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MEMORANDUM FOR: B. J. Youngblood, Director  
Division of High-Level Waste Management, NMSS

FROM: Margaret V. Federline, Chief  
Hydrology and Systems Performance Branch  
Division of High-Level Waste Management, NMSS

SUBJECT: FOREIGN TRIP REPORT, PARIS, FRANCE, OECD/NEA/RWMC  
PERFORMANCE ASSESSMENT ADVISORY GROUP,  
SEPTEMBER 12-17, 1993

Dr. Budhi Sagar, Technical Director, Center for Nuclear Waste Regulatory Analyses, and I participated in the 9th Meeting of the OECD/NEA/RWMC Performance Assessment Advisory Group held on September 13-16, 1993, at the Nuclear Energy Agency in Paris. Enclosed is a jointly prepared report which summarizes the key issues addressed by the Group during the meeting. Also enclosed is a foreign trip report abstract which has been forwarded to the Office of International Programs.

*/s/*  
Margaret V. Federline, Chief  
Hydrology and Systems Performance Branch  
Division of High-Level Waste Management, NMSS

## Enclosures:

1. Trip Report Abstract
2. Trip Report

cc: J. Taylor, EDO  
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**TRIP REPORT ABSTRACT**  
**DATE OF REPORT: 10/28/93**

**OFFICIAL TRAVELLER:**  
Margaret V. Federline

**TRAVEL TO:** OECD Nuclear  
Energy Agency, Paris, France

**OFFICE:** Office of Nuclear Material  
Safety and Safeguards

**BEGINNING ON:** September 12, 1993  
**ENDING ON:** September 17, 1993

**MEETING TITLE AND/OR AFFILIATION:**

Nuclear Energy Agency (NEA) - Radioactive Waste Management Committee (RWMC) -  
Performance Assessment Advisory Group (PAAG)

**ORGANIZED BY:** Nuclear Energy Agency Secretariat

**SUMMARY OF MEETING RESULTS:**

Margaret Federline, Chief, Hydrology and Systems Performance Branch, Division of High-Level Waste Management and Dr. Budhi Sagar, Technical Director, Center for Nuclear Waste Regulatory Analyses (CNWRA) participated in the 9th Meeting of the Nuclear Energy Agency, Radioactive Waste Management Committee, Performance Assessment Advisory Group (NEA/RWMC/PAAG) held on September 14-16, 1993, at the NEA in Paris. The U.S. delegation also included representatives from the Department of Energy (DOE), Office of Civilian Radioactive Waste Management (OCRWM), the Waste Isolation Pilot Project (WIPP), and their contractors.

The general objective of the NEA in the field of radioactive waste management is to promote a forum for the exchange of information on waste management policies and practices, to develop a common understanding of basic issues, and to promote the adoption of common waste management strategies through the RWMC. The PAAG was formed by the RWMC in 1986 to advise the RWMC on the technical aspects of performance assessment (PA) and to facilitate coordination of the NEA PA activities. The PAAG has been instrumental in building consensus on technical issues that affect all repository programs and has assisted in the development of advanced generic tools and methods for safety assessment of radioactive waste repositories. The focus of PAAG is on post-closure safety assessment. Margaret Federline is the current NRC PAAG representative.

## **SUMMARY AND PERTINENT POINTS:**

The PAAG group is currently chaired by Piet Zuidema of NAGRA, Switzerland. Following is a brief summary of important points from the 9th PAAG meeting:

Among the three databases currently under development at the NEA, the NRC is a participant in the development of the Features, Events, and Processes (FEP) database which was recently initiated. This activity which will promote a consensus on the bases for potential scenario construction is important to the NRC as input to the development of guidance on scenario construction. The databases on thermochemistry and sorption are partially developed.

Two international projects, Alligator Rivers Analog and INTRAVAL, have been concluded and final reports are pending. The BIOMOVs project has been asked by the PAAG to define a set of reference biospheres for comparison of risks.

Proposals for post-INTRAVAL projects include one made by the SKI/LBL to address geosphere transport issues and another by the DOE dealing with methods for discriminating among conceptual models.

The PAAG Human Actions Working Group report on human intrusion will be revised in light of PAAG comments. This report will review relevant work and will discuss a generic approach to address human intrusion.

Since models cannot be validated in the scientific sense, PAAG participants believe alternate terms such as "confidence building" should be used in describing the validation process.

Workshops on Conceptual Model Uncertainty and Validation in Performance Assessment will be held in Paris, November 16-18, 1993, and October 11-14, 1994, respectively.

