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JNMM

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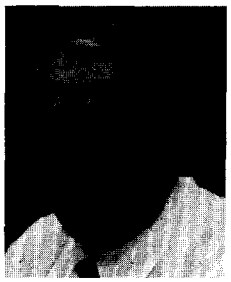

I am excited for the future of the INMM as I assume the office of president of the Institute. We have just completed a very successful 41st Annual Meeting. I must admit that with the government travel restrictions I questioned how many would attend this year's Annual Meeting. Charles Pietri and his program committee assembled a very strong technical program with 276 papers, but there was concern about cancellations. We did have some cancellations, but they were minimal.

Of course the real heroes are those of you who submitted those papers and those of you who attended to listen to them. Our total registration was nearly 600, making this meeting one of the most successful that we have ever had. In addition to the successful meeting, we are strong financially, we have new chapters, and we are poised for even greater growth and development.

In the summer 2000 issue of *JNMM*, our president for the past two years, Debbie Dickman, challenged all INMM members and interested individuals to become even more active in local chapter, division, committee, and workshop activities. She even listed the names and telephone numbers of the chairs of the divisions and standing committees. Included here are the E-mail addresses of each of these individuals. Some of these individuals will change soon, but your messages will be forwarded to the proper people. Additionally, she urged you all to contribute articles and other efforts to making *JNMM* even more useful and successful.

Debbie emphasized that the INMM was organized into divisions to reflect the issues, technologies, and capabilities needed to assist in the implementation of nuclear materials management and nonproliferation objectives. I want to reinforce her emphasis and challenge.

At every INMM Annual Meeting, on the opening Sunday afternoon from 2 to 5 p.m., each of the Institute's technical divisions meet. Not only are the meetings open to all INMM members and interested individuals, you are encouraged to attend one or more of the meetings and participate. Likewise the standing committees also meet at various times during the annual meeting. New volunteers are always welcome. Please contact the chairs of these committees and indicate your interest.

Most of you have E-mail access so I am encouraging a lot of two-way communication between you and the division and committee chairs. All of the chairs are anxious to hear from you and discuss your ideas about existing and proposed division activities. This will allow them to establish a more meaningful agenda for the meetings. I know that many of you are interested in the activities of more than one division or committee, so I will ask the chairs to coordinate their agendas so that those with input and ideas in more than one meeting can be heard.

I believe that the only way we can continue to be a cutting-edge organization and to more fully meet our members needs is for each of us to become more active. The division chairs, program committee, and submitting authors have done an incredible job of addressing relevant issues, but your help is needed for us to continue to be timely and relevant. Several of the divisions have specialty interest areas and more could be created. Likewise new divisions could be formed if the need exists.

I believe that my excitement about the coming year will be realized and will depend upon our individual efforts. In the sharing of our ideas, and in contributing in our own areas of expertise, we can all benefit. Begin now. Contact the chairs or me to let us know in what area you are willing to serve. One of the most active divisions contacts members of the committee on a regular basis by E-mail. Not only do they know each other better, they have developed a strong division.

I welcome your comments and look forward to getting even better acquainted with each of you in the coming years.

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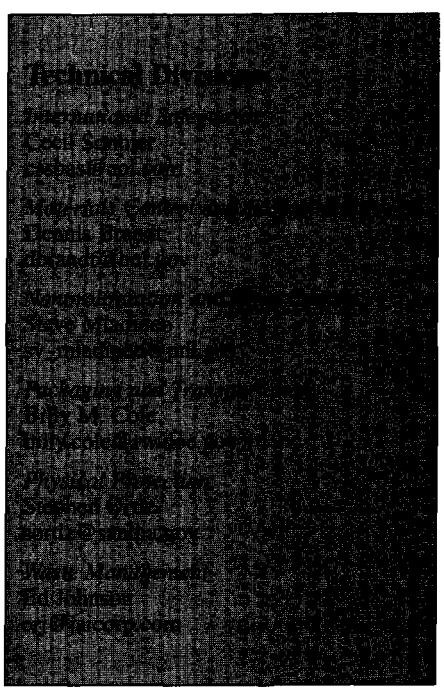
Looking Back at the Outgoing President's Term

The last two years have flown by, and it hardly seems possible that I am writing my last column. As I look back over this time, I see many positive INMM accomplishments. It has been very rewarding to assist in the formation of two new international chapters—the Urals Regional Chapter, in Snezhinsk, Russia, and the Ukraine Chapter, in Kiev, Ukraine. The formation of new INMM chapters is very exciting and increases INMM's ability to influence global nonproliferation and nuclear materials management activities. In addition, the Korean chapter has experienced a growth in membership, and having grown to more than fifty members, is now an *ex officio* member of the Executive Committee. In addition, the Central Chapter of INMM has been revitalized through the dedication of Chris Pickett and a small group of INMM members who realize the value of the INMM to themselves and the community.



I'm also pleased that INMM has been able to remain strong financially and continues to offer services and programs that keep our membership up and our functions well attended. Financial stability is essential to facilitate successful promotion of responsible nuclear materials management through technical meetings, publications and professional interactions. Being able to report financial health is a significant accomplishment in these challenging times. The activities to date this year, including the great attendance at this year's Annual Meeting in New Orleans, indicate that fiscal year 2001 will be successful also.

INMM has participated in, or sponsored a number of international events, including the 20th Anniversary meeting of the Japan Chapter INMM, the 21st Annual ESARDA meeting, the IAEA 42nd and 43rd General Conferences, and the 2nd Russian MPC&A Conference in Obninsk, Russia. Our technical divisions have continued to be very active, conducting well-received technical workshops addressing a wide range of issues facing the international community dedicated to the responsible management of nuclear materials.

I would like to express my gratitude to some of the invaluable volunteers who continue to make significant contributions to the Institute. Secretary Vince DeVito and Treasurer Bob Curl deserve special recognition. They have a vast store of management expertise and institutional knowledge that provides the solid foundation of the INMM. Their presence ensures continuity of knowlege and a smooth transition during the ongoing changes in the Executive Committee. Without their support and guidance, each new incoming president would find the challenge significantly more daunting.

I would also like to thank Past President Obie Amacker for his continued support to the INMM. His interest in the long-term future of the INMM and willingness to serve as the chair of the Fellows Committee demonstrates his personal commitment to the INMM and will extend well into the future.

It is my pleasure to pass the gavel to J.D. Williams as the next president. J.D. has been a long-time supporter of INMM and brings a great deal of experience to the position. The newly elected Executive Committee will face challenges as they direct the Institute in this new millennium. I encourage you to provide input to the Executive Committee to assist it in making decisions that make the INMM stronger and provide the highest quality member benefits.

One of the greatest pleasures of having served as president has been the opportunity to work closely with INMM members and professional colleagues around the world. This experience has enriched my life more than I can say. It has been a privilege to represent the members of the INMM in this role and have the opportunity to work with other dedicated nuclear materials management and nonproliferation professionals.

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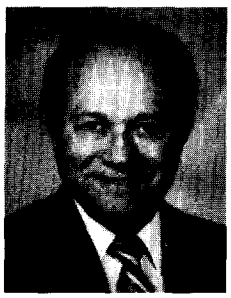
The 41st INMM Annual Meeting—A Hot and Steamy Affair



The 41st INMM Annual Meeting was indeed a hot and steamy affair. A lot of new ideas were presented and some old ones were reworked. Yes, it was also hot in New Orleans—temperatures averaged from 96-102°F and the humidity averaged 75-100 percent. It was a record sustained high for the city! (Remember, I told you so in the closing statement of last year's report of the Annual Meeting.) Anyway, we are really supposed to be inside during the day where the air-conditioned environment can stimulate our creativity for dealing with the challenges of the technical program—and leave the hot stuff for the evenings.

Was it a successful meeting? Did you know that we nearly had a total disaster in logistics for the Annual Meeting when twenty-one out of twenty-four boxes of meeting materials (including award plaques, flags, ribbons, and related items) being shipped by truck never arrived in New Orleans? Thankfully, session signs, the final programs, and a few other critical essentials made it through. The INMM HQ staff made a super recovery and quickly replaced nearly everything. INMM HQ Staff also was right there to help resolve a leaking ceiling incident in one of the meeting rooms so that no talks were delayed. I also need to thank Rachel Airth, our administrative director, whose outstanding performance during the spring program crisis (described later on) and stalwart actions at the Annual Meeting saved INMM from much anguish and ensured our success.

Debbie Dickman and J.D. Williams congratulate Lisa Gee Chiang, recipient of the INMM Student Paper Award.

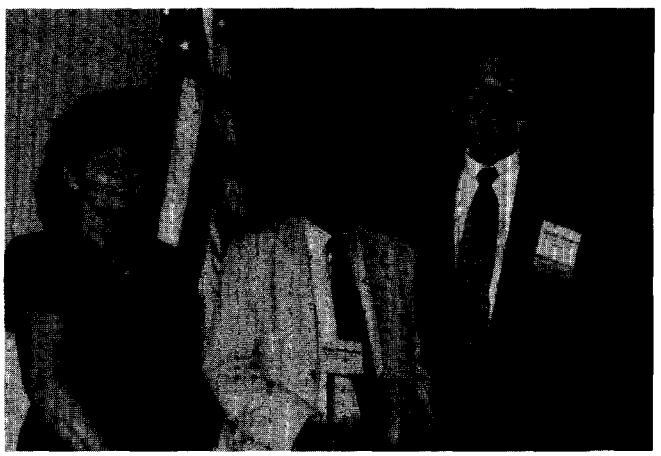
Again, was it a successful meeting? The meeting evaluation forms rate the technical information exchange as good-excellent (78 percent) with a 12 percent rating of poor-fair. However, only 4 percent of the attendees provided a formal response. Those few that registered major concerns felt that the poster session needed more space, the quality of the some papers needed improvement, and a few of the speakers needed to upgrade their presentation skills. Logistics for the meeting were good-excellent but again a few attendees expressed disappointment with the location of the meeting, some meal functions, and the hotel accommodations. The greater majority of attendees raved about the extraordinary opportunities to meet with so many professional colleagues from around the world, participate in valuable private meetings, hear some really outstanding papers, and gather useful information from other specialty areas that they ordinarily might not encounter. The only two exhibitors who responded provided mostly favorable comments but, along with some informal comments from other exhibitors, gave us several really great ideas to improve the effectiveness of the exhibits for next year.

Debbie Dickman and J.D. Williams with INMM Secretary Vincent DeVito (center) who received the INMM Meritorious Service Award at the INMM's Awards Banquet.

Another comment we've had for several years concerns the ability to locate specific papers and speakers in the Final Program. (The Schedule-at-a-Glance shows only session and session chair.) With nearly 300 papers to sort through, it is certainly a problem.

We had planned to fix the matter this year with an expanded matrix-like foldout that would provide paper title, speaker and authors, session, and location. Unfortunately, we ran out of time to develop the system this spring since we were diverted to dealing with some unusual and serious program issues. So, if no major operational obstacles develop, the new meeting plan with sessions and papers listed should be available for the 42nd INMM Annual Meeting.

The program issues that created such



The INMM Distinguished Service Award for Hiromasa Nakano was accepted by Shunji Shimoyama.

a crisis for INMM consisted of a series of unexpected events. Following the Technical Program Committee meeting in March to review submitted abstracts, there were an inordinate number of changes by authors to their titles, the speakers, the authors, affiliations, and even to their abstracts that had to be addressed before the Final Program. (That's why this year the Final Program bears little resemblance to the Preliminary Program. We were not even able to post the revised program on the website in time so several speakers were surprised and somewhat disturbed by some of the drastic changes made just prior to the meeting. For this failure on our part, regardless of the circumstances, we sincerely apologize.) In addition, there were so many paper withdrawals after the Preliminary Program was finalized in April (a total of 44 before we went to press for the Final Program) that all of our time was spent reconstructing the technical program. (In fact, even at the meeting, we had two program addenda issued noting sixteen changes and an additional twenty withdrawn papers!) There's a lesson to be learned here: input to the INMM Annual Meeting Program is not a trivial matter—it needs to be well thought-out and well planned. Changes are costly not only in money, time, and scheduling, but in the impact on speakers and attendees.

The creativity of some of our session chairs was just extraordinary at times. For example, Jack Jekowski reports that in the session on "Stemming Weapons Knowledge Proliferation" where a paper had been withdrawn, Steve Mladineo, the session chair, invited the two previous speakers (Jim Toevs and Ken Ames) back for a panel discussion with the attendees. The reports I get from Technical Program Committee members who report on session chair performance during the meeting indicate that the chairs are doing a very credible job.

We really read the meeting evaluation forms and listen to all the comments from attendees—here's a snapshot of a few of them:

- "Provide 'cyber cafe' stands available for checking email during the meeting." *We'll certainly look into this possibility but the cost may be prohibitive.*

- "Too many good papers are given in parallel sessions but can't get to hear them." *We still get comments that there are useful papers in parallel sessions that attendees want to hear. Except for cloning of individuals or videotaping these presentations, we haven't solved this issue yet and may never do so. The alternative would be to eliminate a lot of valuable papers that others would want to hear. The Annual Meeting Proceedings is one way to get the information. That's why we emphasize the early submittal of papers so that*

The Institute of Nuclear Materials Management wishes to thank the organizations that generously supported the events of the 41st INMM Annual Meeting through sponsorships and advertising. We also greatly appreciate our many exhibitors.

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we can get the Proceedings to attendees and others in a more timely fashion. We also recognize that the Proceedings is not the same as a live presentation.

- "Use evening sessions and expanded poster sessions as a possible recourse for the lack of space in the program to accommodate all the papers that could be accepted for presentation." *The expanded poster session concept looks promising but preliminary feedback says stay away from evening sessions. INMM is also considering some other suggestions provided by attendees.*

- "Need more time for questions and discussion." *That's an acknowledged fact! INMM has provided two meeting rooms so that session chairs can arrange discussion groups. INMM also can try to leave the last 20-minute slot in each session free for discussion. (This reduces the number of available slots per session for papers from nine to eight but may be worth it.) Some sessions already have been structured to use the last hour (three paper slots) for a panel discussion.*

For those who collect numbers, here's the meeting statistics for this year: there were 582 total attendees plus 125 "companion persons," 291 papers (including 15 posters chaired by Sharon Jacobsen), and 47 sessions. (For comparison, last year we had a record 340 papers and 43 sessions.) We limited the number of papers in most sessions to a maximum of nine to avoid information overload and keep from extending sessions into lunch and dinner times. We'll continue to do that next year, too, perhaps even more stringently. Each year, I get a few legitimate complaints, a few goofy comments, and many expressions of appreciation about the meeting. The compliments (the criticism, too) are appreciated but, in reality, the recognition primarily goes to the authors and speakers who continue to make significant professional contributions to the international nuclear materials management community. In support of the speakers, again this year, were the members of the Technical Program Committee, the INMM Executive Committee, the exhibitors and sponsors, the besieged session chairs, our industrious INMM HQ staff, and Chris Hodge, the unrelenting registration chair, and his staff. (Chris and staff did a super job this year.)

Our plenary speaker, Pierre Goldschmidt, deputy director general for Safeguards at the International Atomic Energy Agency, was as open and forthright as could be expected when discussing the evolution of IAEA safeguards. He focused on the hot topic of undeclared nuclear materials and activities, and addressed just what could be accomplished realistically in the turbulent political world in which we live. Read his speech in this issue of the *Journal of Nuclear Materials Management* on page 9. The follow-up interview, led at the INMM Roundtable by our Technical Editor Dennis Mangan, added some clarifying thoughts and a sense of hope for the future. Read the transcript of the Roundtable on page 15. Our closing plenary session was chaired by Jim Lemley with support from Amy Whitworth, co-chair of the Government-Industry Liaison Committee. It featured General Eugene Habiger, U.S.A.F. (Ret.), director of DOE's Office of Security and Operations, and Dr. Michael Rosenthal, director, Office of Multilateral Nuclear Affairs, DOE, speaking on topics in security and nonproliferation. (See the related article on page 39.)

The new Community of Science database for abstract submittal was inaugurated this year as INMM went online again with an improved website that included a revised Call for Papers and Speakers Manual. Look for additional information for participating in the next Annual Meeting by late October at the INMM website: http://www.inmm.org/2001AnnualMeeting. Be sure you go directly to the INMM website home page for 2001—some folks used a previous year's abstract submittal bookmark that resulted in some very unusual consequences.

Each year I remind potential speakers for the next Annual Meeting to start preparing now—the deadline for abstract submittal is February 1. Now's the time to plan your own presentation for the 42nd Annual Meeting—next spring will be too late.

Technical Program Committee

Charles E. Pietri, Chair

Glenda Ackerman	Chris Hodge	Cindy Murdock
Obie P. Amacker, Jr.	Sharon Jacobsen	Steve Ortiz
John Arendt	Ed Johnson	Douglas Smathers
Wendell Belew	Ruth Kempf	Cecil Sonnier
Dennis Brandt	Cathy Key	Richard Strittmatter
James Chapek	James Lemley	David Swindle
Ronald Cherry	Dennis Mangan	James Tape
Billy Cole	John Matter	Lyle Lee Thomas
Pam Dawson	Steve Mladineo	Scott Vance
Deborah Dickman	Bruce Moran	J.D. Williams

The Distinguished Service Award was presented to Marc Cuypers.

Please do us all a favor: If you are not serious about presenting a paper, do not have the funding or management support or have little chance of getting such support, or have conflicting schedules or any other significant uncertainty, please think very carefully before submitting an abstract for consideration.

Annually, several INMM meeting participants suggest special topical sessions of interest for the Annual Meeting. These special sessions need to be planned carefully and submitted in final form by February 1, 2001, for consideration and review by the Technical Program Committee. If you would like to arrange a special topical session I need to hear from you very soon so that we can reserve space in the program for you. Start now!

Once again this year there was some time to relax from the intensive program of presentations, private meetings, and committee meetings. The President's Reception was very well attended. It's a good opportunity to see familiar colleagues and meet new ones. We even got comments that ninety minutes was not enough time to meet and greet all the colleagues and acquaintances that were there. We also had a nice reception for new members on Monday, July 17, and, of course, the Awards Banquet on July 18 that Awards Chair Yvonne Ferris managed well even without a full complement of plaques—remember they never arrived. (Some of us even had an extra treat after the banquet to run next door to hear the ageless Pete Fountain play some real New Orleans jazz.) Two new INMM fellows were named at the banquet. They are Jim Tape and John Arendt.

The Proceedings of the INMM Annual Meeting is an integral part of INMM's legacy as a contribution to the knowledge base and as an historical event. INMM feels strongly that all presentations should be recorded in the Proceedings. We continue to say: If it's significant enough to present, then it's significant enough to be published. INMM plans for the distribution the Proceedings of this meeting on CD by early fall. The Institute, however, cannot start the production of the Proceedings without all the papers in hand to collate, index, paginate, insert graphics, and send off to the publishers. The response by many authors to our request to submit the final papers for publication by July 7 was adequate. We gave extensions to those who requested them based on legitimate reasons, and of course, to the Los Alamos contingent who suffered great personal privation and extensive delays in their work schedules during the late spring fires around their site and homes. Nevertheless, there were too many authors who had not submitted their paper by close of the Annual Meeting.

