

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Specialists' Meeting to Resolve Issues Related to the Preparation of Safety Standards on the Geological Disposal of Radioactive Waste
Account No. 20.01402.771

DATE/PLACE: June 18-22, 2001
Vienna International Center
International Atomic Energy Commission, Vienna, Austria

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PERSONS PRESENT: A cross-section of about 55 senior individuals from the International Atomic Energy Agency (IAEA), the European Commission, the Nuclear Energy Agency, and 15 member States participated in the Specialist's Meeting (see attached list). Participants included direct representatives of both the implementers and regulators, as well as their contractors. The U.S. Department of Energy (DOE) was represented by A. Gil, the U.S. Environmental Protection Agency (EPA) by B. Forinash, and the U.S. Nuclear Regulatory Commission by W. Reamer. W. Patrick, Center for Nuclear Waste Regulatory Analyses (CNWRA), participated on behalf of the NRC.

BACKGROUND AND PURPOSE OF TRIP: This meeting was a key element of the process IAEA is using to develop a body of understanding that will result in establishing standards for the geological disposal of radioactive waste. The overall aim was to foster development of a consensus on a number of topics that are currently being addressed in a variety of ways by the member States. The programmatic basis for the meeting was a number of position papers developed by the subgroup on Principles and Criteria for Radioactive Waste Disposal of the Waste Safety Standards Committee (WASSC).

SUMMARY OF PERTINENT POINTS: Following the introductory session laying out the purpose and context of the meeting, relevant guidance of the International Commission on Radiological Protection (ICRP), and fundamental elements of radioactive waste disposal, each of seven topics requiring consensus was addressed (see attached agenda). These topics were (a) common framework for radioactive waste disposal, (b) making the safety case—demonstrating compliance, (c) safety indicators, (d) reference critical groups and biospheres, (e) human intrusion, (f) reversibility and retrievability, and (g) monitoring and institutional control. The meeting closed with a plenary summarizing the results of the discussions.

The preponderance of time was allocated to presentations, which limited the depth and breadth of discussions. Consensus views were developed on several important topics, but further dialogue will be needed before acceptable Safety Standards on Geological Disposal of Radioactive Waste can be formulated. Pertinent points of discussion and agreement are noted in the following section. Papers and handouts provided at the meeting are available from the authors of this report, for those interested.

SUMMARY OF ACTIVITIES:

1. Introductory Session

The meeting was opened by A. Gonzalez, Director of Nuclear Safety and Radioactive Waste (NSRW) at the IAEA. He noted that the Joint Convention on Radioactive Waste, which coincidentally took effect the opening day of this meeting, was the foundation for the work of the Specialists. He emphasized the importance of working within the framework of the Joint Convention and the most recent recommendations of the ICRP. He closed by noting that K. Bragg is currently leading development of an "action plan" on radioactive waste in accordance with the recommendations of the Cordoba conference. This plan is to be submitted to the IAEA Board of Governors in September 2001.

G. Linsley, IAEA staff and co-chair of the meeting, provided participants with background on the purpose and context of the meeting, emphasizing in more detail the points raised by Gonzalez. His presentation also indicated the organizational relationships among those developing various elements of the regulatory framework, as well as the logical structure among those elements. L. Baekelandt summarized the outcome of the Cordoba conference, and advised the group that the results of that meeting would be summarized in an informal IAEA publication shortly.

J. Cooper provided pertinent background on the history of development of ICRP guidelines and their general provisions. He highlighted several of the general principles of nuclear safety that are treated somewhat differently in the area of radioactive waste disposal. For example, the principle of justification (i.e., that any action do more good than harm) is to be applied generally to the case of waste management, but should be addressed more fully in the context of nuclear power plant siting, which is the action that leads to the production of waste. Furthermore, the principle of optimization has been called into question because it is "linked too closely" to cost-benefit analyses (CBA). Cooper expressed that there is a growing view that instead of formally using CBA, waste management authorities should consider more generally the question "have I done all I can reasonably do" to ensure radiological safety. Patrick and others raised concerns about this approach from several perspectives, including (a) there must be some ultimate judgment of what is "reasonable," (b) cost is a longstanding basis for evaluating appropriate reduction of risk [e.g., through the "as low as reasonably achievable" (ALARA) principle], and (c) without an objective basis of comparison such as cost, "reasonable" can be locally interpreted and may result in placement of waste facilities where officials set a lower standard for what can "reasonably" be done to protect the public. Cooper also introduced the topic of human intrusion and the perspective of evaluating effects of intrusion on the local population. Currently under consideration is that estimated doses of <10 mSv/year (1 rem/year) would "not likely justify" action (e.g., changes in repository design or siting) whereas doses >100 mSv/year (10 rem.) "would likely justify" such action.

