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

WM Record File  
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WM Project 16  
Docket No. \_\_\_\_\_  
PDR   
LPDR

WM DOCKET CONTROL CENTER

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

Distribution: MAR 07 1986  
REB MJB DRM CFR LBH  
MRK JTG Linahan SBilhorn  
(Return to WM 623-SS) Giaratana Sac

FROM: Tilak R. Verma, Senior On-Site Licensing Representative  
Salt Repository Project (SRP)

SUBJECT: SRP SITE REPORT FOR THE MONTH OF FEBRUARY, 1986

1. Waste Package: SRP is in the process of developing a waste package program plan. A number of ONWI and SRPO staff met with PNL staff on February 18-20, 1986, and discussed the waste package program strategy for the waste package program plan for the salt repository project. Don Clark visited Brookhaven National Lab to review progress on salt radiation effects program and to finalize the detailed test plan for FY 86. I have asked Clark for a copy of his trip report.

Attended a technical information exchange meeting between WIPP and SRP, in which waste packages and emplacement concepts were discussed. Some of the conceptual design parameters presented by ONWI are as follows:

Waste Form	DWPF	PWR
Weight	1470	7920
Canister		
Diameter(cm)	61	62
Length(cm)	300	400
Container		
Diameter(cm)	80.8	84.5
Length(cm)	338.5	446.5
Wall Thickness(cm)	8.6	10.0
Weight(kg)	6030	9250
Waste Package		
Total Weight(kg)	7970	17,640

Attached viewgraphs provide some additional details about the waste package conceptual design (Attachment No. 1)

o Recieved an ONWI Draft of SRP Waste Package Metal Barriers Test Plan, dated January, 1986. The metal barriers test plan describes the experimental activities which will be conducted over the next six years. Detailed descriptions of each test, either in describing experimental apparatus or the detailed test matrices are not given. However, the plan does provide (i) the rationale and strategy for the experimental program, (ii) description of the objectives and purpose of the various test series, (iii) a general description of each test series, (iv) the kind and range of controlled parameters, and (v) the intended use of the data. The plan also presents program uncertainties and impediments along with potential contingencies and alternatives.

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- o A copy of brief review comments by Raines (ONWI) on NUREG/CR-2482, Vol. 9, "Review of DOE Waste Package Program", is attached. We should be discussing some of these issues raised through the review of DOE technical reports and positions.

2. Geology: State of Utah has reviewed proprietary geophysical data at the offices of J.J. Richard, Inc. The data was made available by SRPO.

Members of the Geologic Review Group, the Engineering Review Group and ONWI staff reviewed the core at the Texas Bureau of Economic Geology in Austin, Texas. SRPO is using the J. Friemel Well to prepare a reference stratigraphic profile for their ES and repository design work.

Three SWEC topical reports on Microearthquake Monitoring, Palo Duro Basin, Texas, are available in draft form. These reports cover a period of network operation from April, 1984 thru June, 1985, and have been referenced in the EA. Also available in draft form is an ONWI report "Structural Analysis of the Northern Palo Duro Basin", by T.R. Regan and P.J. Murphy.

3. Performance Assessment: BMI/ONWI-545, Performance Assessment Plans and Methods for the Salt Repository Project, August 1984, is being revised. I have obtained a draft copy of the revised version.

DOE/HQ, through the SCP Coordinating Group, has suggested that all three projects adopt the performance allocation methodology developed for NNWSI by F. Bingham of Sandia National Labs. I have obtained a copy of this methodology for their use.

I have also obtained a draft report, "Concepts Involved in a Proposed Application of Uncertainty Analysis to the Performance Assessment of High-Level Nuclear Waste Isolation Systems", prepared by ORNL. The report suggests different ways of treating uncertainty in data to be used for performance assessment.

4. Site/Environmental: SRP is talking to the State of Texas for statutory requirements for Site Characterization work. If DOE is required to get a permit for ESF in the Deaf Smith County site, it will take a minimum of two years from the date an application for permit is filed.

#### Miscellaneous:

- o Waste Package, ESF, In-Situ Test Plans, Repository Design and Performance Assessment are the key areas where there are ongoing activities in the salt repository project. However, most of the work in these areas is being done away from Columbus. Due to lack of travel funds, I am unable to travel to any of these contractors to review ongoing work or to provide surveillance.
- o SRPO has reorganized and a new Branch of Licensing and Systems has been created. (A copy of the new organizational chart is attached).