Remember, authors agreed to submit a final paper on time if their paper was accepted for presentation at the Annual Meeting. Those who don't want to prepare a written paper should not commit to presenting a paper either. INMM will continue to post publicly the names of those who don't meet their commitment and will look for ways, perhaps drastic ones, to resolve this serious dilemma.

INMM always starts planning for the next Annual Meeting even while the current one is in process. What's happening next year? Come to the 42nd INMM Annual Meeting at the Renaissance Esmeralda Resort, Indian Wells, California, July 15-19, 2001, and see for yourself. (It's hot but dry there, folks!) Bring your golf clubs, running shoes, laptops, beer mugs, and be prepared for a few very pleasant surprises. (No hints—you must come to find out what they are.) Tell your friends and colleagues; bring your boss! Remember it's your meeting—make it a success by your presence!

See you sooner than you could imagine.

Charles E. Pietri, Chair
INMM Technical Program Committee
Annual Meeting
Western Springs, Illinois, U.S.A.

The Awards Banquet at the 41st INMM Annual Meeting was a great time for all. The "interactive" DJ led several women decked out in feather boas and Mardi Gras beads in a rendition of Aretha Franklin's song "Respect."

Not to be outdone by the women, JNMM Associate Editor, Packaging and Transportation, Gotthard Stein (left) and fellow INMM members led the crowd in a version of the Village People's "YMCA" at the Awards Banquet at the 41st INMM Annual Meeting.

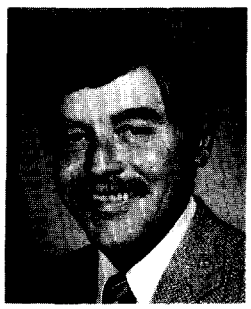
INMM Past President Debbie Dickman and husband Jim smile for the camera at the Awards Banquet.

Newly named Fellow James Tape and wife Ginny at the Awards Banquet at the 41st Annual Meeting.

JNMM Technical Editor Dennis Mangan enjoys the Golf Outing in the hot sun on Sunday, July 15, at the 41st Annual Meeting.

Exhibitor and INMM Member Linda Swago of NAC International and Joe Stainback of BWX Technologies, on the golf course at the Golf Outing.

Annual Meeting Wrap-Up, New Section Highlight Fall Issue



I hope you enjoy the fall issues of the *Journal* as much as I do. The Annual Meeting of the Institute is the highlight of our year, and this fall issue, as in the past, features the highlights of the Annual Meeting.

Technical Program Chair Charles Pietri has provided an excellent summary document of the meeting. As you will read, it was a wonderful and informative meeting. Pierre Goldschmidt, deputy director general, safeguards, of the International Atomic Energy Agency, was our plenary speaker, and in this issue you will find his written text of his speeech, *IAEA Safeguards: Evolution or Revolution?* Goldschmidt was interviewed by *Journal* editors and INMM leadership after the plenary session in the 15th annual Safeguards Rountable. Both of these articles are well worth reading. Goldschmidt was a very impressive person to interview. I believe you will find his answers to some tough questions very interesting.

In this issue you'll also find the two papers presented at the closing plenary. *Security and International Collaboration—A Proper Balance* is by General Eugene Habiger, director of DOE's Office of Security and Emergency Operations. In it, Habiger addresses a serious issue facing the Department of Energy and its national laboratories. *The 2000 NPT Review Conference: An Assessment* is by Michael Rosenthal. He provides an excellent review of the April 2000 NPT Review Conference.

Also in this issue is an article by Owen B. Johnson, director of DOE's Office of Safeguards and Security, *Security and Nonproliferation: The Interface,* that discusses his office's support to various nonproliferation initiatives that are under negotiations.

Rudolf Avenhaus of the Universitat der Bundeswehr Muchen and Mort Canty of Forschungszentrum Juelich GmbH, in their paper, *Multi-Level Variable Sampling in the Attribute Mode,* explore the optimum sampling that an inspector should choose to determine the bias defects and gross defects during a limited time inspection.

Phillipe Revel of Framatome in Paris is author of a paper, *Dry Interim Storage Facility for Spent Fuel Assemblies from Chernobyl Nuclear Power Plant,* which was presented at the INMM Spent Fuel Seminar in January 2000. Revel discusses the efforts needed to design and construct a facility for dry processing and interim storage of some 25,000 spent fuel assemblies from Chernobyl.

Also in this issue, look for Member News, a new feature from the INMM Membership Committee, headed by Nancy Jo Nicholas of Los Alamos National Laboratory. In Member News, we'll highlight the careers and achievements of INMM members.

Finally, two new chapters were admitted to INMM at the Annual Meeting. Outgoing INMM President Debbie Dickman writes about the new Urals and Ukraine chapters.

This issue is getting close to a dream that I have. At each of the three Executive Committee meetings of the Institute (one in the Fall, one in the Spring, and one at the Annual Meeting in the Summer), each of the committees chairs, be it technical division chairs, chapter chairs, or standing committee chairs, are to report on the activities of their respective committees. Since these reports give insight into the happenings of the Institute, it is my desire to publish all their reports in the *Journal* immediately following the Executive Committee meeting. In this issue, we come close. I personally want to thank all the chairs who contributed.

Finally, the peer review process is ready to be implemented. I met with the associate editors at the Annual Meeting, and the process for the review was established. Steve Dupree of Sandia National Laboratories, who is our assistant technical editor, has agreed to lead the peer review process. The appropriate associate editor will be responsible for identifying the reviewers. An electronic form has been developed for the reviewers that we believe will allow for an easy interface with authors. In the next issue we will have an article on the peer review process.

As usual, should you have any comments, please feel free to contact me.

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In Memoriam

The Institute of Nuclear Materials Management has learned that Roy Cardwell, long-time member of INMM, a past president, a winner of the INMM Meritorious Service Award, an INMM Fellow, and chair of the constitution and bylaws committee, died Thursday, September 7. An article on Roy's accomplishments and contributions will appear in the Winter 2001 issue of *JNMM.*

IAEA Safeguards: Evolution or Revolution?

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41st INMM Annual Meeting
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I am especially pleased to talk to you about the evolution of Agency safeguards—a more than forty-year long endeavor that, despite some setbacks, has been effective in verifying states' nuclear nonproliferation commitments. Since the first Agency inspection in 1962 to verify the design of a small research reactor in Norway, the system has developed to a point at which, as of today, 140 states have safeguards agreements in force with the Agency, with nearly 900 facilities and approximately 110,000 significant quantities of nuclear material under Agency safeguards.

Within this context, I wish to explore with you the hypothesis that the introduction of this international verification regime has sparked a revolution in that states have become increasingly willing to reduce their sovereignty in exchange for the greater benefit of world security. Admittedly, the transformation of these nonproliferation commitments into practical realities often has been disappointingly slow. Nevertheless, when viewed from the longer-term perspective of more than four decades of Agency safeguards, there have been major advances in world nuclear security.

I therefore invite you to join me in considering the evolution of the Agency safeguards system for verifying nonproliferation commitments and, more recently, for supporting verification initiatives for nuclear disarmament.

The principle of international verification of states' commitments to abide by the terms of agreements and not to engage in violations thereof is a post-Second World War novelty. The initial call for international verification can be traced to increasing awareness of the benefits of peaceful nuclear energy use and the dangers inherent in its misuse, as witnessed by Hiroshima and Nagasaki. As more and more states started to develop nuclear capability, the fear was that, unless strictly monitored, international nuclear trade could lead to horizontal proliferation of nuclear weapons.

This fear prompted the development of the 1946 Baruch Plan to bring nuclear energy under the international control of the United Nations. Considered too visionary, the scheme was abandoned soon thereafter. In 1953, U.S. President Eisenhower put forward to the U.N. General Assembly less radical proposals, collectively called *Atoms for Peace*, which called for international verification of states' commitments to the peaceful use of nationally held nuclear material and nationally controlled nuclear facilities. All this led to the creation of the IAEA in 1957, and is reflected in its dual mandate to promote the peaceful uses of nuclear energy while helping to prevent the spread of nuclear weapons. While states welcomed the newly created Agency, there was some initial resistance to safeguards. This could be traced to the novel component of international verification—namely, that international inspectors would be permitted to come into a state and move freely about that state's most advanced and sensitive research and industrial activities. Some potential recipient states were distrustful of on-site intrusive inspections which, in their view, could threaten the confidentiality of their sensitive and proprietary information.

After divisive debate, in 1961 the IAEA Board of Governors approved the first, but incomplete, set of safeguards measures that limited safeguards to small reactors and placed certain constraints on inspections and on inspectors. During the late 1960s, as political relations between the United States and the (then) Soviet Union improved, the way opened for the Agency to reach agreement on safeguards measures covering reactors of *all* sizes and, subsequently, for reprocessing plants and fuel fabrication plants.

However, the debate on how to balance the rights and obli-

gations of the Agency and the state relative to intrusive international inspections was far from over. It would intensify during the late 1960s and early 1970s with the emergence of the Treaty on the Non-Proliferation of Nuclear Weapons and of NPT comprehensive safeguards.

The NPT and NPT safeguards together represent a watershed in that the NPT is the only global nuclear nonproliferation treaty that obliges each non-nuclear-weapon states party to renounce nuclear weapons and to conclude a comprehensive safeguards agreement with the Agency. The Treaty assigns to the Agency the responsibility for verifying that these non-nuclear-weapon states fulfill their commitment not to use their nuclear activities for explosive purposes.

By the mid-1970s, the major industrialized non-nuclear-weapon states had joined the NPT, thereby undertaking to accept safeguards on all of their nuclear material. The remaining non-nuclear-weapon states of Western and Eastern Europe and the Far East soon followed suit. This process continued throughout the 1980s and early 1990s, with the result that, as of today, 187 non-nuclear-weapon states have acceded to the NPT, thereby accepting the obligation to conclude comprehensive safeguards agreements—an obligation, however, that 51 of these states have yet to fulfill.

Document INFCIRC/153, approved by the IAEA Board of Governors in 1971, represents an agreed upon balance between the rights and obligations of the state and the Agency with respect to comprehensive safeguards agreements. Under such agreements, the Agency is obliged to ensure that all source or special fissionable material in all peaceful nuclear activities of the state is subject to safeguards, and that safeguards are applied to all such material. This obligation is not limited to nuclear material and facilities that a state *actually declares* but extends to that which is *required to be declared.*

Likewise, the Agency's right to information and the right of its inspectors to have access to facilities and other locations are not limited to information, facilities, locations, or material declared by the state. However, the Agency's right to carry out routine inspections is limited to agreed upon strategic points through which nuclear material is expected to flow.

In principle, access to undeclared sites or to locations suspected of containing undeclared nuclear material has always been possible under the provisions of INFCIRC/153 for special inspections. However, *in practice,* these provisions have not been interpreted by member states as an unlimited right permitting the Agency to conduct fishing expeditions to seek out undeclared nuclear material or activities in the absence of strong indications as to the possible presence of such material or activities. Accordingly, the Agency's ability to detect undeclared nuclear material or activities in a state as a whole was seriously restricted.

Before the 1990s—particularly before Iraq and the Democratic People's Republic of Korea (DPRK) challenged NPT safeguards—there were only a few occasions on which the Agency sought to carry out special inspections to confirm the absence of undeclared material or activities. But even then, access was sought only at locations which the state had declared to the Agency.

In short, traditional safeguards have focused almost exclusively on verifying the correctness of a state's declarations about its nuclear material present at facilities—or, in other words, on detecting diversion of nuclear material which the state had declared and placed under safeguards. The architects of traditional safeguards recognized the possibility of clandestine nuclear activities. However, during this period the political consensus had not yet developed that would permit the Agency to have sufficient access both to the information and to locations in a state in order to confirm the absence of undeclared nuclear material and activities in the state as a whole.

As a storyteller, I would be remiss if I did not highlight some of the events that prompted the Agency and its member states to act for a stronger, more rigorous safeguards system.

In 1991, soon after the end of the Gulf War, Agency inspectors discovered Iraq's extensive clandestine program for producing nuclear weapons. One year later, Agency inspectors encountered difficulties—that still persist—in verifying the initial report by the DPRK on its nuclear material subject to safeguards. On the positive side, during the early 1990s the Agency also gained invaluable experience in verifying the initial report on nuclear material subject to safeguards submitted by South Africa and, at the government's request, in assessing the termination of its nuclear weapons program.

Starting in 1990, the Agency and its member states acted jointly to pave the way for the strengthened safeguards system. Two sets of safeguards strengthening measures would evolve. The first set, approved in 1995, comprises measures that can be implemented under safeguards agreements concluded along the lines of INFCIRC/153. Also in 1995, the Board set itself the task of securing the legal basis for applying the second set of strengthening measures—efforts that would culminate in the Board's approval, in May 1997, of the Model Protocol Additional to Safeguards Agreements (known as INFCIRC/540).

Unquestionably, the approval and the overwhelming support expressed by states for INFCIRC/540 represents the most dramatic step the international nuclear community has taken since the entry into force of the NPT and its indefinite extension in 1995. As a result, the safeguards system is changing, and is likely to change even more over the near term, with the implementation of these protocol-related safeguards measures.

Traditional safeguards—or, in other words, nuclear material verification activities performed at facilities—have been strengthened. These measures continue to be the cornerstone of the safeguards system.

In addition, under the impact of INFCIRC/540, the safeguards system now has the capability to assess both the correctness *and* the completeness of a state's declarations and, accordingly, whether there is an indication of undeclared nuclear activities in that *state as a whole.* Clearly, information is crucial for a state safeguards assessment: the more the Agency is aware of the nature and location of a state's nuclear and nuclear-related activities, the more comprehensive the safeguards assessment and the better able it is to provide credible assurance of the absence of undeclared nuclear activities in that *state as a whole.*

INFCIRC/540 provides the authority for the Agency to have increased access to information about a state's nuclear program. This is done in ways that reflect an agreed upon balance of rights and obligations. Thus, for example, a state agrees to provide the information about its nuclear program and the Agency is obliged to maintain a stringent regime to ensure effective protection against disclosure of all commercial, technological, and industrial secrets coming to its knowledge.

INFCIRC/540 also provides the authority for broader IAEA inspector access to relevant locations in a state through the mechanism of complementary access. For states with additional protocols in force concluded on the basis of INFCIRC/540, the Agency may request complementary access for any of the following purposes: (a) to assure the absence of undeclared nuclear material and activities; (b) to resolve a question relating to the correctness and completeness of the information submitted by the state or to resolve an inconsistency relating to that information; and (c) to confirm, for safeguards purposes, the state's declaration of the decommissioned status of a facility or of a location outside a facility where nuclear material was customarily used.

Agency guidelines are in place for the selection of locations and places to access, according to the type of undeclared nuclear activities that could be supported, thereby ensuring that complementary access is implemented in an efficient, technically effective and non-discriminatory manner. Since late 1997, the Agency has performed complementary access in three states (Australia, Japan, and Uzbekistan), and has reported to these states on the activities performed. For both the Agency and the states involved, this experience has proved invaluable, serving to dispel any lingering doubts that Agency inspections can—and will—take place in a state *anywhere, anytime.*

At this point, it is important to underscore that restrictions on how the Agency can conduct complementary access will impact on its effectiveness and efficiency. Considerably more time and effort will be needed to build the case for allowing the Agency to perform complementary access at a non-nuclear location or place, than if it had access *anywhere, anytime.* The necessary surprise potential is therefore diminished.

Comparatively speaking, the Agency's complementary access rights are more restrictive than the access rights in Iraq granted to the Agency under the U.N. Security Council Resolutions—access rights which the international community has deemed necessary for assurance that there are no undeclared nuclear activities taking place in Iraq.

Let me turn now to our most recent and ambitious effort: integrated safeguards, a term referring to the optimal combination of all safeguards measures available under comprehensive safeguards agreements and additional protocols in order to meet safeguards objectives with maximum effectiveness and cost efficiency.

When fully implemented in a state, the measures provided by a comprehensive safeguards agreement and an additional protocol will enable the Agency to draw safeguards conclusions about the non-diversion of declared nuclear material and the absence of undeclared nuclear material and activities in the *state as a whole.* The Agency's ability to draw a positive conclusion about the absence of undeclared activities, particularly about the absence of activities related to enrichment and reprocessing, may lead, over time, to a reduction in the current nuclear material verification effort, particularly for less sensitive nuclear material, and a corresponding reduction in the Agency's inspection costs associated with nuclear material verification.

Since late 1998, the Agency has been working to develop and implement integrated safeguards. The main thrust of the work to date has been on specifying: (a) how a conclusion of the absence of undeclared nuclear material and activities in a state can be drawn and maintained; and (b) having drawn this conclusion, what measures would then be appropriate to apply to declared nuclear material in specific types of facilities so that the Agency can continue to be able to draw a conclusion of the non-diversion of such material.

The full potential of the strengthened safeguards system can be realized only when there is *universal adherence* to the provisions of INFCIRC/540. In May 1997, when the Board of Governors approved the Model Additional Protocol, there was no shortage of supporting statements by member states. Against this background, it is disappointing that so many states have been slow in matching their words with deeds. Indeed, more than three years have passed since INFCIRC/540 was approved, and, as of July 2000, additional protocols for only 54 states have been approved by the Board of Governors. Of this total, only 14 are in force and one is being implemented provisionally pending entry into force.

By way of comparison, the Comprehensive Test Ban Treaty, approved by the U.N. General Assembly in September 1996, has been signed (to date) by 155 states and ratified by 56 states. Seemingly, the CTBT has been perceived to be politically attractive, which has resulted in a concerted and coordinated effort for universal and early adherence to the Treaty. It is unfortunate that many states have yet to appreciate the fundamental importance of INFCIRC/540 from a non-proliferation perspective. After all, how many states have significant nuclear activities versus how many states are likely to test nuclear weapons? One lesson to be learned from comparing the history of INFCIRC/540 to that of the CTBT is the fact that influential states have actively campaigned bilaterally in capitals for early CTBT signature and ratification.

During the 2000 NPT Review Conference, IAEA Director General Mohamed ElBaradei urged all non-nuclear-weapon states party to the NPT to conclude additional protocols to their safeguards agreements at the earliest possible date, to enable the Agency to discharge fully its responsibilities under the Treaty. The final document emerging from this Conference underscored the importance of concluding and implementing additional protocols. Clearly, the IAEA Secretariat stands ready to help in the process.

I have tried to give you a picture of where the Agency safeguards system now stands and where it is heading. The challenges we face are not only political and technological, but also extend to the financial area. We are committed to *do more, do*

better and, at the same time, to *maintain cost neutrality.*

Clearly, we are doing more. Since 1997, our number one priority has been to create the conceptual framework for implementing activities under the Model Additional Protocol, and we have spent considerable effort on this endeavor. For example, in addition to the work associated with complementary access, we are now regularly performing safeguards evaluations of states' nuclear and nuclear-related activities. We have established an Information Review Committee to review these evaluation findings, as part of the process of drawing safeguards conclusions. Also, more than a dozen training courses on strengthened safeguards have been held for our inspectors and for member states personnel.