T. Sumerling (consultant to IAEA) closed the introductory session by outlining the basic elements of a safety requirement for radioactive waste disposal. He reinforced comments by Cooper regarding CBA, based mainly on a misconception that CBA applies only "later on, to evaluation of individual components" and that the "decisions with greatest effects on safety are made early on". Several participants emphasized that CBA is in many countries considered very early on, typically during development of environmental documentation. Sumerling also elucidated the differences between the safety assessment (a process of modeling, consideration of uncertainties, estimation of potential doses, etc.) and the safety case (a broader

evaluation that subsumes the former and includes evidence and arguments to support the applicant position that the facility can be developed and operated safely).

2. Common Framework for Radioactive Waste Disposal

In the opening discussion in this session, P. Metcalf (IAEA) called for consistency with regard to regulation of the many forms of radioactive waste. In addition to low-, intermediate-, and high-level wastes, he included in his list naturally occurring radioactive materials, technologically enhanced materials, residuals from rare-earth processing, mine wastes, and disused sources. Taking a risk-informed approach, he expressed that materials creating similar risk levels should be treated in similar manners, without regard to the activity that produced them. Although there was appeal for this approach at a conceptual level, many expressed concern that it would dilute the attention and effort of the IAEA and assembled Specialists from the central thrust on geological disposal. Metcalf also recommended that dose and probability be desegregated in safety assessments. His position was that doing so would better illuminate the role of each in the ultimate risk measure (i.e., a matter of transparency).

P. Raimbault's principal point was that management of radioactive waste should be "unambiguous." Removal of ambiguity requires such measures as identification of the waste types and good traceability. Other factors were outlined in his paper.

Tanabe took a different approach in his presentation. After briefly summarizing the Japanese program, including organizational aspects, he focused his remarks on specific topics where Japan would benefit from an international consensus. These included (a) whether uranium wastes should be covered in the standard; (b) appropriate dose standards, possibly including an "exemption dose level;" (c) selection of disposal depth; (d) applicability of retrievability for different waste types; (e) appropriateness of a standard human intrusion scenario; (f) the time frame for compliance demonstration and what factors to include in it; and (g) the role and time frame for passive institutional control.

R. Heard (South Africa Nuclear Energy Corporation) closed the session with a presentation on (and something of an appeal for support of) a borehole disposal technique that would be applicable to disused radioactive sources. Known as "Borehole Disposal of Spent Sources" (or BOSS), the technique was argued to be particularly applicable in developing countries where waste management technology is not advanced but access to specialized nuclear sources for industrial and medical purposes is commonplace.

Topics considered in the closing summary for this session that require further discussion include (a) the approach and regulatory limits for naturally occurring radionuclides, (b) use of different human intrusion scenarios for different waste types and disposal depths, (c) role of institutional controls, and (d) extent to which the principals and limits of ICRP-81 should apply (e.g., only as a framework for national programs).

3. Making the Safety Case—Demonstrating Compliance

This session, which was chaired by W. Reamer, opened with a presentation by C. Pescatore. Key messages from this presentation included (a) performance assessment (PA) has evolved to where it is fully integrated into the safety case, (b) communication with stakeholders is essential; (c) the safety case must be seen as more than another technical report; and (d) terminology continues to be a roadblock to effective

communication. He described the safety case as presenting the strategic thinking of the implementer that safety is first, demonstrating the assessment capability of the organization, and arguing confidence based on the current knowledge base and prospects for future developments. C. Ohdnoff (KASAM, Sweden) urged that IAEA consider “values as well as data” in its efforts to assure safety and build confidence in radioactive waste disposal. Crosland (UK NIREX) encouraged the Specialists to focus on addressing three key questions in the regulatory framework: what should a safety case look like, who would make it, and why should one believe it?

