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MEMORANDUM FOR: Malcolm R. Knapp, Chief
Geotechnical Branch
Division of Waste Management

FROM: John Trapp, Richard Lee, and Fred Ross
Geotechnical Branch
Division of Waste Management

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SUBJECT: TRIP REPORT - PERMIAN BASIN CORE EXAMINATION MEETING

On August 5 - 9, 1985 members of the NRC staff and their contractors met with DOE at the Texas Bureau of Economic Geology Offices in Austin, Texas to examine the core obtained from DOE drilled wells in the Palo Duro Basin.

While the primary purpose of this meeting was to obtain familiarization with the stratigraphy and lithofacies of the Permian evaporite sequences, additional discussions were conducted on other stratigraphic units as well as in the structural framework of the Palo Duro Basin, dissolution phenomena groundwater flow, geochemistry, geomechanical properties and the status of ongoing investigations.

Enclosed with this report is a copy of the signed meeting minutes, the agenda and list of participants. Handouts for this meeting were quite extensive so they have not been included, however copies are available for review from the DCC and in R. Johnson and J. Trapp's office.

/s/
John Trapp, WMGT

/s/
Richard Lee, WMGT

/s/
Fred Ross, WMGT

Enclosure:
As stated

OFC	:WMGT	kd	:WMGT	RL	:WMGT	fmr	:	:	:	:
NAME	:JTrapp	JT	:RLee		:FRoss		:	:	:	:
DATE	:85/08/28		:85/08/30		:85/08/29		:	:	:	:

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NRC/DOE PERMIAN BASIN CORE EXAMINATION SUMMARY

Date/Location

August 5-9, 1985
Texas Bureau of Economic Geology Offices
Austin, Texas

Attendees/Organizational Affiliation

A list of attendees and their organizational affiliations is attached as Enclosure 1.

Background/Facts

The primary purpose of this data review was to obtain a familiarization with the Palo Duro Basin stratigraphy and lithofacies through core examination and presentations of interpretations of core, logs, and cross sections. Also discussed were structural framework core observations and interpretations relating to dissolution, groundwater flow and engineering properties. An overview was given of ongoing work being conducted by Stone & Webster and the Texas Bureau of Economic Geology which aided in discussions of future data reviews and technical meetings. The agenda (Enclosure 2) gives a more detailed listing of the topics discussed and the activities during the course of this data review. Enclosure 3 consists of all of the handouts and copies of viewgraphs presented; each package is identified by the person making the presentation and date shown on the agenda. A representative of the Governor's Office of the State of Texas (see Enclosure 1) was present during the first day and did not make any observations for this summary.

Observations

The NRC general observations are given below. More detailed observations on geology, hydrogeology, rock mechanics, and quality assurance are included in the review sheets completed by NRC during the course of the data review and will be transmitted to SRP in a follow-up package. No specific geochemistry observations were made.

1. Interactions such as this core examination serve as one kind of excellent mechanism to transfer current information (data interpretations, methods, etc.) on SRP programs to NRC in a timely fashion. Such information transfer and exchange of ideas is greatly enhanced by including all the key investigators involved with the work as was done for this data review. The ability of NRC to comment in a timely manner to SRP on the various plans being developed is dependent on keeping current with the work in certain key technical areas. NRC noted that keeping up with current work using published reports in some cases is difficult and large time lags have and do exist for release of subcontractor reports (with their QA review completed) due to the additional technical review process.

2. Detailed lithologic logging of the DOE core by TBEG appears to be of extremely high quality.

3. Correlation of major units between DOE wells appears to be well established and documented by TBEG.

4. Correlation of minor units between DOE wells by TBEG appears reasonable. Continued efforts to strengthen the correlations by using geophysical logs from intermediate petroleum exploration wells is encouraged.

5. The core appears to be well treated within the TBEG facilities. Storage appears to be well organized and preservation techniques appear to be adequate.

6. The characteristics of the San Andres salts are such that considerable variation in their properties on the size scale of a repository is expected. Vertical and lateral lithologic variations probably will be present.

7. The preliminary investigation of the Dockum Group appears to be well thought out and focused. Information developed by this study should be integrated with hydrologic and structural geologic studies by others.

8. The structural framework of the basin is well known with respect to major structures. Minor structures are not as well known.

9. Significant work still remains to be done to understand dissolution phenomena. Problems still remain on understanding the relationship of interior to peripheral dissolution, timing of dissolution episodes, relationship to structural features, dissolution rates, and effects on waste isolation.

10. SWEC and TBEG are preparing several types of lithologic and geotechnical logs based on different classification schemes. A method of relating all classification schemes to each other should be developed.

11. Basin-wide correlations of individual stratigraphic units, based on the cyclicity interpreted from the core, provides a powerful means of interpreting the stratigraphic details between widespread drill holes. Further resolution of the extent and importance of sabkha-like versus marine influences would enhance the ability to predict the likely magnitude of local anomalies.

12. The DOE has not published information on the Quaternary Blackwater Draw formation, an eolian-lacustrine deposit. The extent and characteristics of this formation are important to the resolution of issues such as Quaternary dissolution and warping and ages of latest movement on faults. Information on this unit is also needed for foundation engineering.