Further, the verification of nuclear material, primarily through on-site inspection, remains a key element of Agency safeguards, with the continuous need for staff, equipment and travel funds. The number of facilities and the amount of material under safeguards continue to grow. New tasks have emerged, such as verification of fresh MOX fuel and the transfer of spent fuel to long-term dry storage. And we are developing, testing and progressively using new digital equipment with unattended and remote monitoring capabilities.

We also continue to look for improvements that will allow us to do our work better. For example, we are working to improve inspection goal attainment, mainly through enhanced technology and equipment use.

However, these technological improvements are costly. Certainly, our effectiveness will be improved, but it remains to be demonstrated whether these technological improvements will, in the longer term, also bring cost savings.

Turning now to the challenge of maintaining cost neutrality, let me explain what I mean by cost neutrality. The Agency's budget for safeguards has been practically frozen for over a decade as a result of a policy of zero-real-growth. Thus, while our regular budget for safeguards has remained at around $82 million per year for the last several years, our expenditure has averaged about $95 million per year. This $95 million level is what is meant by cost neutrality. However, it is important to point out that this level does not include the costs associated with new, major projects such as the Rokkasho reprocessing plant in Japan.

The shortfall in regular budget funds has inevitably led to an increasing reliance on extrabudgetary funding. Voluntary contributions are currently projected to reach 20 percent of the safeguards program costs by the year 2001. In view of the uncertainties surrounding the receipt, timing and amount of extrabudgetary resources, this reliance is unsound. It inhibits good managerial planning and makes it difficult for the Agency to fulfill its mandate effectively and efficiently.

I have urged—and will continue to urge—member states to provide us with the minimum financial resources necessary to do the job that they themselves have commissioned us to do. At stake is nothing less than world security. To put things in perspective, I note that, in 1991, during the war in Iraq, the amount of money that was spent over a couple of months represents 1,000 years of our annual budget.

I have spoken at length on the NPT as the core of the international nonproliferation regime. As you are aware, the NPT singles out the five states that had tested a nuclear weapon or other explosive device by the time the Treaty was concluded. In return for the nonproliferation undertakings of all other NPT parties, these five nuclear-weapon states committed themselves not to assist other states in acquiring nuclear weapons and to work towards the early cessation of the nuclear arms race and towards nuclear disarmament.

The NPT was extended indefinitely in 1995, with the understanding that these nuclear-weapon states would work more in earnest to eliminate all nuclear weapons. However, in the ensuing five-year period limited progress was made. Non-nuclear-weapon states have criticized the slow pace of progress, but the task is monumental. Nevertheless, at the 2000 NPT Review Conference these five nuclear-weapon states reaffirmed their commitment to work towards that goal.

There is no prescription embodied in the NPT as to how nuclear disarmament is to proceed. While there is reference to strict and effective international control, there is no mention of what is to be controlled or of how the international dimension of that control would be realized.

Nuclear disarmament agreements achieved to date—namely, between the Russian Federation and the United States—have been bilateral in nature, as have been the associated verification mechanisms. Nevertheless, effective international verification is fundamental to permanent nuclear disarmament. Since the 1995 Review and Extension Conference, international expectations have been high, as the non-nuclear-weapon states grow increasingly restive.

Obviously, each state possessing nuclear weapons is free to take unilateral actions to reduce or to eliminate its nuclear arsenal. The United States and the Russian Federation have eliminated intermediate range nuclear missiles through bilateral verification, and the two strategic arms reduction treaties are eliminating thousands of strategic weapon delivery systems and tens of thousands of warheads. A further strategic arms reduction treaty (START III) is now under discussion in the Russian Federation and the United States. Despite these developments, *true* multilateral nuclear disarmament negotiations have not yet occurred.

While the Agency has had limited experience in verifying nuclear disarmament, with the notable exception of South Africa, it has more than four decades of experience in verifying States' non-proliferation commitments. These experiences have instilled confidence that the Agency verification expertise could further support the non-proliferation regime, particularly the recent initiatives for the international verification of nuclear disarmament.

Both the Declaration of Principles and Objectives of the 1995 NPT Review and Extension Conference and the Final Document of the 2000 NPT Review Conference emphasized a step-by-step approach to the eventual elimination of nuclear weapons. Three such steps could be anticipated. In certain areas, initial efforts have already begun. These steps are: (1) verifying weapon-origin and other fissile material specified by a state as released from its defense program (excess fissile

material); (2) banning the production of fissile materials for use in nuclear weapons or other nuclear explosive devices; and (3) reconciling the amount of fissile material produced for military applications.

Step 1: Verifying Weapon-Origin and Other Excess Fissile Material

Placing the fissile materials identified by nuclear-weapon states as being excess to their military requirements under an appropriate international verification regime would ensure that those materials remain irreversibly removed from nuclear weapons or other nuclear explosive devices, or from military applications. Under the Trilateral Initiative, the Russian Federation, the United States, and the Agency are, for example, creating an Agency verification regime appropriate for weapon-origin and other excess fissile material. The expectation is that this regime could provide a framework for verifying excess fissile material in all states possessing nuclear weapons.

Work under the Trilateral Initiative is well along. A model verification agreement should, in the not too distant future, be completed for presentation to the IAEA Board of Governors, together with an estimate of the costs associated with the verification of the storage and disposition of excess plutonium and highly enriched uranium in the Russian Federation and the United States, out to 2010, and proposals for funding the verification regime.

The Trilateral Initiative should result in the first Agency verification regime designed for disarmament purposes. As it is presently being worked out, such a regime would include provisions for verifying classified forms of fissile materials, including nuclear weapon components, to allow the verification activities to commence much earlier than would otherwise be the case. The schedule of activities is intense. Twenty meetings have been held on various legal, technical, and financial aspects of the Initiative since December 1999, and a further twenty meetings are foreseen before the end of 2000.

Step 2: Banning the Production of Fissile Materials For Use in Nuclear Weapons or Other Nuclear Explosive Devices

Verifying nuclear material declared excess to states' military requirements is not sufficient for achieving nuclear disarmament and preventing future arms races. A treaty banning the production of fissile materials for use in nuclear weapons or other nuclear explosive devices would be a further step on the road to nuclear disarmament, capping the ability of states to produce nuclear material for weapons. International verification would have to cover existing production facilities within such states, and to provide assurance against clandestine production operations.

The Conference on Disarmament has yet to begin serious negotiation of a Fissile Material Cut-off Treaty; however, because of the complexity of many of the attendant issues and the linkage of an FMCT to other disarmament issues, most observers anticipate protracted negotiations. Nevertheless, such a treaty is essential if international control of fissile materials useful for nuclear weapons is to be a key element for the verification of nuclear disarmament. In 1998, the U.N. General Assembly requested the Agency to provide assistance in relation to the negotiation of the verification system for an FMCT, as required, and the IAEA Director General has offered such assistance as may be requested by the Conference on Disarmament, once the negotiations get underway.

Step 3: Reconciling the Amount of Fissile Material Produced For Military Applications

Assuming that the Trilateral Initiative leads to the envisaged verification regime and that the FMCT is concluded and enters into force, then the remaining control on fissile material as an instrument for the verification of nuclear disarmament would be reconciling the total amount of fissile material produced by or otherwise acquired by all relevant states. The question here is what has happened to such material: how much was exported, how much was expended in nuclear tests, how much was used as reactor fuel, and how much is left?

Considering the secrecy associated with the composition of individual weapons and the makeup of a state's nuclear arsenal, progress in this area is likely to be extremely slow.

In closing, it is well worth remembering that, over the past four decades, we have come a long way in translating into practical realities the principle of international verification of states' nonproliferation commitments. The question addressed by international and constitutional lawyers is the extent to which states are prepared to relinquish elements of their sovereign rights and to commit to binding undertakings embodied in treaties and conventions, in return for the collective security resulting if all, or nearly all, states sign on. On a subject like this, there is of course no unanimity. But I tend to be cautiously optimistic considering the increasing acceptance by states of such binding commitments with international verification as a consequence.

Related and unrelated developments point in this direction: the entry into force of the Chemical Weapons Convention, for example, provides, not unlike the NPT, for controls on certain imports and exports of chemicals and for intrusive inspections in states. The CTBT also includes provisions for inspections in the event a test is suspected. In the broader sense, states are demonstrating their willingness to relinquish sovereign rights in relation to the pursuit of war crimes and the outlawing of child labor.

Nevertheless, the final objective of eliminating all nuclear weapons will only be realized if all states commit to that goal and work to prevent further proliferation, to prevent illicit trafficking in nuclear materials, and to eliminate the eight existing nuclear weapons arsenals. The evolution in that direction, over almost five decades, is encouraging, but fragile.

The Agency safeguards system is not perfect; it never will be. As I have tried to show, we have made major strides in strengthening the system in order to cope with the threat of clandestine nuclear programs. We appreciate that the costs of verification are a burden to member states, although the benefits of effective verification to prevent proliferation of nuclear weapons far exceed the levies placed on these states.

The Agency will continue to work toward increased effectiveness and efficiency of its safeguards operations. But it is now for states to demonstrate their practical support by signing and bringing into force their additional protocols and by providing the Agency with sufficient financial and human resources to do the work which they themselves have asked us to do.

In the grander scheme, the NPT regime might not be perfect, but no effort should be spared in supporting the principles and objectives contained in its articles.

If, at the time of the 2005 NPT Review Conference: (a) the vast majority of non-nuclear-weapon states have ratified additional protocols to their comprehensive safeguards agreements; (b) both the Trilateral Initiative and the FMCT are in force; and (c) there are significant reductions in nuclear weapons arsenals, then we will have witnessed a revolutionary accomplishment in world nuclear security.

Those are our goals and I hope that each of you will join me and my colleagues in this effort.

Pierre Goldschmidt has been deputy director general of the International Atomic Energy Agency since May 1999. Previously, he served as general manger of SYNATOM from 1987 until 1999. Since 1978, he has been a member of the Advisory Committee of the EURATOM Supply Agency. Since the end of 1997 he has been chairman of the Organization des Producteurs d'Energie Nuclèaire in France.

Goldschmidt studied electro-mechanical engineering at the University of Brussels in Belgium and nuclear engineering at the University of California Berkeley, in the United States. He graduated with a Ph.D. in Applied Sciences from the University of Brussels. In 1979, he was awarded a diploma in marketing and management from the Ecole de Commerce Solvay.

In 1971 he joined Electrobel Engineering in Belgium as engineer and then chief engineer. In 1977 he joined SYNATOM, the company responsible for the fuel supply and spent fuel management of the seven Belgian nuclear plants meeting about 60 percent of the country's electricity demand.

15th Annual INMM Roundtable

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INMM Vice President

Representatives of the INMM Executive Committee and technical divisions met during the 41st INMM Annual Meeting to interview Pierre Goldschmidt, opening plenary speaker, at the 15th Annual INMM Roundtable.

Goldschmidt has been deputy director general for Safeguards at the International Atomic Energy Agency since May 1999. Previously, he served as general manger of SYNATOM from 1987 until 1999. Since 1978, he had been a member of the Advisory Committee of the EURATOM Supply Agency and chairman from 1981 to 1985. He had been chairman of the Uranium Institute in London from 1992 to 1993 and since the end of 1997 chairman of the Organisation des Producteurs d'Energie Nucléaire in France.

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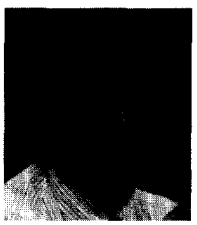
Gotthard Stein: First of all, I very much appreciate your presentation this morning especially the last part, where you offer some perspectives on where the Agency can be involved in the future. My comment deals with this part of your presentation. You mentioned international verification in connection with the Trilateral Initiative. I think a problem might evolve, if one is concerned with the Trilateral Initiative and international verification, because the Agency was always involved in implementing and applying safeguards. In my understanding, Agency safeguards has a very successful history and therefore it seems very important not to change this terminology. It is obvious that safeguards has to be adapted to the special situation of the Trilateral Initiative. But the new



verification system for the Trilateral Initiative should still be understood as a safeguards system. You also mentioned in your presentation that we should aim for the elimination of all nuclear weapons. For reaching and guaranteeing this demanding goal, we need a universal safeguards system, which must take into account the new technical and political boundary conditions. For instance, if you are dealing with the specific problem of safeguarding pits, you cannot solve this problem in applying measures taken from the classical system. Take the Fissile Material Cutoff Treaty as another example. Also there is a need for an adaptation of the classical safeguards system, but it should still be safeguards.

My other comment is related to research and development. I didn't hear anything on this topic in your speech this morning. But I am convinced that research is a very important pillar for implementing effective and efficient safeguards. As an example I would like to mention the information barrier to protect know-how related to sensitive material and equipment during inspections. For all those fields intensive research and development is needed especially under the Member States' Support Programs.

Pierre Goldschmidt: It's true that we are not currently using the word *safeguards* in the context of the Trilateral Initiative. Not yet knowing what the precise nature of the verification arrangements to be worked out is, we are referring to "appropriate verification." I think it is important to use different terms so as not to create any impression that we are going to apply the full range of INFCIRC/153-type safeguards measures in nuclear weapons states. One day, yes, when there will be no nuclear weapons arsenals left, then it might well be that we will apply the same comprehensive safeguards system all over the world. Today it would not be realistic. Exactly how appropriate verification will look under the Trilateral Initiative, we don't know today. But we should know in the very near future.

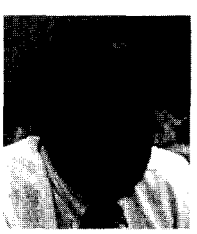
As you are aware, we will have to deal with components of nuclear weapons, because there is a wish not to delay the international verification process until such time as the relevant nuclear weapons materials are in declassified form. In order to protect the classified information relevant to certain nuclear weapons materials and components, we are devising attribute-type measurements that would enable us to identify quantities and material types and to ensure that it is indeed nuclear weapons material. It might sound modest, but I think it would be a major step forward if that were done under an international verification regime. But this would clearly not be safeguards as we apply them in non-nuclear weapons states.

Stein: I agree completely, but I am looking from a different viewpoint at the problem. As I said there are different technical boundary conditions, so that you may never apply classical accountancy for some specific categories of material in connection with the Trilateral Initiative, because you cannot release relevant sensitive information. So you need a technical adaptation to a specific safeguards problem. So the difference in applying safeguards in connection with the Trilateral Initiative is related to a technical problem and not to the specific situation of safeguards in nuclear weapon states.

Goldschmidt: Well, I think this is essentially a question of semantics.

Stein: Yes, it is also a semantic point, but looking to the future we have to take into account also psychological and political aspects. I think it is very important to bring to people the message that materials coming from disarmament are under optimal and appropriate safeguards. We should avoid creating the new terminology of "safeguards light."

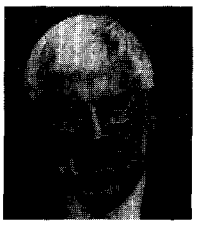
Goldschmidt: I'm not sure many people would automatically see the kind of difference between "safeguards" and "verification." I can assure you that it is the wish of the Secretariat that the verification mechanism be irreversible. But, in the end, it will depend on what each of the two countries are prepared to accept and whether the best we can achieve will be endorsed by our member states. I cannot prejudge. The intent is to make sure this material cannot be used again for weapons purposes. When weapons-origin plutonium becomes irradiated MOX fuel, then it's like normal commercial spent fuel. When it's immobilized, it should also be declassified. So at these stages we could, for example, apply traditional safeguards measures. Whether that would be the best use of Agency resources is, of course, a different issue.



Dennis Mangan: I think it was Bruno Pellaud, when the Trilateral Initiative was first announced by the Director General, the Secretary of Energy, and the Minister of Minatom, whose comment was "This is not Article III of the NPT, therefore it's not safeguards. This is Article VI which is arms control, dismantlement, disarmament, therefore we'll call it verification." And I

think he did that just to keep them separate, as Pierre said initially, until the lawyers figure out exactly what the words mean.

Goldschmidt: To go back to Gotthard's second comment, research and development is extremely important, of course. A lot has been done and is being carried out under the Trilateral Initiative because this is a completely new area—for example, this attribute verification to make sure that we know the type and amount of material present in items subject to verification without any risk that our inspectors would have access to classified information. A lot of progress has been achieved and we're quite optimistic about it. Thus, R&D is clearly needed in this field. I don't know if you had something broader in mind, Gotthard, than the Trilateral Initiative. Of course we have R&D continually supporting safeguards. We rely heavily, as you all know, on Member State Support Programs for that, especially the United States, because we cannot conduct R&D ourselves.



James Lemley: Has the Agency discussed the possibility of disseminating weapons-relevant information as part of the inspection process? Does this worry the Agency? Is it going to complicate your problem? Will you be able to do your job? Or is there a danger that this will actually spread information and hinder the verification process by spreading information that is helpful somehow in building weapons?

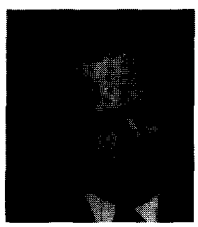
Goldschmidt: Under the Trilateral Initiative?

Lemley: Under whatever you perceive coming down the line, something that would involve the Agency.

Goldschmidt: I think that preventing the kind of dissemination that you have referred to is a major concern of all parties involved in the Trilateral Initiative. Clearly the level of protection that is being developed to make sure our inspectors do not gain access to any classified information is considerable. It is a complicated matter because, if you push the level of protection too far, it is questionable what the verification measurements can still guarantee. However, progress has been achieved. Degrees of sensitivity on this issue can sometimes be different for the United States and for Russia. For instance, concern about knowing the precise isotopic composition of plutonium is higher on the Russian side. We have to take that into account.

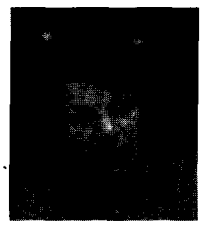
Lemley: So basically you're saying this is a problem that should be left to the two states to solve and the Agency can perhaps work with whatever solution they come up with.

Goldschmidt: The key point is that the Agency would be very concerned if we thought that our inspectors could have access to classified nuclear weapons related information. But I'm pretty confident that this is not going to be the case.



Scott Vance: In the United States we've been in the process of designing a repository since the 1970s. Several times the IAEA has been asked to offer some guidance as to what kind of safeguards would be appropriate, but to this point no formal guidance from the IAEA has been released. I'm wondering if you can respond to why that may be the case, why it would be difficult for the IAEA to come up with guidelines for implementing safeguards at a repository? Also, respond to the thought that it would be beneficial for the IAEA to come up with some guidelines or policies now before the designs are finalized so that we can be assured that it will be incorporated into the design as opposed to trying to back fit it later.

Goldschmidt: There has been some work carried out on safeguards at final repositories.