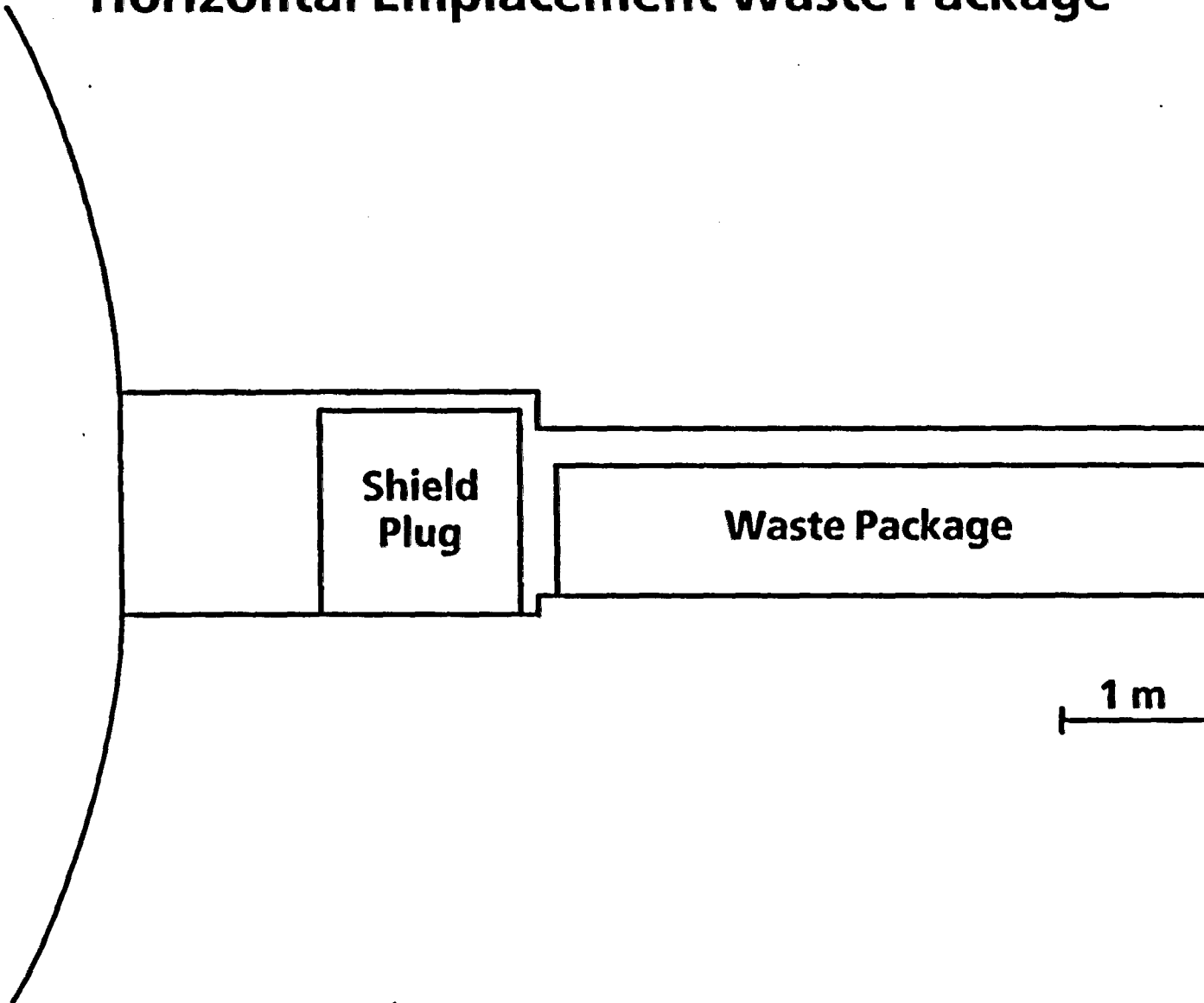
- o In my review of "General Assumptions for SRP Current Plan", I find that the following assumptions made by SRPO are not valid and NRC should be raising those with DOE in the form of issues:
  - Networks reflect aggressive, success-oriented, minimum technically defensible program.
  - Data for models is confirmatory. There is not time scheduled for iterations between field data, laboratory data, in-situ data, and model development.
  - Sufficient rock mechanics labs and test equipment are available.
  - Potential requirement from NRC were not considered in shaft sinking and mining durations.
- o A technical information exchange meeting was held here between SRP and WIPP on February 11-12, 1986. I attended the meeting as a NRC observer. Areas of discussion included past exchanges, waste packages, emplacement concepts, and potential for equipment testing and SRPO interactions. A list of actions from this meeting is attached. WIPP indicated that their site characterization amounted to an iterative process, in that the results of investigations tended to redirect the program from what was originally planned. After 8-9 years of investigation in the site area (SRP only has about eight months of underground testing), they found quite a few surprises. Instrument failures are quite common.
- o On February 26 and 27, 1986, SRPO gave an overview of Salt Repository Project to Edison Electric Institute - Utility Nuclear Waste Management Group. I attended all the presentations and discussions on different aspects of the Project. The Utility Nuclear Waste Management Group was very critical of SRP's cost and schedules. Other areas of their concern were waste-package, QA, EAs, SCP and in-situ testing.
- o A list of SRPO Priorities for FY 1986 and Key Milestones is attached for your information.

*Tilak R. Verma*  
Tilak R. Verma  
Senior On-Site Licensing  
Representative  
Salt Repository Project

TRV:max:1755C

cc: M. Bell  
J. Bunting  
J. Linehan  
M. Knapp  
J. Greeves  
R. Johnson  
S. Bilhorn  
J. Giarratana

## Horizontal Emplacement Waste Package



# **Container Material**

## **Desirable Properties**

- **Acceptable uniform corrosion rate**
- **No local corrosion**
- **Simple material**
- **History of application**
- **Weldability**
- **Castability**
- **Radiation attenuation**
- **Material strength**
- **Cost**

## **Material Selected**

**ASTM A216, Grade WCA**

# Reference Overpack Material

## ASTM A216-77, Grade WCA

<u>Element</u>	<u>Composition, Max., %</u>
C	0.25
Mn	0.70
P	0.04
S	0.045
Si	0.6
<b>Total Cu, Ni, Cr, Mo, V</b>	<b>1.0</b>
<b>Tensile Strength, Min.</b>	<b>60 to 85 KSI (415 to 585 MPa)</b>
<b>Yield Strength, Min.</b>	<b>30 KSI (205 MPa)</b>
<b>Elongation, Min.</b>	<b>24%</b>
<b>Reduction of Area</b>	<b>35%</b>

## **Expected Processes**

**Brine quantity  $\ll$  -- Container consumption quantity**

**Brine rate  $<$  -- Container corrosion consumption rate**

**Surrounding porosity/permeability -- very low**

## **Alternate and Contingency Concepts**

- **Alternate Container Materials**
- **Thicker container**
- **Galvanic package**
- **Tailored packing material**



# **Alternate Container Material Concept**

## **Alternate Materials**

- **Ti Code 12**
- **Nickel alloys**

## **Uses**

- **If low carbon steel is unacceptable**
  - **General**
  - **Local**

## **Disadvantages**

- **May not react sufficient brine**
- **Susceptibility to localized corrosion**

# Potential Material Degradation Modes

- **General corrosion**
- **Non-uniform corrosion**
  - **Pitting**
  - **Crevice**
  - **Intergranular**
- **Stress-corrosion cracking**
- **Hydrogen embrittlement**
- **Bacterial corrosion**
- **Aging**
- **Mechanical failure**
  - **Creep**
  - **Overload**

**Comparison of Estimated Corrosion Rate Averages  
for General Corrosion in Oxidic (1.5 ppm O<sub>2</sub>) PBB2 at  
150 C**

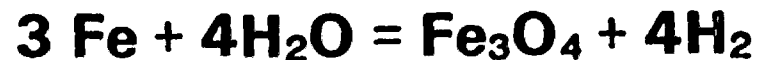
<u>Material</u>	<u>Estimated Rate, <math>\mu\text{m}/\text{yr}^{(a)}</math></u>	<u>Standard Error</u>	<u>Comparison<sup>(b)</sup></u>
A216 Steel	25.2	0.68	A
High Purity Iron	24.5	1.06	A
Normalized Cast A27	17.1	0.76	B
1025 Wrought Steel	14.7	0.90	BC
Ductile Cast Iron	14.5	0.84	BC
A27 Cast Steel	12.1	0.84	CD
2 1/2% Cr, 1% Mo Steel	10.1	0.84	D

<sup>(a)</sup> Rates are estimated at the average time period (4100 hours).

