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ACNW WORKING GROUP MEETING AND VISIT TO THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

On June 26 - 28, 1991, ACNW members, consultants, and staff held a working group meeting at the Center for Nuclear Waste Regulatory Analyses (CNWRA), Southwest Research Institute (SwRI), San Antonio, Texas. The first day of the Working Group meeting (June 26) was open to the public. On June 27 and the morning of June 28 ACNW Members, Consultants, and staff toured the laboratory facilities of the CNWRA and were shown examples of ongoing research.

Dr. Dade Moeller opened the meeting on June 26 and introduced Mr. John Latz, President of the CNWRA and Vice President of SwRI, who welcomed the Committee to the CNWRA. The Committee was also welcomed by Mr. Richard Curtin, Executive Vice President of SwRI.

Dr. Wes Patrick, Technical Director of the CNWRA, provided the Committee with an overview of what could be expected during the first day's presentations and the tour. He noted that it had been approximately a year and a half since the Committee had last visited the CNWRA and stated that they planned to emphasize what the CNWRA had accomplished in that time and what the CNWRA plans to accomplish in the near future.

Dr. Patrick noted that the CNWRA was organized along the same lines as the repository subsystems such as the geological setting, the engineered barrier system, and the repository design, construction, and operation elements. Another important integrating element in the organization is the performance assessment element. The CNWRA also has a quality assurance manager who reports directly to the president and a small technical support office located in the Washington, DC area. There is also an advisory board that meets with the CNWRA quarterly. Members of that board include Dr. Peter Flawn, geologist from the University of Texas; Dr. Guy McBride, former president of the Colorado School of Mines; Major General Andrew Rollins, retired deputy chief of the Corps of Engineers; and Mr. Frank Carter from Westinghouse Electric Corporation.

Dr. Patrick stated that the CNWRA was very concerned about integration within its program. The same staff members are used to conduct both technical assistance and research. Tasks are accomplished by matrix assignment; therefore, work in the area of performance assessment (PA) can draw from all disciplines.

The CNWRA staff increased by 50 percent in the last year, bringing the total to 42. Dr. Patrick noted that the CNWRA is proud of the publications produced by the staff and called the Committee's attention to the publications list.

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The CNWRA is concentrating on developing a "few select areas" of expertise. Those areas are geochemistry, hydrology, rock mechanics, material sciences, structure and tectonics, PA, mechanical and facilities engineering, systems engineering, and administration and support. They have established target numbers of staff they wish to have in each area, which will ultimately total 54.

The CNWRA staff is predominantly Ph.D. level. They are careful to avoid hiring staff with any conflicts of interest and the management of the CNWRA works with the NRC legal staff to ensure this. They especially avoid persons that may have, at some time in the past, taken a position on the acceptability of the Yucca Mountain site.

To ensure that the CNWRA staff is up-to-speed, the CNWRA has implemented a biweekly series of seminars for staff to present their project related work. NRC has also been supportive of a program to provide specific training for CNWRA staff.

The CNWRA is very concerned about the development of computational resources for the staff. A new building for additional CNWRA office facilities is planned for construction this year.

The CNWRA has access to the supercomputing facilities at Idaho National Engineering Laboratories (INEL) and also has access to computer facilities through a commercial firm, the Minnesota Supercomputing Facility. There is also a staff member who has a grant for 200 hours of Cray-2 time with the NASA computer facility. All staff have at least an IBM PS/2 computer workstation. Some staff have access to a SUN system.

Dr. Pomeroy asked what the opportunities were for setting up computer communication between the NRC staff and CNWRA. Dr. Patrick noted that the NRC staff now have their own access to the INEL facility and to two mainframe facilities at SwRI for the Systematic Regulatory Analysis (SRA) information. Mr. Raleigh Johnson of the CNWRA also stated that there is a plan for a computer link between NRC and the CNWRA, but the timing for its implementation has not been determined.

Mr. Patrick explained that the CNWRA has started an exchange of technical staff with the NRC. These exchanges will be for one to several months in duration.

In addition to technical assistance and research work, the CNWRA also works on a small scale with the Licensing Support System administrator and assists the NRC in research on the West Valley demonstration project.

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In the area of technical assistance, the CNWRA takes a systematic approach to developing the regulatory basis for the work and for any positions that are taken. It also examines the technical basis for work so that when guidance is issued by the NRC staff, that guidance will be consistent with the regulations. The CNWRA participates with the NRC staff in the iterative PAs and is now involved in Phase II of that effort.