## **CONCLUSIONS:**

This meeting provided a good forum for discussion of the critical issues related to long-term performance assessment of nuclear waste repositories. Participation is particularly valuable to the NRC because of the focus of the group on such issues as validation which are of immediate interest to the staff in developing guidance to DOE and developing compliance determination methodologies for the license application review plan. In attending this meeting, the NRC/CNWRA directly benefit by gaining access to the deliberations and technical bases of over ten countries who face similar problems and issues in the projection of long-term repository performance. Even though the NEA has no legal standing in the U.S. high-level waste program, international consensus and/or technical opinions will carry significant weight. Similarly, the comparison of PA methodologies and development of the international databases are of help to the NRC in the development of staff capabilities for conducting independent performance assessment.

**DETAILED TRIP REPORT OF:**

**Margaret V. Federline  
Hydrology and Systems Performance Branch  
Division of High-Level Waste Management  
Office of Nuclear Material Safety and Safeguards**

**SUBJECT: TRIP REPORT ON THE 9TH MEETING OF THE NUCLEAR ENERGY AGENCY (NEA)  
RADIOACTIVE WASTE MANAGEMENT COMMITTEE (RWMC) PERFORMANCE ASSESSMENT  
ADVISORY GROUP (PAAG) PARIS, FRANCE, SEPTEMBER 14-16, 1993**

**BACKGROUND AND PURPOSE:**

The general objective of the Nuclear Energy Agency (NEA) in the field of radioactive waste management is to promote a forum for the exchange of information on waste management policies and practices, develop a common understanding of basic issues, and promote the adoption of common waste management strategies through the Radioactive Waste Management Committee (RWMC). The Performance Assessment Advisory Group (PAAG) was formed by the RWMC in 1986 to advise the RWMC on the technical aspects of performance assessment (PA) and to facilitate coordination of the NEA PA activities. The PAAG has been instrumental in building consensus on technical issues that affect all repository programs and has assisted in the development of advanced generic tools and methods for safety assessment of radioactive waste repositories. The focus of PAAG is on post-closure safety assessment. The PAAG is currently chaired by Piet Zuidema of NAGRA, Switzerland. Mr. S. Coplan was NRC's representative and Chairman of PAAG until last year. Margaret Federline is the current NRC PAAG representative. The U.S. delegation also includes Department of Energy (DOE) representatives from the Office of Civilian Radioactive Waste Management (OCRWM) and the Waste Isolation Pilot Project (WIPP). PAAG meets annually at NEA headquarters in Paris. Dr. Budhi Sagar, CNWRA Technical Director, and Margaret Federline attended the 9th PAAG meeting September 13-16, 1993, and have jointly prepared this report.

Details of the meeting proceedings are provided in the following. The sequence of description follows the agenda (Attachment 1). Attachment 1 is provided with the report. Other attachments are available from the authors.

**ITEM 1. Opening of the Meeting**

Jean-Pierre Olivier, Head of NEA's Division of Radiation Protection and Waste Management, opened the meeting by welcoming the attendees. He introduced new delegates and observers. All attendees then introduced themselves.

**ITEM 2. ADOPTION OF AGENDA**

The agenda was approved after delegates agreed to combine discussion of Item 14 (draft report on human intrusion) with Item 9C (3rd meeting of the Humans Action Group). It was agreed that the topical discussion on model validation would last about three-quarters of a day.

It was announced that delegates from Japan, Finland, and Germany would make extended presentations on recent performance assessments with other delegates making brief presentations.

**ITEM 3. APPROVAL OF THE SUMMARY RECORD OF THE 8th MEETING OF PAAG**

In the absence of any comments, the summary record was approved. (Attachment 2).

**ITEM 4. REPORT FROM THE 25th MEETING OF THE RWMC**

Mr. Olivier reported on the 25th meeting of RWMC. He indicated that there was a suggestion in RWMC for developing another collective opinion regarding feasibility of geologic disposal. If developed, this collective opinion will explain the rationale of geologic disposal showing how this policy is derived from concerns for the environment and protection of future generations. The Environmental Directorate of the NEA is expected to participate to add a perspective on the common objectives of the disposal of radioactive and chemical wastes.

He also discussed NEA's assistance program for safety improvements of nuclear facilities in the Central and Eastern European Countries (CEECs). Also PAAG members were informed that the NEA will not participate significantly in the International Atomic Energy Agency (IAEA) initiative on radioactive contamination of arctic waters due to radioactive waste management practices of the former Soviet Union.

**ITEM 5. LONG-TERM PLAN OF ACTIVITIES DOCUMENT**

Documentation of PAAG's long-term plan of activities (see Attachment 3) was reviewed by RWMC. Dr. C. Pescatore, a member of the NEA Secretariat staff, reported on their review. The RWMC supports PAAG's proposal to focus on conceptual model uncertainties and validation as key activities. Members of RWMC also suggested that scenario analysis and near-field analyses also be given high priority. The RWMC agreed to the general orientation of the PAAG long-term plan and implementation of a SKI proposal to examine methodological approaches to performance assessment.