Jill Cooley: Clearly. I guess our familiarity with it is through the SAGOR Project and the next phase of this project, SAGOR-2. We maintain a presence in the discussions through the support program tasks on geological repositories. We do have a policy paper on safeguards for final disposal of spent fuel in geological repositories and there are a number of technical studies in progress. I'm not quite sure if you've been involved with this SAGOR project because I was under the impression that a lot of the issues you raise were being discussed and worked on in terms of the technical application of safeguards, including safeguards requirements and measures to be taken into account in the design of the repository.

Vance: Well certainly SAGOR has released studies that say long-term safeguards are necessary at a repository. That didn't surprise anyone. What we're looking for is specifics. What does the IAEA want to be implemented at a repository?

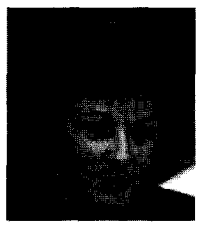
Cooley: You mean specific safeguards, measures, procedures, and approaches, is that it?

Vance: Yes, certainly, and what are the expectations? What does the IAEA want to see in terms of long-term? Do they want to have absolute assurance of certain aspects of the materials placement? Or is

it satisfactory to just say seals haven't been broken? What is the level of security that the IAEA expects and desires?

Cooley: I'm not familiar with the technical details of the studies. As I indicated, we have a policy paper. It is more than five years old and obviously in this area, like everything, is subject to change. Unfortunately it's the issue that we have so many activities going on and so many near-term needs in our development efforts. I have to be honest and say that in terms of prioritizing what we have to do, geological repositories is a little further down the line. There are issues we have to discuss. We recognize the need to set some priorities on these tasks.

Goldschmidt: There is indeed some pressure from outside the Agency for us to look into those questions. In non-nuclear weapons states, traditional safeguards would be applied to the material before it gets to the final repository. So the real question is whether and at what point the application of safeguards should be discontinued. One possible answer could be: when the repository is back-filled, after which it would be appropriate to use other types of verification—that use seismic detectors and satellite imagery—to make sure there is no undeclared attempt to have access to the repository. But it's true that, with the limited human and financial resources that we have, developing safeguards for geologic repositories is not high on our priority list. I would like to be able to devote more effort to it. When I was working in industry, I was really hoping that the IAEA would come with policies regarding the specific safeguards measures that would be applied to our final repository with regard to spent fuel or to high-active waste, for instance. Would one apply the same type of safeguards measures or not? How much cheaper or more expensive would different measures be? Questions such as these are very important to the industry. However, for the time being back-filled repositories seem so far away that, as Jill said, it's not very high on the Department of Safeguards' priority list. That's unfortunate, but our resources are limited.



Cathy Key: Along those same areas, I know in Oak Ridge we have a vault of materials that's under IAEA safeguards. Over and above the IAEA systems and tamper indicating devices that are there, many different technologies have been tested for material control and surveillance. These different technologies range from some that would give you constant weight and assay of the material in the containers within the vault up to remote monitoring with TVs, et cetera. Has the IAEA looked deeply into these options? Are they really being considered later for safeguards? Is the intent to cut back on the actual inspections once we find the technology that is acceptable to the IAEA?

Goldschmidt: I'm not aware, honestly, of what you are doing in this field in Oak Ridge, but any project that you have that would come to any type of meaningful conclusion or preference could be very useful to us. We would welcome that. Clearly if we can find solutions that are effective and less costly, they would be in everyone's interest. We would be more than happy to study your test results, but the resources available for such work are extremely limited. You have to realize it's not a joke when we say we have scarce resources. More and more, we'll have to prioritize and say "Sorry, we just can't do that now."

Key: That leads me to my next question concerning your discussion this morning on budget and the fact that your budget has not increased in the past decade and has stayed constant at $82 million. You've been spending $95 million and that's going to be increasing at approximately 20 percent.

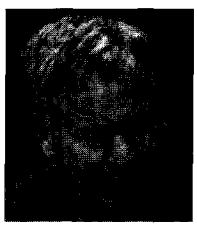
Goldschmidt: No, our long-term goal is to keep our level of expenditures constant, in real terms. What I said is that extra-budgetary funding would be in the order of 20 percent by 2001.

Key: Of course your request was that the member states continue to supplement your budget. If this does not occur and/or you are unable to get your budget raised, where do you see the shortfalls will be?

Goldschmidt: I'm not very optimistic in the near term. I don't expect that we will any day soon see the $15 million extra-budgetary funding becoming part of our regular budget. However, my efforts are directed at trying to convince member states that the present situation is not sustainable from a managerial point of view. Extra-budgetary funding is much less predictable. You don't know at what time of the year the funding will come and you don't know under what conditions because there are usually strings attached. If we had the money in our regular budget, we could use the same amount more efficiently than we do with extra-budgetary and voluntary funding.

The other question relates to what activities we would not undertake. But there's another related one that was raised this morning. It is looking at future types of facilities, including reactors, to see whether they could be designed in more "safeguards friendly" fashion. The Nuclear Energy Department in the Agency is always asking, "We want to look into new types of reactors. Can you help us by giving us advice on the most safeguardable fuel cycle or safeguardable facilities?" I would like to say yes, but

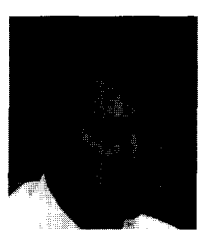
again, it's not on our priority list. Our priority is increased safeguards goal attainment. Our energy is devoted to that, to the development of integrated safeguards and better equipment, and to the provision of enhanced assurance about the absence of undeclared nuclear material and activities. Information technology is also a priority for the Department of Safeguards, rather than concepts for new reactors that may be twenty years down the road and for geological repositories that are perhaps fifty years down the road.



James Tape: I'd like to ask a question that I think is related to many of the topics we've touched on so far and that has to do with your philosophy about the use of inspectors vs. technology. So, for example, one can have unattended monitoring, one can have smart seals, one can have proliferation-resistant reactor designs, all of which are designed to get the inspector away from the site. After all, the cost driver is the cost of having the inspector on site. But then there's a very strong counter-argument that there's no substitute for the curious human walking around the site. Where do you come down on this tradeoff?

Goldschmidt: I'm a great believer in the value of on-site inspectors. I think a good inspector is always better than any kind of technology. We have to be very careful in assessing how much we can save on the inspector workforce. There are cases where clearly you can do so, but it would be a mistake to think that technology can replace and/or in some areas ever be as efficient as a good inspector.

We are experiencing that sometimes new equipment costs more than inspections, at least initially. One should nevertheless avoid over-simplification. The reality is complex. There will be a good paper this week from Nikolai Khlebnikov on remote monitoring and cost-benefit analysis. We now have a policy that every major development of equipment, such as remote monitoring equipment has to undergo a cost-benefit analysis before implementation in order to avoid some of the misconceptions of the past. It's extraordinary how costs can differ from one country to another depending on the infrastructure. For instance, if you have remote monitoring in a country that is far away from Agency headquarters or any of its regional offices and in which there are only a few light water reactors, it would save on the need for visits by inspectors, and significant savings could be made. On the other hand, if there are a lot of other types of nuclear facilities in the country and your inspectors have to go to them anyway, your savings are only related to the marginal cost of the reactor inspections. These marginal costs are usually much smaller than the cost of remote monitoring equipment, including maintenance and data teletransmission cost. In such cases there is a kind of threshold, i.e. you need to have a significantly large number of facilities in which you would install remote monitoring so that you would indeed need to send fewer inspectors to the country.



Chad Olinger: You made some really interesting comments about Article VI, the move toward general disarmament. The Trilateral Initiative and START I through III and beyond are important steps obviously to achieving that. But there's a huge challenge in bringing all these materials that are currently outside of safeguards into a safeguards regime. Bringing them into the safeguards process with respect to declarations and verification will be difficult because materials accountancy of weapons processes was not performed with IAEA safeguards in mind. It may be difficult for some nations to have a high degree of confidence in their own declarations because historical records may have been lost or destroyed. On top of this, subsequent IAEA analyses to verify the absence of un-allowed or undeclared activities will be hampered by environmental background associated with historical activities when the country did not need to declare weapons production activities. So I'm curious, first, do you view the total general disarmament as possible? And if it is, then what are the preconditions both from a technology and political perspective in order to effectively verify disarmament?

Goldschmidt: We're working on the assumption that global disarmament is a common objective. Whether that is in fact the case remains to be seen. I think that the nuclear weapons states are very concerned about horizontal proliferation. So it is in their own interests, if they want to support effective and efficient international nonproliferation regime, to take the appropriate steps to send the right message to the other countries and to show that they are fulfilling their part of the treaties obligations and commitments relating to disarmament. So without losing sight of the final goal, which is complete disarmament, I believe that any step on that road is significant. This is why the Trilateral Initiative is important and why a Fissile Material Cut Off Treaty would also mark an extremely significant progress. The Trilateral without an FMCT, i.e. without a cap on what nuclear weapons states could produce as fresh weapons grade material, for me does not in isolation seem sufficient. But the two together would constitute a really major step in the right direction. I didn't mention the CTBT because it is a different case. I'm not saying it's not impor-

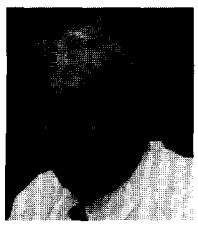
tant, and clearly the fact that the United States didn't ratify it has conveyed a negative message to the world community. However, the CTBT is not directly within the Agency's purview. Every step is valuable, but global disarmament is still far away.

Jim Clark: Pierre, today in your speech, you used Nagasaki and Hiroshima as examples of the misuse of nuclear weapons. Could you amplify on that? Was it relative to a point in history, a misuse at the time, a misuse in relationship to our current goal of eliminating nuclear weapons?

Goldschmidt: It was just historical. Why? Do you have a concern?

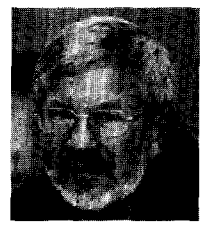
Clark: I don't know that those of us who might of lost people in the Second World War would choose to call the termination of that war as a misuse.

Goldschmidt: Yes, I am aware of that.



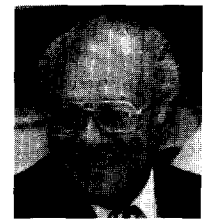
J.D. Williams: Years ago, when we first started using technology for physical protection, the people who were trying to push technology were saying that by the use of technology we could decrease the number of guards. Very quickly we learned that we probably could slightly decrease the number of guards but we had to add electronic technicians who are more expensive than guards. We came to the conclusion, like you did, that you can never take the human out of the system and that we really didn't decrease our total costs. However, by combining technology and guards you greatly increased the level of security. Maybe we can think about the same thing in increasing the level and effectiveness of safeguards by some judicious combination of technology and people instead of going all one way or another.

Goldschmidt: It makes a lot of sense. This is exactly what we are doing in order to improve effectiveness. There's no doubt about that. The cost aspect, we have already discussed. We have instances where, thanks to advanced technology, we expect to make significant savings. In others, however, costs have been 40 percent higher than when using the "traditional" method. We are in a transition phase, for implementing new digital surveillance, for instance. But we are not removing older equipment immediately because we want to make sure that the maintenance costs and failure rates are acceptable. It can be OK in the lab, and OK when we test it. And then, when implementation proceeds, you suddenly find that the equipment doesn't work as reliably as expected. So we have to be very careful. We cannot afford to take risks.



Bernd Richter: My question is related to nuclear disarmament. What is the relationship between weapons material and fissile material for propulsion of nuclear submarines and how does that fit into the disarmament process and the verification of that?

Goldschmidt: Presently, it is up to weapons states to decide where material submitted to international verification will come from. The Russians have insisted that the Trilateral Initiative should deal with material coming exclusively from nuclear warheads. On the U.S. side, they want to broaden it to material related to nuclear weapons programs. As far as I know it does not, at this stage, involve fuel for the propulsion of submarines. That said, we are dependent on what each of the two countries decide. It's not our choice. We will seek to verify whatever they give us to verify.



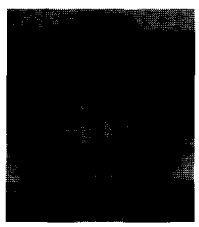
Charles Pietri: A different kind of question for you, Pierre. We've discussed a lot of issues around this table. We're discussing lots of issues out in the technical program. What do you perceive as the role of INMM in relation to IAEA? We perform a function that IAEA is a very large component of INMM and we like to be able do something useful. There's been some criticism that INMM doesn't do enough.

Goldschmidt: Tough question! We are working more and more with a results-based budgeting principle. We are asked to justify what result we expect from any trip, any participation in a conference. Clearly the annual INMM meeting is the number one gathering of safeguards experts in the world. I consider it an extremely useful professional forum allowing for all those concerned to exchange information on the latest research, technological developments and new concepts. I have the difficult task every year of deciding how many people will be sent to the INMM meeting. I can tell you it's a headache. I always have twice as many candidates as slots. The enthusiasm to come here is clearly there. However, it has to take a lower priority than our verification activities, even if it's undoubtedly very useful. We will continue to participate.

If I may also ask a question, what would be your perspective on the role of INMM and our participation?

Pietri: I would like to see continued cooperation and discussion but there are

also issues that perhaps the INMM as a group, if we selected task groups, could help you with. Maybe we're doing that in a formal way, maybe we're not. Because we have a varied and expert constituency here and if there are any issues that you feel, outside of the infrastructure that's already set up, that might be of value to you on an informal but expert basis, that's something we would perhaps want to consider.



Debbie Dickman: I wonder if you would comment on a couple of items. Following the opening plenary session this morning, you had a discussion with one of our Russian colleagues about nuclear verification issues. Could you share this with the group? I'm also interested in your thoughts relative to the limited amount of dollars and the nongrowing budget of the IAEA and how cooperation with an individual country's state system of accounting and control could achieve positive results and save the Agency money. Last November in Tokyo, at the Japan Chapter's annual INMM meeting, this topic was discussed by B.K. Kim, president of the INMM Korean Chapter, (Vienna Chapter Vice President) Anita Nilsson of the IAEA, and others.

Goldschmidt: The talk with the Russian gentleman, with the help of an interpreter, was on technical questions related to R&D efforts on nuclear verification.

Regarding the B.K. Kim conversation, you refer to cooperation between the Agency and an SSAC. That's an important subject. We discussed it yesterday, also, in the International Safeguards Division meeting. We have had very good experience of such cooperation with EURATOM. I know it took a long time to get the New Partnership Agreement and that there have been some heated debates in the past.

Since I've been in charge of the Safeguards Department and thanks to the work done by my predecessor, I must say the relationship with EURATOM has been excellent. I think they are satisfied and we are satisfied. We are working more and more together. We are sharing equipment. We have implemented the "one-man, one-job" principle. We have made cost savings, so it's very positive. Can we go further? Further meaning what? More for us? More for them? And how can we maintain our independence of judgment?

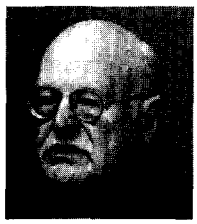
Clearly the new partnership approach with EURATOM is taken as a reference by others such as ABACC, Japan, and South Korea. They are seeking to ensure that the relevant RSAC or SSAC is such as to enable us to consider increased sharing and cooperation with them thereby diminishing our own activities.

From our perspective, however, we must be very careful not automatically to give the impression that what works well in one area will automatically work just as effectively elsewhere in the world. We are therefore proceeding cautiously. The extent to which cooperative arrangements with the Agency can be implemented are yet to be defined.

Cooley: The important issue here is what's required for the Agency to draw an independent conclusion. The activities that we're talking about in sharing equipment, sharing training, and sharing some of the verification activities are just the first steps. What is also being discussed and evaluated is an audit-based approach whereby the regional or state systems do the verification with the Agency auditing those activities. We'll need to investigate what's required at the state and facility levels. There are different aspects of this under intense discussion with member states.

Vance: The U.S. has made a decision not to pursue reprocessing because of the concern of proliferation. Any time that reproceessing and now MOX fuel fabrication is discussed, it's an argument that you hear—that it's going to lead to proliferation and that's a concern. My question is, do you believe that reprocessing or MOX fuel fabrication can be safeguarded and if the arguments are correct that it cannot be, then how can we make the argument that we can safeguard any nuclear activity? Why are those activities so unique in terms of applying safeguards?

Goldschmidt: In a country with a reprocessing plant where you have a Comprehensive Safeguards Agreement and an Additional Protocol in force, as in Japan, I believe that the safeguards system can give the necessary guarantees. However, it is important to bear in mind that safeguards can never provide 100 percent assurance, whether for a reprocessing plant or any other type of nuclear facility. It's true that a reprocessing plant is a complex facility, but if you have, as we do in Japan, adequate design information and a measurement system in place that we can review and verify before the plant starts, this generates a high degree of confidence. The fact that at the Rokkasho Reprocessing Plant they are not going to separate plutonium from uranium before it goes to MOX fuel, is also helping very much in the process. I think it's quite a safeguardable plant. If you question this, then the whole system has to be brought into question. Either you consider that what we have done over the last forty years has been worthwhile and appropriate or you don't. What is clear is that we're improving the effectiveness of the safeguards system everyday. I don't view MOX fuel, in itself, as any major stumbling block. We have a lot of experience on how to safeguard it.



Steve Dupree: Under the Additional Protocol, you will be considering specific measures for applying safeguards to facilities within each country. And these specific measures will depend on a number of aspects—the extent of the nuclear facilities within the country and other things. Do you foresee a time when you might prepare a set of guidelines in which you would tell a country, if you do the following things then the Agency will do the following things? Do you think it will ever reach a point where you could do that? So there'd be some predictability to the specific measures? I realize they're just under development right now.

Goldschmidt: I'm not sure I quite understand the question. Clearly as Jill said this morning, we are reviewing traditional safeguards for each facility type and in principle, the criteria that we will apply in all countries that have this type of facility and an Additional Protocol in force would be the same.

Cooley: As I heard your question, it was what level and intensity of measures from the Additional Protocol will we apply to a state with an Additional Protocol in force. Is that right?

Dupree: Specifically, do you foresee a time when you will reach the point where there will be some guidelines, that if the state does the following things, or does not have the following facilities or does have the following facilities, then our specific measures will address these things? Will there be some sort of guideline or checklist or is it going to continue to be on a case-by-case basis?

Cooley: I wouldn't describe it as either cookbook or case-by-case. We have a set of guidelines that we're developing. The first step in the process is being able to draw a conclusion based on the evaluation of all the information we have that there are no indications of undeclared nuclear materials or activities in the state. For this we have a set of conditions that the state needs to meet and a set of activities we need to perform.

Because the nature of any follow up activities is very dependent on our review of all this information, we can only say in general that we will follow-up. If we have a need for clarification or if we identify questions or inconsistencies, we will go back to the state for more information, and in some cases we may conduct complementary access. But to be any more specific on guidelines on what constitutes a question or inconsistency at this point is clearly case-by-case. What is certain, and this is some of the detail that will be provided in our paper to the December Board of Governors, is that we have a process by which we perform a comprehensive state evaluation.

