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FEB 18 1993


Lake H. Barrett, Acting Director, Civilian Radioactive Waste Management,  
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FOREIGN TRIP REPORT

Enclosed please find a revised version of the report for travel to France by Robert Levich during the period November 6-18, 1992. It has come to Mr. Levich's attention that all superscripts and subscripts (including chemical formulae), compound letters (including mathematical symbols), and foreign letters (including accents) were incorrectly shown in the report.

This error was due to the installation of new printers at the Yucca Mountain Site Characterization Project Office (YMPO) which are not completely compatible with the current YMPO computer system and, therefore, did not correctly reproduce the symbols referred to above. We apologize for any inconvenience or confusion this may have caused.

If any recipient has any questions or seeks any information related to the enclosed report, please contact Robert A. Levich at (702) 794-7946.

*for*   
Carl P. Gertz  
Project Manager

YMP:RAL-2496

Enclosure:  
Foreign Trip Report

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FEB 18 1993

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## FOREIGN TRIP REPORT

Name: Robert A. Levich

Affiliation: Yucca Mountain Site Characterization Project Office, Las Vegas

Dates: November 6 - 18, 1992

Destination: Paris, France

Purpose:

1. To attend the SEDE-'92 Workshop, "Paleohydrogeological Methods and their Applications for Radioactive Waste Disposal" in Paris, France. The Workshop was organized by the Organization for Economic Cooperation and Development (OECD)/ Nuclear Energy Agency (NEA) Coordinating Group on Site Evaluation and Design of Experiments (SEDE), and was hosted by the NEA.
2. To represent the U.S. Department of Energy (DOE) and lead the U.S. Delegation to the third SEDE Coordinating Group Meeting in Paris. The U.S. Delegation consists of representatives of DOE's Office of Civilian Radioactive Waste Management (OCRWM), the U.S. Nuclear Regulatory Commission (NRC) (which was not represented at this meeting), and DOE's Waste Isolation Pilot Plant (WIPP).
3. To meet with technical staff from France's Agence Nationale pour la Gestion des Déchets Radioactifs (ANDRA) at Fontenay-aux-Roses and discuss the development of possible technical cooperative activities between ANDRA and DOE's Yucca Mountain Site Characterization Project (YMP).
4. To meet with the staff of the OECD/NEA at their offices on Iles St. Germaine to discuss current and proposed NEA activities.

Commitments:

1. I committed that DOE would consider supporting and sending a participant to a proposed SEDE-sponsored Workshop in May, 1993 in Seville, Spain on "Hydraulic Testing and Groundwater Sampling Methodologies in Argillaceous Rocks."
2. I committed that DOE would send Charlie Voss or a more appropriate new representative to a proposed meeting in January or February of 1993, of the SEDE Core Group to consider future programs for SEDE.
3. I committed to host one or more visits by ANDRA technical staff to visit the offices of the YMP and the Yucca Mountain site during 1993.

ENCLOSURE

Recommendations:

1. I recommend that OCRWM continue to participate in the SEDE Coordinating Group and the international workshops developed by that group. These workshops have proved of great interest to the U.S. program as well as to the entire international community, and have proved both well planned and well implemented.
2. I also recommend that OCRWM contact Henri Wallard, Director of ANDRA, and make every effort to determine whether DOE and ANDRA must develop a new bilateral agreement, separate from the DOE/CEA Agreement.
3. I recommend that OCRWM, and in particular the YMP develop technical cooperative activities with ANDRA, beginning in 1993 with meetings for the purpose of exchanging technical information and determining the most fruitful areas for closer cooperation.

Description of Travel Activities:

**I. OECD/NEA SEDE-'92 WORKSHOP**

The OECD/NEA SEDE-'92 Workshop "Paleohydrogeological Methods and their Applications for Radioactive Waste Disposal" took place at the headquarters of OECD in Paris, France on 9-10 November, 1992. It was attended by between 40 and 50 scientists representing 11 nations, the Commission of European Communities (CEC), and OECD/NEA. The Workshop consisted of 16 formal technical presentations, and 5 periods for both specific technical and general discussions. Jean-Pierre Olivier and Ned Patera of OECD/NEA opened the Workshop and Mme. Raymonde Andre-Jehan welcomed the participants to Paris on behalf of ANDRA.

Neil Chapman (Intera Information Technologies), U.K. provided the keynote address for the Workshop and developed the theme that the workshop would address the "Application of Paleohydrogeological Information to Repository Performance Assessment - Using Information from Natural Systems to Build Confidence in Performance Assessment (PA)".