**ITEM 6. NEA DATA BASES**

The progress on three NEA sponsored databases was reported. Issues related to the thermochemical database are described in Attachment 4. It was reported that progress toward completion of the first four elements has been delayed because of funding limitations. Spain and Switzerland have been contacted for funding for completion. Data on Np and Pu is being added. An expert group of scientists and performance assessment experts met to establish priorities for the future development of the thermochemical database. First priority will be given to completion of the first set of elements (Np, Pu, Am, Tc). The second priority will be to fill gaps in existing data and the third priority will be to compile organo-metal data.

S. Altmann, from BRGM, France, made a presentation on the outcome of an NEA workshop that took place April 5-7, 1993, at Stanford University on sorption (curiously, neither the NRC nor the DOE was represented in this workshop). The possibility of using surface complexation models to represent sorption in natural systems in performance assessment calculations was discussed in this workshop (see Attachment 5). If surface complexation models, which are based on mass action and mass balance principles, are chosen then a different set of parameters rather than the Kd's will have to be included in the NEA database. Exceptions were taken to Altmann's view on the basis that: (i) surface complexation models introduce their own set of empirical parameters and have their own limitations; (ii) it will take a long time to come to a stage where such models can be routinely used; (iii) the cost may be prohibitive; and (iv) uncertainties in geochemistry are so large that surface complexation models cannot resolve them. It was recommended by several commentators that the Kd approach not be abandoned at this time. After the discussion, recommendations were made to: (i) continue the demonstration project for analytical technique development, (ii) identify critical parameters in such models, and (iii) hold regular meetings to assess progress. The surface complexation group was directed to define more clearly the objective of their work, the criteria by which the success of the work will be judged, and a schedule plan for completion of work. The group will report its progress to PAAG in the next meeting.

Bertrand Ruegger of the NEA Secretariat provided an update on the status of the sorption database. He indicated that the database will include bibliographic information, but no numerical data. The bibliographic information will include the objectives of the researchers, primary quantities measured, experimental method, solid phase type or name, and aqueous phase. The PAAG Chairman stressed that the value of the project will only be as good as the support from organizations assisting with the operation. The PAAG recommendations were to start with the first phase and evaluate at the end of year.

The report of a working group to develop an international database of Features, Events, and Processes (FEP) to be considered in scenario development is discussed in Attachment 6. The first meeting of the working group took place on June 17-18, 1993. Rex Wescott, NRC, participated along with representatives from AECL, SKI, NAGRA, and DOE. The working group concluded that such a database is feasible and would be beneficial to several countries as a useful tool in performance assessment. It could be useful in checking completeness of scenario development and as a basis for peer review and quality assurance (QA). The working group identified four levels of development corresponding to four different uses and priorities. The working group supported Level 2 which will develop a tool to check interactions between FEPs incorporated in national assessments against an international list of FEP interactions for completeness. Comments on the working group's proposal were requested from various member countries by mid-October. It was suggested that the database and the tools developed to manipulate the database be reviewed by experts other than those engaged in conducting performance assessment. PAAG recommended that the work group: (i) get input from various interested organizations by the end of October, (ii) discuss the database structure in the next meeting, (iii) establish a flexible structure to allow restructuring and addition of other information, (iv) invite experts other than PA to review, (v) set an objective to depict FEP's from all PA's, and (vi) acknowledge the need for periodic update by the NEA Secretariat supplemented by information from members.

#### ITEM 7. INTERNATIONAL PROJECTS

It was reported that the Alligator Rivers Project has been completed and a report will be available by the end of 1993.

DECOVALEX has completed thermal-hydronechanical models. This project has been underway for about two years and the next meeting is scheduled in October in Japan.

Pedro Carboneras, ENRESA, Spain, presented the work done by BIOMOVs, an international exercise to test and validate biosphere models sponsored by Canada, Sweden, and Spain with participation from over 50 organizations in 20 countries. PAAG requested BIOMOVs to investigate the feasibility of producing a reference set of conversion factors for intercomparison of long-term performance assessments. Because conversion factors depend upon site-specific conditions, several PAAG participants expressed doubt about the feasibility of developing "reference" values for them. Mr. Carboneras indicated that BIOMOVs plans to develop a methodology, a set of reference biospheres, and conditions under which they may be used. Some PAAG representatives were concerned that the program proposed by the BIOMOVs group (see Attachment 7) was much more wide-ranging than envisioned in the original PAAG request and that it may not be possible to complete the work by 1995. It was noted that the

U.S. waste program currently has no participant in the BIOMOVs group. A concern was evident that the U.S. needs may not be considered in developing such a set of reference biospheres. The discussion was summarized by the Chairman as follows: (i) while PAAG is impressed about the level of detail proposed by the BIOMOVs group, it is also concerned that PAAG may not get what it asked for in the time allocated; (ii) the PAAG request may have been confusing in that PAAG did not request a universally appropriate biosphere; (iii) BIOMOVs was urged to keep to the 1995 milestone; (iv) PAAG needs to provide input to the BIOMOVs working group; and (v) convene a small working group to clarify what PAAG wants. To the last point, Pedro Carboneras, representing the BIOMOVs group, suggested that further clarification of the PAAG's intent probably will not be helpful. He noted that the Committee understands the PAAG request, but believes a simple reference biosphere cannot be defended.

