

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

FOREIGN TRIP REPORT

SUBJECT: Attendance at the 8th Meeting of the Integration Group for the Safety Case (IGSC) of the Organization for Economic Co-Operation and Development (OECD) Nuclear Energy Agency (NEA) (20.06002.01.352.702)

DATE/PLACE: October 25–27, 2006, Paris, France

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Subject: Attendance at the 8th Meeting of the Integration Group for the Safety Case (IGSC) of the Organization for Economic Co-Operation and Development (OECD) Nuclear Energy Agency (NEA)

Dates of Travel and Countries/Organizations Visited: October 25–27, 2006, Paris, France—OECD NEA Office

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Background/Purpose: The IGSC is one of the three groups created by the NEA Radioactive Waste Management Committee (RWMC); the other two are the Forum on Stakeholder Confidence (FSC) and the Working Party on Management of Materials from Decommissioning and Dismantling (WPDD). The U.S. Nuclear Regulatory Commission (USNRC) has been involved with RWMC and the three groups it established from their very beginnings because of the direct relevance of the subject matter to the USNRC mission. The purpose of this particular trip was to attend the IGSC 8th plenary meeting held on October 25–27, 2006.

Abstract: Summary of Pertinent Points/Issues: Following are the points of interest from the IGSC meeting.

- Preliminary results of the study on impacts of advanced fuel cycles [or of partitioning and transmutation (P&T)] were presented by the P&T group. A preliminary conclusion of this study is that because of reduced heat generation, advanced fuel cycles may reduce the needed repository footprint by a factor of 3 to 9, but the eventual dose risk may not be significantly affected. The study results were discussed at the 9th P&T Workshop that took place in Nimes, France, September 2006.
- The NEA will cosponsor a conference in October 2007 in Bern, Switzerland, as a followup to the Denver and Stockholm conferences of 1999 and 2003, respectively. This will be a policy-level conference, and ministerial-level participation is encouraged.
- There is a proposal to create an international expert group to systematically include post-irradiation examination (PIE) data in the Spent Fuel COMPOsition (SFCOMPO) database maintained by the NEA. Data on spent fuel from pressurized water reactors (PWR), boiling water reactors (BWR), and the Russian-designed VVER reactors will be included. Expressions of interest or comments should be communicated to K. Suyama at suyama.kenya@jaea.go.jp. The expert group plans to produce a report by December 2008.
- An international workshop on mobile fission and activation products in nuclear waste disposal is being convened on January 16–19, 2007, in L'Hermitage, La Baule, near Nantes (France). The workshop will focus on I-129, Cl-36, Se-79, C-14, and Tc-99, which are commonly found to be the important radionuclides in long-term safety

assessments. The thermodynamic data collected by this project is used by national programs for speciation and sorption models.

- The Approaches and Methods for Integrating Geologic Information in the Safety Case (AMIGO) project is planning to produce a compendium report titled Role of Geosphere in Safety Case. Information for this compendium has been gathered using a questionnaire. The questionnaire was suited more to implementers [e.g., U.S. Department of Energy (DOE)] and, for that reason, USNRC and CNWRA did not participate. Fifteen organizations, however, responded. The theme of the third and the last AMIGO workshop of the series is “Approaches and Challenges for the Use of Geological Information in the Safety Case.” This workshop will be held in Nancy, France, February 26–28, 2008. A site visit to the Bure site will be arranged during the workshop.
- A questionnaire for gathering information on International Experience in Developing Safety Case (INTESC) was sent to the IGSC members last summer. Responses were received from 15 organizations in 9 countries, 3–4 of which are regulators. Preliminary analysis of responses indicates that national programs follow similar approaches for developing safety cases. There is wide agreement on what is needed, such as quality assurance (QA) procedures, multiple lines of reasoning, traceability, technical justifications, and overall confidence statements. The regulators’ expectations are also similar in various countries. The documentation of the safety case can be very extensive (many thousands of pages), leading to a question as to whether resources are being spent appropriately on explaining important aspects.
- A 3-day workshop on Geosphere Stability is proposed for June 2007. The focus will be on hard crystalline rocks, including tuff, in which the flow and transport occurs primarily in fractures. The stability and buffering capacity of such rocks will form the topic of the first two sessions followed by a focus on one or two specific processes. The initiative for this workshop is being taken by Nirex, Posiva, and Swedish Nuclear Fuel and Waste Management Company (SKB). The conclusions from this workshop will be reported in the third AMIGO workshop scheduled to be held in February 2008.
- The European Commission (EC) has included in its Framework 6 research program a Integrated Project on improvement and harmonization of integrated performance assessment (PA) methodologies and tools called PAMINA. This project has the objective of producing a handbook on safety assessment for use by European programs. The EC is also sponsoring its Framework 7 program for research projects focused on waste management. Ninety million euros have been earmarked for the program, which will span 2007 to 2011.
- The chairman of the Sorption Forum presented a proposal for Phase III of the NEA Sorption project. The proposal consists of two parts: (i) Part 1 provides relevant background information and describes the goals of the proposed Phase III and the work packages to accomplish these goals and (ii) Part 2 describes the implementation plan of the proposed work. A guidebook for modeling sorption in PA is proposed to be produced at the end of this project. USNRC Office of Regulatory Research and CNWRA had participated in the first two phases of this project. It is recommended that both organizations continue to participate in Phase III of this project.

- The IGSC will sponsor an international symposium in Paris on January 23–25, 2007, titled Safety Cases for Deep Disposal of Radioactive Waste: Where Do We Stand? The symposium will have four sessions: (i) Session I—a comprehensive overview of recent progress, (ii) Session II—international evolution of the safety concept, (iii) Session III—experience in developing and reviewing the safety case, and (iv) Session IV—role of the safety case in societal dialogue. A poster session will also be held. About 40 papers will be presented. USNRC and CNWRA staffs plan to present two papers in this major symposium.
- The main conclusions from the Fourth Engineered Barriers System (EBS) workshop were (i) ranking of system requirements is essential to guide an efficient iterative optimization process; (ii) a formal framework for documenting decisions is useful; (iii) design alternatives should be assessed in relation to various types of uncertainties; (iv) integration of science, PA, and engineering should be attempted from an early stage of the project; (v) iterative multiscale testing/modeling approaches are warranted; and (vi) sound management and QA programs are essential for providing confidence. Proceedings of the fourth workshop are expected to be produced by spring 2007, and a synthesis of all four workshops is being considered for summer 2007. Dr. Sitakanta Mohanty of the CNWRA attended this workshop and has produced a more detailed trip report.
- Version 2.0 of the NEA database on features, events, and processes (FEPs) was recently completed and is available on CD-ROM. The international FEP list consists of 150 factors, each with a definition and further comment. These are generic, relatively high-level factors and together form a master list and classification scheme by which to examine project-related FEPs. Two project databases (SCK-CEN data for the Mol site and Swedish data on SFR and repository) have been added. The database in Version 2.0 includes 10 projects; 1,650 FEPs; and 700 literature references.

The 9th annual IGSC meeting will be held at the NEA office in Paris during the week of October 22, 2007.