- The Far Field presents the Stable Conditions in which the Near Field exists
- Credibility of Methods may be questioned because of:
  - o Use of the predominantly engineering approach to predict behavior of natural systems (not entirely appropriate)
  - o Complex coupled systems are commonly treated as linear systems
  - o Uncertainty in long-term predictions and validation
  - o Quantitative and prescriptive regulatory and numerical constraints
- Geological Frameworks for Evaluating Assessments
  - o Natural Analogues
  - o Natural Geochemical Fluxes
  - o Paleohydrology
- A good paleohydrogeological construction of the past evolution of a system is the best tool for building and presenting PA

- Conceptual Model biases design and conduct of characterization program and data collection
- There are limitations and biases to purely hydraulic models of flux
  - o Only useful for portraying broad trends
  - o No means of internal validation for long-term prediction
  - o Usually steady-state driving forces
  - o Coupled hydraulic and geochemical processes may lead to errors
- PA Risk Analysis - Difficulties of dealing with Information
  - o Time-Dependant Calculations
  - o Scenarios (great variations, e.g., glaciation, sea-level changes)
- Paleohydrogeology (P/H/G)
  - o Combined groundwater hydrology/geochemistry/isotope chemistry
  - o Compiled and related to geologic past
- Data Inputs for P/H/G
  - o Hydrochemistry
  - o Hydraulics: Flow rates/other driving forces
  - o Rock Chemistry: Fracture mineralogy, etc.
  - o Site History/Climatic History
- Inputs and Questions (P/H/G)
  - o Age
  - o Stability
  - o Unloading/compaction, tectonics, sea-level changes, ascending waters, etc.
- Assumptions
  - o Initial system conditions
  - o Processes
- Problems (with Isotope studies)
  - o Disentangling isotope data
  - o Multiple mechanisms
  - o Natural in-situ isotope production
  - o Sampling
- Outputs (Ideal) of Isotope Hydrology
  - o Identify major bodies of deep groundwater
  - o Estimate residence times and "stability" to external change
  - o Degrees of mixing and transport processes across interfaces
  - o Flow pathways and influence on evolution
  - o Zones and extent of dilution by shallow waters
  - o Transit times from surface to depth (and visa versa)
- Applications (Simple)
  - o Site suitability
  - o Evidence of stability
- Applications (Sophisticated)
  - o Natural analogue studies to test "blind" predictions
- P/H/G to Test PA Models
  - o Select definable past state of site
  - o Define parameters to be predicted "blind"
  - o Use PA models to evolve site and predict present conditions
  - o Compare to measured parameters

- Framework for Presenting and Evaluating Conditions
  - o Past behavior is indicator of future
  - o Overall rates should remain similar
  - o Range of perturbations can be defined and enveloped
  - o Future response can be illustrated
  - o Future response can be predicted
- Repository will (or may) effect Future Changes and Evolution
  - o Gas generation
  - o Thermal buoyancy
- Use of P/H/G
  - o Can act as principal support for normal evolution
  - o Can supplant many scenerios normally superimposed on base cases
  - o Does not dispose of need to analyze other scenerios (e.g., human intrusion)
- P/H/G is part of qualitative and semi-quantitative way of validation

Rick Forrester [US Geological Survey (USGS)], Denver, CO, USA, of the YMP presented a Paper on "Microfossils as Indicators of Paleohydrology and Paleoclimate" (with A. Smith).

John Stuckless (USGS), Denver, CO, USA, also of the YMP presented on "Applications of Natural Tracer Isotopes in Paleohydrologic Studies" (with Z. Peterman).

Jean-Charles Fontes (Université de Paris Sud), France, presented a Paper on "Stable Isotope Contents and Deuterium Excess as Paleohydrological Indicators".

- Clear climatic influence on both heavy isotope content and deuterium excess
- Effect is higher under arid conditions (hot and cold) than under temperate and humid climate
- Effect reflects not only temperature but type of precipitation
- Effect is more difficult to relate to paleoclimate
- Paleoclimatic shift is greater in Europe than in North America.

Sean Frape (University of Waterloo), Canada, presented a Paper on "The Use of Inorganic Geochemistry in Understanding the Origin and Evolution of Hydrochemical Flow Systems".

- Geochemical parameters have a limited use in paleohydrology studies and should be supported by stable and/or radiogenic isotope analyses
- Evolutionary and mixing plots are useful provided that:
  - o end members can be found
  - o no extremes of H<sub>2</sub>O/rock interaction, exchange, etc. have occurred
- As age prediction tools, geochemical parameters are relative or indirect and dependent on rates of reaction (kinetics).

Incorporation of reaction kinetics as indirect dating tools is at a very early stage in development.

Adrian Bath (British Geological Survey), UK presented a brief discussion on mineralogy used for P/H/G.

Pierre Toulhoat [Commissariat à l'Énergie Atomique (CEA) Centre d'Études Nucléaires (CEN)], France, discussed "Chemical Evolution of Deep Groundwaters in Granites: Information Acquired from Natural Systems" (with C. Beaucaire, G. Michard, and G. Ouzounian).

- In deep groundwaters most major elements are controlled by secondary mineral precipitation:
  - o Na by low temperature Albite
  - o Ca by Laumontite or Prehnite
  - o K by Andularia
  - o Mg by Chlorite
- Major and trace elements control mechanisms and predictions are established and validated for deep groundwaters
- Trivalent and tetravalent elements are controlled by particles and concentration may be difficult to address
- Uncertainties remain

Yasuhisa Yusa [Power Reactor and Nuclear Fuel Development Corporation (PNC)], Japan, discussed "Geological and Geochemical Indicators of Paleohydrogeology in Tono Uranium Deposits, Japan".