Based on interest from the assembled Specialists, Reamer provided a summary of the recently released EPA standard and the NRC path forward to develop its regulation. B. Forinash (EPA), augmented the summary and assisted by answering questions pertinent to the EPA.

P. Zuidema (NAGRA) summarized the Swiss approach, and noted difficulties early in their program because of biases toward use of particular computer codes. He stressed a “stepwise approach” to siting, building a safety case, and decision making.

A. Gil (DOE) provided an overview of the Yucca Mountain (YM) program. She emphasized the importance of a single performance measure, multiple barriers, and other familiar elements of the U.S. regulatory framework. Interestingly, her paper appeared to support the perspective of the Nuclear Waste Technical Review Board that at least some of the multiple lines of evidence should be separate from PA. Although no consensus emerged, several argued in favor of PA calculations running to peak dose. These arguments were consistent with the National Academy of Sciences position that there are no technical bases for limiting the calculations to 10,000 years.

F. Besnus (IPSN, France) closed the session with a somewhat philosophical paper on the safety case. Building confidence was a central theme, and he expressed that comparison of alternatives and provisions for retrieveability had more to do with confidence than safety.

Topics considered in the closing summary for this session that require further discussion include the following.

- The safety case needs a clearer definition. There was a general sense that its role is to convince (first the implementer, then the regulator and stakeholders); it should be iterative and structured; it builds on the safety assessment; includes a safety strategy; addresses the quality and quantity of data and associated uncertainties, including their importance to performance; is based on multiple lines of reasoning; and demonstrates safe performance and regulatory compliance with enough confidence to support moving to the next step. There was also general agreement that the case should address the effects of human intrusion, multiple barriers, and retrieval.
- The safety assessment also needs to be better defined. It, too, should be iterative and integrated, addressing both pre- and post-closure performance. Most agreed that it should be expressed in terms of an “estimate of performance,” not a prediction. It must address uncertainties, use of judgment, sources of bias, traceability, and transparency.
- The programmatic context of the safety assessment and safety case need to be clarified. In particular, their role in supporting a stepwise decision-making process needs to be elucidated, taking into consideration the decision maker, the decision to be made, the timing of the decision, and the degree of confidence required at each stage.

- Various Specialists highlighted the importance of addressing public involvement, establishing a timescale for the safety assessment, describing the role of retrievability (e.g., to build public confidence versus increasing safety), but a clear consensus was not evident on whether or how to include these in the international standard.
- Martens (Germany) suggested including a statement on the role/need for deterministic and probabilistic approaches, but Carboneras (ENRESA) expressed that this is “no longer relevant” in general guidance. He and Sumerling argued that proper treatment of uncertainties is the more important part.

4. Safety Indicators

W. Miller (Enviros QuantiSci) lodged a strong argument for introducing “natural safety indicators” to augment the dose/risk values used by most countries. His presentation built on a theme he addressed at the International High-Level Radioactive Waste Management Conference last Spring. Although there was general agreement that factors such as absence of mineral resources, reducing geochemical conditions, and presence of old groundwaters may be helpful in building the safety case, there was strong opposition to regulating using such measures. Furthermore, many of the proposed measures (e.g., groundwater travel time) are at least as problematic as the PA itself, since they involve the same approximations, uncertainties, and modeling assumptions. Given the vigor of the advocacy for including alternative measures, the NRC should carefully monitor inclusion of such measures in the draft standards.

E. Ruokola (STUK, Finland) reviewed progress in their program and summarized their regulatory basis. He stated that expressing PA results in the context of natural radionuclide fluxes (about 10–100 times those from the repository for their case) helped build public confidence.

K. Rohlig (GRS, Germany) provided a status report on the German program. They have found groundwater age, bromide concentrations, saline profiles, and other “natural indicators” to be useful. Individual dose, however, will continue as the sole regulatory basis for their program.

K. Miyahara (JNC, Japan) summarized the Japanese “H12” safety assessment. This included comparison with naturally occurring radionuclide fluxes. The “H12” report is available in the CNWRA library for those interested.