The INTRAVAL group was congratulated on its successful completion. Johan Andersson, SKI, reported that a final report containing conclusions is currently under preparation. He also indicated that INTRAVAL participants felt a continuing need for a forum to discuss geosphere issues. Chin fu Tsang, LBL, and Johan Andersson, SKI, are looking at future options.

#### ITEM 8. ORGANIZATION OF UPCOMING PA MEETINGS

A Conceptual Model Uncertainty Workshop will be held November 16-18, 1993, sponsored jointly by the SEDE/PAAG. This workshop is being organized by the French National Institute for Science and Technology. Topics to be discussed include: (i) use of conceptual models, (ii) construction and development of conceptual models, and (iii) how to represent and communicate uncertainty in conceptual models. In addition to two keynote addresses (one with perspective on site characterization and the other on performance assessment), the workshop will include overview reports of various national programs. Four subgroups will be created for detailed discussions. Reports from the subgroups will be summarized in a general session of the workshop.

GeoVal'94 is planned for October 11-14, 1994, in Paris and will be organized by the SKI/NEA (see Attachment 9). This meeting will celebrate the good work of INTRAVAL, promote and integrate lessons learned from INTRAVAL with other significant validation activities, and announce follow-up to the INTRAVAL. Model testing with the help of laboratory experiments and underground laboratory testing will be discussed on the first and second day respectively; interaction between the engineered barriers and the geologic setting on the third day and finally, strategies for model validation on the fourth day. Questions were raised as to why the meeting was steering away from a focus on regulatory definition of validation and what is the type of evidence required for a license.



**ITEM 9. SEDE GROUP AND PSAG SUB-GROUP**

A report of the 3rd SEDE meeting noted that paleo-hydrogeology was the topic of this meeting. The SEDE group felt that more effort was needed to communicate the usefulness of paleo-hydrologic studies. It was also reported that SEDE revisited its mandate and objectives in developing a long-term plan. Its objectives were reiterated as: (i) the information exchange between different programs on site characterization, (ii) the information exchange on underground testing, (iii) discussion on role of the geosphere as a barrier in each program strategy, and (iv) hypothesis testing as a method for planning site characterization activities. For the next SEDE meeting, the topic of discussion will be seismic characterization and interpretation. Future topics will include faulting. SEDE suggested three workshops: (i) modeling of dynamic geological/hydrological systems, (ii) validation of geosphere models, and (iii) field tracer experiments. PAAG participants felt that these topics were too broad and were topics of discussion in other professional meetings. A SEDE workshop on "how to decide how much data is enough" was suggested.

A report was presented from the 14th meeting of the Probabilistic System Assessment Group (PSAG) (see Attachment 10). Jim Sinclair, Chairman of the PSAG, reported there was insufficient interest in and support for the Level 2 PSACON exercise initiated by the PSAG group. Several reasons were given for the low level of participation: (i) many countries are busy with their own performance assessments, (ii) PSAG activities were suited to the initial development of probabilistic methodology, but they are not suited for the current status of methodology development in various countries, and (iii) some organizations are unable to spare resources even though they are interested. It may be noted that Drs. Eisenberg (NRC) and Bagtzoglou (CNWRA) have participated in PSAG meetings. After discussion, it was decided to conclude the activities of the PSAG group. Within twelve months, a meeting of the active participants in the Level 2 exercise will be convened to bring it to closure and develop a report. It was suggested that the PSAG group also consider producing a final report documenting lessons learned. This should include a discussion on the relationship between Probabilistic System Assessment (PSA) and PA deterministic approaches, explain the value of the PSA approach, and provide recommendations on how to communicate results of PSA. It was suggested that the recent article by B. Thompson and B. Sagar may be helpful in producing the final report. The PAAG Chairman congratulated the PSAG group for a job well done and suggested that the final report draft should be presented to PAAG for discussion before finalization. It was also indicated that PAAG should explore the option of initiating focused working groups to address well-defined issues.

**ITEM 10. TOPICAL DISCUSSION ON MODEL VALIDATION**

The topical session was chaired by Tonis Papp of SKB. Presentations were made by Alfred G. Wikjord (AECL), Peter Wikeberg (SKB), Jorg Hadermann (Waste Management Laboratory - Switzerland), Johan Andersson (SKI), and Roger Wilmot (Galson Sciences Limited). Written material on all four talks is included in Attachment 11. Providing an example from the Canadian program, Wikjord stated that a continuing process of model calibration, evaluation, and refinement would lead to increasing reliability of models. He suggested that uncertainty from model predictions cannot be eliminated entirely and hence the final decision will be made under uncertainty. Model evaluation should be viewed as a measure of confidence of regulators. The question to be answered, given a mathematical model, computer program, data input, numerical results, and interpretations, is the conclusion justified?

