible explanation for the levels of iodine-129 found in some Hanford test wells is that the isotope was carried by vertical movement of ground water.

The issue is critical because ground water is the most likely way radioactive material stored at a Hanford repository could make its way to parts of the environment accessible to people.

If ground water beneath Hanford moves vertically, it could carry radioactive material from a deep-un-

derground repository up to the accessible environment. If movement is primarily horizontal, contamination carried in ground water would remain far below the surface.

The NRC requested data on iodine-129 in June 1985, according to Cook's report. The issue was addressed in DOE's environmental assessment of the Hanford repository site, but the NRC has not officially received a copy of the data.

The problem is that DOE hasn't completed its report on iodine-129, Anttonen said. Efforts are underway to prepare a report, which will be released publicly as soon as it is completed, he added.

Including the Rockwell documents on the isotope in the NRC report for October violates agreements between the commission and DOE, Anttonen said.

However, according to Cook, the agreement is limited to BWIP documents. Iodine-129 studies were not conducted as part of the repository program and the NRC is not obligated to withhold the documents.

Both Cook and Anttonen said a healthier relationship may develop between DOE and the NRC because of the Rockwell memo ordering some BWIP employees not to talk to Cook.

As a result of the order, all BWIP employees will take part in a training sessions devoted to cooperating with the NRC.

Cook will sit in on the meetings and offer any comments he feels are necessary. "He can answer any questions and respond to any comments the instructor makes," Anttonen said.

While the law calls for a repository site to undergo NRC licensing, it doesn't provide any rules for interaction between now and 1991, when the DOE is scheduled to submit a license application.

In the meantime, NRC's relationship to DOE is spelled out in a document called Appendix 7, which sets some ground rules for interaction between the two agencies.

Appendix 7 doesn't carry the force of law, but it does carry the signatures of top DOE and NRC officials.

Apparently, DOE's and the NRC's interpretation of Appendix 7 are fairly close, but there are key differences that led to Cook's criticism in the latest NRC report.

"Essentially, what it (appendix 7) says is that the on-site representative has access to all information on the project, which means he has access to the raw data, to drafts as well as final documents, reports, etcetera," Anttonen said.

"The other aspect is personnel. He has access to all personnel on the project the only thing that is asked in the agreement is that he check with their supervisors first."

Cook said there have been several disagreements over NRC access to

BWIP, but added that if he's denied access to meetings, documents or personnel, he can raise the issue up the line, to Mike Lawrence, DOE's Hanford manager, if necessary.

The problem is usually resolved in NRC's favor, Cook said. He added that he believes Lawrence is sincere in expressing a desire to cooperate with the commission.

However, problems between NRC and the DOE date back several years. A 1982 letter from John B. Martin, NRC's former director of the waste management division, refers to problems in BWIP.

According to the letter, which was sent to Franklin Coffman, then a DOE deputy assistant secretary at the department's waste management office in Washington, D.C., difficulties in scheduling discussions between the NRC and BWIP officials threatened to delay the repository process.

"Until such time as our concerns are resolved, we are not sanguine about orderly licensing proceedings," Martin wrote in the 1982 letter.

According to Cook's October report, the situation has not improved greatly. "The current recalcitrance on (the part of Hanford officials) is not unlike that referred to in the Martin letter," the report states.

According to Anttonen, Cook's complaints boil down to two issues. One is the timing of DOE's release of documents. "That is the biggest

disagreement that we have with Bob," Anttonen said.

Cook, as the NRC's on-site representative, can review draft documents, but until DOE publicly releases a document, he cannot obtain copies.

Part of the problem is that any document Cook obtains is automatically made available to the public. The idea is that an open door is the only way to credibly serve as public watchdog for nuclear industry, according to Cook. "They (DOE) don't like that sometimes."

A second issue is access to the project for NRC technical staff temporarily assigned to Hanford. Their access to BWIP documents and personnel is not as free as Cook's.

"I have fairly good access," Cook admits. "The idea is that the rest of the staff can't help. They can't participate in the same mode."

High level DOE and NRC officials are attempting to draft an agreement for cooperation with NRC interim staff, Anttonen said.

But DOE's current interpretation of the cooperation agreement makes NRC's review "problematic just because of the extensiveness of the program," according to Cook. "It's hard for us to do our reviews," he said.

"The free flow of information, that's the issue," Cook added. "It's not an automatic, free unfettered access. It's a controlled access that they provide."

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