The CNWRA provides quality assurance support by participating in NRC observations of DOE audits. This includes audits of the technical reviews conducted by DOE.

To broadly define its program, the CNWRA develops a five year plan in parallel with the NRC's five year plan. On an annual basis the CNWRA prepares operations plans for technical assistance to cover a two-year period. Plans are also prepared that cover the life of a research project. In all, planning is done on a broad five year basis, a one to two-year basis, and on a day-to-day basis.

Under the terms of the contract the binding document is the one to two-year plan. These documents are based on a statement of work from the NRC and interactions and negotiations between the NRC and CNWRA. If the CNWRA lacks the staff expertise to conduct assigned work, it attempts to acquire the best consultants it can. Consultant fees now total approximately 15 to 20 percent of the funding. Consultants have been used in areas such as natural resources assessment, tectonics, PA codes, and for staff training courses.

In response to a question from Dr. Hinze about funding for the University of Arizona contractual services, Dr. Patrick noted that those fees are not paid by the CNWRA, but directly through the NRC Office of Nuclear Regulatory Research.

The CNWRA also works on development of confirmatory data and the associated analyses and calculations needed in the review process. In addition, it conducts exploratory research to examine areas where a safety problem could arise in the future. In this role, the CNWRA examines phenomena, processes, and conceptual models that may not be considered by DOE.

Dr. Steindler asked if the CNWRA had the luxury of setting aside resources with which to conduct research of its own choosing? Dr. Patrick stated that the CNWRA does not have direct funding for this type of activity, but through the award-fee contract, the CNWRA can take a percentage of the earned fees and apply those to internal research and development. That program is independent of NRC direction and now has funding of over half a million dollars.

Dr. Pomeroy asked how the CNWRA planned to interact and integrate

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with DOE on the waste package experiment programs being conducted by DOE and the CNWRA. Dr. Patrick responded that the CNWRA staff interacts with DOE formally and informally through technical exchanges and meetings, reviews, and informal discussions.

Mr. Ted Romine of the CNWRA provided an overview of the status of the Systematic Regulatory Analysis (SRA) and plans for the future relative to the SRA efforts. The SRA objective was to test the sufficiency and the clarity of 10 CFR Part 60. It was determined that it was important to minimize questions of meaning or intent in Part 60 and to reduce technical issues to a minimum prior to the license application review period. The SRA project began with the identification of the requirements of Part 60 and the collection of those requirements under topical headings. Uncertainties in those requirements were identified and evaluated and regulatory and technical bases for guidance documents were developed. All of this information was set up in a data base that will, at the time of licensing, provide information such as the results of all the analyses done in the SRA process, the rationale for the decisions made, and the sources and timing of those decisions. This examination of the regulations is not totally restricted to 10 CFR part 60 and includes 40 CFR Part 191 regulations to the extent that they are referenced in Part 60.

The SRA system is purposely flexible. In the early stages it will be necessary to establish models based on "best judgment." These will be changed as data are gathered and models are developed. For each regulatory requirement, there will be a strategy for compliance determination.

Dr. Steindler inquired about the level of effort expended on the SRA and related work. Dr. Patrick responded that work on the Program Architecture and SRA had been conducted over the past three years with three to five FTE per year.

Mr. Romaine discussed in detail how the CNWRA conducted a functional analysis of Part 60. Some of the reasons for the functional analysis were to identify the regulatory uncertainties, and to provide an independent basis for the evaluation of DOE's systems approach. Some of the information discussed by Mr. Romaine is in a report recently submitted to the NRC staff for review. Mr. John Linehan of the NRC staff stated that the staff is not trying to change the CNWRA's positions, but is reviewing the document to be certain that the CNWRA has achieved what was requested.

Dr. Asadul Chowdhury of the CNWRA staff provided a discussion of the program for repository design, construction, and operation of the surface and underground repository facilities. Involved in this program element are technical personnel from a number of disciplines, including CNWRA staff and consultants. The current

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activities of this group include analyses for 24 regulatory requirements for design, construction, and operation of the repository, participation in NRC technical meetings (e.g., ESF Alternatives), reviews of study plans and related site characterization reports, and work on technical positions (e.g., TP on thermal loads and TP on regulatory considerations for the ESF).

Dr. Chowdhury noted that the CNWRA is concentrating its efforts on four regulatory requirements at this time. These include technical analyses of waste retrievability, thermal loads for repository design, mining regulations, and site characterization.