Discussion:

The discussions of information in this trip report are organized into three sections: (i) Regular Business, in which the status of various IGSC working groups is reported; (ii) Topical Session, in which a summary of the session on FEPs is provided; and (iii) Country Reports, in which a brief report of the progress in waste management in member countries is summarized.

Regular Business

RWMC Activities: In addition to its direct activities with respect to the Regulators Forum, long-term safety criteria, and international peer reviews, RWMC continued to oversee the activities of its three subordinate groups (i.e., the FSC, IGSC, and the WPDD). In its March 15–17, 2006, meeting, RWMC reviewed and approved the plan of work of all of its subgroups. It directed the IGSC to provide a newly prioritized list of activities for its consideration and approval. In addition, the RWMC developed a white paper on support to member countries and relationships with other agencies such as the International Atomic Energy Agency (IAEA) and the EC. The white paper clarifies the role of each organization and activities to enhance

cooperation among them. The RWMC noted the value of the NEA international peer review of the Agence nationale pour la gestion des déchets radioactifs (Andra) "Dossier 2005—Argile." A decision was made to publish the self-assessment that the RWMC and its subordinate groups conducted last year.

The NEA has decided to help in the multinational evaluation of nuclear power plants, an initiative proposed by the United States (USA).

The NEA will cosponsor a conference in October 2007 in Bern, Switzerland, as a followup to the Denver and Stockholm conferences in 1999 and 2003, respectively. Ministerial-level participation in this conference is encouraged. The RWMC decided to update the brochure on Strategic Area in Radioactive Waste Management and to create a new document on Directions Regarding Geological Disposal after the Bern conference.

The NEA is considering one new post for nuclear waste management in mid-2008. In 2007–2008, work will be initiated to compare safety measures for chemical toxic waste. Alexander Nies (Germany) was elected to succeed Margaret Federline as Chair of the RWMC; Margaret Federline will continue to serve on the RWMC Bureau.

Advanced Fuel Cycles: Jan Marivoet [Belgian Nuclear Research Center (SCK-CEN)] summarized the results of the preliminary study titled Impact of Advanced Nuclear Fuel Cycle Options on Waste Management Policies. The study considered potential waste resulting from (i) once through (current technology); (ii) recycling of plutonium once (partially closed cycle); (iii) multiple recycling of plutonium from a pressurized water reactor (fully closed cycle); and (iv) fast reactor (fully closed cycle) for disposal in (a) granite, (b) salt, (c) clay, and (d) tuff medium. Because Iodine-129 was a major contributor to dose in all of the options included in the study, the peak dose from the disposal of high-level radioactive waste was not very different for the options considered (fuel cycles and disposal media). However, because of the reduction of waste volume and decay heat, the repository footprint could be reduced by a factor of 3.5 for closed fuel cycles and by a factor of 9 if cesium and strontium are also removed before disposal. However, because of a much lower activity (a factor of 100) in waste after 1,000 years in the case of fully closed fuel cycles, doses from inadvertent human intrusion may be smaller than from other fuel cycles.

Proposal for Setting up an Expert Group on Isotopic Composition Data of Spent Fuel by Post Irradiation Examination: Measured isotopic compositions are particularly important in criticality analyses related to any application of burnup credit as well as to evaluation of far-field criticality in geologic repositories. The proposal is to create an international expert group who will systematically include PIE data in the SFCOMPO database maintained by the NEA. Data on spent fuel from PWR, BWR, and VVER reactors will be included. Expression of interest or comments should be communicated to K. Suyama at suyama.kenya@jaea.go.jp. The expert group will examine PIE activities and data to understand the current situation and gather new data from OECD countries for inclusion in the SFCOMPO database. In addition, the expert group will provide technical advice to member countries. The expert group proposes to produce a report by December 2008.

Peer Reviews of Andra "Dossier 2005—Argile" Under the Aegis of the NEA: The NEA describes a peer review as the systematic examination and assessment of a national waste management program or a specific aspect of it, with the ultimate goal to help the requesting

country to adopt best practices, comply with established principles and, in some cases, improve policy. The NEA conducts peer reviews on a nonadversarial basis and relies heavily on mutual trust among the NEA Secretariate, the RWMC, and the country requesting the review, as well as on shared confidence in the process. The NEA formed a group of 10 international experts to conduct the peer review of Dossier 2005—Argile. The peer review concluded that Andra has developed a sophisticated concept that supports the feasibility of disposal in clay. The peer review recognized that precision underground engineering would be required for success and recommended that Andra develop a demonstration plan. Andra's scientific program was found to be consistent with international best practices and, in some areas, in the forefront.

FSC: The FSC Program of Work for 2005–2008 has five themes, which explore links between stakeholder confidence and (i) research, development, and demonstration; (ii) radioactive waste management organizations and media; (iii) cultural and organizational changes in radioactive waste management organizations; (iv) tools and processes to derive decisions; and (v) the value of the waste management facility to local communities. The FSC has reported on public engagements in France and Canada. This information and the recent FSC workshop was found to be very helpful in developing the decisionmaking process for siting a centralized interim storage facility for spent fuel in Spain. The FSC also continued to work on the Value Added project. The various documents developed by the FSC can be found at <http://www.nea.fr/html/rwm/fsc.html>. The next FSC workshop will be held in November 2006 in Hungary.

WPDD: The WPDD has 41 members from 17 different countries, the EC, and the IAEA. Its mission includes studies of policies and strategies for decommissioning as practiced in various member countries. The WPDD recently produced three reports: (i) Selecting Strategies for the Decommissioning of Nuclear Facilities; (ii) Releasing the Sites of Nuclear Installations; and (iii) Decommissioning Funding, Ethics, Implementation, and Uncertainties. Ivo Tripputi is the new chairman of the WPDD. A report providing an overview of decommissioning and dismantling funding ethics is currently under preparation. Future work of the WPDD includes producing a status report on the release of materials and buildings in 2007. This report will compare release levels for different industries across different countries and the cost impacts of these release levels.

Clay Club (Philip Lalieux): The clay medium is being investigated for geologic disposal in several countries. Sixteen organizations in eight countries dealing with clay medium are members of the Clay Club with two observers including the USDOE. The Clay Club recently published a catalog of clay characteristics that explain commonalities and differences between 12 different clay media ranging from Boom Clay in Belgium to Pierre Shale in the USA. The 16th meeting of the Clay Club was held in Horonobe, Japan, in September 2006. A Belgian case-oriented workshop will be held on November 30–December 1, 2006; the emphasis will be on comparing the two Belgian clay formations with respect to faults and fractures. Experts from outside the waste management arena will be invited to participate. A state-of-the-art report on the self-healing of fractures in clay, developed by the United Kingdom British Geological Society (BGS), was found to not meet project goals, and the BGS contract has been terminated by the NEA. A new group of consultants has been selected for developing this report. The future priorities for the Clay Club, based on self evaluation and discussed at its 16th meeting, were (i) gas migration through engineered bentonite, (ii) impact of alkaline plume on clay, and (iii) diffusion at various scales. The next Clay Club meeting will be hosted by Andra will be held on September 20–21, 2007, and will coincide with the Lille Clay Conference.