During the summary session on this topic, general agreement was reached in three areas. These are (a) no explicit criteria should be included aside from dose/risk, (b) non-dose/risk indicators appropriate to the scenarios and timeframes should be considered, and (c) associated terminology should be clarified. Agreement was not reached on appropriate indicators. Both Patrick and Gil expressed strong opposition to supplemental criteria (i.e., subsystem requirements), and Reamer stated concern that requiring specific supplemental indicators unduly constrained the implementer.

5. Reference Critical Groups and Biospheres

I. Crosland (UK, NIREX) opened the session summarizing the results of the BIOMASS and BIOMOVs programs, emphasizing consistency with both ICRP-81 and IAEA TECDOC-1077. He emphasized that a reference biosphere provides a practical basis to translate nuclide fluxes into dose, risk,

or other appropriate safety measures. This is needed despite the inherent unpredictability of future human behavior.

T. Sumerling repeated the presentation he made at the International High-Level Radioactive Waste Management Conference last spring (see the previous CNWRA trip report for details). He takes a strong position that one can only "illustrate" a "construct" of human behavior. While his argument is true in absolute terms, he seems to require a much higher level of precision for human intrusion than for geological factors. For example, he spoke in terms of "what one had for breakfast" and "whether one eats potatoes or carrots," things no one would argue should reasonably be included in defining a critical group and its behaviors. He also appeared to believe that the biosphere should not be used in siting and design considerations, a position seemingly inconsistent with taking reasonable measures such as siting in remote areas. NRC needs to monitor how these views are expressed in the draft standard, because such "cautions" can undermine confidence when taken to the extreme.

K. Rasilainen (VTT, Finland) clarified the status of the Finnish program; namely that Parliament has made a "decision in principle" (DiP) regarding waste disposal. Authorization of construction and operation will follow, assuming site characterization supports proceeding. He highlighted the importance of peer reviews, but cautioned that these must be constrained, consistent with the stage of development of a project (e.g., peer review criticisms that are inappropriate in early stages of a project, before sufficient data are collected, can undermine confidence).

P. Pinedo (CIEMAT, Spain) contrasted traditional evaluation of normal/routine releases from operating facilities and potential post-closure releases from repositories. She expressed a difference of opinion with the European Community position on use of a truly static biosphere and the CIEMAT perspective that the biosphere should evolve consistent with geosphere and climate evolution. Interestingly, the PA calculation she presented showed a higher mean dose for the probabilistic analysis (0.3 mSv/yr) than for the deterministic analysis (0.02 mSv/yr). This seems to reflect the "confidence bias" that is often observed in scientific and engineering endeavors: fully reflecting the range of uncertainty in parameters produces a less favorable outcome than the "best" estimate. In the discussion that followed, Forinash (EPA) expressed that residents in the vicinity of the Waste Isolation Pilot Plant wanted to "see themselves reflected" in the selected biosphere model, which is an argument for the biosphere model for any particular site being a reasonable representation of local practices.

General agreement was reached that the BIOMASS and BIOMOVs programs should be completed in a timely manner, the results documented, and the general principles reflected in the draft standard. The basic concepts for defining the biosphere are now mature and there appears to be significant agreement on implementation of these in a standard. Most agreed to a three-part approach: use examples biospheres as a baseline, use common methods to develop other biospheres where needed, and consider the local needs and conditions of stakeholders in developing site-specific biospheres. Agreement was not evident regarding the need to better define the geosphere-biosphere interface and related processes, and the extent to which uncertainties should be incorporated in the safety case.

6. Human Intrusion

The session on human intrusion was chaired by A. Hooper (Managing Director, NIREX) and initiated with a discussion by J. Cooper. This presentation was largely a restatement of his opening remarks, and focused on the provisions of ICRP-81.

The following presentation by P. Carboneras (ENRESA, Spain) raised several important questions, regarding human intrusion scenario development. In the discussion that followed, Patrick and others suggested a two-step approach: use more realistic characteristics during siting and design, and employ a more idealized representation to evaluate regulatory compliance over the long term.

B. Forinash (EPA) presented WIPP and YM as "case studies of the treatment of human intrusion in regulations." She highlighted what she saw as "significant differences" in the two regulations, and summarized the bases for these differences (primarily differences in the availability of data on intrusion by drilling).