Dr. Chowdhury listed the basic approach for the SRA process for dealing with the four requirements on which his group is concentrating. First, the regulatory requirement is divided into elements of proof and the uncertainties are identified and analyzed. Following that step, a compliance determination strategy is developed and then the compliance determination methods and the technical review components are defined. These methods are how NRC will determine whether DOE has satisfied all the technical review components dictated by the regulations.

Thus far, the CNWRA has identified technical uncertainty in the predictive methodology for thermal loads for repository design and regulatory uncertainty in waste retrievability. Also there are some regulatory uncertainties in the mining regulations.

Dr. Pomeroy asked about the CNWRA's independence. Mr. Patrick explained that the CNWRA was chartered to provide NRC with an independent technical and regulatory analysis. The CNWRA works with NRC on some projects in a collegial manner to address various problems (e.g., performance assessment work), but CNWRA staff express independent technical opinions. In other areas the CNWRA conducts independent reviews of NRC or DOE work.

Mr. John Hageman talked to the Committee about the Repository Operational Criteria study (ROC) and briefly explained the results to-date. The intended product for the ROC study are an integrated repository operational rulemaking and guidance criteria. As part of the ROC study, they plan to address all the criteria that deal with repository design, construction, and operations for the preclosure period and determine whether there is a void in the regulations and if they ensure safety.

The ROC study will also analyze other applicable regulations to determine if there is a major inconsistency or difference between any of those and Part 60. It will also categorize the criteria and determine whether the regulations are too specific in certain areas. Finally, there may be an external peer review of the results and recommendations of the ROC study.

Dr. Steindler noted that all of the topics designed to be addressed by the ROC study are in some other regulation such as Part 72 or Part 100. Mr. Hageman stated that a question that is being addressed is whether other regulations should apply or should they be incorporated into Part 60 to streamline the licensing process.

Mr. Hageman stated that the ROC study has been in progress for nine months. During that time, that group has analyzed other relevant regulations and identified 46 individual ROC topics. Several preliminary areas of concern have been identified and are being reviewed by the NRC. Some of those areas of concern can be addressed by the guidance found in the Format and Content Guide or the License Application Review Plan. Other concerns will necessitate a rule change, a technical position, or some other guidance.

Mr. Hageman provided some examples of ROC study areas of concern. They include preclosure site investigations, geologic repository operations area and postclosure interfaces, and design basis accidents. Future plans for the ROC study include determining which topics require further action and the action required. They will also contrast the results of the analysis with other regulations and then determine if external peer review is needed.

Dr. Shewmon asked if most of the items identified in the ROC study that are already covered in other regulations will be added to Part 60 or will those other regulations apply? Mr. Hageman stated that they do not have an answer at this time, but will consider what action the NRC wishes to be taken.

Dr. John Russell, CNWRA program element manager for the geologic setting, presented an overview of work in that area. He stated that work also included input to the SRA, prelicensing reviews and interactions, and preparation and review of regulatory and technical guidance. That group is also involved actively in research projects in the areas of unsaturated mass transport, geochemical analogs, and sorption modeling. They plan to initiate work on volcanism in the near future and in FY92 they plan to initiate research on long term climatological effects on groundwater, natural analogs for volcanism, regional hydrology, and seismicity and tectonics. These projects will rely on CNWRA staff and consultants.

Dr. Pomeroy asked about the rationale for NRC research on volcanism given that both DOE and the State of Nevada have very detailed programs to address this topic. Mr. Silberberg noted that work initiated by the Office of Nuclear Regulatory Research is examining alternative conceptual models. He stated that in a review by the NRC oversight committee for research, volcanism was cited as an area

that should be addressed by the NRC research staff.

Dr. Russell listed a number of areas where the geologic setting program group has been active in the last year. They have participated in reviewing study plans and the Szymanski report, technical exchanges and meetings, and work on technical positions. They have recently completed a natural resources assessment methodology and a pilot study of computerized balancing of Yucca Mountain geologic cross sections. They will be examining groundwater travel time, and questioning if that regulation is technically sound. In all their examinations of the regulations, the first thing they do is to review the background information and rationale for the regulation.

For groundwater travel time they will first perform a regulatory analysis (SRA), then a technical analysis, and finally a technical analysis. This will include considering alternatives to the groundwater travel time performance objective. Then after alternatives are examined, they will subject the results to a technical peer review. Following that step, a final report will be made available and in fiscal year 1992 the CNWRA will initiate an extensive computational analysis on groundwater travel time.