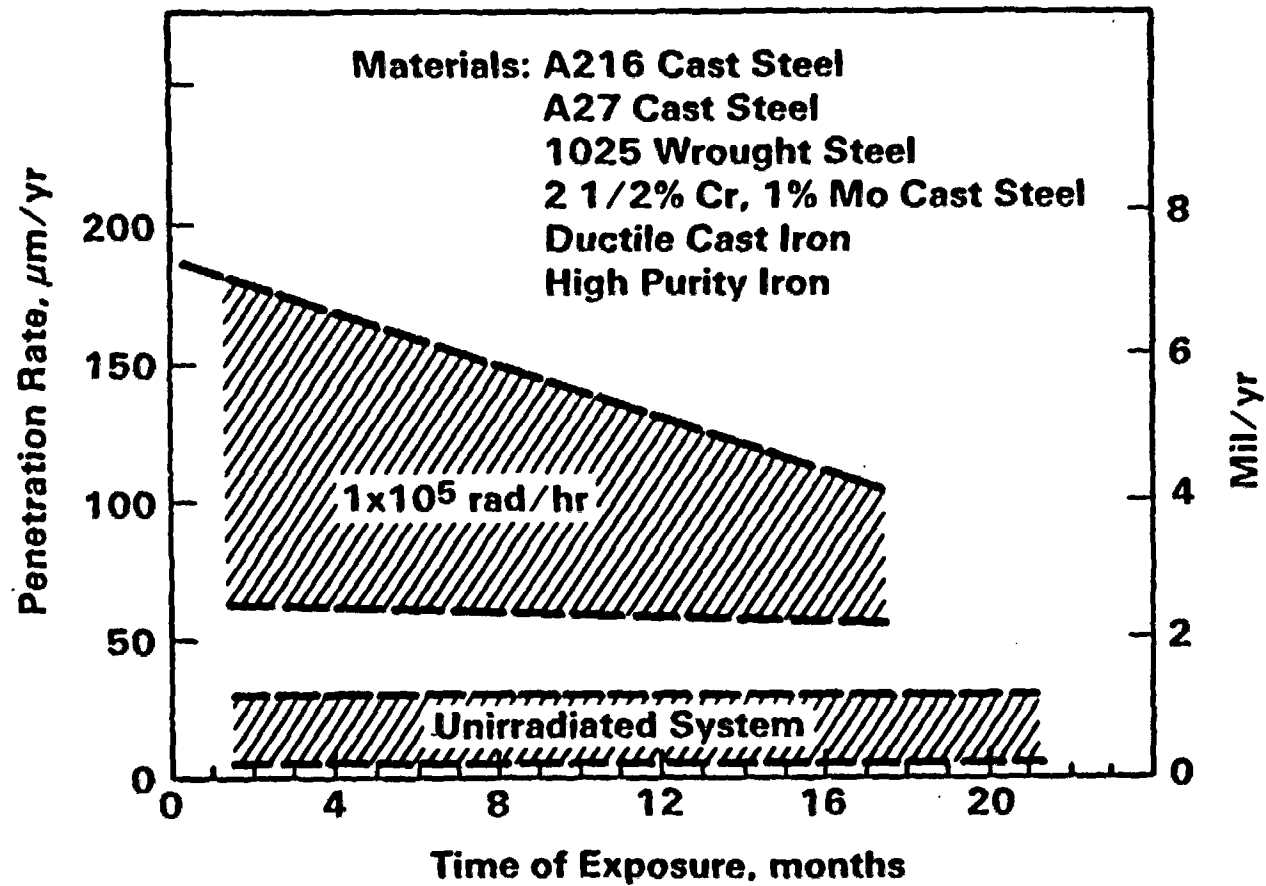
<sup>(b)</sup> Materials that share at least one letter are not significantly different with respect to corrosion rate at the 95% confidence level.