- Uranium deposit at Tono is an analogue of Geological Isolation System
- Tono is the largest Sandstone-type uranium deposit in Japan and is developed in horizontally layered Mio-Pliocene sediments overlying granitic rocks
- Tono contains In-situ research facilities at a depth of 130-150 m
- Used for estimating paleohydrogeological properties and variations
- Climate is estimated by use of plant fossils
- Groundwater chemistry:  $\text{Na}^+\text{HCO}_3^-$  dominates; origin is meteoric water
- Local topography and geology controls near-surface water flow

John Stuckless (USGS), USA, reported on "Isotopic Studies of Cavity Filling and Fracture Coating Minerals as an Aid to Understanding Paleohydrology, Yucca Mountain, Nevada, USA" (with Z. Peterman, B. Marshall and J. Whelan).

Runar Blomqvist (Geological Survey of Finland), Finland, discussed "Crustal Rebound-Related Groundwater Flow and Calcite Formation in the Crystalline Bedrock of the Fennoscandian Shield: New Observations from Finland" (with P. Vuorela, P. Nissinen, T. Ruskeeniemi, S. Frape and M. Ivanovich).

- Isotopic studies of fracture calcites from crystalline bedrock from the Fennoscandian Shield in Finland, which included  $^{14}\text{C}$ ,  $^{13}\text{C}$ ,  $^{18}\text{O}$ ,  $^2\text{H}$ ,  $^{234}\text{U}/^{238}\text{U}$  activity ratios and  $^{87}\text{Sr}/^{86}\text{Sr}$  indicate that times of fast crustal rebound are likely to be hydrogeologically active periods in the surficial parts of the crust

Denis Bottomly [Atomic Energy Control Board (AECB)], Canada, reported on "Application of Paleohydrogeological Evidence to Investigations of Potential Spent Fuel Repository Site: Evidence from the Isotopic Composition of Fracture Calcites".

- Carbon and oxygen isotopic shifts from samples of fracture calcites from the Chalk River Pluton were used, along with supporting chemical and isotopic information, to determine the major paleohydrogeologic events in the history of the Chalk River Pluton, as well as to identify relatively permeable fractures from those that have remained tight over time

Andrew Campbell (New Mexico Tech), Socorro, NM, USA, presented "An Investigation of Paleo-recharge at the WIPP Site, New Mexico: Stable Isotopic Study of Soil Water" (with R. Vanlandingham and F. Phillips).

- Evidence of recharge through the vadoze zone is small but quantifiable
- Water in the Rustler Formation does not have a stable isotope composition which precludes it from being modern recharge

Doug Stevenson [Atomic Energy of Canada Limited (AECL)], Canada presented a Paper by T. Chan and M. Gascoyne, "Comparison of Numerically Modelled Groundwater Residence Time with Isotopic Age Data".

- At URL location, salinity increases with depth
- Shallow waters are modern fresh recharge and < 10,000 years old
- Moderate depth waters are low temperature, > 10,000 years old, and represent Pleistocene recharge
- Deep waters are saline and oxygen isotopes indicate they were formed at higher temperatures during pre-Pleistocene time

Manfred Wolf (GSF - Institut für Hydrologie), Germany discussed "Isotopic-Hydrological Study of Groundwaters from Overlying Rocks of the Asse Salt Anticline, Germany" (with H. Batsche, W. Rauert, P. Trinborn, C. v. Stempel and K. Klarr).

- Isotope-hydrological investigations are basic data for model calculations regarding the groundwater flow regime and possible pollutant transport around the Asse repository site
- Shallow groundwaters show same  $^2\text{H}$  and  $^{18}\text{O}$  values as recent precipitation, circulate to depths of 150 - 200m and are generally less than 2000 years old
- Medium deep groundwaters circulate to depths of ca. 700m, show  $^2\text{H}$  and  $^{18}\text{O}$  values similar to shallow groundwater and are mostly free of  $^3\text{H}$
- Deep groundwaters lie below a depth of 700m and are characterized by higher values of  $^2\text{H}$  and  $^{18}\text{O}$

Peter Wikberg (SKB), Sweden, presented "Experience from Geohydrochemical Investigations at the Äspö HRL Site in Sweden" (with J. Smellie, B. Wallin, E-L Tullborg, and M. Laaksoharju).

- Geohydrochemical studies at Äspö have helped unravel the complex groundwater evolution which characterizes this area

Peter Vogel [Federal Institute for Geoscience and Natural Resources (BGR)], Germany, discussed "Paleohydrogeological Information as an Important Tool for Groundwater Model Calculations at the Gorleben Site" (with K. Schelkes).



- Conducted two-dimensional numerical studies to investigate vertical movement of groundwater as a function of density in a subglacial channel over the Gorleben salt dome
- Initial salinity distribution (conditions at the end of glacial time) and the length of time for the simulation had a profound influence on the density distribution calculated for the present time as well as on the associated flow field

Christian Sonntag (University of Heidelberg), Germany presented "Isotope and Noble Gas Investigation of Paleowaters in the Sediments above Salt Dome Gorleben" (with A. Suckow).