The key point in the presentation by M. Westerland (SKI, Sweden) was that the fundamental practice of concentrating and isolating waste is the very thing that makes the potential for human intrusion a risk. He also established a relationship between human intrusion and retrieveability: in general, actions to improve the latter increase the risk of the former. Consensus was not reached on this because the means of inadvertent intrusion (which is all most nations intend to regulate) are quite different from those used to retrieve. Westerland also called for greater emphasis on how intrusion affects repository performance, rather than just considering the doses arising directly from the intrusion (i.e., bringing waste to the surface).

The session summary drew several conclusions and observations.

- The basic issues are who to protect, how to protect, whether different groups warrant different levels of protection (e.g., the intruder versus the local community), how to distinguish between near-surface versus deep geologic disposal, the appropriate time frame, the relationship between human intrusion and retrieval, and the role in siting and design.
- There was general agreement on (a) the need to emphasize that the intent is safe disposal and, consequently, that the design and siting should be optimized with respect to expected events and processes, not necessarily human intrusion; (b) the modes, probability, and effects of human intrusion will differ for deep and near-surface disposal; (c) ICRP-81 provides useful bases for radiological protection, but the distinction it draws between intentional and unintentional intrusion may not be helpful when addressing possible effects on the local population; (d) societal norms play a major role; (e) site- and waste-specific information influences strategies for addressing human intrusion; (f) using a common method but varying its application consistent with the site, design, etc; (g) the importance of evaluating the capability of the system to continue to protect public health and safety following an intrusion; (h) using the common sense argument that the nature of deep geologic disposal is to protect against human intrusion; and (i) different time frames may be applicable to different types of human intrusion that must be guarded against. Although there was agreement on the appropriateness of considering these matters, it was not clear whether there was agreement on including all of these in an international standard.

- Agreement was not reached on what should be considered “unintentional” and what level of protection should be afforded such an intruder (e.g., the driller who drills for water for use by the community versus the one who drills for waste).
- There appeared to be agreement that the international standard should not prescribe markers—depending on societal norms, markers could either attract or warn future generations.
- It was noted that the standard needs to consistently address human intrusion in the context of safeguards and retrieveability.

7. Reversibility and retrieveability

F. Gera (IAEA) opened this session with a lengthy tutorial on the work of the Secretariat to date. He stated that actions taken to provide for retrieval should not “compromise” long-term isolation. His view is that the principles of isolation and retrieval are diametrically opposed. Furthermore, he raised issues about how providing for retrieval would adversely affect post-operational pre-closure (POPC) safety and dramatically increase cost. Rohlig, Sumerling, Patrick, and others disagreed with his rather sweeping statements, noting various benefits obtained by providing for retrieval and maintaining a prolonged POPC, as has been proposed by DOE.

S. Webster (EC) offered strong opinions against providing for retrieval. Among these were (a) it is “very unlikely” a better disposal means will be found, (b) finding a serious site-specific problem is “very unlikely,” and (c) alternate uses for HLW is “very unlikely” and for SNF is arguable. He concluded saying retrieveability is “fashionable” because it “makes the public feel better.”

H. Selling summarized the Netherlands program, where clay and salt are under consideration. Interestingly, the Netherlands includes retrieveability as a consideration for all toxic wastes, including chemical wastes. In the near term, they plan for monitored interim storage, with disposal options to be studied. Specialists from the Netherlands, Belgium, and Germany noted the tradeoffs between safety and retrieveability in creeping geologic media such as clay and salt.

C. Odhnoff (Swedish National Council on Radioactive Waste, KASAM) gave a broad philosophical discourse on matters associated with retrieveability. She stated the KASAM Principle: there must be a balance between the current generation assuming responsibility for wastes, while not foreclosing the right to choose of future generations. She discussed such concepts as the “unfoolproofness of man,” waste disposal creating a “window open to eternity,” “nature does not accumulate waste,” and the need to include “values in addressing waste issues.”

During the summary session on this topic, the following points were noted.

- The appropriate measures to take are site and design specific.
- Any actions taken to provide for retrieval should not degrade the performance or safety of the repository.
- The role of retrievability needs to be clarified: some believe the main/only reason is to build confidence while other consider the potential future need to recover the energy resource.