# Magnetite Corrosion Product

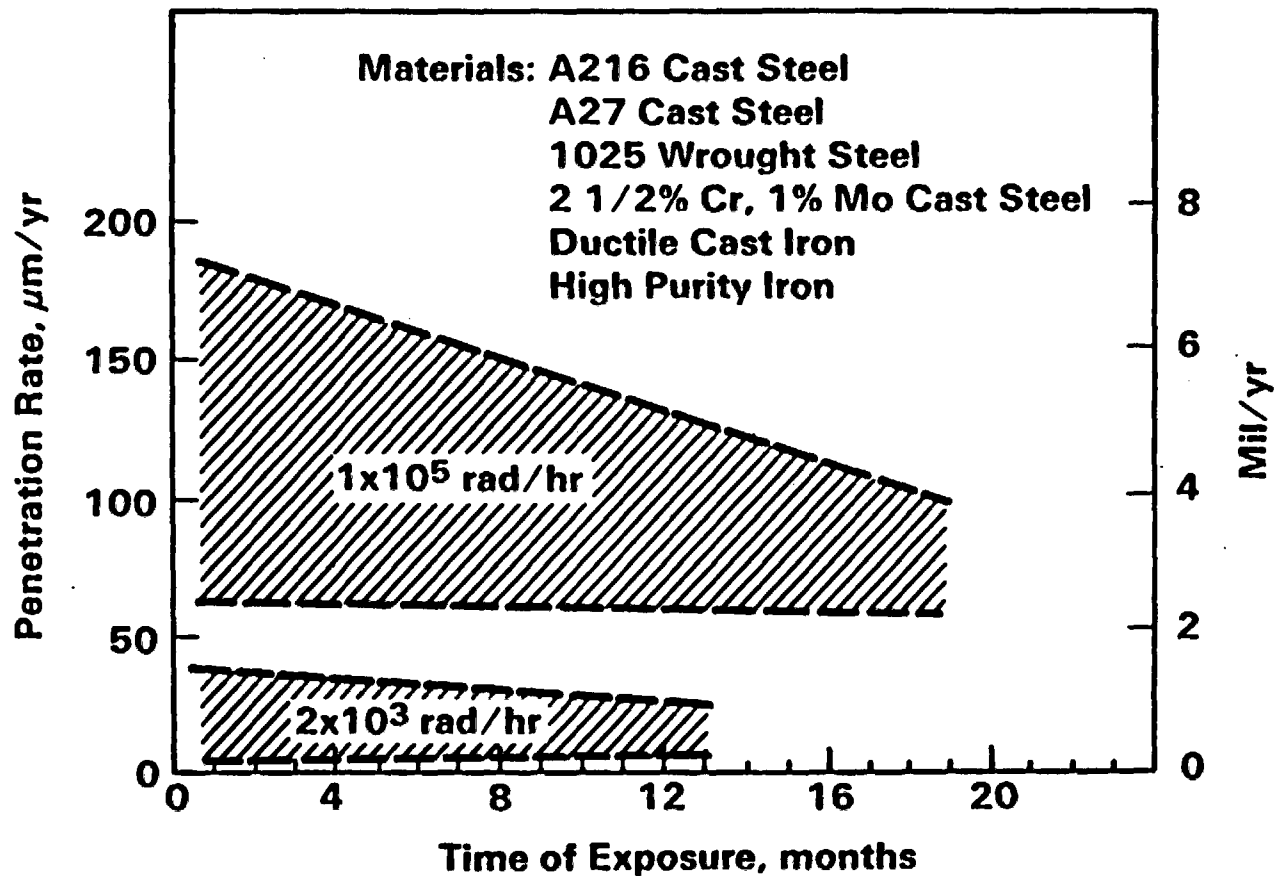
- **Forms in all low-Mg brines on all ferrous materials tested**
- **Offers some degree of protection**
- **Produced by reaction of iron and water:**



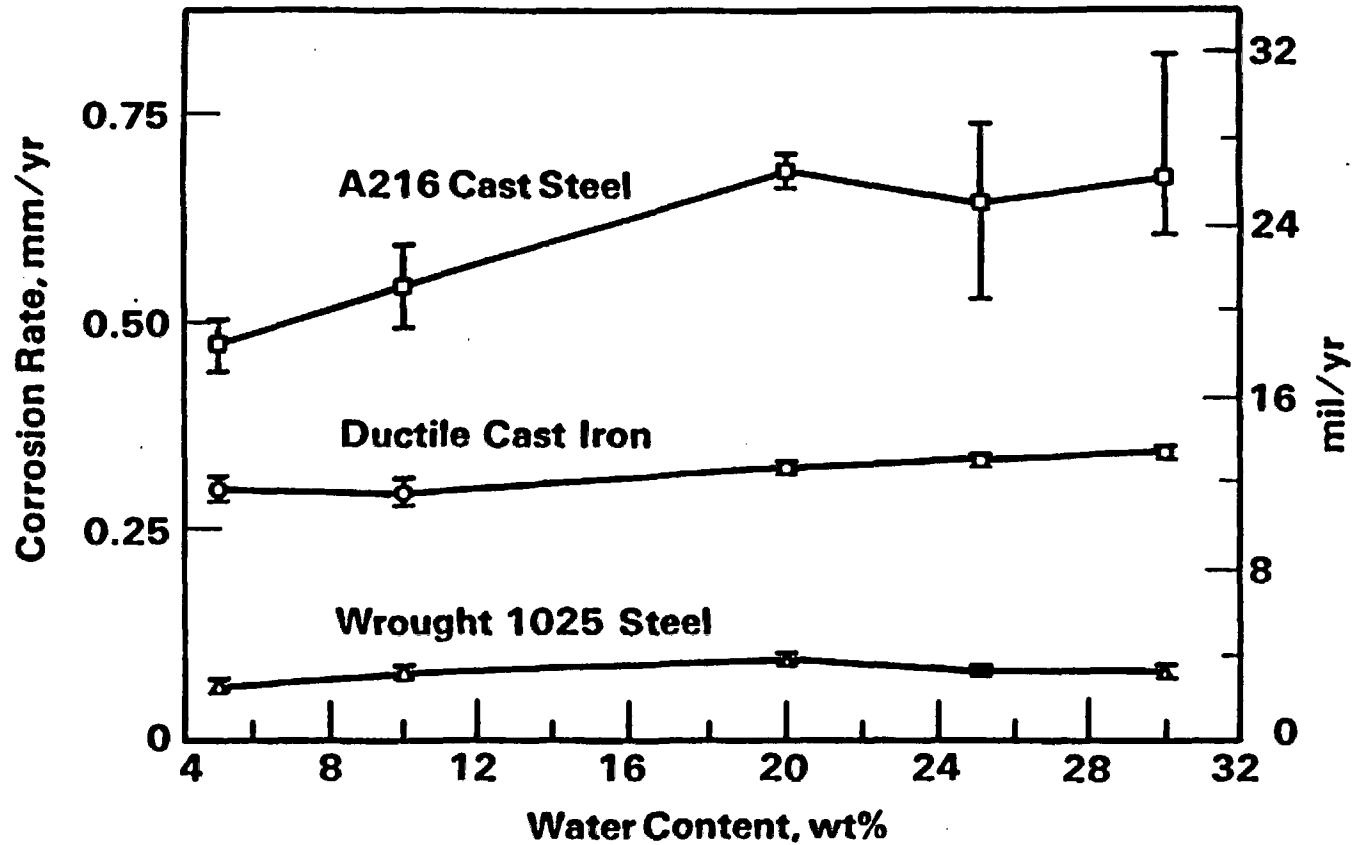
# Irradiation-Corrosion of Ferrous Materials in Permian Basin Brine No. 2 at $1 \times 10^5$ Rad/Hr, $150^\circ\text{C}$