- Isotope dating in combination with noble gas measurements indicate the age of fresh groundwater in the upper part of the sediment cover over the Gorleben Dome ranges from modern groundwater in the top layers to Holocene or late Pleistocene waters at ca. 150m depth.
- Isotopic depletion in  $^2\text{H}$  and  $^{18}\text{O}$  show that highly saline groundwater in the lower part of the sediment cover was formed mainly during the last glacial period

Hans Herbert (GSF), Germany discussed "Stable Isotopes of Gypsum Crystallization Water - a New Method for the Investigation of the Paleoclimatic Regime During Cap Rock Formation of Salt Domes".

- Investigations of stable isotopes including  $^{18}\text{O}$  for gypsum hydration water from Gorleben caprock indicates that one can determine both the isotopic composition of the paleowaters and the temperatures prevailing during caprock formation.

Lieselotte von Borstel (TU Clausthal Institute für Mineralogie und Mineralische Rohstoffe), Germany became ill and was unable to present her Paper "Quantitative Analyses of Individual fluid inclusions from Salt Minerals for the Assessment of Long Term Safety of Underground repositories in Salt Domes."

#### SUMMARY & CONCLUSIONS FROM WORKSHOP

Neil Chapman (Intera, UK): Can we use P/H/G to test assessment models?

- Select a definable past state of the site
- Define parameters to be selected blind
- Use assessment models to "evolve" the site and predict present conditions
- Compare predictions with measured parameter values

Adrian Bath (BGS, UK) commented that he is opposed to blind prediction as it was a remnant of the politics of nuclear waste disposal and is not compatible with scientific method.

Andres Gautschi (Nagra, Switzerland): P/H/G has started to give some input to PA, however it cannot continue without more interaction with hydrogeologists and PA specialists.

Which methods should be applied?

- As many as possible
- There aren't very many methods
- One method by itself is commonly ambiguous
- Site specific programs must be set up
- Which measurements must be done immediately (as soon as borehole is drilled):
  - o Hydrochemistry
  - o Noble gas analyses
- Which measurements can be done later (back-up samples):
  - o Sr-isotopes
  - o U-Th Series
  - o  $^{36}\text{Cl}$
  - o  $^{13}\text{C}/^{14}\text{C}$  precipitates
  - o Rock analyses

Critical Issues:

- Comparison of hydraulically active and inactive zones
- Zonation of minerals
- Very young reaction/alteration products

Adrian Bath (BGS, UK):

How did site evolve to present system?

- How much detail is relevant to PA?
  - o Main needs:
    - \* Hydrologic "peaks and troughs"
    - \* Time integrated changes and fluxes

What is the future evolution?

- Is there unnecessary complexity in our model?
  - o Short term influences have no influence on PA

The Story so far:

- More complexity
- Spatial heterogeneity - hydrodynamic significance
- Episodic change - events
- 1. Episodic vs. Evolutionary Change
  - Calcites suggest episodic change is important
  - What is the relationship between calcites and groundwater flow?
  - Retrograde changes obscure some "signals"
  - Is groundwater flow during retrograde alteration more significant for PA?
  - Most successful if scenarios are already posed by PA
  - Otherwise explicit conclusions are difficult
- 2. Support of Hydrodynamic Interpretation
  - Surprisingly weak: Time-dependence of hydrochemistry
  - Steady-state hydrodynamics vs. secular change
  - Haven't addressed present rate-of-change in system
  - Are we presently in a climatic/hydrologic extreme?
  - Problems with isotopic evidence for groundwater transit times
  - Much weight placed on stable isotope shift ( $\lambda^{18}\text{O}/\lambda^2\text{H}$ )
    - o We need to be explicit as how far these can be used

3. Development of Conceptual Models
  - Difficult because of hydrochemical complexities
  - Decoupled short and long scale variabilities
  - Concepts often involve salinity change or density change
  - Must set up hypothesis to be tested

John Stuckless (USGS, USA):

- Current state of P/H/G is "development of tools"
- Paleohydrogeologists are testing hydrologic models but independent of PA
- Building Public Confidence: Scientists need to be able to speak to the Press

Neil Chapman (Intera, UK):

- We are at tool development stage (or perhaps a little further)
- Data people and modellers need to talk more
- Sampling and studies need to be planned from the beginning

## II. OECD/NEA SEDE COORDINATING GROUP MEETING

The OECD/NEA SEDE Coordinating Group held its Third Annual Meeting at the Headquarters of OECD in Paris on 12-13 November, 1992. It was attended by official delegations from 12 OECD/NEA Member Nations (the Netherlands was absent), plus representatives from the CEC and the IAEA, as well as OECD/NEA staff. The U.S. Delegation consisted of Robert A. Levich representing OCRWM, and Susan Howarth (SNL) representing WIPP. The U.S. Nuclear Regulatory Commission (NRC) was not represented at either the SEDE'92 Workshop or the Third Meeting of the SEDE Coordinating Group.