Another area in which the Geologic Setting Program Element staff are involved is in the generation of probabilistic fault displacement and seismic hazard analysis regulatory guidance. They are providing review of a related technical position (TP) on seismic and faulting investigations and they will assist in the development of the probabilistic TP. Dr. Renner Hoffman, a consultant to the CNWRA, is assisting with this project.

The CNWRA has recently initiated research related to tectonics. Dr. Russell explained that the CNWRA staff believe tectonics to be a key issue for Yucca Mountain because of its impact on groundwater flow and the impact of volcanic and seismic activity on the site. Work in tectonics will be both generic and site-specific. Recent work on a pilot project on structural computer modeling by Dr. Gerry Stirewalt and Dr. Steve Young will be part of the CNWRA's program on tectonics.

Dr. Hinze asked Dr. Russell to identify any areas he viewed as needing work at this time. Dr. Russell noted that more research on the topic of unsaturated zone hydrology needs to be initiated and NMSS needs to develop an expanded program to address geochemistry.

Mr. Michael Miklas of the CNWRA staff presented an overview of a draft natural resources assessment methodologies report. This report is being developed to address the Part 60 potentially adverse conditions related to the potential for inadvertent human intrusion due to the presence of natural resources at a HLW site.

The major concern, according to Mr. Miklas, is whether, in the future, the perception that there are resources at the HLW site would cause the repository to be breached and radionuclides to be released to the accessible environment. Although the waste may be considered a resource, intrusion for that reason would not be considered inadvertent intrusion and, in that case, the assumption is made that whoever is seeking the resource also understands the risks involved.

As part of the approach to the human intrusion and natural resources concern, the staff used the systematic regulatory analysis (SRA) to analyze the technical considerations and regulatory and technical uncertainties that could be present as part of the regulations.

Mr. Miklas showed the Committee maps of the Yucca Mountain area that delineate the locations of known economic mineral deposits. He noted that Yucca Mountain could be interpreted to be in a region where gold and silver are present. He also discussed the presence of petroleum resources and the potential for geothermal resources in the area. Mr. Miklas stated that after the site has been characterized and some idea of what the natural resources within the area is known, a determination will need to be made as to the likelihood of human intrusion. To deal with this concern, NRC will have to conduct an independent analysis of the literature and data gathered on this topic by DOE and consider whether DOE's program for investigating the presence of natural resources is adequate.

If the potentially adverse condition does exist, it will need to be evaluated. DOE will have to show that the adverse condition of naturally occurring materials will not affect performance of the repository, or demonstrate that there are favorable conditions that could offset the adverse condition.

It was also noted that Mr. Miklas would be working with the NRC staff at the NRC offices in Rockville as part of a one-month exchange between the NRC and CNWRA.

Mr. Miklas also talked about the problems encountered in defining the geologic setting. Plans are to conduct further analysis on the topic of geologic setting to determine how it should be defined.

Dr. Sagar presented a discussion on the work of the CNWRA on PA and hydrologic transport. He emphasized that the PA work is a multidisciplinary project with participation by representatives from all groups at the CNWRA and the NRC.

Some of the technical issues being addressed by Dr. Sagar and his group include the implementability of the EPA standard, scenario definition and analysis, evaluation of uncertainties, and

multiphase transport. To answer some of these concerns they are participating in the work on the iterative PA and SRA. They are also conducting laboratory research on flow and transport.

Dr. Sagar explained that as part of the SRA they are identifying the relationship of 10 CFR Part 60.112 to the other parts of the regulation, primarily the 60.113 subsystem performance requirements, 60.130 design criteria, and 60.122 siting guidelines. They know there is a technical relationship, but they must determine if there is a regulatory relationship and how compliance with the regulations can be demonstrated. Their conclusions are that to show compliance with 60.112, it is not necessary to meet all the requirements in 60.113, 60.122, and 60.130; therefore, 60.112, 122, and 130 are independent requirements, but will share common data. Part 60.122 is more than a checklist. Independent analysis for each condition is necessary.

Dr. Sagar talked about the Phase II PA. The CNWRA will participate with the HLW and RES staff on this project. The objective is to acquire and develop the skills to review the license application. A detailed plan that lists the activities, participants and products has been developed for this work. This will not be a complete PA, but critical parts will be completed to see how a PA works and pertinent data will be factored into the PA as it becomes available.