13. The existing seismic network, as described in this meeting, does not appear to be properly deployed to accurately locate events within potentially seismogenic areas such as the Oldham Nose, Matador Arch, Amarillo Uplift and eastern New Mexico.

14. The nature and extent of fracturing that may have been induced by interior dissolution needs to be determined and its influence on hydrologic properties of strata above the base of dissolution assessed.

15. The geophysical logs appear to be sufficient to aid in stratigraphic correlations and geotechnical studies. The influence of halite cement on the values of geotechnical parameters so obtained is not yet fully understood.

16. At present, there is no document that synthesizes and integrates the stratigraphic, structural and hydrogeologic research by all DOE contractors.

17. With respect to quality assurance, SRP should improve their overview of TBEG work in the areas of surveillance, records management, TBEG QA organization, and supplier control. It is believed that these concerns would be surfaced and corrected in a timely manner if the SRP implemented a planned, disciplined program of surveillance and monitoring of work activities as well as the audit which is conducted annually.

18. NRC Rock Mechanics/Design staff and contractors observed core custody, core storage, and protection procedures pertinent to several borings within the Palo Duro Basin. In addition discussions with representatives of SWEC and RE/SPEC addressed such topics as core protection, rationale for selection of samples for testing, representativeness of samples, sample transportation, type of tests and documentation of core selection, handling procedures, test procedures and results. Observations relative to these activities will be part of the follow-up material to be provided by NRC.

19. NRC, SRP, ONWI, and TBEG discussed ideas for future interactions in the areas of geology, hydrogeology, geochemistry, and rock mechanics. NRC and SRP discussed the advantages and disadvantages to having large meetings covering many topics/issues versus meetings more focused on issues and the information pertinent to understanding the issue. NRC in general favors the more focused approach to interactions. The following summarizes NRC's current ideas on interactions for fiscal year 1986:.

Geology:

1. The only presently scheduled interaction between SRP and NRC is the surface based test plan. The NRC needs to discuss with the SRP contact the general philosophy which will be used in preparation of this plan prior to NRC and SRP setting a firm date for interaction.

2. Specific topical meetings are needed in the fields of structural geology, near surface stratigraphic units and dissolution.

3. The specific topical meetings while focused must be broad enough so that all disciplines which have input are represented.

Hydrogeology:

The following are topics to be included in one or more interactions.

1. Hydrogeologic conceptual model(s) - integration of current interpretations of all aspects of the existing data base including structure, stratigraphy, hydrochemistry, isotopes, and hydrogeologic properties.

2. Explanation and examination of hydrochemical and isotopic data.

3. Core data - how will core data be used to develop hydrogeologic properties?

4. Potentiometric head data

   a) error estimation
   b) fluid density variations with respect to head

5. Hydrogeologic properties of evaporite section including unit 4 dolomite.

Geochemistry:

The most immediate need is to read a draft of the geochemistry program plan when it becomes available. This will provide a better understanding of the geochemistry program which will allow NRC and SRP to more intelligently plan technical meetings as soon as possible.

Rock Mechanics:

Between now and January 1986, three interactions have already been agreed to by NRC and SRP. These are for exploratory shaft construction and sealing, repository design, and in situ testing. No additional interactions are needed during this time period.

20. NRC stressed the importance of having staff members, while assigned to the NRC on-site representative, read and understand program plans and detailed hierarchies (milestones charts) being developed by SRP/ONWI. This background should be very useful in mutually planning out an effective and timely series of interactions.

21. The NRC is of the opinion that this data review was extremely useful to their understanding of the present basis of stratigraphic studies in the Palo Duro Basin and has provided an excellent springboard from which other more focused topical workshops can be developed. The open discussion by all parties, especially in the core examination area, was extremely helpful. The NRC wishes to thank all personnel involved, and especially TBEG for hosting this review.

Agreements and Open Items

1. NRC and SRP agreed to further discuss ways (in addition to those currently in place) for enhancing the transfer of new interpretative information. A possibility suggested by the NRC is to open-file draft reports produced by contractors and subcontractors.

2. NRC will continue discussions with SRP on the topics, schedules and most effective approach to future interactions.

3. NRC will send SRP follow-up material within one month. This material will consist of the specific observations and any concerns developed during the meeting.

Robert L Johnson 8/9/85
Robert L. Johnson, NRC/WMRP

Jo-Ann Sherwin 8/9/85
Jo-Ann Sherwin, DOE/SRP

John Trapp 8/9/85
John Trapp, NRC/WMGT

Enclosure 1

Participants

NRC Core Workshop
August 5-8, 1985
Austin, Texas

Sam Panno	DOE HQ/Weston	
Jo-Ann Sherwin	DOE-SRPO	
Steve Frishman	Office of the Governor, Texas	
Don McReynolds	High Plains Water District	806/762-0181
Dick Berry	NRC/Lawrence Livermore	
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Robert Cummings	NRC/Engineers International	602/884-8818
Jaak Daemen	NRC/University of Arizona	602/621-2501
Claudia Hackbarth	NRC	301/427-4639
Dale Hedges	NRC	
John Imse	NRC/Weston Geophysical Corp.	617/366-9191
Gary K. Jacobs	NRC/ORNL	615/576-0567
Robert Johnson	NRC/WMPP	301/327-4785
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Fred Ross	NRC/Williams & Associates	
Jack Sharp	NRC/Williams & Assoc./Univ. Texas	
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Tilak (Teek) Verma	NRC/Columbus	
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Gerry Winter	NRC/Williams & Associates	
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Owen E. Swanson	ONWI	
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Paul Senseny	RE/SPEC	605/394-6400
Tom Lamb	SWEC	
John Peck	SWEC	
Philip J. Murphy	SWEC	617/589-2173
Ev Washer	SWEC	