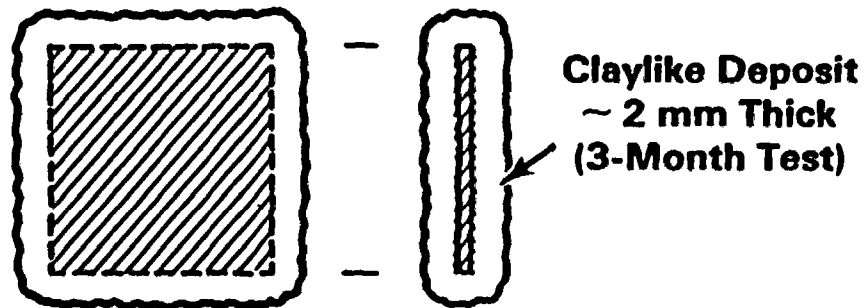
# Irradiation-Corrosion of Ferrous Materials in Permian Basin Brine No. 2 at 150°C and Either $1 \times 10^5$ Rad/Hr or $2 \times 10^3$ Rad/Hr



# Corrosion Rates of Ferrous Materials in PBB1 Salt Moistened with PBB3 Brine, 3 Months Exposure at 150°C



## Surface Deposition Found on Specimens not Forming Magnetite

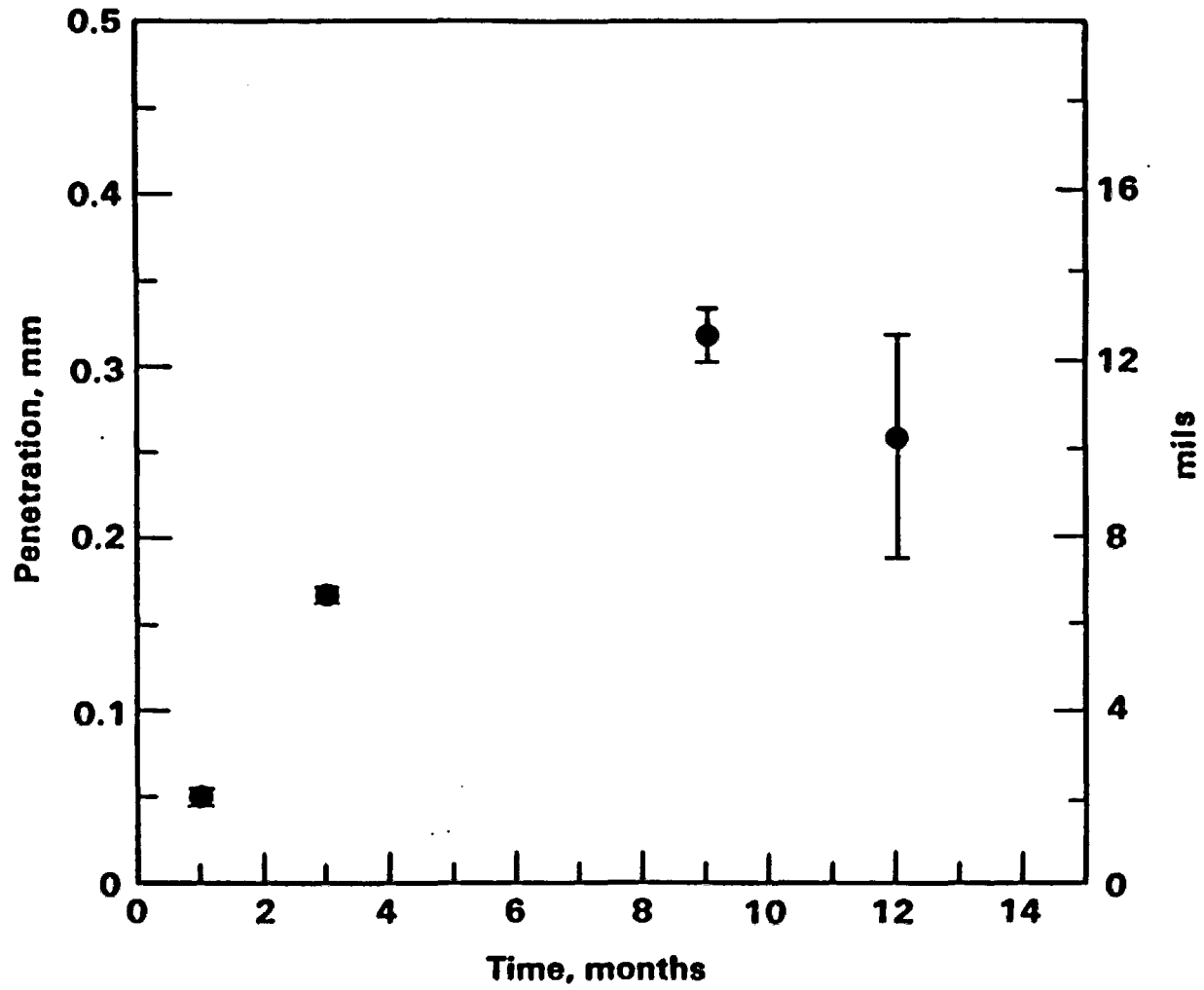