8. Monitoring and Institutional Control

K. Bragg (IAEA staff) presented the draft position paper on this subject. The paper suggests the following purposes for institutional control: (a) ensure long-term safety, (b) reduce the probability of intrusion, (c) reduce the consequences of intrusion, (d) expedite intervention and remediation, and (e) provide societal confidence in the safety of a waste facility. He suggested four principles of institutional control. These are:

- It is acceptable from a radiation protection perspective to rely on institutional controls to achieve safety.
- No generation is able to impose its will on a future generation.
- Institutional controls do not constitute an “undue” burden from a radiation protection perspective.
- The producer of the waste must provide sufficient financial resources to cover the full cost of safely managing its waste, including any costs associated with long-term institutional controls.

J-P. Minon (Belgium) delineated three key purposes for monitoring: observation, control, and protection. He called for monitoring consistent with the range of anticipated actions, and for incorporating plans for monitoring in design so it can be executed effectively and with minimum adverse affects.

The presentation by M. Jensen (SSI, Sweden) focused on institutional controls. He expressed caution about how standards address such controls, noting that a recent TECDOC on the subject may incorrectly imply that controls are needed because of a “lack of safety,” rather than “lack of certainty.” Furthermore, he questioned why there is so much debate on the subject, given the extensive nature of ongoing monitoring and control of all other nuclear activities.

A. Fattah (IAEA safeguards staff) raised important and potentially far-reaching points. In particular, he stated that from a safeguards perspective the repositories remain “active” long after closure. He characterized a repository as a “uranium and plutonium mine” that becomes easier to access over long periods of time because the intense short-lived radionuclides decay away. These perspectives are apparently discussed in detail in TECDOC-909, but the Specialists were generally unaware of Fattah’s perspective. Selling and others challenged the basic premise of this presentation, noting that the whole point of deep geological disposal is to significantly decrease accessibility to the waste.

The closing session on this topic summarized a number of points of agreement and identified several areas where further discussion is needed.

- The fundamental purpose of deep geological disposal is to avoid the need for long-term monitoring and control.
- Monitoring and institutional control can, nevertheless, contribute to long-term safety (e.g., by preventing human intrusion and/or mitigating its consequences).
- Monitoring and institutional controls should be permitted only to the extent that they do not detract from performance and required only to the extent that they contribute to performance or confidence in such performance.
- Various participants stated what they considered appropriate reasons for implementing monitoring and institutional control; these included safeguards, public interest, confirmation of performance, developing an environmental database, and furthering the general interests of science.

- There was a general sense that reasonable monitoring and institutional controls are not likely to be considered “undue” long-term burdens, but rather part of good stewardship.
- There was general agreement that each generation will make own decisions, and that it is important to pass on information/knowledge to the next generation. The IAEA may need to develop or explore mechanisms to do this effectively.

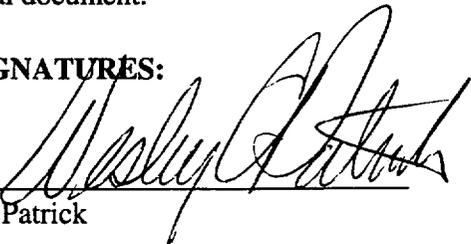
CONCLUSIONS: Conclusions are included in the summaries at the end of each individual section, above.

PROBLEMS ENCOUNTERED: None.

PENDING ACTIONS: Several IAEA TECDOCs were mentioned in the course of the meeting. Appropriate staff should review these to increase NRC/CNWRA familiarity with the subjects. When reviews are conducted, summaries should be provided to management, as appropriate. Succeeding drafts of the proposed safety standard should be carefully reviewed and timely comments provided to the IAEA WASSC. Careful coordination of the flow of information through M. Bell, J. Blaha, and others should continue.

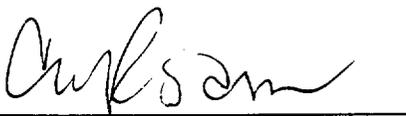
RECOMMENDATIONS: The series of meetings on this subject is very important to the U.S. radioactive waste management program. Although non-binding, the international consensus positions established through this process will need to be addressed in any positions taken in the U.S. It is the authors’ sense that public perception regarding the U.S. program and public confidence in the program will be bolstered by participation and adoption of a regulatory regime that is not inconsistent with international consensus. Consequently, appropriate NRC and CNWRA staff should continue to participate in the process and in preparation of the final document.