1. Timo Äikäs, Chairman of the SEDE opened the meeting. All the national delegates were introduced.
2. The agenda was adopted as per NEA/SEN/RWM(92)6.
3. The group approved the summary record of the second SEDE Meeting in Helsinki (12-13 September, 1991) as per NEA/SEN/RWM(91)5.
4. Jean-Pierre Olivier (NEA), summarized recent developments within the NEA.
  - Discussion of proposed new international project on site characterization and development. The RWMC (April 1992) determined that the proposal was not "ripe" at this time and should be postponed for the future.
    - o Delegates expressed disappointment that the proposed new project had not been accepted
    - o It was suggested that the reasons it had not been accepted were due to tight budgets; active bilateral agreements plus numerous new test facilities that lessen the need for such a group

- Formal Paper has not yet been prepared from the Expert Judgment Meeting. The Meeting's conclusions did not necessarily indicate that a Formal elicitation Process for Expert Judgment was preferable to less formal responses. The two regulators present (NRC and SKI) did not necessarily agree that a formal process is needed.

5. Claudio Pescatore (NEA), summarized the 7th and 8th Meetings of the Performance Assessment Advisory Group (PAAG) from February and September, 1992. The next PAAG meeting will be held in September 1993.

Ned Patera (NEA), discussed the January 1992 Meeting of the PAAG's Human Intrusion Working Group, held in Albuquerque, NM.

Fritz Kautsky (SKI, Sweden), discussed the SKI-90 report. He noted that the INTRAVAL Phase 2 Workshop was concurrently taking place in San Antonio, TX, USA. INTRAVAL Phase 1 Reports have been printed. Single copies are available from NEA and larger numbers can be obtained directly from SKI.

6. Recent developments in National and International Programs were summarized by the SEDE delegates. More detailed National Program reports are enclosed for most nations with this report.

- Belgium: SCK is currently planning a seismic survey. No technical problems, however political problems due to use of explosives and vibrseis to discern geology and stratigraphy of Boom Clay. Measurements are continuing at the Mol Test Facility for mechanical and hydrological behavior of clay layer and cement. Migration experiments are also continuing. ONDRAF's approach to Final disposal is contained in a Report enclosed with this trip report.
- Canada: AECL is presently writing the Environmental Impact Statement (EIS) for the Canadian Nuclear Fuel Waste Management (CNFWM) Concept. AECL intends to submit the EIS to the Environmental Assessment Panel in late 1993. Drillholes have been placed around the URL. Below 500m are anomalous high pressure zones apparently unrelated to the areas above 500m. A new conceptual model is being developed for the Whiteshell Area.
- Finland: TVO will issue the Reports of site investigations in June 1993. It is expected that the the Finnish regulatory authority will request International review for these site investigations. VTT has conducted scientific studies of groundwater chemistry, as well as structural and mineralogical studies.
- France: CEA/IPSN reports that the Oklo Project is continuing. Work is also continuing in two underground research laboratories. Studies in shale is taking place in a gallery belonging to Electricité de France. The second underground research laboratory is in argillite in an old railroad tunnel at a depth of 250 - 270m. Geological studies and drill holes are being used to determine the hydrogeology, and IPSN intends to conduct a large series of tests.

ANDRA has opened a new center for waste disposal. The new law of December 1991 has separated ANDRA from CEA. ANDRA is now responsible for the disposal of all radioactive waste. ANDRA has been inventorying all radioactive waste in France. Research on long-lived waste awaits new Parliamentary proclamations. A negotiator will be appointed in 1993 and an expected new proclamation will designate two underground research laboratories. In 1992, ANDRA began activities to study granite. ANDRA has a bilateral agreement with AECL to jointly study permeability and has recently signed an agreement with SKB to study and model flow and transport at Äspö. Currently, France remains interested in salt.

- Germany: Morsleben repository site has been licensed and successfully transferred from former DDR (East Germany) to German Federal Republic. Since September 1992 public hearings have been held for the Konrad repository site and are expected to continue through December 1992 or January 1993. At Gorleben (proposed HLW repository site), Shaft No. 1 has reached a depth of 340m. At 350m a foundation will be placed for a shaft lining. Shaft No. 2 has attained a depth of 274m. There are some problems with brine intrusion from freezing and unfreezing overburden. The HLW experiment has been set up and is ready awaiting the license required to emplace the HLW canisters. The ILW experiment is also ready at the Asse Mine, however no license application has been filed pending the outcome of the license application for HLW.
- Italy: The 5-year moratorium against nuclear power will expire on 18th December, 1992. ENEL hopes that Parliament will permit them to resume studies. Three advanced reactor designs (US, French and Swedish) are being examined but now await the government's decision.
- Japan: PNC has been conducting in-situ research in the Tono and Kamaishi mines to establish methodologies to study the geological environment. Research includes a mine-by experiment, hydrology studies, hydrochemistry, natural analogue studies, and studies of the long-term stability of the geologic environment.
- Spain: ENRESA hopes to start operations at the El Cabril L/ILW storage facility at the beginning of 1994. ENRESA has reorganized its HLW program. They have completed 400 km of high resolution seismic lines and have currently attained an 800m depth in their second drill hole in a clay formation.
- Sweden: The recently completed SKB'91 Report indicated that the KBS-3 concept is still the most appropriate for a HLW repository. In summary, with stable tectonics and groundwater controls, copper canisters will remain intact for a longer period of time than is necessary, and therefore the geology is not as important as the engineered barrier. SKB has proposed a new schedule (currently under review by SKI) for a demonstration facility to conduct an actual test of spent fuel disposal. SKI is beginning a new two year project (SITE-94) for a complete PA of the Äspö site. SITE-94