Peter Wikeberg (SKB) related SKB's experience of site investigation and modeling that was done in relation to the setting up of the ASPO Hard Rock Laboratory. He explained how the conceptual models of the site progressed as more and more site data was collected and generally the models were refined to explain that data. He emphasized the gradual introduction of complexity in models supported by the site data and a combination of appropriate disciplinary-based submodels resulting in an integrated site scale model. He was of the view that validation should be considered separately for repository design, for PA, and for overall safety analyses.

J. Hadermann (Swiss, Paul Scherrer Institute) described model validation with respect to the tracer migration field experiments at the Grimsel underground test site. The scale of the migration experiment varied from 1.7m to 14m with various nonsorbing and sorbing tracers. From the analyses, he concluded that for radionuclide migration, no new processes (at least on the scales indicated above) needed to be postulated and that the basic model using the retardation coefficient was sufficient to explain the experiment. Results also showed that the retardation could be scaled from the laboratory scale to the field scale.

Johan Andersson (SKI) discussed the lessons learned from the recently concluded INTRAVAL project. The conclusion appeared to be that one cannot validate models in the absolute scientific sense. Reliability of modelling results depend upon sound scientific reasoning and knowledge of basic principles. The focus of INTRAVAL was on determining how well a model can describe experiments and how much uncertainty is involved given that experiments involve biases and artifacts. Often experimental data was not sufficient to discriminate between different conceptual models. In such cases, the INTRAVAL group believes that all of the viable conceptual models should be presented. Other conclusions will be reported in the final INTRAVAL report.

R. D. Wilmot (Galson Sciences Ltd.) summarized the deliberations of a recent workshop on model validation that was sponsored by Her Majesty's Inspectorate of Pollution, Department of the Environment, UK. Participants in this workshop were of the view that model validation is an integral part of the assessment process, rather than a stand-alone aspect. Peer review was regarded as an important element of validation. Applicability of classical validation methods of comparing model results with experiments is limited to component models with limited parameter range and restricted spatial and temporal scales. The workshop suggested that to build confidence in models, these should be: (i) well documented, (ii) subject to peer review, (iii) defensible/pragmatic, (iv) traceable, and (v) iterative. They recommended that the regulator should provide guidance on acceptable methodologies for enhancing confidence.

At the conclusion of the topical session, Tonis Paap, SKB, provided the following list of issues to be discussed by PAAG: (i) definition of validation, (ii) what to validate, i.e., how to identify issues and how to set priorities, (iii) level of validity needed, (iv) practicalities, i.e., robustness of models, requirements of probabilistic assessments, and (v) communication of our concept of validation. On the first issue, most agreed that a new definition was not needed as any definition that was different from the dictionary will only cause confusion. Participants argued that the term validation not be used at all. However, the meaning of whatever other term is used (e.g., confidence building) should be explained (quantitative or qualitative). Confidence building was described as an iterative process in which quality is characterized by documentation, traceability, and defensibility. On the second issue (what to validate), it was stated that certain basic laws are well established and need not be validated any further. Perfect understanding of natural processes is not required - only that which is sufficient to prove the safety case. It was observed that high priority should be given to enhancing confidence where uncertainties have a large impact on acceptable performance. On the level of confidence needed, participants were of the view that a numerical level is difficult to define and will be arbitrary. Therefore, a qualitative criteria is to be preferred. These criteria should specify the systematic methodology that must be followed in the validation process. It was pointed out that it is not necessarily easier to construct conservative models. The WIPP representative asserted that due to nonlinearities in the system, it is not possible to use auxiliary analyses to demonstrate conservativeness of total system analysis. Other views were that detailed models should be tested and then the conservativeness of abstraction for deriving the simplified system model proven. Regarding communications of our ideas on validation, it was stated that problems in the traditional method of scientific validation should be admitted. All agreed that peer review of models is a good idea. The need to communicate regarding the propagation of uncertainty in time was recognized.

A hand-written summary of the topical discussion was produced by Tonis Papp. This is provided in Attachment 12. In this regard, the forthcoming NRC/SKI joint development of a regulatory strategy for model validation was noted and a request was made that it be presented to PAAG in their next meeting. The NRC and SKI representatives agreed to report on progress. PAAG agreed to revisit the validation topic in the next meeting.

ITEM 11. REPORT FROM THE NEAR-FIELD WORKSHOP (CADARACHE, MAY 11-13, 1993)

A very brief report was presented by Timo Vieno, (Technical Research Center, Finland) on the subject workshop. The conclusion of the meeting was that because of the rather substantial difference in the concepts of engineered barriers in different countries, an NEA working group for comparing near-field models will not be useful. Instead, it was recommended that periodic workshops on focused topics should be organized. See Attachment 13 for more details.