Dr. Sagar stated that in the Phase II PA there are no plans to elicit expert judgment. This will be done later, but for this phase Dr. Sagar emphasized the word "iterative." They will test the models they employ in the PA and "plug" in the data. He also emphasized that for now the data are insufficient.

Dr. Sagar's group is trying to develop the total system PA computer code that partially comes from Sandia National Laboratories and partially will be developed by the CNWRA. They have written a requirements document. He emphasized that a very important objective for the project is to have flexibility in code because of the variety of users within the contributing organizations. The code also has to be "user-friendly" and produce easily understandable outputs. The system is also designed to be used on a variety of personal computers.

Dr. Sagar also discussed various computer codes that they plan to use in the Phase II PA and activities devoted to examining flow and transport. They are conducting research on multi-phase flow and transport models and have written a paper on model testing and verification.

Dr. Pomeroy asked about the evaluation and documentation of codes. Dr. Sagar stated that there are written procedures now being reviewed by NRC for control of codes. They decided that they would document only those codes that they are planning to use for a specific purpose. They are not evaluating all existing codes, but are using information from NEA on worldwide codes.

Dr. Sagar stated that the Phase II PA is the NRC staff's product with input from the CNWRA. Dr. Hinze asked how many iterations of the PA will be conducted? Dr. Sagar replied that the staff will probably go through four or five iterations and Mr. Silberberg stated that the number of iterations are "infinite, within limited resources."

Dr. Shewmon asked if DOE was doing the same sort of iterative PA? Dr. Sagar stated that DOE did an exercise called PACE, Performance Assessment Calculation Exercise. Both groups within the DOE and NRC interact and have presented their work to their peers.

Dr. Sagar noted that the models used are limited by the data available. He stated that the assessments conducted by EPRI are not user-friendly and therefore, are not appropriate to be used at this time. A major problem is that it is necessary to integrate all disciplines such as chemistry, hydrology, and tectonics.

Dr. Gureghian presented a discussion of a sensitivity uncertainty analysis that is one of the tasks associated with the iterative PA and involves an analytical solution of radionuclide transport in fractured rocks. From this work they hope to develop prelicensing guidance and review methods for the license application. They will select likely scenarios that could affect the containment characteristics of the site and then select conceptual models to examine the consequences of the scenarios. This will be done with the application of mathematical models, one of which has been developed to model some of the geohydrological features at the site. This work is being conducted jointly with the NRC staff.

Dr. Gureghian stated that the models used will be verified by duplication of results. This should be sufficient to demonstrate that the model has been verified.

Dr. Gureghian also stated that the analytical model that has been developed to model some of the geohydrological features relevant to the proposed site has limitations.

Dr. Wittmeyer discussed another task, methodology for validation of models, being conducted in the PA element area. He was asked by Dr. Pomeroy to explain what was meant by validation of models. Dr. Wittmeyer explained that they have attempted to ensure that the models that were used provide an accurate or conservative estimate

of the important hydrological features at the proposed repository site. One way to do this is to validate the models against other test cases where there are observed data.

Another way to validate models is to ask certain questions such as whether the model describes and includes all relevant processes and does it describe the geometrical structure of the system. Other considerations include the validity of the assumptions about the physical-chemical environment and whether experiments can be adequately simulated using the model.

The specific case being studied under this task is the INTRAVAL test case 10 at the Las Cruces Trench. although conditions there are unsaturated, the site is not a direct analogue to Yucca Mountain because the soil properties at Las Cruces are less heterogeneous than at Yucca Mountain, the experimental scale is much smaller than that of Yucca Mountain, and there are no fractures at the Las Cruces site. Technical questions that the INTRAVAL test case at Las Cruces is attempting to answer are how much data are required to validate a model and what spatial resolution of the soil hydraulic properties is required to properly describe the solute plume movement.

Dr. Wittmeyer concluded his presentation with some examples of results that were obtained when a series of three models were run. Following this demonstration, the Committee adjourned its formal meeting and tours of the laboratory facilities were conducted on the following day and one-half.

NOTE: A transcript of the meeting is available at the NRC Public Document Room, Gelman Bldg. 2120 L Street, N.W., Washington, D.C., Telephone: (202) 634-3383 or can be purchased from Ann Riley & Associates, LTD., 1612 K St., N.W. Suite 300, Washington, D.C. 20006, (202) 293-3940.