We also have a framework defining the activities we will apply at different facility types if we can draw the required conclusions regarding non-diversion of declared nuclear material and the absence of undeclared nuclear material and activities and can proceed with implementation of integrated safeguards. We will have criteria for these activities. State-level approaches will be developed by combining integrated safeguards approaches for specific facility types taking into account the interaction between facilities, implementation of the measures of the Additional Protocol and other state-specific features. So as I said, it's not case-by-case and it's not cookbook. It definitely has to be tailored for a state but will be based on some consistent elements across the board.

Lemley: I have a follow up on that with regard to providing assurance that there are no undeclared activities or material. You carry out this large information review including reviews of a collection of unclassified public information. How else could you do that? Do you see that as a continuous process? And if so, how does that save any money on the budget? Can you afford to do that continuously and effectively?

Goldschmidt: Clearly open source information analysis is a continuous process, and it is true that it is also using increasing resources. But we are supplementing our efforts with outside resources. There are a number of institutes helping us; we started with everything which was available in electronic form and in English. That's a double limitation. There are now institutes that are providing us with a lot of information that they have digested and translated, and this is extremely useful. The broader the number of independent sources that are helping us, the better. We are trying also to go beyond English language sources, but again, it could be endless in terms of resources. Better information is among our priorities. It's vital. Absolutely vital.

Lemley: So you're going to continue to rely on extra-budgetary resources to help you with that process, is that fair?

Goldschmidt: Yes and no. Information analysis is too sensitive to rely on extra-budgetary resources. This is something we have to do on our own. We cannot subcontract that. This is one of the fundamental pillars of our evaluations. So we need to develop our database. We need to have people competent to analyze it in-house. We rely on extra-budgetary resources to train them when countries have more knowledge about that than we have. But we are not going to delegate that to cost-free experts or to non-Agency personnel. And the ironic thing about open-source information is that, when you put all the data and information

together, although everything derives from open sources, the final product becomes "safeguards confidential."

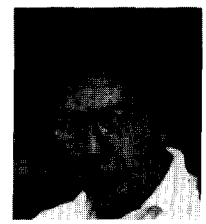
Mangan: I have a question on the agreement that the Russians and the United States are reaching with regard to the Plutonium Management Disposition Agreement. In the closing of your plenary speech today, you talked about the possible future involvement of the IAEA; you mentioned, of course, the Trilateral Initiative which is ongoing. You mentioned the Fissile Material Cutoff Treaty. In fact, your graph even stated the IAEA will provide assistance as requested. And then the third area was the reckoning the amounts of fissile material. No where in there did you mention the Plutonium Management Disposition Agreement. Did you include it under Trilateral by inference?

Goldschmidt: Yes, I did include it. I assume that the Plutonium Disposition Agreement will be part of the Trilateral. We are told that the Plutonium Disposition Agreement will be signed within days. We haven't seen it. We don't know what's in it and how compatible or incompatible it is with the work we have done so far on the Trilateral. Isn't it preferable not to have two separate verification agreements rather than having twice, in a short time period, to go through the relevant approval processes in Russia, the United States, and the Agency?

Mangan: I have one final question. This one is totally on a different subject. One of our technical divisions is physical protection, and I don't remember when it occurred but they moved the physical protection activities that the IAEA supports under you. Could you give us a brief overview of the kinds of work you're doing in physical protection to help member states and where you see this program going?

Goldschmidt: Physical protection is the responsibility of states. What we can do is to help states be aware of what needs to be done and what can be done. So we conduct seminars and training courses. We are cooperating on questions related to physical protection. For example, should the Physical Protection Convention be revised and reinforced? In this case we are really the support program to member states as opposed to the other way around. I thought you were going to ask about illicit trafficking. This is directly related to proliferation. There we have a database and we have established contact points in member states.

But I find the results still a little frustrating because we know, when we are so notified, that there has been seizure of material somewhere and that people have been arrested. But usually the information stops there. When those people are on trial, we are not provided with a copy of the judgment, the description of the case, and the findings. It would be helpful to know not simply that 100 grams of enriched uranium at 3.6 percent were seized in a given state but also where it came from, who were the people arrested, and where they were heading. If we could discern any patterns on that kind of basis, it would be really valuable. Today that's not the case. Any suggestions in this field would be welcome.



Stephen Ortiz: On the physical protection thing, if I could just add, I think the Agency is playing a really important role in regional training courses in the Czech Republic, China, and Argentina. What that provides to the member states is a common methodology on how to protect nuclear material. That is a very big role you're playing.

Mangan: Thank you, sir. I think this discussion is going to be very, very interesting to our members.

Security and Nonproliferation: The Interface

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The Department of Energy's Office of Safeguards and Security is actively involved in supporting U.S. government initiatives in international nonproliferation. While our primary role is to ensure the strength of domestic security at DOE facilities, we make the concerted effort to ensure that this mission does not adversely impact the implementation of nonproliferation initiatives.

As recently as five years ago, most people working at DOE weapons facilities worked under the assumption that only "Q-cleared" individuals would be permitted access to the Department's most sensitive facilities. However, as nonproliferation and arms control initiatives have begun to focus on special nuclear material, rather than the delivery systems, it is clear that virtually all DOE facilities could be required to permit international inspectors access. As access is granted to these sensitive areas, DOE must make every effort to allow the inspectors to fulfill the objectives of their visit, but at the same time, ensure that classified and sensitive information is protected from compromise.

Members of the OSS staff work with DOE's Office of Nonproliferation and Arms Control as well as U.S. government arms control interagency working groups, providing technical input and helping ensure that DOE security interests are protected. In addition, we provide outreach to DOE field personnel to assist them in preparing for these inevitable visits to their facilities. We have established high priorities for involvement on several major U.S. government initiatives, to include the revision of the Physical Protection Convention, the U.S./Russian/IAEA Trilateral Initiative, Cooperative Threat Reduction, and START III. We believe these are each initiatives in which this office can make significant contributions to U.S. nonproliferation objectives even as we strive to continue protection of DOE domestic nuclear security interests.

Physical Protection Convention

In 1998, the U.S. government began an effort to gain support of signatories to the Physical Protection Convention to expand its scope. Currently, the Convention applies only to international transport of special nuclear material. In particular, the United States wanted to expand the scope to domestic use, storage, and transport. The focus of this initiative is to enhance the physical protection of special nuclear materials around the world to provide assurances that the material will remain in the control of proper authorities. A major element of this effort has been to require states to give *due consideration* to INFCIRC 225, an IAEA document that provides guidance on the physical protection of special nuclear material.

Representatives of OSS served on the working groups that crafted the original INFCIRC/225, as well as its four revisions. These security professionals also support U.S. arms control policy personnel to identify whether policy objectives are practical and will truly improve security at nuclear facilities. In addition, they serve on U.S. delegations to international meetings to support discussions with other delegations with respect to technical aspects and potential impacts of the proposed changes in the convention.

INFCIRC/225 is the result of a near-continuous effort by the international nuclear security community to identify appropriate levels of physical protection for special nuclear material. As such, it establishes an international norm for the protection of special nuclear material in use, storage, and transit.

A fundamental concept of the Physical Protection Convention is that the domestic protection of special nuclear material is a nation's sovereign right and responsibility. In other words, the specific implementation of domestic physical protection cannot be dictated by outside parties. The proposed revision to the Convention would require nations to use INFCIRC/225 as a baseline for the protection of special nuclear material. Each country would evaluate its protection with respect to national interests and issues. It would then implement the guidance as appropriate to meet its own internal requirements. using INFCIRC/225 as a baseline, as opposed to a requirements document, would provide assurances that appropriate analysis is completed on the design and implementation of physical protection systems at nuclear facilities worldwide.

In an additional aspect of these negotiations, the U.S. government is supporting international training initiatives to broaden the use of design basis threats and performance testing. It is important for nations to understand what threat their security systems should be designed to protect against. They should also performance test their systems to determine the practical effectiveness in protecting against their unique design basis threat. We believe that these efforts, coupled with nations giving due consideration

to the guidance in INFCIRC/225, will provide enhanced physical protection at nuclear facilities worldwide.

Trilateral Initiative

The U.S./Russia/IAEA Trilateral Initiative dates back to 1996, when the three parties agreed to conduct trilateral consultations on implementing IAEA verification of excess weapon-origin fissile material in the United States and Russia. Since that time, workshops have been held both trilaterally and bilaterally among the parties to work out numerous conflicts inherent in such work. Recently, a working draft of a model agreement has been circulated among the parties. The intent is to produce two bilateral agreements, one between the United States and the IAEA, the other between Russia and the IAEA. This will provide the agreements general consistency with respect to legal obligations and commitments, while allowing each state to customize the specific activities to its facilities, operations, and security and classification requirements.

By its nature, this work complements other U.S.-Russian bilateral transparency and irreversibility commitments, such as the START series, the HEU Purchase Agreement, the Plutonium Production Reactor Agreement and the agreement to store weapon-usable material at the Fissile Material Storage Facility at Mayak. In fact, the underlying principle of the Trilateral Initiative, that measurement of materials must be verifiable while not revealing sensitive weapons information, is common to all such work. It was during early Trilateral discussions that the inclusion of an information barrier arose.

During Trilateral discussions and technology development, and recently implemented during planning for a technical demonstration, the concept came to life in the form of an Attribute Measurement System with Information Barrier, developed by scientists at DOE's national laboratories. This system was demonstrated to the Russians and IAEA staff last year. The demonstration was conducted in a high-security area at the Los Alamos National Laboratory. Extensive coordination between technology developers and security professionals allowed for a demonstration that was successful in all respects. Most importantly, the proof-of-concept was confirmed and security was not compromised. Although the current version of such a system is being used to demonstrate proof-of-concept, cooperative development among the Trilateral parties will be needed to develop and implement a system that will work both in the United States and Russia. It should be noted that each implementation of attribute measurement systems will employ different attributes depending on the different purposes of the agreements/initiatives.

Recent Trilateral work in the U.S. has focused on the K-Area Material Storage project at Savannah River Site, which is due to begin receiving excess plutonium from Rocky Flats. The Trilateral has piggybacked on the construction and security upgrades required to accommodate the transferred material.

Support to the Cooperative Threat Reduction Program

A related activity that is an important element of the U.S. government nonproliferation program is the Cooperative Threat Reduction Program, established to enhance the controls on and protection of special nuclear material in the former Soviet Union. Of paramount importance to the progress of CTR has been the construction of the Fissile Material Storage Facility at Mayak. This facility was built for the storage of plutonium removed from Russian nuclear weapons. Congressional legislation authorizing the funding of this facility required the U.S. government to assure that the material to be stored there actually comes from dismantled nuclear weapons. This has been a very difficult task. Most measurements of weapons or weapons components would reveal classified information that the Russian Federation may not be willing to share with the United States.

DOE and its laboratories have been working with the Department of Defense, the executive agent for CTR, to identify approaches that might satisfy the congressional mandate while protecting the classified information from disclosure. Working with DOE and DoD security professionals, the DOE laboratories identified a number of attributes that might provide confidence that an item in a container was in fact from a dismantled nuclear weapon. They then derived a wide variety of measurement approaches to confirm these attributes. Next was development of an information barrier to display whether or not the attribute measurements surpassed a threshold, while not revealing classified design information.

To demonstrate this concept, the United States invited a delegation from the Russian Federation to Los Alamos National Laboratory earlier this year. A primary goal of the demonstration was to initiate discussions on future cooperative development of a measurement system that incorporates features agreeable to both sides, particularly in the protection of sensitive weapons design information. With support from other laboratories and DOE and DoD security professionals, Los Alamos successfully conducted this technology demonstration, both on unclassified objects and on a classified weapons component. Security planning for the demonstration was crucial, requiring methods for allowing access of a delegation from the Russian Federation to a high security area at the lab, and performing multiple measurements on a classified weapons component without disclosing any classified information. To all parties' credit, the demonstration was successful from both a technology and a security perspective, and should lead to continued collaboration between U.S. and Russian laboratories.

START III

Finally, the U.S. government has been actively analyzing options for START III negotiations. With its increased emphasis on the actual dismantlement of nuclear warheads, the impact on DOE facilities, such as the Pantex Plant, may be significant. Security personnel and arms control policy staffs from DOE and DoD have conducted extensive studies and site visits to identify options that could enhance transparency objectives of a START III treaty without adversely impacting security or operations at DOE sites.

A major focus of this activity has been to identify how to

structure tours or demonstrations to support negotiations or for actual on-site inspection activities under a START III regime. The study groups, consisting of security, operations, and arms control policy personnel, are identifying activities that would support a variety of policy objectives in ways that minimize impacts on operations and eliminate potential access to extraneous sensitive information. In most instances, the study groups have been able to develop approaches to achieve policy objectives without compromising security and operations. I'm certain this preparation will serve United States well if and when we get to START III reduction levels.

Conclusion

The Office of Safeguards and Security has long recognized the importance of these nonproliferation activities to the worldwide security of nuclear materials. Conversely, we understand that implementation of these programs will necessarily affect U.S. domestic security. Our jobs are to ensure that the negative effects are minimized and to leverage those efforts that can strengthen security at DOE facilities.

Accordingly, my office has had multifaceted involvement in these initiatives. We have been involved in system development, including participation on departmental and interagency working groups, and by service on U.S. delegations to international meetings. OSS has supported the planning and implementation of all of the activities involved in these initiatives, providing expert advice in the areas of physical security, protective forces, and material control and accounting. We participate in technical discussions among the interested parties, serve as liaison to official negotiations, and assist the affected DOE sites on matters of classification, security plan development and preparation for visits by foreign nationals.

My office will continue to take an active role in national-level initiatives involving DOE facilities, particularly as they intersect with the security of our most sensitive assets. Success in each of the above described activities is dependent on the active involvement and cooperation of hundreds of individuals from various countries and agencies, many of whom have affiliations to the INMM. I remain confident that through proper coordination and continued expert collaboration, the United States can fulfill what often seem to be inconsistent missions: reducing the worldwide nuclear threat and protecting our domestic nuclear secrets. My office intends to continue to actively support such efforts.

Multi-Level Variable Sampling in the Attribute Mode

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Abstract

For many years it has been the practice in verification of reported data in certain material classes to use a multi-level sampling procedure. With the aid of an exact but time-consuming method, a relatively small number of measurements are made to determine whether some data were falsified by small amounts, and an inexact but quick method is used to check if a smaller number of items have been falsified by large amounts.

If one assumes that an inspector has only a limited amount of time available, the question immediately arises as to the most efficient number of samples to choose for each measurement method. Hereby one must take into account that the inspectee, should he wish to deliberately falsify the data, will do so in such a way so as to minimize the chance of detection. In other words, the problem is one of strategy and can only be solved with game-theoretical methods.

The present work analyzes this problem under the simplifying assumption that the first and second kind of errors associated with the measurement errors can be neglected.

Introduction

For many years it has been the practice in verification of reported data in certain material classes (such as fresh reactor fuel elements) to use a multi-level sampling procedure. With the aid of an exact but time-consuming method, a relatively small number of measurements are made to determine whether some data were falsified by small amounts (so-called *bias defects*). An inexact but quick method is used to check if a smaller number of items have been falsified by large amounts (*gross defects*).

If one assumes that an inspector has available to him only a limited amount of time, the question immediately arises as to the most efficient number of samples to choose for each measurement method. Hereby one must take into account that the inspectee, should he wish to deliberately falsify the data, will do so in such a way as to minimize the chance of detection. In other words, the problem is one of statistics, due to the random sampling of items for verification and to the unavoidable measurement errors, but also one of strategy, because of the essentially antagonistic nature of verification. A game-theoretical analysis is therefore needed.

The problem described here was treated some time ago on a heuristic basis, among others by Sanborn[7] and Jaech[4]. Later Avenhaus[1] showed how game-theoretical methods might be brought to bear, but because of the complexity of the calculations he restricted himself to specific examples. More recently, interest in the problem has been renewed, with Jaech[5] and Lu[6] presenting new heuristic approaches.

This paper once again takes a game-theoretical approach. For the case of drawing with replacement, for given gross and bias falsifications, and under the assumption that the errors of the first and second kind deriving from measurement error can be neglected (so-called variable sampling in the attribute mode), an explicit solution is derived and discussed.

It should be noted that the problem treated here is a partly more general and at the same time partly more specialized version of a similar problem treated by Avenhaus and Canty.[3] Therefore it is not surprising that a similar solution method finds application in the present case.

Problem Statement

We assume that N material content data for similar items or batches are reported to an inspector, who then verifies them by independently measuring a random sample of the items. He has at his disposal an accurate but time-consuming measurement procedure as well as a faster but less accurate method with which he can detect large falsifications of the data. The accurate method of course will also detect large falsifications.

If the inspector verifies n_1 data with the accurate procedure and n_2 with the less accurate procedure, and if r_1 data are falsified by a small amount and r_2 data by a large amount, then the overall nondetection probability β for sampling with replacement is given by

$$\beta = (1 - \frac{r_1 + r_2}{N})^{n_1} \cdot (1 - \frac{r_2}{N})^{n_2}$$

if we ignore statistical errors of the first and second kind. We can write this equivalently as

$$\ln\beta = n_1 \cdot \ln(1 - \frac{r_1 + r_2}{N}) + n_2 \cdot \ln(1 - \frac{r_2}{N}). \quad (1)$$

Here it should be noted that in a real situation the inspector will sample the items without replacement, at least for a given measurement method. Since the difference is negligible for small samples, we shall continue to restrict discussion to sampling with replacement.