ITEM 12. ELICITATION OF EXPERT JUDGEMENT

The Secretariat staff reported on an informal NEA meeting on the elicitation of expert judgement which was held in Paris on October 7-9, 1992. Application of expert judgement and methodological issues were discussed. Recommendations from this meeting indicated the need for an information exchange mechanism on expert judgement techniques and examples, but that NEA should not make formal recommendations on its use. Further, the NEA need not initiate a working group on this topic at this time. The meeting identified areas of further work in this area. Details are included in Attachment 14.

A report was presented on the U.S. DOE workshop on the use of expert judgement. This workshop was held in Albuquerque on November 18-20, 1992. Dan Fehringer (NRC) and Bob Baca (CNWRA) attended the meeting and have already provided details of it in their meeting reports. Abe Van Luik (INTERA) presented a short summary for the PAAG members. A written summary is provided as Attachment 15.

ITEM 13. PROPOSAL FOR AN AD-HOC WORKING GROUP ON INTEGRATED PERFORMANCE ASSESSMENTS

A proposal has been made by the SKI to initiate an examination of recent performance assessments, such as from Canada, Finland, Japan, Sweden, Switzerland, and USA. Issues related to the development and implementation of performance assessment methodologies and their resolution, including the degree of validation effort, process logic, and treatment of uncertainties will be examined. The SKI proposal is to initiate a workshop in which about six existing PAs will be discussed. A report will be presented to the PAAG in a year with suggestions for further work. The presentation made by Johan Andersson is included as Attachment 16. It was generally agreed by PAAG members that such an effort is feasible and worthwhile to

promote an understanding of common methodological issues without reflecting on the general quality of each assessment. Johann Andersson (SKI) was named to Chair this activity.

#### ITEM 14. HUMAN INTRUSION

A report was presented from the 3rd meeting of the Human Actions Group. This meeting was held immediately following the International Seminar on Long-Term Record Keeping - Archives for Millennia, sponsored by the Nordic Nuclear Research Program, in Stockholm, December 2-4, 1992. Mikael Jenson (SSI) reported that a report based on the ideas presented in the seminar has been prepared and will be sent to all PAAG members. Various approaches and their utility along with case studies (Vatican archives and German archives) will be included in the report. The minutes of the third meeting of the Future Human Actions Group are provided as Attachment 17.

Dan Galson (Galson Sciences Ltd.) gave a brief presentation on the report being prepared by the PAAG working group on human intrusion. Several PAAG participants commented on the draft report. It was suggested that the report should include a review of relevant work and discuss the formulation of a generic approach. PAAG had intended the report to focus on a philosophical framework rather than on methods for detailed assessment. Comments from the RWMC pointed out that some of the member countries do not include human intrusion in their safety assessments and that the main role of human intrusion should be in siting and design. The comments reflected the view that cost benefit analysis in deciding whether human intrusion should be included in safety assessments was of doubtful value. Further, the RWMC comments reflected the belief that reference scenarios should be based on current technology. Also, the focus of the report should be on postclosure, inadvertent rather than intentional intrusion for deep repositories for long-lived waste. A focus on risks to society rather than intruders was also believed to be appropriate. It was recommended that both direct and indirect effects should be considered. Member organizations have provided written comments. Another draft of the report will be needed.

In summary, the working group was directed to raise questions about regulatory implementation, but not take positions in this report. The new draft should be available by the end of 1993. Suggestions were also made to add more members to the working group to represent alternative views. Ms. Federline agreed to provide this report to the National Academy of Sciences (NAS) Committee on Technical Bases of the Yucca Mountain Standard if the report is completed within the timeframe of their deliberations.

#### ITEM 15. UPDATING OF THE LONG-TERM PLAN OF ACTIVITIES

No changes to the PAAG long-term plan of activities were made.

SKI's proposal that future work should include activities to enhance the understanding of the available total system performance assessment studies was further discussed. PAAG members agreed to the importance of developing a mutual understanding of performance assessments which have been completed and agreed to a one year effort to evaluate the feasibility of SKI's proposal.

ITEM 16. NEXT TOPICAL DISCUSSION

Because of the number and significance of other topics, no topical session will be included in the next PAAG meeting, but will be organized into every other meeting.

ITEM 17. SHORT PRESENTATIONS ON RECENT PROGRESS

Each member country made brief presentations on the status of performance assessment both from the view of the regulator and the applicant. Margaret Federline presented the status of the NRC work. Written statements are enclosed as Attachment 18.