### Deposit is

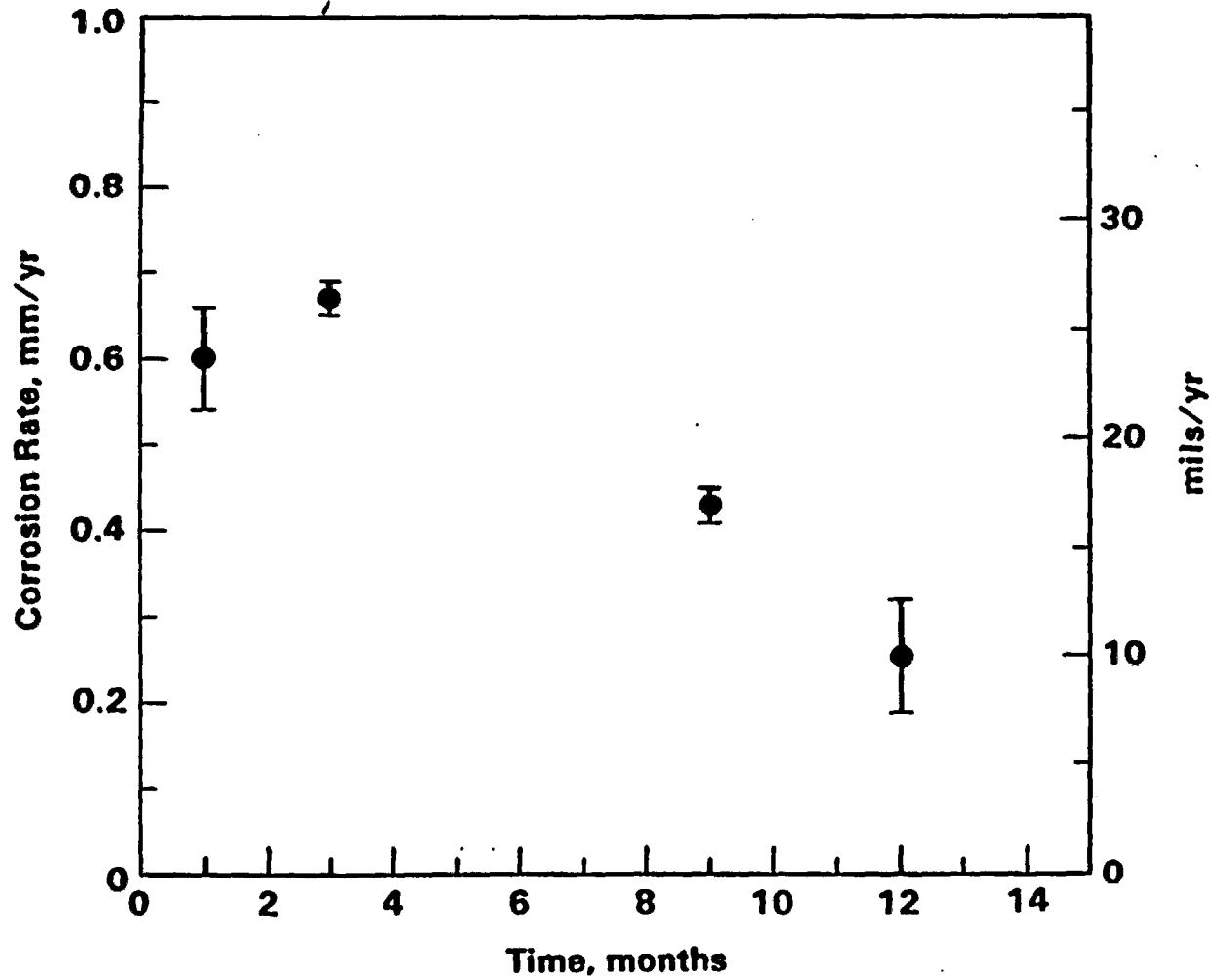
- Bluish Gray
- Not Water Soluble, Easily Rinsed From Sample Surface
- Non-Crystalline in Bulk
- Fe, Mg (OH)<sub>2</sub> on Rinsed Surface



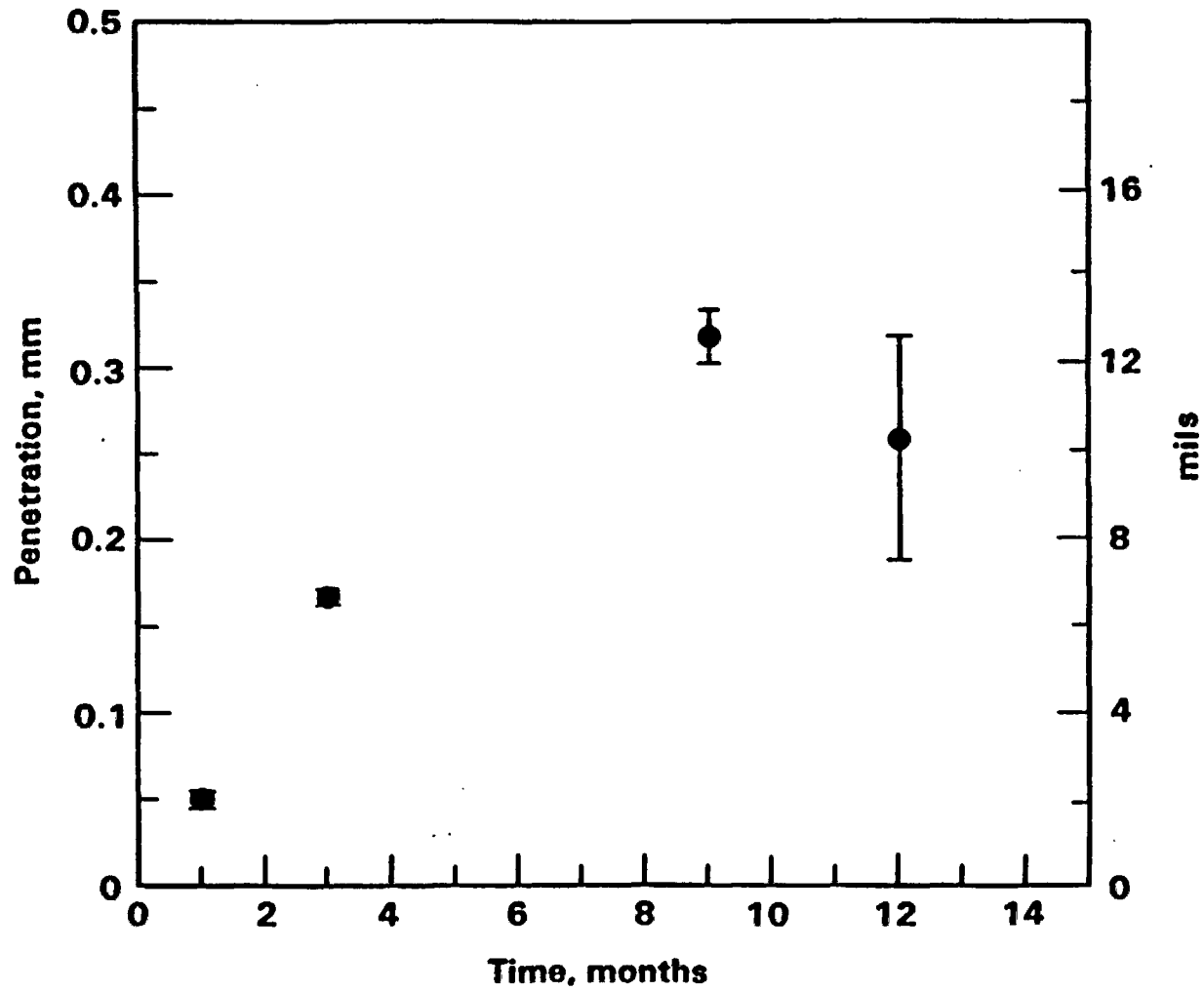
# Penetration of As-Cast A216 Steel Specimens PBB1 Salt, PBB3 Brine, 20% H<sub>2</sub>O, 150°C