Now we shall assume that the inspectee falsifies his data by a total amount μ, his goal quantity. Let μ_1 and μ_2 be the small and large individual falsifications respectively. Then obviously we have

$$\mu_1 \cdot r_1 + \mu_2 \cdot r_2 = \mu; \mu_1 \ll \mu_2. \quad (2)$$

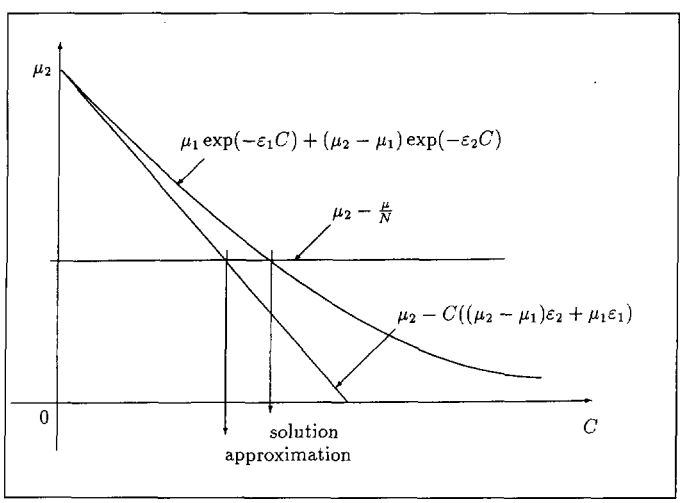
Similarly we assume that the total amount of time available to the inspector for his measurements is ε, and that ε_i is the time required for the verification of a single datum with the ith method, $i = 1, 2$. Then

$$\varepsilon_1 \cdot n_1 + \varepsilon_2 \cdot n_2 = \varepsilon; \varepsilon_1 \gg \varepsilon_2 \quad (3)$$

A rational solution to this problem, see again Avenhaus and Canty[3], involves the determination of a saddle point $(n_1^*, n_2^*; r_1^*, r_2^*)$ in the non-detection probability β, or equivalently in its logarithm, in the strategy space $(n_i, n_2; r_1, r_2)$ of the two protagonists, inspector, and inspectee, whereby the boundary conditions (2) and (3) for given μ and ε are to be met. The saddle point $(n_1^*, n_2^*, r_1^*, r_2)$ is defined by the condition

$$\ln \beta (\mathbf{r}, \mathbf{n}^*) \le \ln \beta (\mathbf{r}^*, \mathbf{n}^*) \le \ln \beta(r^*, \mathbf{n}) \quad (4)$$

Figure 1: Graphical Determination of C According to (10) and its Approximation



for all $\mathbf{r}$ and $\mathbf{n}$, where $\mathbf{r} = (r_1, r_2)$ and $\mathbf{n} = (n_1, n_2)$ and where we assume that these variables may be treated as being continuous.

Thus the problem we wish to solve is characterized by the parameters

$$\varepsilon, \varepsilon_1, \varepsilon_2; \mu, \mu_1, \mu_2; N. \quad (5)$$

We shall assume that their values are common knowledge for both inspector and inspectee. We will return to this point later.

Determination of (r_1^*, r_2^*)

We begin with the following Ansatz for the saddle-point solution (r_1^*, r_2^*):

$$\ln(1 - \frac{r_1^* + r_2^*}{N}) = \varepsilon_1 \cdot C, \quad \ln(-\frac{r_2^*}{N}) = -\varepsilon_2 \cdot C \quad (6)$$

Substitution into (1) and using (3) gives

$$\ln \beta = -C \cdot (n_1 \cdot \varepsilon_1 + n_2 \cdot \varepsilon_2) = C \cdot \varepsilon, \quad (7)$$

that is, with (6) the right hand condition in (4) is satisfied as equality for arbitrary $\mathbf{n}$, including $\mathbf{n}^*$: The inspector is *indifferent* to this choice of $\mathbf{r}^*$.

From (6) we obtain

$$\frac{r_1^*}{N} + \frac{r_2}{N} = 1 - \exp(-\varepsilon_1 \cdot C), \quad \frac{r_2^*}{N} = 1 - \exp(-\varepsilon_2 \cdot C) \quad (8)$$

or finally

$$r_1^* = N \cdot (\exp(-\varepsilon_2 \cdot C) - \exp(-\varepsilon_1 \cdot C))$$
$$r_2^* = N \cdot (1 - \exp(-\varepsilon_2 \cdot C)). \quad (9)$$

The proportionality constant C, which has no intuitive interpretation, is determined by the boundary condition. With (2) and (9) we must have

$$\mu = N \cdot (\mu_1 \cdot (\exp(-\varepsilon_2 \cdot C) - \exp(-\varepsilon_1 \cdot C))) + \mu_2 \cdot (1 - \exp(-\varepsilon_2 \cdot C))$$

or simplified

$$\mu_2 - \frac{\mu}{N} = (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C) + \mu_1 \cdot \exp(-\varepsilon_1 \cdot C). \quad (10)$$

Discussion of Equation 10

Equation 10 is a transcendental equation for C and can easily be solved graphically (and hence, of course, numerically). This is indicated in Figure 1. As can be seen from the figure, since $\mu_2 > \mu_1$ a solution to 10 exists only for

$$\mu_2 \ge \frac{\mu}{N} \text{ or } \mu \le N\mu_2,$$

which is reasonable.

For $\mu = 0$, i.e. for $C = 0$ we have $r_1^* = r_2^* = 0$; for $\mu = N\mu_2$, i.e. for $C = \infty$ we have $r_1^* = 0$, $r_2^* = N$, both of which are again reasonable.

For $\varepsilon_i C \ll 1$, i=1, 2, one can approximate the exponential function with a linear function to obtain

$$\mu_2 - \frac{\mu}{N} = \mu_2 - \mu_1 + \mu_1 - C((\mu_2 - \mu_1) \cdot \varepsilon_2 + \mu_1 \cdot \varepsilon_1$$

or explicitly

$$C = \frac{\mu}{N} \cdot \frac{1}{\mu \cdot \varepsilon + (\mu_2 - \mu_1) \cdot \varepsilon_2}.$$

Determination of (n_1^*, n_2^*)

Following the left-hand side of the saddle point criteria (4) we determine the value of $\mathbf{r}$ which maximizes $\beta(\mathbf{r}, \mathbf{n}^*)$. If we equate this to (8) and (9) we then obtain the saddle point values (n_1^*, n_2^*), which for simplicity we write in the sequel as (n_1, n_2).

We carry out the maximization itself with the help of a Lagrange procedure: We determine the unconstrained maximum of the function

$$F(r_1, r_2) := \ln \beta(r_1, r_2) + \lambda \cdot (\mu \cdot r_1 + \mu \cdot r_2),$$

(λ is the Lagrange parameter) according to

$$\frac{\partial F}{\partial r_1} = \frac{n_1}{1 - \frac{r_1 + r_2}{N}} \cdot (-\frac{1}{N}) + \lambda \cdot \mu 1 = -\frac{n_1}{N - r_1 - r_2} + 1 \cdot \mathrm{m1} = 0$$

$$\frac{\partial F}{\partial r_2} = \frac{n_1}{1 - \frac{r_1 + r_2}{N}} \cdot (-\frac{1}{N}) + \frac{n_2}{1 - \frac{r_2}{N}} \cdot (-\frac{1}{N}) + \lambda \cdot \mu_2$$

$$= -\frac{n_1}{N - r_1 - r_2} - \frac{n_2}{N - r_2} + \lambda \cdot \mu_2 = 0$$

Combining these two equations we obtain

$$\frac{-n_2}{N - r_2} + \lambda \cdot (\mu_2 - \mu_1) = 0 \qquad (12)$$

or finally

$$r_1 = \frac{1}{\lambda} \cdot (\frac{n_2}{\mu_2 - \mu_1} - \frac{n_1}{\mu_1}) \qquad (13)$$

$$r_1 = \mathrm{N} - \frac{1}{\lambda} \cdot \frac{n_2}{\mu_2 - \mu_1} \qquad (14)$$

With (2) we obtain

$$\mu = \mu_1 \cdot r_1 + \mu_2 \cdot r_2 = \frac{1}{\lambda} \cdot (n_1 + n_2) + \mu_2 \cdot N.$$

The Lagrange parameter is given therefore by

$$\frac{1}{\lambda} = \frac{\mu_2 \cdot N - \mu}{n_1 + n_2} \qquad (15)$$

Thus, with (13) and (14) we obtain

$$r_1 = (\mu_2 \cdot N - \mu) \cdot (\frac{1}{\mu_2 - \mu_1} \cdot \frac{n_2}{n_1 + n_2} - \frac{1}{\mu_1} \cdot \frac{n_1}{n_1 + n_2}) \qquad (16)$$

$$r_2 = N - \frac{\mu_2 \cdot N - \mu}{\mu_2 - \mu_1} \cdot \frac{n_2}{n_1 + n_2} \qquad (17)$$

It still remains to be shown that the solution just found is indeed a maximum of $\ln(\mathbf{r}, \mathbf{n})$; but this can be done as above.[2] Of course we could have eliminated one of the variables $\mathbf{r}_1$, for example, with the help of boundary condition (2), and then optimized over the other. Since this would have destroyed the symmetry of the problem, we have preferred not to do this. One could also imagine an extension of the problem to three measurement methods, and then a Lagrange procedure would have been in any case necessary.

Following our program, we now have to equate the results (16) and (17) with (8) and (9). To this end we go back to (11), to obtain

$$1 - \frac{r_1 + r_2}{N} = \frac{1}{\lambda} \frac{n_1}{\mu_1}$$

$$1 - \frac{r_2}{N} = \frac{1}{\lambda} \cdot \frac{n_2}{\mu_2 - \mu_1}$$

i.e. with (6) and (13)

$$\frac{\mu_2 \cdot N - \mu}{\mu_1} \cdot \frac{n_1}{n_1 + n_2} = \exp(-\varepsilon_1 \cdot C) \qquad (18)$$

$$\frac{\mu_2 \cdot N - \mu}{\mu_2 - \mu_1} \cdot \frac{n_2}{n_1 - n_2} = \exp(-\varepsilon_2 \cdot C) \qquad (19)$$

Together with (3) we have an overdetermined system of equations for n_1 and n_2. The apparent problem resolves itself at once: Appropriate addition of (18) and (19) gives

$$1 = \frac{\mu_1}{\mu_2 \cdot N - \mu} \cdot \exp(-\varepsilon, C) + \frac{\mu_2 - \mu_1}{\mu_2 \cdot N - \mu} \cdot \exp(\varepsilon_2 \cdot C) \quad (19)$$

which is just (10) again. Thus either one of the equations (18) and (19) together with the boundary condition (3) serves to determine $(n1, n2)$.

From (18) we obtain

$$\frac{n_2}{n_1} = -1 + \frac{\mu_2 \cdot N - \mu}{\mu_1} \cdot \exp(-\varepsilon_1 \cdot C) =: A \qquad (20)$$

On the other hand, from (3) we get

$$n_1 = \frac{1}{\varepsilon_1} \cdot (\varepsilon - \varepsilon_2 \cdot n_2)$$

or finally

$$n_2 = \frac{\varepsilon \cdot A}{\varepsilon_1 + \varepsilon_2 \cdot A}$$

$$n_1 = \frac{1}{\varepsilon_1} \cdot (\varepsilon - \frac{\varepsilon_2 \cdot \varepsilon \cdot A}{\varepsilon_1 + \varepsilon_2 \cdot A}) = \frac{\varepsilon}{\varepsilon_1 + \varepsilon_2 \cdot A} \tag{21}$$

Now we have with (10)

$$\frac{\frac{-\mu}{N} + \mu_2}{\mu_1} \cdot \exp(\varepsilon_1 \cdot C) = -\exp((-\varepsilon_2 + \varepsilon_1) \cdot C) \cdot \frac{\mu_2 - \mu_1}{\mu_1} + 1$$

and hence

$$A = \frac{\mu_2 - \mu_1}{\mu_1} \cdot \exp((-\varepsilon_2 + \varepsilon_1) \cdot C)$$

After appropriate multiplication we obtain the final solution, when we again write (n_1^*, n_2^*) for (n_1, n_2),

$$n_1^* = \frac{\varepsilon}{D} \cdot \mu_1 \cdot \exp(-\varepsilon_1 \cdot C)$$

$$n_2^* = \frac{\varepsilon}{D} \cdot (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C) \tag{22}$$

$$D = \varepsilon_1 \cdot \mu_1 \cdot \exp(-\varepsilon_1 \cdot C) + \varepsilon_2 \cdot (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C)$$

We consider two limiting cases of these formulae:

i) For $\mu = 0$ we have $C = 0$ and hence

$$n_1^* = \frac{\varepsilon}{\varepsilon_1 \cdot \mu_1 + \varepsilon_2(\mu_2 - \mu_1)} \cdot \mu_1$$

$$n_2^* = \frac{\varepsilon}{\varepsilon_1 \cdot \mu_1 + \varepsilon_2(\mu_2 - \mu_1)} \cdot (\mu_2 - \mu_1)$$

These expressions hold also for the approximation, $\varepsilon_i \cdot C \ll 1$, $i = 1, 2$. ii) For $\mu = N \cdot \mu_2$ we have $C = \infty$ and therefore

$$n_1^* = 0, n_2^* = \frac{\varepsilon}{\varepsilon_2},$$

which is again reasonable.

Proofs

We have derived the saddle point (8, 9) and (22) constructively and shown that the solution (8, 9) satisfies the right-hand side of (4) as equality. Now we prove the left-hand side of (4). We have with (7)

$$\ln\beta(r^*, n^*) = -\varepsilon \cdot C$$

and furthermore with (2)

$$\ln\beta(r, n^*) = \frac{\varepsilon}{D} \cdot [\mu_1 \cdot \exp(-\varepsilon \cdot C) \cdot \ln(1 \frac{r_1 + r_2}{N}) +$$

$$(\mu_2 - \mu_1) \cdot \exp(-\varepsilon \cdot C) \cdot \ln(1 \frac{r_2}{N})] \tag{23}$$

We have therefore to show, according to the left-hand side of (4)

$$\mu_1 \cdot \exp(-\varepsilon_1 \cdot C) \cdot \ln(1 - \frac{r_1 + r_2}{N}) + (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C) \cdot$$

$$\ln(1 - \frac{r_2}{N}) \leq -C \cdot D \tag{24}$$

for all **r** satisfying (2).

We shall again apply the Lagrange procedure. We determine the unconstrained maximum of the function

$$G(r_1, r_2) = \mu_1 \cdot \exp(-\varepsilon_1 \cdot C) \cdot \ln(1 - \frac{r_1 + r_2}{N}) \tag{25}$$

$$+(\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C) \cdot \ln(1 - \frac{r_2}{N} + \chi \cdot (\mu_1 \cdot r_1 + \mu_2 \cdot r_2)$$

where χ is the Lagrange parameter, according to the conditions

$$\frac{\partial G}{\partial r_2} = \mu_1 \cdot \exp(-\varepsilon_1 \cdot C) \cdot \frac{1}{1 - \frac{r_1 + r_2}{N}} \cdot (-\frac{1}{N}) + \chi \cdot \mu_1 = 0 \tag{26}$$

$$\frac{\partial G}{\partial r_2} = \mu_1 \cdot \exp(-\varepsilon_1 \cdot C) \cdot \frac{1}{1 - \frac{r_1 + r_2}{N}} \cdot (-\frac{1}{N})$$

$$+ (\mu_2 - \mu_1) \cdot \exp(-\varepsilon \cdot C) \cdot \frac{1}{1 - \frac{r_2}{N}} \cdot (-\frac{1}{N}) + \chi \cdot \mu_2 = 0 \tag{27}$$

Substituting (26) in (27) and back gives

$$(\mu_2 - \mu_1 \cdot \exp(-\varepsilon_2 \cdot C) \cdot \frac{1}{1 - \frac{r_2}{N}} \cdot (-\frac{1}{N}) + \chi \cdot (\mu_2 - \mu_1) = 0 \tag{28}$$

or

$$1 - \frac{r_2}{N} = \frac{1}{N} \cdot \frac{1}{\chi} \cdot \exp(-\varepsilon_2 \cdot C) \tag{29}$$

From (28) and with (2) we have

$$\mu = \mu_2 \cdot (N - \frac{1}{\chi} \cdot \exp(-\varepsilon_2 \cdot C)) + \mu_1 \cdot \frac{1}{\chi} \cdot (\exp(-C_2 \cdot C) - \exp(-\varepsilon_1 \cdot C))$$

or

$$\mu = \mu_2 \cdot N - \frac{1}{\chi} \cdot (\mu_1 \cdot (\exp(-\varepsilon_2 \cdot C) - \exp(-\varepsilon_1 \cdot C)) - \mu_2 \cdot \exp(-\varepsilon_2 \cdot C))$$

Thus, because of (10) the Lagrange parameter is given by

$$\frac{1}{\chi} = \mathrm{N}, \tag{30}$$

and we obtain (6) again from (28) and (29). If we substitute this into (24) we get with (23)

$$\mu_1 \cdot \exp(-\varepsilon_1 \cdot C) \cdot (-\varepsilon_1 \cdot C) + (\mu_2 - \mu_1) \cdot \exp((-\varepsilon_2 \cdot C) - (-\varepsilon_2 \cdot C)$$
$$= -C \cdot (\varepsilon_1 \mu_1 \cdot \exp(-\varepsilon \cdot C) + \varepsilon_2 \cdot (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C)) = -C \cdot D$$

as expected.

Similarly to the situation in the section on Determination of (n_1^*, n_2^*), we should still demonstrate that we have in fact found a maximum. This can be done within the Lagrange framework, which is complicated, or through elimination of one of the two variables with the help of the boundary condition, which, as mentioned, destroys the symmetry of the problem and its solution.

Summary and Interpretation

The optimal sample sizes for the inspector are

$$n_1^* = \frac{\varepsilon}{D} \cdot \mu_1 \cdot \exp(-\varepsilon_2 \cdot C) \tag{31}$$

$$n_2^* = \frac{\varepsilon}{D} \cdot (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C)$$

where, with (10) and (23) the quantities C and D are given by

$$\mu_2 - \frac{\mu}{N} + \mu_1 \cdot \exp(-\varepsilon_1 \cdot C) + (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C) \tag{32}$$

$$D = \varepsilon_1 \cdot \mu_1 \cdot \exp(-\varepsilon_1 \cdot C) + (\mu_2 - \mu_1) \cdot \exp(-\varepsilon_2 \cdot C)$$

The optimal sample sizes for the inspectee are given by

$$r_1^* = N \cdot (\exp(-\varepsilon_2 \cdot C) - \exp(-\varepsilon_1 \cdot C)) \tag{32}$$
$$r_2^* = N \cdot (1 - \exp(-\varepsilon_2 \cdot C))$$

and finally the non-detection probability at the saddle point is

$$\beta^* = \exp(-\varepsilon \cdot C) \tag{33}$$

For $\varepsilon \ll$ for $i = 1, 2$, we have, with the approximate solution to (10)

$$\mathrm{C} = \frac{\mu}{N} \cdot \frac{1}{\mu \cdot \varepsilon_1 + (\mu_2 - \mu_1) \cdot \varepsilon_2} \tag{34}$$

and hence

$$n_1^* = \frac{\varepsilon}{\varepsilon_1 \cdot \mu_1 + \varepsilon_2(\mu_2 - \mu_1)} \cdot \mu_1$$

$$n_2^* = \frac{\varepsilon}{\varepsilon_1 \cdot \mu_1 + \varepsilon_2(\mu_2 - \mu_1)} \cdot (\mu_2 - \mu_1) \tag{35}$$

$$r_1^* = N \cdot (\varepsilon_1 - \varepsilon_2) \cdot C \tag{36}$$
$$r_2^* = N \cdot \varepsilon_2 - C$$

Solution (22) or (35) confirms what we might have expected before a quantitative analysis: The sample size n_1^* for the exact method is proportional to the small falsification μ_1, that for the inexact method, to the large falsification μ_2, if we take $\mu_2 - \mu_1 \approx \mu_2$. The ratio of sample sizes is thus the ratio of the individual falsifications:

$$\frac{n_2^*}{n_1^*} = \exp((\varepsilon_1 - \varepsilon_2) \cdot C) \cdot (\frac{\mu_2}{\mu_1} - 1)$$

or with $\varepsilon \cdot C \ll 1$, $i = 1, 2$, and $\mu_2 \gg \mu_1$

$$\frac{n_2^*}{n_1^*} = \frac{\mu_2}{\mu_1}$$

One advantage of the approximation (35) is that the solution is independent of the total falsification, which the inspector of course doesn't know, but rather follows the form of the alternative hypothesis.