EC Research: Michel Raynal presented the status of the EC Framework 6 research program; this included (i) studies of near-field processes (Integrated Projects NF-PRO and FUNMIG), (ii) engineering studies and *in-situ* demonstration (Integrated Project ESDRED), (iii) societal issues related to public acceptance (projects STREP and COWAM-2), and (iv) strategic studies in support of new member states (projects SAPIER and CATT). Also included in Framework 6 is the Integrated Project on improvement and harmonization of integrated PA methodologies and tools (PAMINA). This project has the objective of producing a handbook on safety assessment for use by European programs. The Framework 6 program will end in 2010. The Framework 7 program is currently going through a consultation phase. It will span from 2007 to 2011, and the first call for proposals is expected in December 2006. The EC has allocated 90 million euros for research on management of radioactive waste in Framework 7.

International Commission on Radiation Protection (ICRP) Draft General Recommendations on Radiation Protection: While the IAEA and national programs set the basic safety standards, the ICRP takes science, applies judgment, and articulates policy with respect to radiation safety. In the current recommendations, there is little or no fundamental change to policy except for greater emphasis on optimization. The ICRP also emphasizes the concept that dose estimated far into the future should be considered as only a “potential” dose and that it cannot be estimated precisely. The ICRP recommendations do not explicitly discuss waste management. The draft recommendations retain the concept of collective dose but will explicitly recognize its limitations. For radiation protection, the idea of risk (probabilities × impact) can be used, or probabilities and impacts can be treated separately. ICRP is also considering explicit protection of environment, although it is recognized that it is hard to define.

Sorption Workshop: Dr. Mehdi Askarieh, Chairman of the Sorption Forum, presented a proposal for “Phase III” of the NEA Sorption project. The proposal consists of two parts: (i) Part 1 provides relevant background information and describes the goals of the proposed Phase III and the work packages to accomplish these goals and (ii) Part 2 describes the implementation plan of the proposed work. A guidebook for modeling sorption in PA is proposed to be produced at the end of this project.

The objective of the Sorption Forum is to investigate the feasibility of using thermodynamic sorption models (TSM) in safety assessments. At the end of Phase II, a need arose to develop a guidance document for application of TSMs that will discuss (i) appropriate overall strategies and decisions during TSM development; (ii) methods for determining model parameters; (iii) identification of critical parameters by sensitivity analysis, in particular the effect of parameter uncertainty on the calculated K_d ; and (iv) the scientific basis for applying TSMs to complex and/or compacted materials relevant for the near- and far-field of disposal sites. The overall conclusion of Phase II of the study was that it is feasible to use TSMs in safety assessments, and their use adds confidence to the calculations. Phase III will begin immediately, and it is planned to last two years; the estimated effort is 136 man-days.

Thermodynamic Data Base Project: The objective of this project is to develop a comprehensive, internally consistent, and quality-assured thermodynamic database for solid and aqueous phases of elements that are of interest to the waste management community. The task is accomplished primarily by assigning peers to review literature data to include in the database. Data on uranium, americium, technetium, neptunium, nickel, selenium, and zirconium have been gathered and published in the first two phases of the project. In Phase III,

data on thorium, tin, and iron are being gathered. The database on these three elements is planned to be published in May 2007. An international workshop on mobile fission and activation products in nuclear waste disposal is being convened on January 16–19, 2007, in L'Hermitage, La Baule, near Nantes (France). The workshop will focus on I-129, Cl-36, Se-79, C-14, and Tc-99, which are commonly found to be the important radionuclides in long-term safety assessments. The thermodynamic data collected by this project is used by national programs for speciation and sorption models.

Status of Proposed International Symposium on Safety Cases for Deep Disposal of Radioactive Waste: Where Do We Stand? (January 23–25, 2007, Paris): The last symposium was held in 1989 in Paris. Since then, NEA activities and national programs have progressed significantly. Activities related to the thermodynamic database, the Sorption Forum, the Clay Club, AMIGO workshops, the Regulators Forum, and timescales, as well as new safety reports by the Swiss implementer Nagra, Andra, the Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS), USDOE, and others] can be presented at this symposium. Andra has agreed to cosponsor the symposium by contributing financially. The symposium will focus on deep disposal facilities and address technical aspects with examples from practical experience. Several speakers will be invited, and about 200 participants are expected. The symposium will be held at either Salle Poincare—Ministere de la Recherche or Salle des Nations—OECD La Defense. Details can be seen at <http://www.nea.fr/html/rwm/safety-case>.

The symposium will have four sessions: (i) Session I—a comprehensive overview of recent progress, (ii) Session II—international evolution of safety concept, (iii) Session III—experience in developing and reviewing safety case, and (iv) Session IV—role of safety case in societal dialogue. A poster session also will be held. About 40 papers will be presented.

Fourth EBS Workshop: Forty-seven participants representing 13 countries participated in the fourth and final EBS workshop, held in Tokyo on September 13–15, 2006. The project was initiated in 2001. In 2002, a state-of-the-art report was published, and the first organizational meeting was held in Oxford, United Kingdom. The objective of the project is to clarify the role that the EBS can play in a safety case and how to achieve integration with the natural system. The workshop cycle was Design (Turku, Finland), Process Issues (Las Vegas, Nevada), and Role of Modeling (La Coruna, Spain). The fourth EBS workshop was sponsored by the Japanese Nuclear Waste Management Organization (NUMO), where a tour of the Japan Atomic Energy Agency (JAEA) facilities (e.g., the Horonobe Underground Research Center or the Mizunami Underground Research Laboratory at Rokkasyo, Tokai) was given to the workshop participants.

The main conclusions from the fourth workshop were (i) ranking of system requirements is essential to guide an efficient iterative optimization process; (ii) a formal framework for documenting decisions is useful; (iii) design alternatives should be assessed in relation to various types of uncertainties; (iv) integration of science, PA, and engineering should be attempted from an early stage of the project; (v) iterative multiscale testing/modeling approaches are warranted; and (vi) sound management and a QA program is essential for providing confidence. Proceedings of the fourth workshop are expected to be produced by spring 2007 and a synthesis of all four workshops is being considered for summer 2007. The core group may develop the next steps for enhancing this useful initiative.

AMIGO Series of Workshops: The second of the three planned AMIGO workshops was held on September 20–22, 2005, in Toronto. The proceedings of this workshop have been prepared and soon will be published by the NEA. The AMIGO project currently is working on approaches and methods for integrating geoscientific information. It is implementing plans for gathering information to include in a compendium through a questionnaire. The questionnaire was designed to obtain hard geoscientific information from national programs. Fifteen organizations responded to the questionnaire; some of the responses, however, were incomplete. A preliminary draft (about 30 pages) will be available by December 2006. The theme of the third and final AMIGO workshop of the series is “Approaches and Challenges for the Use of Geological Information in the Safety Case.” This theme will be covered under four main topical areas: (i) use of site characterization and geological data in the safety case, (ii) heterogeneity and variability of the geosphere, (iii) site evolution and its links to scenario development, and (iv) feedback loop between safety assessment and geoscience investigations. This workshop will be held in Nancy, France, February 26–28, 2008. A site visit to the Bure site will be arranged during the workshop.