SIGNATURES:



 W. Patrick

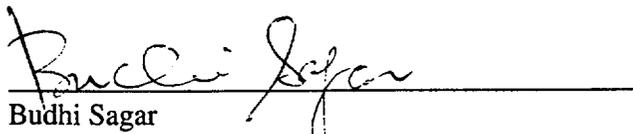
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 Date



 W. Reamer

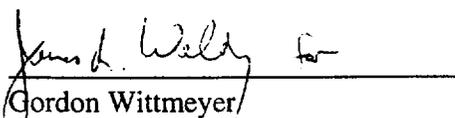
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CONCURRENCE:



 Budhi Sagar

7/6/2001
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 Gordon Wittmeyer

7/6/2001
 Date

Department of: Nuclear Safety

Division / Section of: NSRW/WSS

Issue No. 5

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NOTIFICATION OF AN AGENCY MEETING

Title of meeting:	Specialists' Meeting to resolve issues related to the preparation of safety standards on the geological disposal of radioactive waste						
Dates, inclusive:	18-22 June 2001	Place:	Meeting Room C07IV	Ext.:	22702	Convening Time:	
Scientific Secretary	Room No.	Ext.	Secretary	Room No.	Ext.	Conference Clerk	
Gordon Linsley	B0719	22666	Ms. Nerri Barrios Linton	B0717	22702	Ms. Stefanie Schimann	
Phil Metcalf	B0725	22676					

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18-21 June

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International Atomic Energy Agency

**Specialists' Meeting to Resolve Issues Related to the Preparation of Safety Standards on
the Geological Disposal of Radioactive Waste**

**18-22 June 2001, Conference Room C07IV
Vienna International Centre**

In the context of the Agency's programme to create a corpus of internationally accepted Radioactive Waste Safety Standards, focus is currently being placed on establishing standards for the "geological disposal of radioactive waste". This is a challenging task and the Specialists Meeting is intended as one mechanism for promoting discussion on some of the associated scientific and technical issues and as a means of developing the consensus needed for establishing the standards. The meeting will use, as its basis, a number of position papers developed in recent years with the help of a subgroup of the Waste Safety Standards Committee (WASSC), the subgroup on Principles and Criteria for Radioactive Waste Disposal, together with selected relevant regional and national papers.

PROVISIONAL PROGRAMME

Monday, 18 June

Morning

9:30 a.m.

- | | | |
|--|---|---------------------------|
| 1. Opening/Welcome | - | <i>A. González</i> |
| Meeting Chair | - | <i>L. Baekelandt</i> |
| 2. Introductory session | - | Chair - <i>H. Selling</i> |
| Purpose and context of the meeting - the IAEA waste safety standards programme | - | <i>G. Linsley</i> |
| ICRP guidance on radioactive waste disposal | - | <i>J. Cooper</i> |
| Elements of a safety requirement on the geological disposal of radioactive waste | - | <i>T. Sumerling</i> |
| Discussion | | |

Afternoon

2:00 p.m.

3. Common framework for radioactive waste disposal - Chair - *J. Cooper*

Different disposal options are adopted for different waste types and while the practice being followed in countries is generally consistent it would be useful to have a coherent and technically defensible strategy which covers the disposal of all major waste types.

A common framework for the safe disposal of radioactive waste - *P. Metcalf/I. Barraclough*

Safety of radioactive waste management in France - *P. Raimbault*

Basic strategies for radioactive waste disposal in Japan - *H. Tanabe*

The borehole disposal of spent sources (BOSS) - *R. Heard*

Discussion

5:30 p.m. Cocktail - VIC Restaurant

Tuesday, 19 June

Morning

9:00 a.m.

4. Making the Safety Case — Demonstrating compliance - Chair - *W. Reamer*

The safety case for a geological repository may have to satisfy/convince persons from a variety of backgrounds, not all technical. While the core of the safety case should be based upon a formal performance assessment, other arguments may also need to be brought to bear, for example, the perspective of natural analogues, arguments on the retrievable nature of the waste.