The inspectee's sample are oriented toward the inspector's measurement times: For $\varepsilon_1 \gg \varepsilon_2$we have from (36)

$$\frac{r_1^*}{r_2^*} = \frac{\varepsilon_1}{\varepsilon_2}.$$

In other words, if data are falsified then many more will be falsified by a small amount than by a large amount, again an intuitive result.

As was mentioned in the introduction, the above solution is a variant of an earlier, partly more specialized, partly more general solution of a related problem.[3] There not just 2, but $k \geq 2$ measurement methods are considered, but each method could detect only one class of data falsification.

Numerical Example

We consider the following fictitious example

$N = 500$
$\mu = 5$, $\mu_1 = 0.1$, $\mu_2 = 1$
$\varepsilon = 1h$, $\varepsilon_1 = 0.2h$, $\varepsilon_2 = 0.01h$

Then we get from (34)

$$C = \frac{5}{500} \cdot \frac{1}{0.2 \cdot 0.1 + 0.01 \cdot 1} = 0.35,$$

that is, the approximation is justified. From (35) and (36) we have then, rounding down to integers,

$$n_1 = 1 \cdot \frac{0.1}{0.03} = 3$$

$$n_2 = 1 \cdot \frac{1}{0.03} = 29$$

$$r_1 = 5 \cdot \frac{0.2}{0.03} = 29$$

$$r_2 = 5 \cdot \frac{0.01}{0.03} = 1$$

$$\beta^* = \exp(-\varepsilon \cdot C) = 1 - 1 \cdot 0.33 = 0.67$$

and we see that the approximation of drawing with replacement is also justified. For larger values of ε and μ, where the approximation (34) can no longer be justified, we can use figure 1 or a corresponding numerical procedure to determine C.

Legal Behavior

In our considerations so far we have assumed that the inspectee falsifies his data by some total amount $\mu > 0$; i.e. he behaves illegally. The question arises whether the inspector can induce the inspectee to behave legally.

This question cannot be answered in the context of the present formalism, which makes use of purely *technical* parameters. It is necessary to introduce *subjective* quantities which describe the gains and losses of the inspectee in all possible situations. Let

0 be the inspectee's payoff for legal behavior (normalization),

$d > 0$ be his payoff for undetected illegal behavior, and

$-b < 0$ be his payoff for detected illegal behavior.

His expected payoff is then

0 for legal behavior.

$-b \cdot (1 - \beta) + d \cdot \beta$ for illegal behavior.

The inspectee will thus behave legally, provided

$$0 > -b \cdot (1 - \beta) + d \cdot \beta$$

or, equivalently, provided

$$\beta < \frac{1}{1 + b/d}$$

With (33) this is equivalent to

$$\varepsilon > \frac{1}{C} \cdot \ln(1 + \frac{d}{b})$$

which is reasonable: the larger the ratio of profit for undetected to cost of detected illegal behavior, the larger the inspector's invested inspection effort.

Discussion

Our treatment of multi-level sampling hitherto was made under the assumption that statistical errors of the first and second kind resulting from measurement error could be neglected. How would a treatment look which took these errors into account?

Let us assume that the false alarm probabilities for each for the $n_1 + n_2$ individual tests are all equal and given by α'. Then the overall false alarm probability α is given by

$$1 - \alpha = (1 - \alpha')^{n_1 + n_2}. \tag{37}$$

The non-detection probability β_i' for a single test involving the ith method is then

$$\beta_i' = \Phi(U(1 - \alpha') - \frac{\mu_i}{\sigma_i}), \quad i = 1, 2, \tag{38}$$

where σ_i^2 is the variance of the ith test, Φ is the standard normal distribution and U is its inverse. Using (37) we can write (38) for fixed α as

$$\beta_i' = \Phi(U(\sqrt[n_1 + n_2]{1 - \alpha}) - \frac{\mu_i}{\sigma_i}), \tag{39}$$

With the help of the theorem of total probability the overall non-detection probability for drawing with replacement is

$$\beta = (\beta_1' \cdot \frac{r_1}{N} + \beta_2' \cdot \frac{r_2}{N} + (1-\alpha') \cdot (1 - \frac{r_1 + r_2}{N}))^{n_1} \cdot (\beta_2' \cdot \frac{r_2}{N} + (1-\alpha') - (1 - \frac{r_2}{N}))^{n_2} \tag{40}$$

where β_1' and β_2' are given by (39) and where α' can be eliminated in favor of α with (37). For $\alpha' = \beta_1' = \beta_2' = 0$ this reduces to our original starting point (1).

We see that the kind of analysis performed in the main body of this work will not lead to explicit formulae: If β_1', β_2' and α' were constants, we could seek the corresponding generalizations. However β_1' and β_2' are complicated, non-linear functions of n_1 and n_2 and such an attempt would be hopeless. One must resort to numerical calculation.

Another question is the choice of appropriate values for the individual falsifications μ_1 and μ_2, which we have assumed as being given. Heuristically one could assume that μ_1 is of the order of the measurement accuracy (which means taking into account statistical error), and that μ_2 is as large as possible, perhaps the total material content of a measured item.

A rigorous treatment in which μ_1 and μ_2 are strategic variables can of course not be carried out without considering statistical errors. Obviously then only the simplest situations can be handled so that the Neyman-Pearson lemma, which allows the construction of optimal test procedures and corresponding game-theoretical solutions,[3] can be applied successfully.

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Dry Interim Storage Facility for Spent Fuel Assemblies from Chernobyl Nuclear Power Plant

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Note: This paper was presented at the INMM XVIII Spent Fuel Management Seminar, January 12-14, 2000, Washington, D.C.

Abstract

Final shutdown of the Chernobyl nuclear power plant in Ukraine necessitates safe on-site interim storage of irradiated fuel. Plant operator EnergoAtom placed a contract with a Framatome-led consortium for the design and construction of a facility for dry processing and interim storage of some 25,000 spent fuel assemblies from Chernobyl. The designed solution combines a facility for processing spent fuel arriving from the power plant with the qualified NUHOMS™ storage system. Processed spent fuel is packaged in sealed stainless steel containers in an inert atmosphere and placed in horizontal reinforced concrete storage modules. The design takes account of RBMK fuel architecture as well as the need for safe storage of absorber rods. Commissioning is currently scheduled for late 2001. The design service lifetime of the storage facility is one hundred years.

Introduction

Ukrainian electric utility EnergoAtom commissioned a consortium comprising Framatome (as lead member), Campenon Bernard-SGE and Bouygues TP to design and construct a facility for handling, processing and storing spent fuel assemblies from all four RBMK (light-water cooled, graphite-moderated) units at the Chernobyl plant. The site, which currently has one unit still in operation, is the focus of decommissioning and cleanup efforts with a view to final closure, the work being supported via the Nuclear Safety Account, a European Bank for Reconstruction and Development-administered G7 fund and by the European Union.

The key design requirement is capability for safe, retrievable storage over a period of one hundred years of some 25,000 spent fuel assemblies and 3,000 absorber rods accumulated at the power plant over its entire service life of twenty-plus years since startup in 1978. This includes spent fuel arising from operation of the plant's last unit until final shutdown. The design throughout for the processing facility is targeted at enabling placement in storage of over 2,500 fuel assemblies per year. The project model applied combines short lead times with a high level of local involvement, with 40 percent of the total contract value placed with Ukrainian firms through civil construction and equipment subcontracts.

Fuel Status/Characterization

Spent fuel assemblies and absorber rods discharged from the reactors at Chernobyl nuclear power plant are currently stored under water in the spent fuel pools in units 1, 2, and 3, as well as at a separate temporary interim storage facility (Khoyat 1) nearby. RBMK fuel assemblies exhibit unusual design features compared with light water reactor (LWR) fuel (see Figure 1), with two 18-rod bundles combined in a two-tier fuel assembly with a long extension shaft. Fuel assemblies are generally cylindrical in external geometry, each fuel bundle measuring approximately 3,644 mm in length, with an outside diameter of 79 mm. The length of the extension shaft is 2,600 mm, giving an overall fuel assembly length of approximately 10,000 mm.

Facility Design

Overview

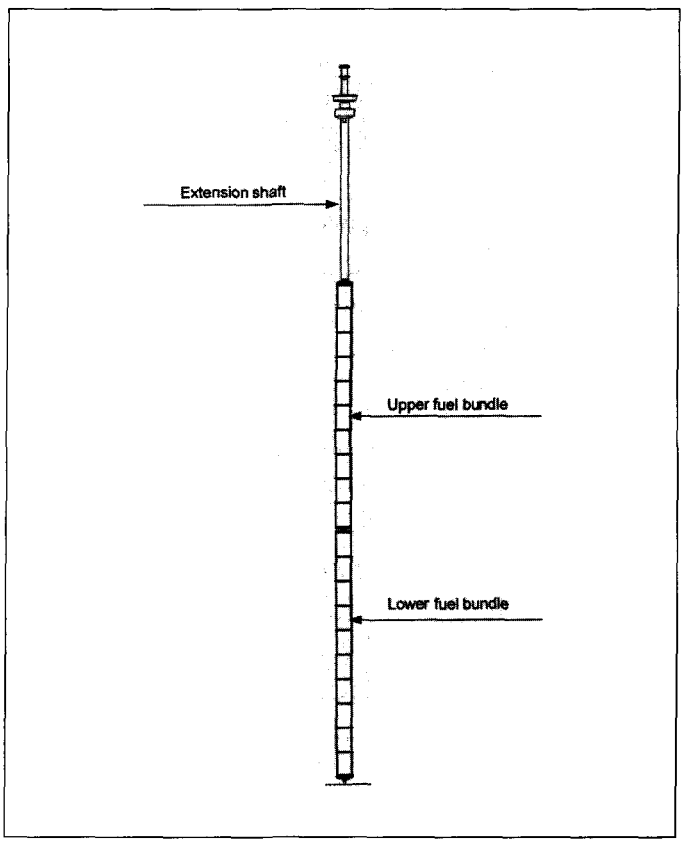
The design solution combines an upstream process building (spent fuel processing facility) with a dry interim storage facility comprising NUHOMS™ horizontal reinforced concrete storage modules. The SFPF, necessitated by the non-standard fuel architecture described above, enables processing of spent fuel following receipt from the plant in transfer casks. Assemblies are separated into three sub-parts (extension shaft, and upper and lower fuel bundles) prior to insertion into NUHOMS™-type storage canisters. A separate vault is also provided for storing the 3,000 absorber rods.

The now widely-used NUHOMS™ technology was devel-

oped, qualified and licensed in the United States for storage of LWR fuels, and is utilized for this and other Framatome projects (e.g. Medzamor VVER fuel storage facility in Armenia) under an exclusive license agreement with Transnuclear.

The whole processing and storage concept has been optimized and adapted for use with Chernobyl (RBMK) fuel, to take account of issues such as geometry, source terms, materials, and failed or damaged fuel.

Figure 1: RBMK Fuel Assembly



Spent Fuel Processing Facility

On receipt of fuel and absorber rods from the power plant under dry conditions in existing TK-8 casks, fuel assemblies and absorbers are sorted, and the extension shafts are removed, sectioned and drummed (see Figure 2). The absorber rods are packed into cartridge tubes and placed directly in storage in a special vault in an adjacent building. The upper and lower fuel bundles are separated, ensuring similar overall dimensions to an LWR fuel assembly, and hence compatibility with typical NUHOMS™ canisters.

The separated fuel bundles are placed inside stainless steel cartridges, which are sealed with a welded lid, and inerted. The cartridges are then inserted into a NUHOMS™ canister, also sealed under inert gas conditions. Each canister holds 196 cartridges, equivalent to a total of 98 fuel assemblies. Two processing lines enable maximizing of facility throughout (see Figure 3).

The stainless steel cartridges and canisters provide an effective double containment barrier between the active products and the environment. Operations are carried out in a cascade of shielded hot cells via remote control from decentralized protected workstations equipped with CCTV monitoring. Biological protection of the operators is ensured by the thickness of the cells' concrete walls. The entire process is dry, reducing secondary waste and eliminating criticality risks. In addition, the number of hot cells is minimized to reduce potential contamination issues, and hot cells are provided with double containment.

Other key features include minimized handling height and reduced load drop potential, and avoidance of load handling above unprotected fuel assemblies. The SFPF design also incorporates ancillary systems for functions such as decontamination, effluent handling/treatment, access control, HVAC, and radiation protection.

Interim Storage Facility (see Figures 4, 5 and 6)

Filled NUHOMS™ canisters are transferred from the spent fuel processing facility to the interim storage facility in transfer casks, via a direct straight-line rail connection. The interim storage facility comprises a total of 256 reinforced concrete storage modules of typical NUHOMS™ design arranged in two parallel lines of 128 modules facing each other at a distance of 10 meters, with the rail track in between.

Canister transportation and transfer into the horizontal storage module is provided by an automotive rail-mounted carrier equipped with a transfer cask support skid (typical NUHOMS™ design) with docking alignment and canister ramming functions.

Natural convection of ambient air ensures passive removal of residual heat, while probes located inside the storage modules enable temperature monitoring via portable remote IR readers. The reinforced concrete modules ensure protection of the canisters against external aggressions, as well as protecting personnel against radiation from the nuclear fuel. Specific local environmental conditions are taken into account through special devices fitted over air inlet orifices to prevent blocking by drifting snow.

Current/Future Status

The entire facility is scheduled to be operational at the end of 2001, with supply of the final fuel storage canisters to be effected some months after spent fuel processing and packaging has come on-stream. The currently scheduled service lifetime of the interim storage facility is one hundred years.

Conclusion

The dual solution developed by the Framatome-led consortium, the first large-scale on-site project associated with decommissioning of the Chernobyl plant, combines a dry spent fuel processing facility with extensive spent fuel interim storage capability to meet the needs expressed by the utility. The fully-qualified dry storage technology provides an effective double containment barrier with passive heat removal, as well as ensuring package

Figure 2: Processing and Interim Storage of Spent Fuel and Absorbers

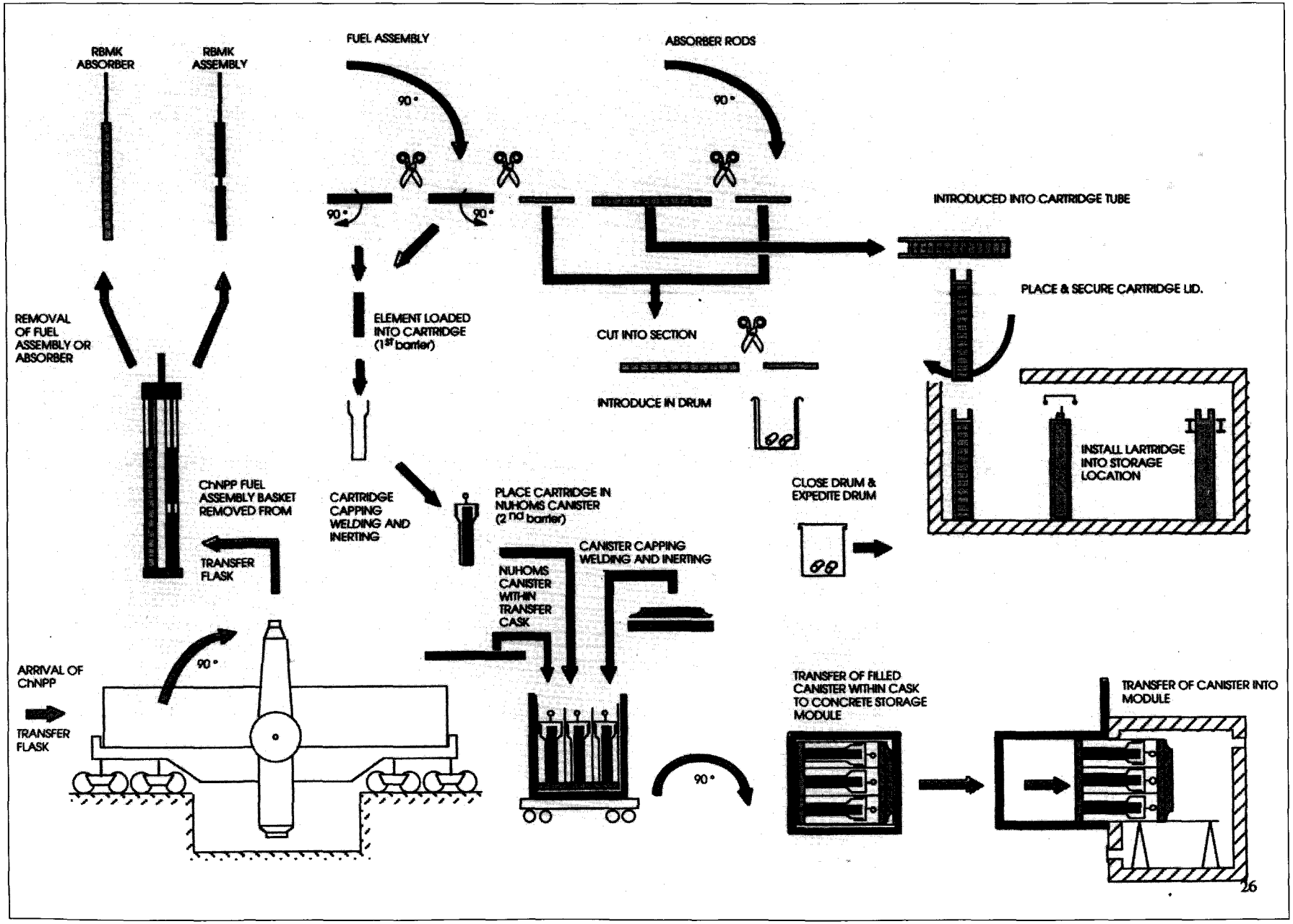
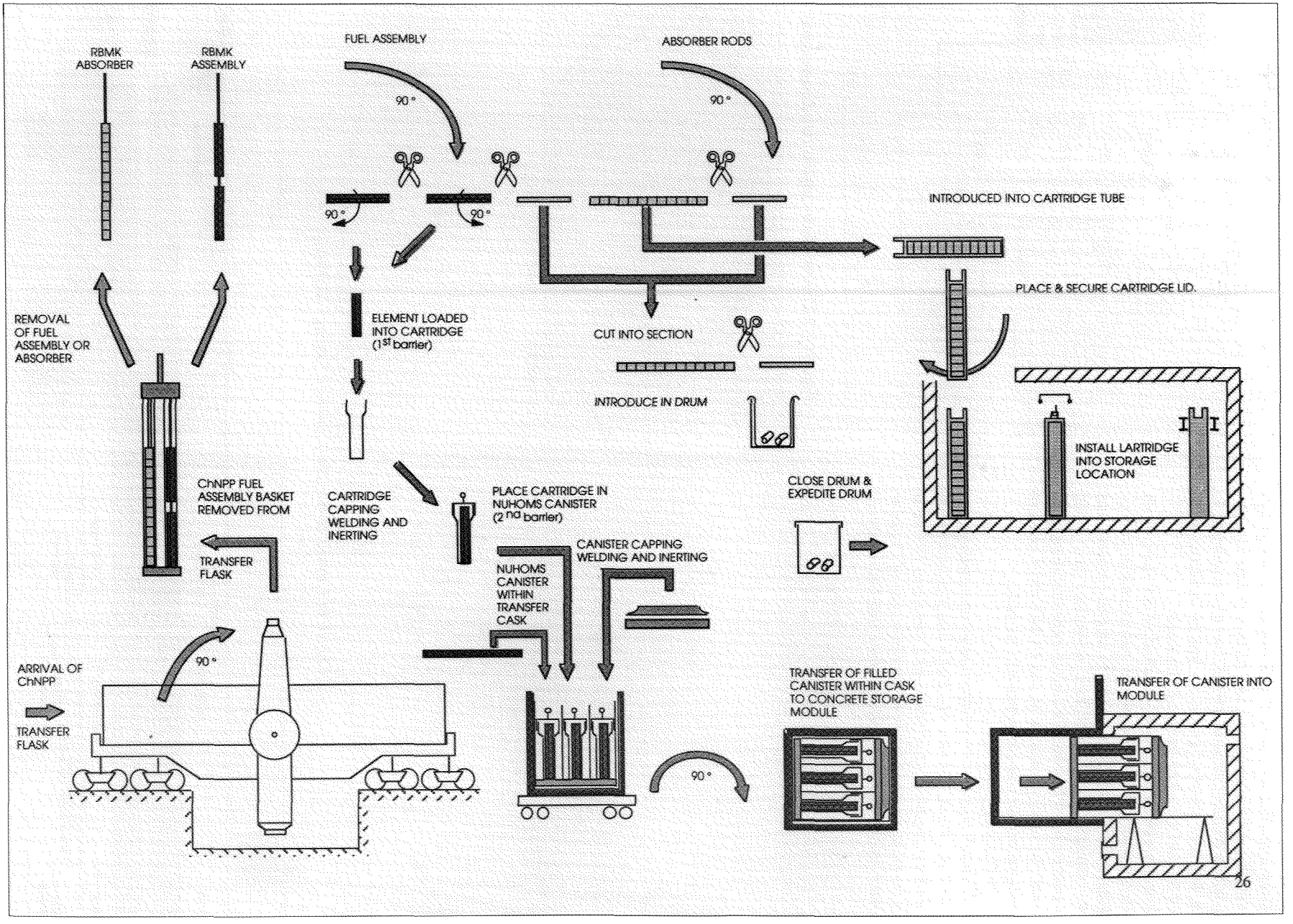