Geosphere Stability Initiative: A 3-day workshop is proposed for June 2007. The focus will be on hard rocks, including tuff, in which the flow and transport occurs in fractures. The stability and buffering capacity of such rocks will form the topic of the first two sessions followed by a focus on one or two specific processes. The initiative for this workshop is being taken by Nirex, Posiva, and SKB. The conclusions from this workshop will be reported in the third AMIGO workshop scheduled to be held in February 2008.

Timescales Initiative: A working document was presented to the RWMC in March 2006. The RWMC expressed some concern about the link between the timescale report and the long-term safety criteria discussion paper. The RWMC could not agree on publishing the timescale document as an NEA blue-colored document. A decision was made to publish a level 2 document summarizing the topical session held in the 7th IGSC meeting. The timescale group is considering an extension of their work to develop a state-of-the-art report taking into account the evolving ideas about consideration of timescales.

Long-Term Safety Criteria Seminar: The Regulators Forum of the RWMC, formed in 1999, took reviewing the regulations in various countries and examining their consistency as their mandate. The initial comparison revealed a broad range of different criteria and practices. A followup initiative was undertaken to develop a collective opinion on protection standards. A seminar in November covered the research of several years on this topic. The research found three basic approaches to setting regulatory criteria: (i) criteria derived from dose limits and constraints used in current practices, (ii) criteria derived from doses from naturally occurring material, and (iii) risk-based criteria without explicit reference to dose.

INTESC (J. Andersson/NEA Secretariate): There is a recent convergence on the basic concept of safety case as is evidenced by the NEA brochure on safety case (2004) and IAEA safety requirements (2006). The RWMC required the IGSC to assess the status of safety cases internationally. The goals of the exercise are (i) analyze existing cases and identify key concepts, (ii) provide a clear overview, (iii) describe regulatory expectations, and (iv) identify weaknesses and strengths. Information was to be obtained by a questionnaire. Ten organizations are providing financial help. The questionnaire was sent last summer. The questionnaire is structured on the lines of 2004 brochure.

Answers were received from 15 organizations in 9 countries, 3–4 of which are regulators. Some of the answers were quite extensive—a combined total of 200 pages. There was quite a bit of overlap between the questions and answers. Preliminary analysis of responses indicates that national programs follow similar approaches, and there is wide agreement on what is needed, such as procedures, QA, multiple lines of reasoning, traceability, justifications, and overall confidence statement. The regulators' expectations are same in various countries. The documentation of the safety case can be very extensive (many thousands of pages), leading to an observation as to whether we are spending resources on the things that are really important.

The questionnaire sought information on

- safety culture (integration, QA, planning)
- information management
- stepwise approaches to decisions (stakeholder involvement)
- flexibility (design updates, new information)
- QA plan for safety case
- qualification of experts
- application of best available technology (not required in many countries)
- siting and design strategy
- management and treatment of uncertainty (a key regulatory concern)
- probabilistic versus deterministic
- conservative assumptions
- exploration of parameter sensitivity
- alternate conceptual models
- stylized approach
- what-if scenarios
- cutoff time
- handling diverse sources of opinion

The information received will be compiled, and a subgroup will draw conclusions to be included in the final project report.

Future Work of the IGSC (Discussion): IGSC mandate is clearly defined by the RWMC [NEA/RWM(2005)6]. IGSC has three areas of activities: (i) core (e.g., timescales group), (ii) technical (e.g., AMIGO), and (iii) cooperative (e.g., Clay Club). The IGSC conducts these activities through events such as annual meetings, workshops, ad hoc group meetings, questionnaires, and core group meetings. Since 2000, the IGSC has had seven plenary meetings. The work is progressing well but is reaching a crossroad as some key activities are reaching completion, and national programs have some key milestones in front of them. It is important to decide the future course of the IGSC.

The RWMC Bureau noted that activities related to AMIGO, EBS initiative, timeframe initiative, INTESC and safety case symposium will be completed in 2006; therefore, a review and prioritization of future activities is timely. The RWMC recognized high interest in (i) issues dealing with very long-time scales (can we understand the issues and communicate safety issues?), (ii) implementation of optimization strategies, (e.g., how to implement best available technology), (iii) dialog with other groups, (e.g., policy makers), and (iv) operational safety issues. Organizational issues such as key aspects of safety culture and knowledge management are also of interest.

The IGSC also needs to consider how it can project itself more effectively as a reference platform both for providing information to others and for generating the highest professional level discussion and cooperation on RWM issues.

It was noted that the IGSC members attend many meetings, and traveling consumes time; therefore, thought should be given to technology solutions that will allow working together without need for travel. The IGSC should also create a learning environment for new staff. More papers from the IGSC in international conferences are also desirable; however, press releases are not favored.

Responses from IGSC members to a questionnaire on future activities show that members believe there is a continuing need for international collaboration and consider IGSC to be a good forum for such cooperation. Some interest in expanding the current initiatives was expressed. Many programs are approaching an advanced state of development, such as developing license applications, where issues of methodology and knowledge management are coming to the forefront. Some of the suggestions made for future work include

- detailed discussion of approaches in recent safety cases (advantages and difficulties include workshops focusing on 1–2 countries and review of approaches in other disciplines)
- guidance on managing uncertainty
- systematic methods for confidence evaluation, presentation, and communication of safety cases
- gas generation and transport
- practical experience on optimization
- direct exchange with the regulators' forum
- operational issues and safety
- treatment of human intrusion
- long-term monitoring
- advanced fuel cycles
- retrievability

These and other topics need better definition before activities can be planned. More thought on this topic will be given by the core group, and discussions will continue in the next IGSC meeting. Current priority topics will continue to be (i) continuation of the EBS platform (a new work plan will be developed), (ii) FEP database, and (iii) integration of geology and engineering as a workshop series.

Members were reminded of the RWMC recommendation that the IGSC select fewer topics and be focused. Members decided to form a smaller working group (including a representative of RWMC) to develop a list of future activities and suggest priorities. The group will produce a comprehensive and structured list of key issues and priorities and check complementarity with other international programs. The priorities will reflect needs/priorities of national programs and will include a formalized process to review programs, consider collaboration with other NEA committees and with other international organizations, and define end products for activities.

Next IGSC Meeting: The 9th IGSC meeting will be held during the week of October 22, 2007, at the NEA office in Paris.

Topical Session: Handling of FEPs in the Safety Case: Recent Progress and New Methods

The aim of the topical session was to examine current treatment of FEPs in the safety case, specifically in relation to methods for identifying, screening, prioritizing, and modeling. The perspectives of both the implementers and regulators was considered.