- will emphasize traceability of site-specific information and the evolution of the site rather than model development. It is planned for completion by the end of 1994. SKB has received full license for the Forsmark SFR facility including the silos for ILW.
- Switzerland: HLW Program is being conducted in Northern Switzerland in Crystalline rocks as well as both Opalinus Clay and Molasse sedimentary rocks. The synthesis report for the Crystalline Phase I Program will be completed in 1993, as well as reports on the Opalinus Clay and the Molasse sediments. There is a proposal for further field studies in each rock type. L/ILW Program is looking at the Valaginian Marl at Wellenberg and also three other sites. One of the four sites will be selected. Phase 3 studies at the Grimsel Test Site will be completed in 1993. Phase 4 has been proposed and will be conducted between 1994 and 1996.
  - United Kingdom: UKNirex has responsibility for only low and intermediate level wastes, however this includes long-lived wastes produced from the Reprocessing Program. UKNirex is working in the vicinity of the Sellafield Plant studying "basement rocks lying under sedimentary cover". Plans include drilling inclined boreholes. At the end of October 1992, UKNirex announced that it wishes to develop an Underground Research Laboratory. Report includes technical programme and environmental impact. Public hearings will be held.
  - United States: Both oral and written reports were provided by the delegates from DOE's OCRWM and WIPP programs.
  - Commission of the European Communities (CEC): Participating in URLs at Asse (Germany), Mol (Belgium), Tunamiere (France) and at potash mine in France. Also will be participating at Sellafield (UK). Discussed activities under Project MIRAGE including Chemval, CoCo Club, etc. CEC is sponsoring natural analogue studies at Oklo (Gabon) and El Berrocal (Spain), and is also negotiating for a proposed project in Italy. The biannual Natural Analogue Working Group (NAWG) Meeting was successfully hosted by ENRESA at Toledo, Spain, 4-9 October, 1992. A new "Plan of Action in Radioactive Waste" is being developed to replace the former plan. Inspection activities will continue and Public Information will be added. CEC has active bilateral agreements with Nagra, SKB/SKI and AECL, and are awaiting determination of renewal of bilateral with US.
  - International Atomic Energy Agency (IAEA): Developing a new project (Coordinated Research Program) to focus on issue of extrapolating short-term data for long periods of time. IAEA intends to produce a book to document the current state of research and have clearly written explanations to inform management, the public, etc. as to how scientists use short-term information to draw long-term conclusions.

7. Ned Patera (NEA) led a discussion concerning the recently completed SEDE-'92 Workshop on Paleohydrogeological Methods and Their Applications for Radioactive Waste Disposal (9-10 November, 1992). Discussions included delegates from Finland, Canada, Japan, France, Sweden, UK, USA and NEA.
  - In general all agreed that it was an excellent technical workshop and much had been gained by all who participated.
  - Hydraulic testing essentially provides a "time snapshot" of present hydrology. Geochemistry and isotope geochemistry, etc. is important to PA as it provides a longer-term picture.
  - P/H/G can be used to refine conceptual model uncertainty, and in a similar manner to natural analogues as bounding conditions for model validation.
8. Ned Patera (NEA): Discussion of proposed SEDE/PAAG Workshop on Treatment of Conceptual Model Uncertainty. It was suggested that the Workshop be held in March 1993. The organizers include Timo Aikäs (TVO, Finland), Piet Zuidema (Nagra, Switzerland) and Rip Anderson (DOE/SNL/WIPP, USA). The dates for the Workshop may be postponed to better achieve its planned goals.
9. Mark Thury (Nagra, Switzerland) presented a Progress Report given for the SEDE Working Group on Measurement and Physical Understanding of Groundwater Flow Through Argillaceous Media (informally referred to as the SEDE "Clay Club"). The working group has proposed developing a state-of-the-art report on "Basic Concepts and Mechanisms for Water, Gas and Solute Movement through Argillaceous Rocks". The estimated costs of developing and producing this report will be ca. US\$100K.
10. Mark Thury (Nagra, Switzerland) proposed a SEDE-sponsored Workshop on Hydraulic Testing and Groundwater Sampling Methodologies in Argillaceous Rocks [Document: NEA/SEDE/DOC(92)3]. The SEDE Clay Club (consisting of Switzerland, Belgium, France, Japan, Spain, a BGS participant jointly sponsored by Nagra and UKNirex, and Ontario Hydro of Canada) will develop this workshop which will be held in Seville, Spain during the week of 10-14, May, 1993 and will be hosted by ENRESA.
11. Ned Patera (NEA), reported on the Fourth and Final International Stripa Symposium, held in Stockholm, Sweden 14-16 October, 1992. The delegates discussed both the final Stripa Symposium as well as the Stripa Project. Discussion was led by delegates from Finland and the USA who had participated in both the Stripa Project and the Stripa Symposium.
12. The Joint SEDE-PAAG Workshop on Gas-generation and Release from Radioactive Waste Repositories was hosted by ANDRA at Aix-en-Provence, France on 23-26 September, 1991. The results of this workshop was discussed before the SEDE in three presentations by Wernt Brewitz (Germany), Susan Howarth (SNL/WIPP, USA) and Alan Hooper (UKNirex, UK).