**Average Corrosion Rates of As-Cast A216 Steel Specimens  
PBB1 Salt, PBB3 Brine, 20% H<sub>2</sub>O, 150°C**



**Penetration of As-Cast A216 Steel Specimens  
PBB1 Salt, PBB3 Brine, 20% H<sub>2</sub>O, 150°C**





FBAB: JF Kircher *OGW 1/22/86*  
 RK Kennedy *for RKK 1/22/86*  
 WA Carbiener *1/23/86*

Project Number 25102(b)

Internal Distribution

BATTELLE Project Management Division

Date January 22, 1986  
 To J. F. Kircher  
 From G. E. Raines *GER*  
 Subject Comment on NRC Report Reviewing Waste Package Program

WA Carbiener G Jansen  
 RK Kennedy SB Ludwig  
 RN Helgerson GE Raines  
 JA Carr **ONWI Files**  
 DA Waite SAD Files  
 LB

The semi-annual report, NUREG/CR-2482, Vol. 9, "Review of DOE Waste Package Program", for April, 1985 - September, 1985 prepared by Brookhaven National Laboratory contains a grossly misleading and incompetent review of the radionuclide inventories reported in the EAs. This review is Section 7.0 starting on page 40 of the Brookhaven report. The review claims in the first paragraph that "--inventories reported within each salt EA are not internally consistent and, therefore, the conclusions drawn regarding controlled release are open to question." The rest of the section attempts to illustrate these "inconsistencies". They make the assumption that all of the carbon, selenium, etc. in the waste is carbon-14, selenium-79, etc. ignoring the stable element content and then state that our calculations of solubility-controlled release are not conservative (because the release is diluted with the stable element). They then recognize what we are doing and then claim that our mass inventories are undocumented. Jansen's waste package topical, which goes into detail on calculation of inventories including stable elements, was referenced. They claim that a more conservative approach would be to assume that all of the carbon released was carbon-14, etc. This is obviously true but so unrealistic as to be ridiculous. They also claim that it is not possible to reproduce our solubility-limited release calculations. The calculations can be reproduced by using the stated total quantity of each element (and if doubted, examine the reference). In addition to the main thrust of their review, statements like "Presumably this design is for---" are made. We clearly state in the same section of the EAs what the design covers.

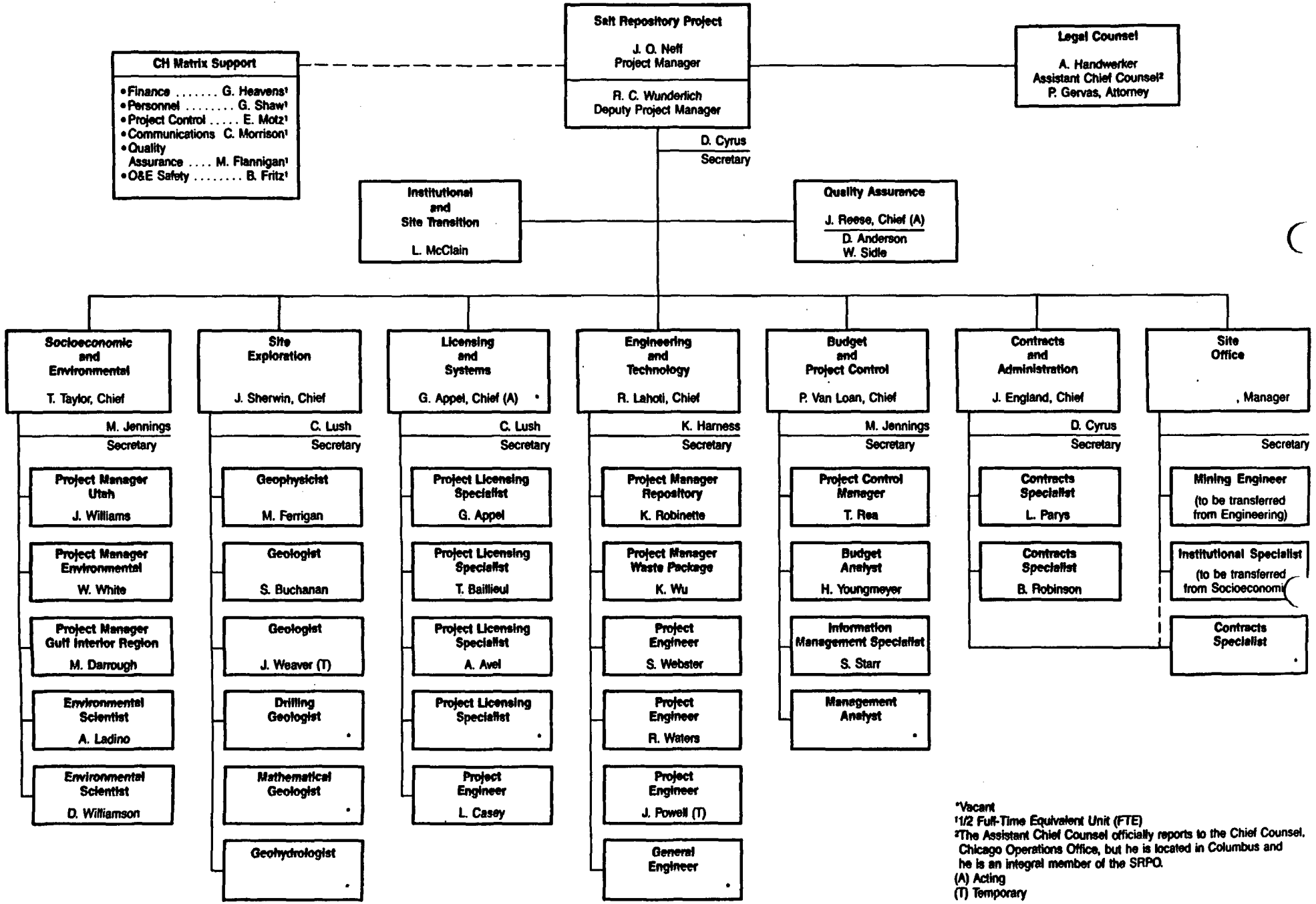
L-012786-004

I do not understand how such reviews can help either the NRC or DOE.