Andra: Treatment of FEPs in the Safety Case for Dossier—Argile 2005 (S. Voinis): Andra did not use an FEP database. Design Studies (functional analysis and technical solution) and

Scientific Knowledge (Phenomenological Knowledge Analysis of Repositories Situations—PARS) were used to conduct safety analyses. Three iteration loops have been conducted since 1991 (1996, 2001, 2005). Functional analysis was used to define components and constraints for design and safety; PARS was used to provide a simple and prudent representation of the repository and expected geological environment; and Quantitative Safety Analysis (AQS) and Risk Analysis considered normal evolution through sensitivity and uncertainty analyses. Overall, the project feels that the uncertainties have been reduced during various iterations.

Quantitative safety indicators are used for quantitative comparison; there are no specific limiting values assigned to them. Specifically, functional analysis considered (i) safety, cost, reversibility, and constructability in operational phase and controlling water flow; (ii) limiting the release of radionuclides; and (iii) delay and reduction in radionuclide migration in the postclosure phase. A segmentation into “situations” based on thermal-mechanical-chemical-radiation processes was used for analysis. AQS consisted of systematic identification of uncertainties by safety engineers who have not participated in the scientific work. Uncertainties in data, processes, and models were considered.

The normal evolution scenario (SEN) considered container/overpack failure, seal failure, and a borehole drilled through the repository. The altered evolution scenarios (SEAs) considered heavily degraded operation (all safety functions set at a more pessimistic level than normally expected). Sensitivity cases for both SEN and SEAs were conducted.

The NEA FEP database was used to check comprehensiveness of FEPs.

Nagra (J. Schneider): An FEP database was used to ensure completeness of input information for developing assessment cases and selecting adequate tools. Nagra uses “super-FEPs,” which are aggregated FEPs, in its analyses. The Nagra safety assessment consists of three steps: (i) integration of scientific understanding and abstraction/decomposition for quantitative modeling; (ii) development of assessment cases—significance of individual super-FEPs, construction of scenarios that are “What If fs,” and judging of suitability of codes to implement the FEPs; and (iii) ensuring completeness (as a starting point and during processing and abstraction of information)—audits and checks. The use of “reserve FEPs” is specific to Nagra. Reserve FEPs are those that are omitted from analysis because they imply a conservative safety calculation; however, they can be brought into the analysis, if required. FEPs are used only to develop scenarios, and the FEP database is used for bookkeeping.

Uncertainties are translated into “assessment cases.” A bias audit is done to identify any biases. The Swiss regulator pointed out that interaction between FEPs should be considered. An update of the NEA FEP database to include FEPs from other programs will be useful. Scenario development is done iteratively based on scientific investigations.

SKB: Relation to Safety Functions (A. Hedin): An application for an encapsulation plant is to be filed soon; it will contain a complete safety case. SR-Can is only a preparatory step for the SR-Site (the license application) assessment; it is, however, not a part of any license application. The SR-Can will include analyses of potential KBS-3 repositories at Forsmark and Laxemar to dispose canisters as will be specified in the application to build the encapsulation plant. SKB is making the SR-Can public to obtain feedback from regulatory authorities and other stakeholders. In the Swedish program, the primary safety function is defined as complete isolation of waste for the duration of 1 million years.

Construction of interaction matrices was the starting point for handling FEPs. The FEPs were divided into six categories: (i) initial state, (ii) methodology, (iii) EBS and geosphere processes, (iv) biosphere, (v) external, and (vi) irrelevant. An FEP catalog was created, consisting of all the FEPs to manage data. Deviations from initial conditions were used to define scenarios. Process reports—which are compilations of safety-relevant components such as fuel and canister, buffer and backfill, geosphere, and biosphere—document the relevant FEPs. External FEPs include climate change and future human intrusion.

The analysis approach defines safety functions, analyzes reference evolution (120,000-year glacial cycle, analysis in four timeframes, assessment of isolation potential, and quantification of radiological consequences), and selects scenarios to analyze. A safety function of a component is a role of the component through which it contributes to safety. An indicator is a measurable or calculable property, and a criterion is a quantitative limit of the safety function. The basic process considers every safety function and how it can be lost [e.g., failure of a canister for any reason (such as high buffer density, more massive ice sheet, and severe design flaws)]. Such considerations create scenarios for analysis. Creation of an FEP chart helps keep track of FEPs considered.

In scenario analysis, if a scenario can happen, then the approach estimates its probability or pessimistically assumes it is equal to 1, calculates consequences, and includes in it risk summation. If the scenario cannot happen, then it is considered a residual scenario not to be included in risk summation, but consequences are calculated for illustrative purposes only.

Erosion of buffer materials by dilute glacial meltwater and thermally induced spalling of the near-field rock are the two main FEPs affecting safety.

USDOE (A. VanLuik): The initial FEP list for the 2001 site recommendation (SR) included 1,261 FEPs from NEA, 292 site-specific FEPs, 95 additional FEPs from internal review, and 8 from external review (NRC audits). These were grouped for SR into 328 Primary FEPs. Disposition of SR FEPs is documented in 11 Analysis and Model Reports (AMRs). The FEP list is now frozen for license application (LA). For the LA, 370 Yucca Mountain Project FEPs have been identified. Screening of FEPs is based on regulatory criteria related to probability or consequences. The FEPs that are included are parameterized and abstracted into models. Consistency is maintained at the system level. Scenario classes are constructed from all retained FEPs. Two scenario classes—nominal and igneous—are expected to be used in LA. Human intrusion is treated according to regulations. Seismic scenario has been folded into nominal scenario. The major consequence is from mechanical failure of waste packages due to seismic activity.

Views of Regulators (Philip Bodenez, ASN France): Basic safety rule RFS III.2.f (1991) defines a reference situation of a dose limit of 0.25 mSv/year [25 mrem/year] before 10,000 years; after 10,000 years, regulations require conservative quantitative evaluations with a reference value of 0.25 mSv/year [25 mrem/year]. Regulations also require that dose shall be as low as possible. The operator shall consider effects of heat emissions; mechanical, chemical, and physical changes of rocks; desaturation of repository; defects in engineered barriers; and natural likely events (e.g., climatic change, uplifts, seismic events, and meteoric falls). Human-induced phenomena include drilling, mines, near-surface buildings, and global warming. The operator shall analyze a limited number of representative scenarios and consider combinations of events. Andra defined four main scenarios on the basis of safety functions—seals failure,

package/overpack failure, drilling, and finally, a very degraded scenario, which produced the highest dose of 0.12 mSv/year [12 mrem/year], primarily because the role of the clay barrier was diminished. Good comprehension of phenomena is more important than mere comparison with safety limits; the regulator requested a consequence analysis of a criticality accident. Study of some very low probability (hydrogen production) scenarios was also requested by the regulator because there can be huge consequences.

FEP Database Update (T. Sumerling–SAM): Version 1 of the NEA International FEP Database was developed in 1998–99 and revised in 2000. Version 2.0 has recently been completed and is available on CD-ROM. The basic principle in Version 2.0 remains the same; all functions are accessible by on-screen buttons; no knowledge of the database is needed. Records and data are as they appeared in Version 1.1/1.2 except for some clarification in project description records. The international FEP list consists of 150 factors each with a definition and further comment. These are generic, relatively high-level factors that together form a master list and classification scheme by which to examine project-related FEPs. Overall file structure also remains unchanged. Two project databases (SCK-CEN data for Mol site and Swedish data on SFR and repository) have been added. The database in Version 2.0 includes 10 projects, 1,650 FEPs, and 700 literature references.