Three performance assessments were presented in some detail. Timo Vieno discussed the recently completed PA of the Finish repository concept. He indicated that radionuclide solubilities are key parameters for near-field releases. He recommended that NEA consider organizing a workshop on release from wasteform and gas generation. The PA covers all five sites with detailed groundwater flow analyses under natural present day conditions. Effects of repository and long-term changes are considered at only one site. The general principles followed are robust models, transparent calculations, conservative assumptions, and deterministic modeling. The calculations concluded that all of the five sites are safe. Three sites have been short-listed for detailed study. A copy of the report of the Finish PA has been received at the CNWRA and the NRC and can be obtained from the author for review.

Hiroyuki Umeki (PNC) presented the recent PA of the Japanese concept. No site has been selected in Japan and the program is in the research and development phase. Site selection is planned for the year 2000. At this time, neither a site nor a site geology is fixed, so the disposal concept under development has to be reliable in a variety of geologic settings. The Japanese regulations will probably specify a total performance goal, but no subsystem requirements. However, because of the complexity of geology, heavy reliance on engineered barriers will be called for. The objective of the PA is to identify natural system attributes which optimize performance of the engineered barriers. The Japanese concept will have low water flux and reducing geochemistry as key factors. Canister (steel) lifetimes will be greater than 4,000 years.

Peter Bogorinski presented the recent German calculations. The German R&D program is focused on direct disposal of spent fuel, even though in the calculations a comparison was done for disposal of

spent fuel and reprocessed waste. Little difference in risk was noted between reprocessed waste and spent fuel. The calculations apply to the Gorleben site. Three waste emplacement alternatives - borehole, drift, joint borehole and drift are evaluated. The difference in performance of the three disposal concepts was found to be less than the assessment uncertainties. Several scenarios were analyzed both in probabilistic and deterministic framework. A simple biosphere was used that assumed pumping from a well and dilution in a lake. A report has been published and is available to PAAG members.

#### ITEM 18. ANY OTHER BUSINESS

Post-INTRAVAL activities were discussed. Proposals were made by LBL-SKI and U.S. DOE. Out of these, the LBL-SKI proposal was perhaps the best developed. This proposal calls for the creation of a working group to examine problems related to geosphere. Specific issues such as heterogeneity and retardation were suggested as the initial focus of the activity. Participants will be asked to bring their own data and discuss approaches for interpretation and modeling. Any data brought to this forum will be available to all the participants. Meetings of the group will be held annually. Costs will be shared among participants on the model of INTRAVAL/DECOVALEX. A call for identifying a host organization and a strong technical Secretariat was made. A meeting to discuss the organization is planned for the end of 1993 in Washington, D.C. The long-term objectives of the group will be to seek agreement on methodologies to address selected issues.

The DOE proposal has been authored by Charlie Voss of Golder Associates. He seeks joint sponsorship of PAAG and SEDE. The basic theme of the proposal is to develop methods for discriminating between conceptual models. Yucca Mountain data will be used. This group may suggest tests for discrimination which will be conducted by the DOE. PAAG recommended that a concrete proposal with schedules and costs, etc., be presented to PAAG.

#### ITEM 19. NEXT PAAG MEETING

The next PAAG meeting will be held on October 17-19, 1994, immediately following the GEOVAL workshop. The core group will propose an agenda for the next meeting.

#### IMPRESSIONS/CONCLUSIONS

This meeting provided a good forum for discussion of the critical issues related to long-term performance assessment of nuclear waste repositories. Participation is particularly valuable to the NRC because of the focus of the group on such issues as validation which are of immediate interest to the staff in developing guidance to DOE and developing compliance determination methodologies for the license application review plan. In attending this meeting, the

NRC/CNWRA directly benefit by gaining access to the deliberations and technical bases of over ten countries who face similar problems and issues in the projection of long-term repository performance. Even though the NEA has no legal standing in the U.S. high-level waste program, international consensus and/or technical opinions will carry significant weight. Similarly, the comparison of PA methodologies, and development of the international databases is of help to the NRC in the development of staff capabilities for conducting independent performance assessment. It appeared that at this time, the Europeans participate more actively in this group than the U.S. Among the U.S. participants, the DOE/WIPP group appears to be the most active.

#### **PROBLEMS ENCOUNTERED**

No problems were encountered.

#### **RECOMMENDATIONS**

The NRC/CNWRA should continue active participation in the PAAG with emphasis on those work group activities with the most potential significance and benefit to our regulatory program. Participation in the post-INTRAVAL projects that are currently under NEA consideration should be carefully evaluated. The proposal by Chin Fu Tang of the LBL and Johan Andersson of the SKI should be seriously considered by the NRC/CNWRA for participation. A meeting is being planned in early December 1993 in Washington for planning of this project. The NRC or CNWRA may consider taking a lead role or serving as Technical Secretariat in this project as a means of ensuring focus on issues of most interest to the NRC.

#### **PENDING ACTIONS**

Discussion between appropriate NRC (NMSS and RES) and CNWRA staff to decide on the extent of participation in the post-INTRAVAL projects.