GER:rb

cc: K.K. Wu (SRPO)  
 L.A. Casey (SRPO)  
 J.O. Neff (SRPO) (3)

**U.S. DEPARTMENT OF ENERGY  
CHICAGO OPERATIONS OFFICE  
SALT REPOSITORY PROJECT OFFICE**



\*Vacant  
 ¹1/2 Full-Time Equivalent Unit (FTE)  
 ²The Assistant Chief Counsel officially reports to the Chief Counsel, Chicago Operations Office, but he is located in Columbus and he is an integral member of the SRPO.  
 (A) Acting  
 (T) Temporary

## SRPO PRIORITIES FY 86

- COMPLETE THE ENVIRONMENTAL ASSESSMENTS
- COMPLETE PLANNING FOR SCP AND INITIATE WRITING
- DEVELOP A SITE TRANSITION PLAN
- PROVIDE DOE PRESENCE AT THE SELECTED SALT SITE
- INITIATE LAND ACQUISITION
- ENSURE FULLY OPERATIONAL QA PROGRAM PRIOR TO INITIATION OF SCP DEVELOPMENT
- INITIATE BPHD/ONWI CONTRACT RECOMPETITION
- ENSURE FULLY OPERATIONAL SRP MANAGEMENT SYSTEMS - BASELINE MANAGEMENT SYSTEM, SEMP, TDMS, ETC.
- COMPLETE ENVIRONMENTAL AND SOCIOECONOMIC MONITORING AND MITIGATION PLANS
- INITIATE ADVANCED CONCEPTUAL DESIGN FOR REPOSITORY
- EXPAND INTERACTIONS/WORKSHOPS WITH THE NRC
- COMPLETE REGULATORY/STATUTORY COMPLIANCE PLANS
- BEGIN FINAL DESIGN FOR THE EXPLORATORY SHAFT FACILITY
- REVISE GRANT AGREEMENT FOR RECOMMENDED SALT SITE
- COMPLETE SURFACE BASED TEST PLAN
- INITIATE FIELD WORK AT RECOMMENDED SITE AND DECOMMISSION OTHER SITES

KEY MILESTONES - SALT REPOSITORY PROJECT

	<u>OGR SEPT GUIDANCE</u>	<u>SRP CURRENT PLAN</u>
ISSUE FINAL ENVIRONMENTAL ASSESSMENT	12/20/85	4/20/86
PRESIDENTIAL APPROVAL OF SITES TO BE CHARACTERIZED	2/86	6/20/86
ISSUE SITE CHARACTERIZATION PLAN TO PUBLIC	12/86	4/87
START ESF SITE PREPARATION	2/87	9/87
START EXPLORATORY SHAFT CONSTRUCTION	7/87	6/88
START LA WASTE PACKAGE DESIGN	6/87	9/87
START LA REPOSITORY DESIGN	2/88	10/88
COMPLETE FIRST EXPLORATORY SHAFT	1/89	9/89
START EXPLORATORY SHAFT IN-SITU TEST PROGRAM	4/89	11/89
COMPLETE EXPLORATORY SHAFT IN-SITU TESTING FOR DRAFT ENVIRONMENTAL IMPACT STATEMENT	12/89	7/90
COMPLETE LA REPOSITORY DESIGN	5/90	1/91
COMPLETE LA WASTE PACKAGE DESIGN	5/90	8/90
ISSUE DRAFT ENVIRONMENTAL IMPACT STATEMENT	6/90	8/91
COMPLETE EXPLORATORY SHAFT TESTING FOR LA	11/90	5/91
ISSUE FINAL ENVIRONMENTAL IMPACT STATEMENT	12/90	11/91
ISSUE SITE SELECTION REPORT	1/91	12/91
PRESIDENTIAL SITE RECOMMENDATION	3/91	3/92
SUBMIT LICENSE APPLICATION TO NRC	5/91	6/92

ALL DATES ASSUME THE FIRST DAY OF THE MONTH UNLESS OTHERWISE SPECIFIED.

CRITICAL PATH ASSUMPTIONS FOR SRP CURRENT PLAN

- PERMIT RELATED SITE WORK PRECEDES THE FINAL SBTP. FIELD WORK WILL PROCEED AT RISK PENDING NRC/STATE REVIEW AND COMMENT ON TEST PLAN.
- THREE OR FOUR DRILL RIGS EACH ARE USED FOR STRAT HOLES, DEEP HYDRONESTS AND SHALLOW HYDRONESTS. EAs ASSUME THAT ONE DRILL RIG EACH IS USED.
- STATE AGENCY DISCUSSIONS WILL BEGIN WITH THE SITE RECOMMENDATION.
- METEOROLOGICAL TOWER IS INSTALLED BEFORE THE FINAL AGENCY DETERMINATION.
- UNDERGROUND TEST DATA FOR THE EIS INCLUDES SHAFT AND UNDERGROUND AREA 2 (CONNECTING DRIFT) ONLY.
- THE SCP CONSTRAINS ONLY SHAFT SINKING.
- NO NON-FLOWDOWN STATE PERMITS ARE ACQUIRED.
- PERMIT APPLICATION DURATIONS DO NOT ALLOW TIME FOR ADJUDICATION HEARINGS.
- REGIONAL DATA IS USED FOR AIR QUALITY PERMIT.
- EXISTING HYDROLOGY DATA IS USED FOR THE SOLID WASTE AND WATER QUALITY PERMITS.
- NO DEDICATED SHAFT MAPPING.
- START OF SHAFT SINKING IS DEFINED AS EXCAVATING BELOW 100'.
- LAND ACQUISITION IS EXPEDITED TO SUPPORT FIELD WORK.
- NO FULL LINER TO SHAFT BOTTOM IS INCLUDED IN THE SCHEDULE BUT CONTINGENCY MONEY IS INCLUDED IN THE BUDGET.



SALT REPOSITORY PROJECT CRITICAL PATH ANALYSIS

FY 1986				FY 1987				FY 1988				FY 1989				FY 1990				FY 1991				FY 1992			
1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr				