13. As no plans have been made for future SEDE workshops and topical discussions the national delegates to the SEDE provided suggestions for future topics. It was decided that a meeting of the SEDE Core Group would be convened in early 1993 to evaluate these topics and make recommendations for the next SEDE meeting (1993) concerning future Workshops and Topical Discussions. The following list of possible topics was provided by the SEDE delegates:

- Abnormal (over and under) Pressures and Flow in Low-Permeable Formations including Transient Effects
- Hydrogeological influence of a Dynamic Stress Field
- Interpretation of and Interpretation Techniques for Seismic Surveys
- Hydrochemistry: Obtain Field Samples for Analysis
- Scaling Effects
- Dynamics of Hydrological Systems
- Validation Strategies: Validating Site Characterization Studies
- Two-Phase Flow Systems and Studies including Laboratory and Field Testing, Experimentation, Interpretation and Viscous Fingering
- Relationship of Paleohydrogeochemistry to Hydrodynamic Modelling
- Use of Paleohydrogeology in Performance Assessment
- Geophysical Methodologies and Interpretation for Site Characterization
- Data Acquisition Methodology for Geochemistry
- Effect of Earthquakes on Hydrodynamic Systems
- Brine Pockets in Salt Formations
- Evidence for Paleoseismicity
- Coincidence of Fracture Models and Real Data including Hydrodynamics and Stress Fields
- Transport: Planning and Implementing Migration/Tracer Experiments to Define Flow Paths for Radionuclides
- Quality of Samples
- Long-term Monitoring of Groundwater including Philosophy for Post-Closure (Jean-Pierre suggested this topic be excluded)
- Testing Methodologies in Argillaceous Rocks
- Design of Experiments: Site Characterization, Data Confirmation, Validation, Safety Assessments
- Demonstration Experiments
- Retrievability of Waste (Costs, Safety, Repository Design) (Jean-Pierre suggested this topic be excluded)
- Experiments to Confirm and Validate Conceptual Models

14. Jean-Pierre Olivier (NEA) thanked Timo Äikäs (TVO, Finland) for serving as Chairman of the SEDE for three years. Jean-Pierre then nominated Alan Hooper (UKNirex, UK) as new chairman and it was seconded by the delegates from the USA and Spain. The SEDE approved the nomination unanimously.



### III. VISIT TO ANDRA OFFICES AT FONTENAY-AUX-ROSES

On Monday, 16th November, 1992, I visited the Headquarters of ANDRA outside of Paris at Fontenay-aux-Roses. I held meetings and discussions with ANDRA staff including Edouard Scott de Martinville, Jacques Tamborini, Lionel Dewiere, and Jean-Claude Fernique. At the NEA SEDE'92 Workshop and the SEDE Meeting during the previous week, I had also met with and held informal discussions with ANDRA staff including Thierry Merceron, Jacques Delay, and Raymonde Andre-Jehan.

According to the new French law of December 1991, ANDRA is responsible all of France's programs regarding "Stockage". Stockage means disposal and not storage. ANDRA is responsible for any and every type of geologic disposal (deep - shallow - hard rock - soft rock) and in any and every type of nuclear waste (LLW - ILW - HLW) including vitrified and TRU.

Definitions of nuclear waste in France:

- "A": Low Level Waste (Surface Storage)
- "B": Transuranic Waste (TRU)
- "C": Vitrified Waste

Other responsibilities for nuclear waste in France:

- Partitioning and Transmutation: CEA
- Long-lived Waste Package: COGEMA
- Storage: Waste Producer
- Transport: No regulations but NOT ANDRA

Nuclear Waste in France:

- EdF: 36%\*
  - COGEMA: 36%\*
  - CEA: 15%\*
  - Fuel Cycle: 5%\*
  - Industry: 5%
  - Small Producers: 3%
- \* = State-owned companies

EdF and CEA produce and pay for the cost of France's HLW (vitrified) disposal program. ANDRA is under three ministries. It will be headed by a Board of Governors (which has not yet been appointed).

ANDRA is currently awaiting the promulgation of a new French Parliamentary Decree which will define specifics of ANDRA responsibilities and programs. The Decree is expected to be published by the end of 1992. Following its issuance, DOE and ANDRA will examine the need for a new Bilateral Agreement, separate from the Agreement between DOE and France's CEA.

During discussions, the ANDRA and DOE representatives designated three general areas to examine for possible cooperation. These areas are:

- "Geoprospective" (future natural events)
- Geochemistry
- Hydrogeology

ANDRA committed to send to DOE (c/o Bob Levich in Las Vegas) by 15 January, 1993, a list of Studies and Research conducted by ANDRA in a variety of technical disciplines. This list will permit DOE to evaluate ANDRA's programs and determine possible areas for cooperation. The DOE representative left material with ANDRA describing YMP's programs. He also agreed to provide ANDRA's Lionel Dewiere with the following:

- SCP Overview
- Complete set of SCP Progress Reports
- Complete set of YMP Project Bibliographies.