Ed Bingler	TBEG	
Roy T. Budnik	TBEG	
Dow Davidson	TBEG	
Alan Dutton	TBEG	
Steve Fisher	TBEG	
Mike Fracasso	TBEG	
Thomas C. Gustavson	TBEG	
Susan Hovorka	TBEG	
David A. Johns	TBEG	
Charles Kreitler	TBEG	
H. S. Nance	TBEG	
Steve Ruppel	TBEG	
Jerry Wermund	TBEG	
Margaret Hart	Texas Dept. of Water Resources	512/463-7797

Enclosure 2

AGENDA
PERMIAN BASIN CORE EXAMINATION

August 5

1:00 p.m.	Introductions	J. Sherwin (SRPO) E. Bingler (TBEG)
1:30 p.m.	Opening remarks and expectations of meeting.	J. Sherwin (SRPO) J. Trapp (NRC) R. Johnson (NRC) ~~TBD (SWEC)~~ Steve Swindell J. Peck (SWEC)
2:00 p.m.	Overview of the Palo Duro Basin, current understandings of structural and sedimentological history.	P. Murphy (SWEC) Steve Ruppel TBEG
3:00 p.m.	Origin of the Permian evaporites, with emphasis on LSA 4.	~~TBD (SWEC)~~
4:00 p.m.	Core storage/handling/cur Palo Duro Basin stratigraphic section, locations of DOE test holes, regional correlations of major units, major hydrostratigraphic divisions.	Jim Davidson ~~(Texas)~~ (TBEG) S. Hovorka (TBEG)

August 6

8:15 a.m.	Reconvene	
8:30 a.m.	Geologic logging of DOE drill holes, detailed logs of repository horizon (Lower San Andres Unit 4), geologic cross-sections, correlation of formations and units, description of rocks present in the core, (incl. mineralogic, petrologic, geochemical characteristics), with emphasis on evaporite section and host salt beds.	S. Hovorka (TBEG)
9:30 a.m.	Description of features noted in core from "dissolution wells," regional implications	C. Kreitler (TBEG)
10:00 a.m.	Presentation on available material related to DOE drill hole logs: lithologic logs; geophysical logs; applicable reports and data; correlations of geophysical logs with core; applications of geophysical logging to stratigraphic analysis.	~~S. Adams (ONWI)~~ T. Lamb (SWEC)
11:00 a.m.	Development of geotechnical logs based on mechanical properties, geophysical logging and visual core logging-correlated with test results performed on drill core; index of laboratory testing for mechanical properties of rock mass; in-situ stress measurements.	T. Lamb (SWEC) ~~TBD~~ (RE/SPEC) P. Senseny
12:00 - 1:00 p.m.	LUNCH	

PERMIAN BASIN CORE EXAMINATION
PLANNED AGENDA
(Continued)

August 6 (Continued)

1:15 p.m.	Reconvene at Balcones Research Center and proceed to core repository. Core examination: Grabbe #1 J. Friemel #1 Zeeck #1 - LSA Unit 4 One dissolution well - TBD	
	* There is not enough table space for all listed core sections to be laid out simultaneously; over two days all core will be available.	
	Concurrent Quality Assurance discussions	

August 7

8:15 a.m.	Reconvene at Balcones Research Center Proceed to core repository.	
8:30 a.m.	Core examination continues. Tour of TBEG research and core storage/handling facilities	
12:00 - 1:00 p.m.	LUNCH	
1:15 p.m.	Review of status of Palo Duro Studies; published references; on-going work; data availability.	TBEG (Gustavson, Kreitler) SWEC (Washer, Murphy, Lamb) ONWI SRPO (Sherwin)

August 8

8:15 a.m.	Propose topics/agenda for Permian Basin data review.	
10:15 a.m.	Prepare summary of meeting.	J. Sherwin (SRPO) J. Trapp (NRC)

LIST OF SRP EXPECTED PARTICIPANTS

DOE

J. Sherwin

ONWI

W. Newcomb
C. Kuntz
H. Hume
A. Funk
S. Adams

SWEC

E. Washer
J. Peck
P. Murphy
T. Lamb

TBEG

E. Bingler
S. Hovorka
D. Davidson
C. Kreitler
S. Ruppel
S. Nance
D. Johns
S. Fisher
R. Budnik
T. Gustavson
A. Dutton
M. Fantasso

NRC

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R. Williams
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J. Parring
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R. Cummings
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C. Hackbarth
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