Survey Results (NEA Secretariate): The NEA asked members about the future of the NEA FEPs database. Responses from Canada, Germany, Japan, Spain, Sweden, Switzerland, and the USA were received. A number of organizations used the database for defining site-specific FEPs; others used it at the back end to verify their list. Regulators identified the database as a verification tool in their review. The database is limited in that it is somewhat dated, even with recent additions, and the level of information is variable. However, the participants want to have the database readily available, even if further updates are not made. Suggestions for further work included (i) links between FEPs and modeling, (ii) methods for screening and classifications, (iii) detailed supporting documents using indexing technologies, and (iv) in-depth exchange on FEPs for specific media.

Roundup of the Topical Session: The information presented provides insight into use of FEPs in safety assessments. The use of FEPs has evolved, except perhaps in the case of Yucca Mountain, in which the methodology developed by Sandia National Laboratories is still in use. The Yucca Mountain approach is more of knowledge management. In the European programs, there have been more frequent changes in the way that FEPs are used. In the case of the SKB, the FEPs are now based on safety indicators. For Nagra, greater focus is on scientific knowledge, and FEPs are not disaggregated. In the case of Andra, the FEPs are not directly used, but the database is used to check comprehensiveness. Overall, it was recognized that, while it may not be possible to continuously update the FEP database, nevertheless, the FEP Database, Version 2.0 should be readily available to IGSC members.

Country Reports

Czech Republic: The Czech government approved the State Concept of Radioactive Waste Management in May 2002. This concept involves radioactive waste management strategies, including spent nuclear fuel management. Six disposal sites were approved after regional mapping in April 2003, and the siting activities continued with nondestructive research on potential sites. In spring 2004, the program was interrupted for five years by a political decision. As a consequence, geological investigations have been stopped for sites that need an entry

permit. Two candidate sites are expected to be identified by 2015. The other activities in the state concept have continued as planned.

France: An important deadline for completing a national plan for the management of radioactive waste from the Law of 91 (L.542) is coming up in 2006. The plan will include discussions of three research paths: separation and transmutation, geologic disposal, and storage. A parliament report on the law is expected to be published soon. A decision on licensing a repository and long-term storage is expected to be reached by 2016, and a decision on transmutation is expected by 2040. A standing group of experts is providing advice on Dossier 2005—Argile after the review by the Institute for Radiation Protection and Nuclear Safety (IRSN). The Nuclear Safety Authority (ASN) plans to issue an updated version of the Basic Safety Rule RFS III.2.f by the end of 2006 that will include standards for the direct disposal of spent nuclear fuel, retrievability, and other recommendations. Experiments are ongoing at the Bure Underground Laboratory in a niche at a depth of 145 m [476 ft]. The experiments involve geological measurements, geomechanical and tracer tests, and geochemical experiments. An auxiliary shaft will be excavated to a depth of 490 m [1,608 ft], and a laboratory at that depth will be constructed by the end of 2006. An experimental niche is also being built in the main shaft at a depth of at 446 m [1,463 ft]. Greater details on Andra's management changes and plans can be seen at www.andra.fr. Andra's new chairman of the board is a member of Parliament.

Korea: A repository for low- and intermediate-level waste will become operational in 2008; this repository will not accept spent fuel or high-level waste. The repository is located in Wolsong close to the Shin-Wolsong nuclear power plants in the southeast of Korea. This repository will have 42 vertical silos (48 m high and 27 m diameter) [157 ft high and 88 ft diameter] with a capacity of 16,700 drums. In addition, it will have 5 horizontal caves (140 × 20 × 12 m) [46 × 66 × 39 ft] with 20,000 drums. With respect to a high-level waste repository, activities are focused on research to demonstrate confidence in the proposed system. The Korean Atomic Energy Institute (KAERI) has developed underground research facilities for research. A small-scale heater test is currently ongoing.

Sweden: Site investigations for a deep repository for spent nuclear fuel are ongoing in the municipalities of Östhammar (the Forsmark area) and Oskarshamn (the two subareas Simpevarp and Laxemar). According to the SKB schedule, the investigations will continue until 2008, and an application to build a deep repository at one of the sites is planned for late 2009. SKB produced preliminary safety evaluations for the candidate sites at Östhammar and Oskarshamn in 2005 based on available data after an initial phase of site investigations. The aim of these evaluations was to determine whether it is reasonable to (i) continue the investigations from the point of view of long-term safety and (ii) provide feedback to continued site investigations. The safety evaluations concerned only the host rock and essentially encompassed comparisons of site data to previously established criteria for the host rock. SKB is planning to submit an application to build an encapsulation plant in 2006 and, as mentioned, an application to build a deep repository in 2009. The application for constructing the encapsulation plant will discuss operational safety, while the application for the repository will include both the operational and long-term safety. To receive feedback from the authorities, the SKB will publish its SR-Can report in November 2006, which is an update of the previously published TR-04-11, Interim Main Report of the Safety Assessment. SR-Can is based on real site data and data for full-scale EBS manufacturing. It provides the last chance for the authorities to provide comments. Swedish Nuclear Power Inspectorate (SKI) and Swedish Radiation Protection Authority (SSI) plan an extensive review using three international review

groups and several consultants in addition to the staff. SSI also plans to conduct independent calculations to verify SKB models.

Hungary: In Hungary, a systematic program for radioactive waste management started in 1993 with the aim of identifying a suitable host rock for a high-level radioactive waste repository. The exploration tunnel excavated in the Mecsek uranium mine reached the claystone formation in 1995, and the onsite underground data acquisition began in this area. Between 1996 and 1998, a short-term program was launched to characterize the rock mass known as the Boda Claystone Formation. In 1999, a decision was made regarding the closure of the uranium mine that led to termination of the program. However, in 2000, a national screening confirmed that the Boda Claystone Formation (located in the Western Mecsek area, Southeast-Hungary) has the leading position among the potentially suitable sites. Parallel with the strategic development, an exploration program aimed at disposing the high-activity waste and spent nuclear fuel restarted in autumn 2004 in the Western Mecsek area. The Hungarian Waste Management Organization has defined a research program that was approved in July 2003 by the concerned ministry. Based on this program, experts began to select the site for an underground research laboratory (URL). The plan for underground geological explorations also has been described. Licensing was completed for enlarging the interim storage facility. The underground repository exploration for non-nuclear-power-plant low- and intermediate-level waste has started in three blocks of granite at Bataapati, which is located close to Parks nuclear power plant (NPP). Two exploratory tunnels are under construction; the disposal depth is expected to be 250 m [820 ft]. A referendum on the low- and intermediate-level waste repository at Bataapati was conducted by the municipality; 90.7 percent of the people expressing their opinion said “yes” to the proposal. The government pays about 5–6 percent of the investment to the municipality. The Hungarian Cabinet made a positive decision to extend the life of Parks NPP by 20 years. The bill to construct a repository for waste originating at the NPP was passed by the parliament in November 2005. The site at Boda is being investigated for a high-level radioactive waste and spent nuclear fuel repository; a site for a URL in Boda will be selected by 2009. The life of Parks NPP has been extended. A new container for dry storage is also being designed. The site exploration program for high-level waste is proceeding at a low level because of a shortage of funds.