Safety case: an international perspective - *C. Pescatore/S. Voinis*

The role and development of the safety case for geological repositories for radioactive wastes: Experiences with the Swiss programme - *P. Zuidema*

U.S Department of Energy's Perspective on safety case for geologic disposal of high-level radioactive waste - *A. Gil*

A framework for elaborating a geological safety case: main issues to be addressed - *F. Besnus*

Discussion

Afternoon

2:00 p.m.

5. Safety indicators - Chair - *Y. Kawakami*

While radiation dose and risk are the main indicators of safety currently used in the safety assessment of radioactive waste disposal it has been thought desirable to supplement, and in some circumstances replace, dose and risk by other indicators, such as environmental concentrations and biospheric fluxes, which may have a lesser amount of predictive uncertainty associated with them.

Natural safety indicators and their application to repository safety cases - *W. Miller*

Safety indicators adopted in the Finnish regulations for long term safety of spent fuel disposal - *E. Ruokola*

The role of safety indicators in Germany: The past and the future - *K. Röhlig*

Application of non-dose/risk indicators for confidence-building in the H12 safety assessment - *K. Miyahara*

Discussion

Wednesday, 20 June

Morning

9:00 a.m.

6. Reference critical groups and biospheres - Chair - *P. Carboneras*

In the far future it will be impossible to predict with any reliability the nature of the biosphere overlying the waste repository and of the critical group of persons occupying it. A reference biospheres and critical groups are therefore developed as appropriate standards or references for use in converting the results of geosphere transport predictions to dose.

Reference biospheres for safety assessment of radioactive wastes disposal facilities - *I. Crosland/C. Torres*

Some viewpoints on reference biospheres in Finnish performance assessments - *K Rasilainen*

Treatment of the biosphere - seeking credible illustrations - *T. Sumerling*

Experience in biosphere modelling and definition of exposed groups. Concerns on consideration of the long-term." - *P. Pinedo*

Discussion

Afternoon

2:00 p.m.

7. Human Intrusion

- Chair - *A. Hooper*

Assessing the implications of human intrusion into a geological repository and establishing criteria for deciding on the acceptability of the disposal system in this context has been an issue of debate for many years.

Human intrusion: New ideas? - *J. Cooper*

Definition of commonly agreed human intrusion scenarios to be used in long term safety assessments - *P. Carboneras*

U.S. EPA's policies on consideration of human intrusion in evaluating the suitability of disposal systems - *B. Forinash*

Some reflections on human intrusion into a nuclear waste repository - *M. Westerlind*

Discussion

Thursday, 21 June

9:00 a.m.

Morning

8. Reversibility and retrievability

- Chair - *P. Raimbault*

The recent focus on reversibility and retrievability is, in part, a reflection on the need to reassure stakeholders that actions taken now can be rescinded. Is this now a condition for any type of radioactive waste disposal? It is clear that it should not have an adverse effect on safety.

Considerations on reversibility and retrievability - *F. Gera*

Reversibility and retrievability - what is the question? - *S. Webster*

Policy of radioactive waste disposal in the Netherlands - *H. Selling*

Retrievability - a too simple answer on
difficult questions?

- *C. Odhnoff*

Discussion

Afternoon

2:00 p.m.

9. Monitoring and Institutional Control

- Chair - *D. Metcalfe*

Although geological repositories will be designed to provide passive safety after closure, mainly for public reassurance purposes, it is likely that some institutional controls including monitoring of the surface environment of the repository will be retained. Surveillance and monitoring may also be required for nuclear safeguards purposes.

Institutional control

- *K. Bragg*

Aims, perspectives and limitations of monitoring
for the geological disposal of radioactive waste

- *J-P. Minon*

Radiation protection activities after closure of
geological repositories

- *M. Jensen*

Current safeguards policy and its implications

- *A. Fattah*

Discussion

Friday, 22 June

Morning

9:00 a.m.

10. Final discussion and conclusions

- Chair - *L. Baekelandt*

Session Chairs will report on their sessions and attempt to draw conclusions which could be used as a basis for positions to be adopted in the Safety Standards documents.

Reports of Session Chairmen

Discussion of conclusions