It was agreed that this exchange of materials was necessary for each of the national programs to evaluate their counterparts technical interests, and is necessary to determine possible areas for technical cooperation between ANDRA and DOE/YMP. It was also agreed that YMP would host a visit to Las Vegas by ANDRA staff, both to visit Yucca Mountain, and to hold discussions on specific technical areas. It was agreed that it was important to hold these investigations at as low a level as possible, so as to best define specifics for technical cooperation.

#### IV. VISIT TO NEA OFFICES AT ISSY-LES-MOULINEAUX

On Tuesday, 17 November, 1992, I visited the new offices of the NEA at Issy-les-Moulineaux on Ile de St. Germain. I toured the new facilities including offices, library, proposed conference rooms (not completed) and held discussions with Jean-Pierre Olivier, Ned Patera, and Claudio Pescatore. Among the topics discussed was the current membership of the SEDE Core Group and whether it would be appropriate to replace original members who now participate in a limited manner in their national high level radioactive waste management programs. In addition we discussed the failure of the proposed new project on site characterization and development to win approval from the RWMC. It was agreed that the topic should be discussed at the SEDE Core group meeting planned for early 1993. It was also agreed that the probable cause for failure of the proposal was the lack of communication between SEDE members who developed and supported the proposal and the national delegates on the RWMC.

List of People Contacted:

<u>Belgium:</u>	Arnold Bonne Victor Netels Phillip Lalieux	SCK/CEN, Mol Polytech de Mons, Mons ONDRAF/NIRAS, Bruxelles
<u>Canada:</u>	Doug Stevenson Denis Bottomley Sean Frape	AECL, Pinawa, Manitoba AECB, Ottawa, Ontario Univ/Waterloo, Waterloo, Ont
<u>CEC:</u>	Bertus Haijtk Henning von Maravic	CEC, Bruxelles, Belgium CEC, Bruxelles, Belgium
<u>Finland:</u>	Timo Äikäs Runar Blomqvist PaaVo Vuorela	TVO, Helsinki Geological Survey, Helsinki Geological Survey, Helsinki
<u>France:</u>	Raymonde Andre-Jehan Thierry Merceron Jacques Delay Jacques Tamborini Lionel Dewiere Edouard Scott de Martinville Jean-Claude Fernique André Barbeau Pierre Escalier Des Orres Paul-Louis Blanc Pierre Toulhoat Jean-Charles Fontes M. Fouillac Didier Louvat Jean-Luc Michelot	ANDRA/DESI, Fontenay-aux-Roses ANDRA/DESI, Fontenay-aux-Roses ANDRA/DESI, Fontenay-aux-Roses ANDRA/DESI, Fontenay-aux-Roses ANDRA/DESI, Fontenay-aux-Roses ANDRA/DESI, Fontenay-aux-Roses ANDRA/Intntrl Affairs, F-a-R CEA/IPSN/DPEI/SERGD, CEN/FaR CEA/IPSN/DES/SESID, CEN/FaR CEA/IPSN, CEN/FaR CEA/DSD, CEN/FaR Université de Paris-Sud, Orsay BRGM, Orléans CEA/DSD, CEN/Cadarache Université de Paris-Sud, Orsay
<u>Germany:</u>	Wernt Brewitz Horst-Jürgen Herbert Jürgen Larue Christian Sonntag Peter Vogel Lieselotte von Borstel Manfred Schulz	GSF/Ift, Braunschweig GSF/Ift, Braunschweig GRS mbH, Köln Inst/Umweltphysik, Heidelberg BGR, Hannover TU Clausthal Inst/MuMR Perm.Deleg. to OECD, Paris, FRA
<u>IAEA:</u>	Mike Bell	NFC/WM, Vienna, Austria

<u>Italy:</u>	Tommaso Marzullo	ENEL R & D Division, Rome
<u>Japan:</u>	Yasuhisa Yusa	PNC, Chubu Works, Toki-shi
<u>OECD/NEA:</u>	Jean-Pierre Olivier Edward (Ned) Patera Claudio Pescatore	DRPWM, Issy-les-Moulineaux, FRA DRPWM, Issy-les-Moulineaux, FRA DRPWM, Issy-les-Moulineaux, FRA
<u>Spain:</u>	Carlos del Olmo Antonio Hernandez Benitez	ENRESA, Madrid CIEMAT, Madrid
<u>Sweden:</u>	Peter Wikberg Fritz Kautsky John Smellie Lars Ericsson	SKB, Stockholm SKI, Stockholm Conterra, Uppsala SKB, Stockholm
<u>Switzerland:</u>	Erik Frank Andreas Gautschi Peter Hufschmied Marc Thury Peter Bitterli	HSK, Würenlingen NAGRA, Wettingen Emch & Berger Bern AG, Bern NAGRA, Wettingen HSK, Villigen
<u>United Kingdom:</u>	Adrian Bath Neil Chapman Tim McEwen Alan Hooper Anna Littleboy	BGS, Nottingham Intera, Melton Mowbray Intera, Melton Mowbray UK Nirex Ltd., Harwell UK Nirex Ltd., Harwell
<u>USA:</u>	Susan Howarth John Stuckless Rick Forrester Peter Jodoin Andrew Campbell	SNL/WIPP, Albuquerque, NM USGS/YMP, Denver, CO USGS/YMP, Denver CO US Mission to OECD, Paris, FRA New Mexico Tech, Socorro, NM