Netherlands: Spent nuclear fuel is sent to France or the United Kingdom for reprocessing. The plutonium recovered is sold for reuse as fuel. The reprocessing waste is placed in a long-term storage facility, where storage may last 100 years. Netherlands supports the concept of a regional waste facility. The climate for nuclear energy has changed quite dramatically with the life extension of the operating NPP. A new research reactor is being developed to be built by 2014. Both salt formations and Boom Clay in the south are being explored for siting a repository. There is significant support for participating in an European regional repository. The government policy has become more pro-nuclear because of the environmental effects of greenhouse gases, and public opposition to new nuclear power plants has decreased. Partitioning and transmutation is a favored technology to handle spent fuel in the future. A Europe-wide policy for nuclear waste management may also become reality. An election in the next couple of weeks may change the balance toward favoring nuclear power.

Japan: The report Repository Concept (NUMO–TR–04–03) outlines the background, principles, and status of development work and discusses how they might progress during the staged siting and implementation program. The companion report Siting Factors (NUMO–TR–04–04) describes the staged site characterization and evaluation process and places them in the

context of the geological setting of Japan. In addition to the collaborations with Posiva (since May 2001), Nagra (since June 2001), SKB (since September 2001), Andra (since December 2001), and USDOE (since July 2002), NUMO concluded a collaboration agreement with United Kingdom Nirex in June 2004. These collaborations currently focus on the approach to site selection, methodology and techniques for characterization of geological formations, repository design and PA, QA, and public acceptance and confidence building.

The Atomic Energy Commission has decided to maintain the reprocessing option, but direct disposal of spent nuclear fuel in geologic repositories is favored. The JAEA was established in October of this year. JAEA will be responsible for the research and development of nuclear energy for peaceful use. In the area of geological disposal, JAEA will support both the regulator and the implementer. NUMO's call for volunteers for hosting a high-level radioactive waste repository did not result in an application. The search for a volunteer will continue. Japan Nuclear Cycle Development Institute published H17, a report on progress in the last five years since the H12 report. A knowledge management strategy is part of the H17 report. The Atomic Energy Commission is reviewing codisposal of reprocessed waste with high-level waste. Additional institutional framework that may be needed for this is being considered. The JAEA will operate an underground research laboratory in sedimentary rocks.

Finland: An underground rock characterization facility (ONKALO) is being constructed for detailed characterization of the host rock at Olkiluoto. The facility will consist of a system of exploratory tunnels accessed by a tunnel and a ventilation shaft. The main characterization level will be located at a depth of approximately 400 m [1,312 ft], and the lower characterization level will be at a depth of approximately 500 m [1,640 ft]. ONKALO is designed in such a manner that parts of it may serve later as access routes and auxiliary rooms of the repository for spent nuclear fuel. The excavations of ONKALO were started in September 2004; the excavation has been slower than expected and has reached a depth of only 70 m [230 ft]. A QA system was established for all activities. Water leakages in the excavations, stray material left in the excavations, extent of excavation damaged zone, and the potential of the borehole connecting the features at depth are of concern. Data interpretation, integration, and analyses for the license application will be needed by 2012. Olkiluoto is expected to be part of the nuclear facility, and safeguards are being developed in collaboration with the IAEA, STUK, and Posiva. Posiva plans to apply for an operation license by 2020. The waste management program is supervised by the Ministry of Trade and Industry and STUK. An application for construction authorization is expected by the end of 2012. When the implementer applies for a license, the underground laboratory will become part of the nuclear facilities. Discussion with authorities is ongoing. A major concern of the regulator is availability of sufficient expertise to it, as a majority of the experts are being utilized by the implementer.

Spain: Empresa Nacional de Residuos Radioactivos SA (ENRESA) is currently developing reports on management options for spent nuclear fuel and high-level waste, including integrated studies on non-site-specific deep geological repositories (one per geological formation: granite and clay), a compilation report on the research and development results, as well as the geological information obtained in the former Site Selection Plan. A non-site-specific global PA in granite (ENRESA-2000 granite) was completed at the end of 2001, and a similar exercise in clay was completed in early 2004. An integrated study for a deep geological repository in granite titled AGP Básico Granito 2003 was also completed in 2004. The diverse studies and projects of the Nuclear Safety Council program offer a wide view of the regulatory

state-of-the-art so the safety assessment exercises of repository concepts made by ENRESA can be further reviewed.

A parliamentary commission in 2004 recommended that ENRESA and the government collaborate to develop a long-term (60 years) interim storage facility. ENRESA has prepared a proposal for such an interim storage facility, and a host community is being selected. Radioactive waste management, which was formerly financed through a fee on rate payers, will now be financed by taxes and other contributions from industries that produce waste. Under this new scheme, the state, rather than the utility, will own the waste. As a consequence, ENRESA will soon be converted into a state entity. Dismantling an NPP will begin in April 2006, which will be a major task for ENRESA. The Research and Technology Division of ENRESA, which was in charge of geological disposal, has been renamed Engineering Division.

Canada: The Nuclear Management Organization presented its recommended approach for management of radioactive waste in Canada in late 2005. Geologic disposal in granite or sedimentary rocks is one of the proposed options. A decision on an option may be made in 2007. The Research and Development program is ongoing. The municipality of Bruce has agreed to dispose of intermediate- and low-level waste at about a 200-m [660-ft] depth in shale. A telephone poll was conducted to determine public acceptance; a 60-percent "yes" vote was obtained. Detailed planning for this facility is in progress. A detailed site characterization plan is being prepared, and an environmental impact statement is being developed, after which the project will enter a formal regulatory phase. A new interest in nuclear power plants also has been expressed in Canada.

Germany: The radioactive waste disposal policy in Germany is based on the decision that all types of radioactive wastes are to be disposed in one deep geologic repository. The Atomic Energy Act gives the responsibility for the disposal of radioactive waste to the Federal Office for Radiation Protection. According to the German disposal approach, radioactive waste is basically subdivided into waste with negligible heat-generating (i.e., LLW and ILW) and heat-generating wastes (i.e., high-level radioactive waste and spent nuclear fuel). Radioactive waste with negligible heat generation comprises all types of radioactive waste originating from the operation, decommissioning, and dismantling of nuclear facilities (e.g., NPPs; reprocessing facilities; nuclear industry for supply and disposal of radioactive materials; research and development establishments; and smaller waste generators, such as hospitals, industry, and universities). As to the quantities of radioactive waste arising, the Bundesamt für Strahlenschutz (BfS) carries out an annual inquiry to determine the amounts of high-level radioactive waste in Germany. According to the latest inquiry, about 39,500 m³ [1.4 × 10⁶ ft³] of radioactive residues and preconditioned waste and about 67,200 m³ [2.4 × 10⁶ ft³] of conditioned waste with negligible heat generation had accumulated in Germany by the end of 2000. The amount of unconditioned and conditioned heat-generating waste was 450 m³ [15,900 ft³] and 1,500 m³ [53,000 ft³], respectively (without spent nuclear fuel elements). Approximately 280,000 m³ [4.9 × 10⁶ ft³] of conditioned waste with negligible heat generation and approximately 24,000 m³ [8 × 10⁵ ft³] of conditioned heat-generating waste will accumulate by the year 2080.