ORGANISATION FOR ECONOMIC  
CO-OPERATION AND DEVELOPMENT

NUCLEAR ENERGY AGENCY

STEERING COMMITTEE  
FOR NUCLEAR ENERGY

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RADIOACTIVE WASTE MANAGEMENT COMMITTEE  
PERFORMANCE ASSESSMENT ADVISORY GROUP (PAAG)

CONVOCATION AND PROPOSED AGENDA  
FOR THE NINTH MEETING

Paris, 14-16 September 1993

007409

PERFORMANCE ASSESSMENT ADVISORY GROUP (PAAG)  
NINTH MEETING

Paris, 14-16 September 1993

The 9th Meeting of the Performance Assessment Advisory Group (PAAG) will be held at the Château de la Muette, 2 rue André-Pascal, 75016 Paris, from 14 to 16 September 1993. The Meeting will start at 9.30 on the first day.

Delegates participating are advised that the security arrangements in force at the OECD include the obligation to present an identity document bearing a photograph. This document will be requested at the time of issuing Delegates' cards for the meeting on first entry to the OECD. It should also be presented subsequently with the card every time OECD premises are entered.

In order to guarantee the access to the OECD Château, all Delegates are requested to inform the NEA of their participation in advance of the meeting.

The following agenda is proposed.

DRAFT AGENDA

INTRODUCTION AND REPORT FROM RWMC

- |    |   |                  |
|----|---|------------------|
| 1. | Opening of the Meeting                                    |                  |
| 2. | Adoption of the Agenda                                    | NEA/SEN/RWM(93)2 |
| 3. | Approval of the Summary Record of the 8th Meeting of PAAG | NEA/SEN/RWM(92)7 |
| 4. | Report from the 25th Meeting of the RWMC (February 1993)  | NEA/SEN/RWM(93)1 |

REPORTS FROM ONGOING ACTIVITIES

- |      |   |  |
|------|---|--|
| ✓ 5. | Long-Term Plan of Activities Document   | NEA/RWM/DOC(92)7/REV3                      |
| 6.   | <u>NEA Data Bases</u>   |  |
|      | (a) Thermochemical Data Base  | NEA/RWM/DOC(92)9<br>+ NEA/RWM/DOC(92)9/ADD |
| ✓    | (b) Sorption Data Base / Mechanistic Models<br>[special presentation by S. Altmann] |  |
|      | (c) Data Base on Features, Events,<br>and Processes                                 | NEA/PAAG/DOC(93)1                          |

7. International Projects (Oral reports)

- (a) Alligator Rivers Analogue Project
- (b) DECOVALEX
- (c) BIOMOVs
- (d) INTRAVAL (in-depth coverage under Item 10)

8. Organisation of Upcoming PA Meetings

- (a) Conceptual Model Uncertainty Workshop  
(November 16-18, 1993) Oral report
- (b) GEOVAL '94 (October 11-14, 1994) NEA/RWM/DOC(92)12

9. SEDE Group and PAAG Sub-Groups

- (a) Report from the 3rd SEDE Meeting NEA/SEN/RWM(92)9
- (b) Report from the 14th Meeting of PSAG NEA/PSAG/DOC(93)1
- (c) Report from 3rd Meeting of Human  
Actions Group  
(in-depth coverage under Item 14) NEA/PAAG/DOC(92)5

**TOPICAL DISCUSSION**

- 10. The Topical Discussion will be on the subject of validation and under the chairmanship of T. Papp. An addendum to this agenda will be issued before the meeting with a list of contributors.

**RECENTLY EMERGED DISCUSSION ITEMS**

- 11. Report from the Near-field Workshop (Cadache, May 11-13, 1993)
- 12. Elicitation of Expert Judgement
  - (a) Report from the NEA Informal Workshop  
(October 1992) NEA/RWM/DOC(92)8
  - (b) Report from the USDOE Workshop  
(November 1992)
- 13. Proposal for an ad-hoc working group on  
integrated performance assessments  
(incorporated in the list of priorities of  
the Long-Term Plan of Activities document) NEA/RWM/DOC(92)7/REV2/ADD

14. Discussion and comments on the draft report  
on future actions at radioactive waste  
disposal sites (Human Intrusion)
15. Updating of the Long-Term Plan of Activities
16. Next Topical Discussion

NEA/PAAG/DOC(93)2

#### INTERNATIONAL DEVELOPMENTS IN PERFORMANCE ASSESSMENT

- 17.(a) Short presentations by one representative of each participating  
organisation on recent progress in the field of performance assessment
- 17.(b) Longer presentations on a few recent integrated PAs:
  - Finland's TVO-92
  - Japan's H-3
  - Germany's S.A.M.

#### CLOSURE OF THE MEETING

18. Any Other Business
19. Date of Next Meeting