Currently, spent nuclear fuel is either shipped to the French and British reprocessing facilities or stored onsite at the NPPs or at central offsite interim storage facilities. High-level waste originating from reprocessing that is returned to Germany is stored at the Gorleben Interim Storage Facility. According to the agreement between the federal government and utilities and the April 2002 amendment of the Atomic Energy Act, the management of spent nuclear fuel will

be restricted to direct disposal. Transport for reprocessing was allowed until June 30, 2005. In addition, the NPP operators must provide interim storage facilities onsite. Spent nuclear fuel may only be transported if no licensed interim storage capacity exists at the respective NPP site and if the operator of this site is not responsible for this situation (July 1, 2005). Consequently, the utilities will construct and operate new engineered storage facilities at the sites of NPPs.

For the decommissioning of the Mosel repository, the main decommissioning document, called The Plan, has been provided to the authorities. The 20 rooms will be backfilled by 2009. Safety criteria in Germany are late. The proposed criteria are based on IAEA guidelines, except for the stepwise approach, which is not accepted in Germany. The regulator also is developing and defining scenarios.

Switzerland: The revised Nuclear Energy Law became effective in February 2005 with a supplementary ordinance. This law keeps the option of nuclear power open to Switzerland. The responsibility for the waste still lies with the waste producers; disposal abroad is allowed as an exception. Disposal has to be in a deep geologic repository with an extended monitoring period. The site selection process will be defined in a sectoral plan within the framework of the existing land use planning legislation. Site selection will be based primarily on technical criteria but also must address socioeconomic aspects; missing from this process is any mention of volunteers.

Public consultations on Nagra's viability of Opalinus clay as a potential host for the repository took place in late 2005 and led to 6,800 statements, but no new technical issues were identified. On June 28, 2006, the Swiss government decided that the disposal feasibility has been demonstrated. The Nuclear Energy Act requires the supervisory body for nuclear facilities (Swiss Federal Nuclear Safety Inspectorate or HSK) to be separated from the licensing authority (Department of the Environment, Transport, Energy, and Communications and the Federal Office of Energy). According to requirements, the HSK (which is currently a part of the Federal Office of Energy) will become an independent federal institution.

Belgium: For short-lived waste, surface and deep disposal are being studied. Existing nuclear and other volunteering sites are being considered. ONDRAS/NIRAS is in dialogue with three communities for such a site. Two of the three partnerships have completed their programs of work; the third will complete its work by the end of 2006. The federal government will make a site-selection decision in 2007. For the high-level radioactive waste, the supervising Minister asked ONDRAS/NIRAS to develop a program for organizing a dialogue with the stakeholders. A strategic assessment is to be conducted in 2009. A safety and feasibility case is expected in 2012. The feasibility case will be Boom Clay specific, but not site specific. The research and development is focused on a new reference design and a large-scale *in-situ* heater experiment, which is important for clay, because clay is not a good thermal conductor, and its properties are temperature sensitive. The experiment will run over a period of 10 years with final results expected in 2018 to 2019.

United Kingdom: The United Kingdom government is developing a new strategy for long-term management of solid radioactive waste. A new independent committee—the Committee on Radioactive Waste Management (CoRWM)—was set up in November 2003. CoRWM has reviewed the options for safely managing this waste and has recommended a strategy to the United Kingdom government and the administrations for Scotland, Wales, and Northern Ireland. CoRWM considered all wastes that have too high an activity to be consigned to the Drigg site,

which is operated by British Nuclear Fuels Limited (BNFL). They also considered appropriate management routes for certain radioactive materials (e.g., stocks of separated uranium and plutonium) that might be declared as high-level. The CoRWM made 16 recommendations in July 2006. These include (i) geological disposal is the best approach, (ii) interim storage must play an integral part, (iii) a flexible and staged decisionmaking process should be adopted, (iv) research should be intensified, and (v) host communities must participate in the implementation process. The Nuclear Decommissioning Authority (NDA), created in April 2005, will be responsible for geological disposal rather than Nirex. The NDA currently is selecting contractors for managing various nuclear sites. To serve in the future, the CoRWM will be reconstituted to include technical experts. The nation will look for volunteer communities to host repositories. An implementation plan for the CoRWM approach will be available next year. The regulator is revising the guidance for deep and shallow disposal and also for packaging and conditioning of wastes. A new national nuclear laboratory will be created in the United Kingdom with the objective of preserving nuclear expertise and laboratory facilities.

Pending Actions/Planned Next Steps for USNRC:

The Commission may consider participation in the ministerial-level conference in October 2007 in Bern, Switzerland, as a followup to the Denver and Stockholm conferences of 1999 and 2003, respectively. No other policy issues for the Commissioners' attention were identified during the trip. There are, however, topics that need management attention. These are summarized as follows.

- The NEA sorption forum has proposed Phase III of its project with the objective of producing guidance for using thermodynamic sorption models in PAs. It is recommended that USNRC and CNWRA continue their participation in this project.
- An international workshop on mobile fission and activation products in nuclear waste disposal is being convened on January 16–19, 2007, in L'Hermitage, La Baule, near Nantes (France). The workshop will focus on I-129, Cl-36, Se-79, C-14, and Tc-99, which are commonly found to be the important radionuclides in long-term safety assessments. The USNRC and CNWRA should consider participation.
- The USNRC needs to decide whether to participate in a 3-day workshop on geosphere stability proposed for June 2007. The focus will be on hard crystalline rocks, including tuff, in which the flow and transport occurs in fractures. The stability and buffering capacity of such rocks will form the topic of the first two sessions followed by a focus on one or two specific processes. The initiative for this workshop is being taken by Nirex, Posiva, and SKB. The conclusions from this workshop will be reported in the third AMIGO workshop scheduled to be held in February 2008.

Points for Commission Consideration/Items of Interest:

No issues for Commission consideration were identified during this trip.

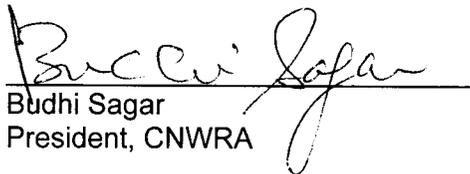
Attachments:

None.

On the Margins:

None.

SIGNATURES:



Budhi Sagar
President, CNWRA

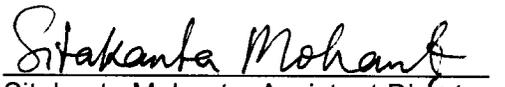
11/17/06
Date

CONCURRENCE:



Jim Winterle, Manager
Performance Assessment

11/17/06
Date



Sitakanta Mohanty, Assistant Director
Engineering and Systems Assessment

11/17/2006
Date