Figure 2: Processing and Interim Storage of Spent Fuel and Absorbers



compatibility with other Ukrainian VVER-type spent fuel storage facilities. Both spent fuel processing and interim storage are optimized to take account of unusual RBMK fuel characteristics, in particular fuel and absorber geometry. Special solutions were developed to meet these key technical challenges.

The sheer scope of the project in terms of the quantity of material to be placed in safe dry storage represented a particular challenge. The facility's capability to receive, process and place into storage 25,000 spent fuel assemblies and 3,000 absorber rods makes it the world's largest spent fuel store, confirming both the appropriateness of the NUHOMS™ concept and Framatome's technical competence in the field.

Phillipe F. Revel is a senior advisor, corporate strategy for Framatone S.A., Paris, France. He has worked primarily on nuclear projects for twenty-five years for Framatone. He has a degree in chemical engineering from the University of Toulouse and another in nuclear engineering from the University of Paris.

Figure 3: SFPF Building Layout (0.00 m level)

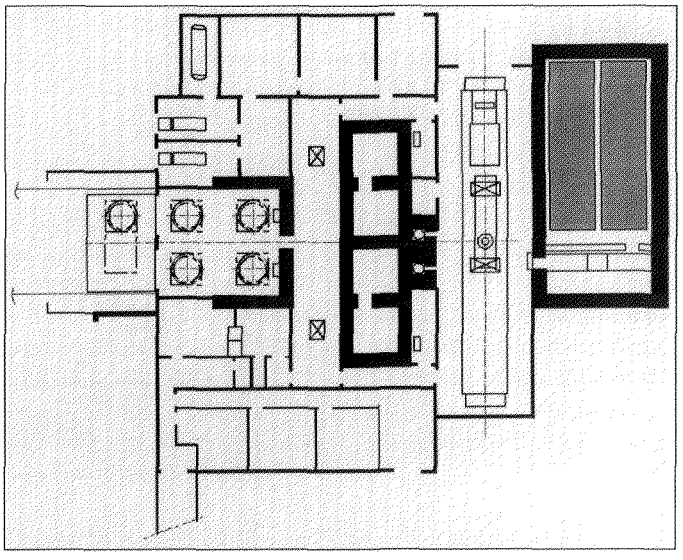


Figure 4: SFSA modules layout (tri-dimensional view)

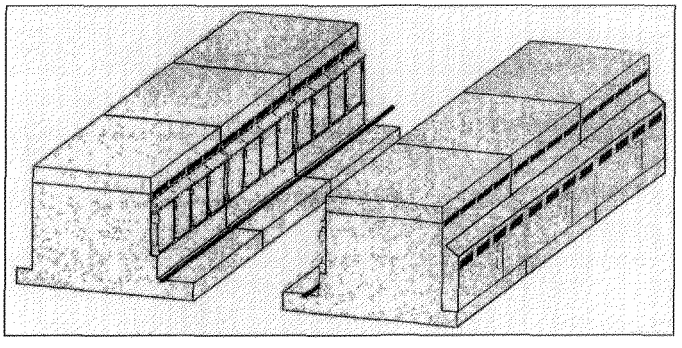


Figure 6: Layout of the 256 Concrete Storage Modules

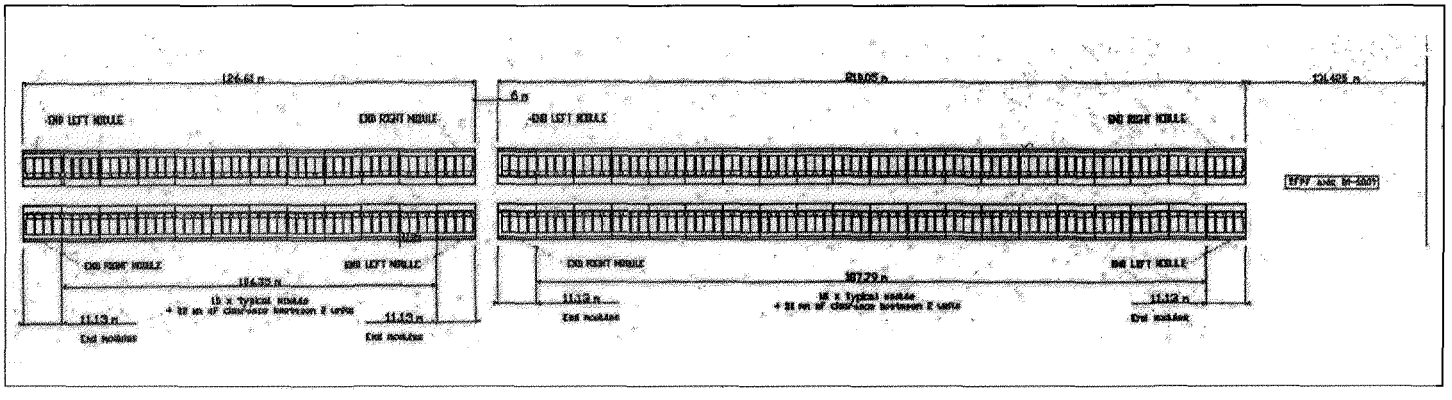
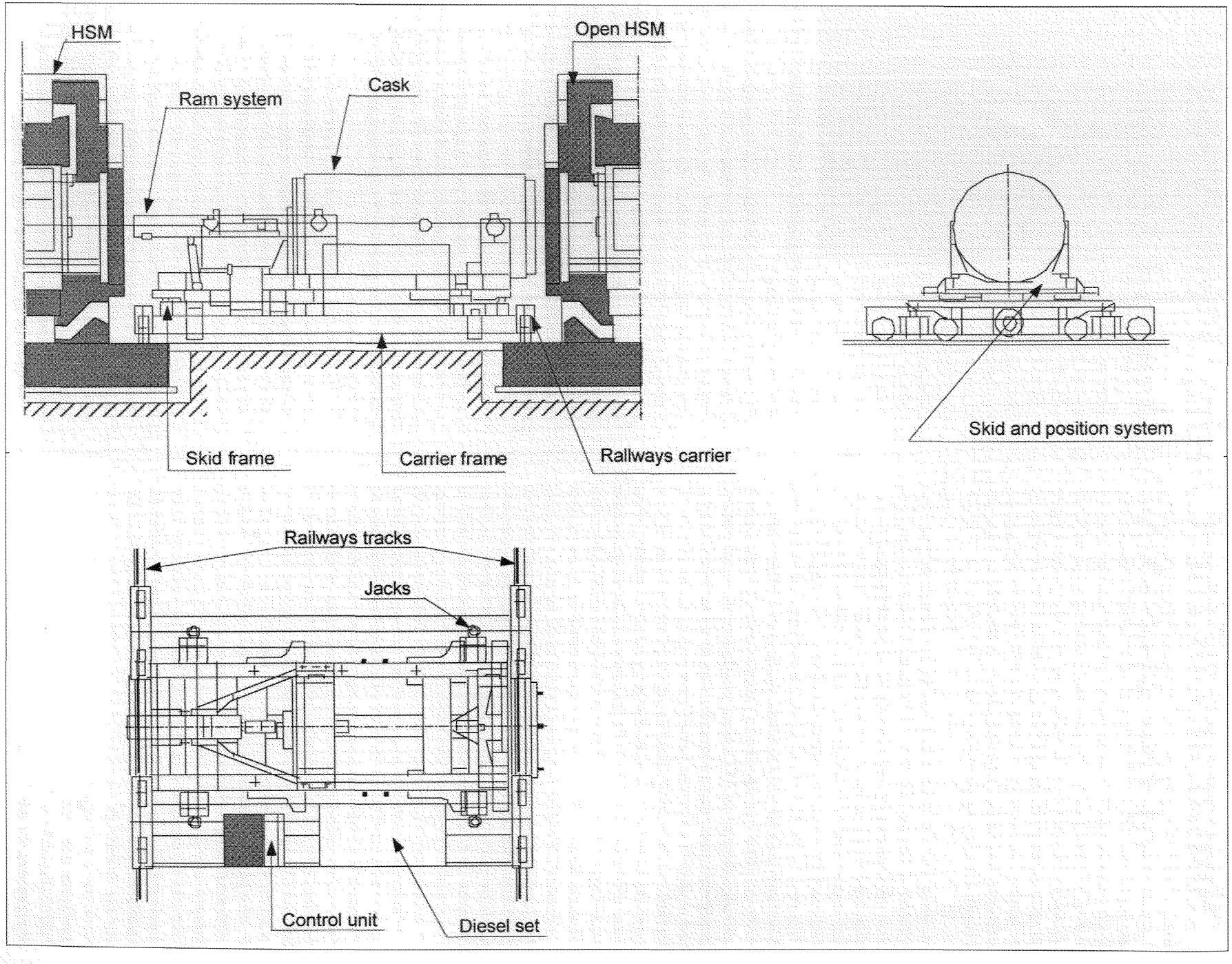


Figure 5: Chernobyl Railways Carrier and Skid



Summary of the Closing Plenary Session of the 41st INMM Annual Meeting

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This year for the first time, the technical program of the Annual Meeting extended over four full days. The closing plenary, organized by the Government-Industry Liaison Committee, was held on Thursday, July 20. GILC planned the closing plenary to address important issues in nuclear materials management, safeguards, and nonproliferation from perspectives not covered in the regular technical sessions. This year, two subjects of current interest were selected: initiatives to enhance security, especially information security, at U.S. Department of Energy laboratories and the impact on international collaborative programs; and the Nonproliferation Treaty Review Conference that concluded in May.

Security-related events at Los Alamos National Laboratory had received wide public and international attention during the preceding year. These events drew attention to the competing needs for more effective security and management of sensitive information, on the one hand, and professional contacts and the effective flow of information in international collaborative projects, on the other. Such projects are essential for progress in global management of nuclear materials, arms control and nonproliferation, and scientific research in general. Eugene Habiger, the U.S. Department of Energy's national security czar, outlined new procedures being implemented at the DOE laboratories to effect the change in attitude that the administration considers necessary to improve security. He discussed the balance between security and international cooperation.

One of the conditions for the indefinite extension of the NPT in 1995 was that the nuclear weapon states enter into a comprehensive treaty to ban explosive testing of nuclear weapons. The U.S. Senate rejected the Comprehensive Test Ban Treaty that was subsequently negotiated. The first NPT review conference since its indefinite extension and since the Senate's rejection of the CTBT took place in May. Michael Rosenthal, U.S. Department of State, was an active participant in the review conference and in previous review conferences. He reported that, in spite of the setback regarding the CTBT, the review conference was very successful in further strengthening the international nuclear nonproliferation regime.

Security and International Collaboration — A Proper Balance

Remarks by Eugene E. Habiger, U.S. Department of Energy
Text submitted by Eugene E. Habiger

General Eugene E. Habiger, U.S. Air Force (Retired), is the U.S. Department of Energy's director of security and emergency operations. As the Department's security czar, he is responsible for implementing the Secretary's security reform plan and oversees all security functions, including safeguards and security policy, cybersecurity, critical infrastructure protection, foreign visits and assignments, and emergency operations functions. He is charged by the Secretary of Energy with changing the security culture at DOE and establishing a program to re-energize and restore confidence in the Department's security program.

Habiger has more than 35 years of experience in national security and nuclear operations. In his last assignment as the commander-in-chief of United States Strategic Command, he was responsible for all U.S. Air Force and U.S. Navy strategic nuclear forces supporting the national security objective of strategic deterrence.

The General began his military career by enlisting in the Army. He went on to complete Air Force Officer Training School in September 1963 as a distinguished graduate. He is a command pilot with more than 5,000 flying hours, primarily in bomber aircraft. During the Vietnam War, he flew 150 combat missions.

Introduction

It was a little more than a year ago that I left my home in San Antonio and started my present position as director of the Department of Energy's Office of Security and Emergency Operations. Prior to accepting this job, I, like many of you, had been following the stories in the media regarding espionage activities directed at our national laboratories and security lapses at the Department of Energy. I followed these

General Eugene Habiger, U.S.A.F. (Retired)

reports with equal degrees of interest and alarm. As the former commander-in-chief of the U.S. Strategic Command, I was intimately familiar with the critical national security responsibilities of the Department of Energy, particularly as they relate to the nation's nuclear weapons program. On June 16, my interest became even more acute, as this was the day Secretary Bill Richardson asked me to become the Department of Energy's security czar. Shortly thereafter, on July 6, I reported for duty.

Why would I take this job? Well, first I believe the protection of U.S. nuclear assets is absolutely critical to the preservation of national and international security. Second, I love a challenge. And what a challenge it has been. Despite the many successes we have achieved over the past year in enhancing our protection posture, recent events such as those at Los Alamos serve to underscore the tenuous nature of the trust and confidence that the U.S. Congress and the American public have in our ability to protect the national security assets under our charge.

Their concerns, many of which are justified, highlight the need for changes to some of our policies, procedures, and practices. More importantly, however, is the need to change our attitude toward security. We need to ingrain security into the mindset of everything we do, much as we do with safety. Policies and procedures can change with the stroke of a pen; attitudes take much longer.

A Sense of Ownership

This Department has always gained from the contributions by foreign nationals to the intellectual life and vitality of the Department's laboratory complex. Beginning with the Manhattan Project, the importance of the contribution of foreign scientists to major national defense and scientific advances has been widespread. The importance of this contribution is no less important today than it was almost sixty years ago. Also no less important is the need to protect the very information and matter from those who wish us harm.

While it is a necessary imperative to continue the international collaboration essential to the advancement of scientific research, it is equally essential to provide the controls to ensure that the information and/or material are not compromised.

This sounds great, but how do we make this happen? First and foremost we must instill a sense of ownership in those individuals who generate and otherwise work with our national security assets. This is easier said than done. Time and again, I have heard it offered that the private sector protects its secrets much better than does the government. In some instances this is true. But an important question is why is this true? What is it about private industry that enables it to provide the necessary protection of its corporate secrets? It is not the systems or technology. We employ some of the most sophisticated systems in the world using cutting edge technology. It is not the protective forces. Our security forces and special response teams are world class. So what is it?

I believe that in the private sector there is a true sense of ownership of the information and material generated. Equally importantly, however, is the greater realization among the rank and file of corporations of the effects of the loss or compromise of their most sensitive material. Should corporate secrets fall into the hands of a competitor, it might very easily lead to a loss of business and, ultimately, jobs.

This sense of ownership and ultimate cause and effect is a little more difficult to convey in government. To do so effectively requires the dedication and commitment from the top which under the best of circumstances changes every four years, sometimes more often.

We are fortunate in this regard at the Department of Energy in that we have Secretary Bill Richardson leading the charge. Beginning with his issuance of a zero tolerance policy for security infractions in June 1999, Secretary Richardson has demonstrated his commitment to security time and again since he asked me to assume my present position within the Department. Security has a seat at the Secretary's table in the person of me. At each of his senior staff meetings I am provided the same opportunity to express my views as any of the line programs. This is significant for two reasons. One, it sets a precedent in that it elevates security to a level within the department never previously achieved; and two, it affords me the opportunity to learn more about the line programs thereby facilitating the communication necessary to ingrain our collective protection responsibilities into program planning and implementation.

Let me underscore the significance of the Secretary's zero tolerance policy. This directive is critical in that it provides clear guidance on personal accountability for protecting classified and other sensitive materials and ensures accountability of performance in DOE's management contracts of its field sites. It provides a pivotal first step in that it demonstrates to everyone, not just those at the Secretary's staff meeting, of the commitment from the top. But this level of commitment is not the sole answer. As I said earlier we have to change the mindset among our workforce so that security and its associated responsibilities becomes second nature in everything we do. This is accomplished through positive reinforcement as well.

To this end, over the past year we have mounted an aggressive security campaign. A significant portion of this campaign has been directed at reminding employees of the responsibilities

associated with the clearance they are granted by the Department. This comprehensive education and awareness effort has taken many forms to include:

- The conduct of department-wide operational stand-downs that focused the Department's employees and contractors on their security responsibilities. On June 21-22, 1999, stand-downs were directed at Lawrence Livermore, Sandia, and Los Alamos national laboratories to carry out a two-day security immersion program.
- In April 1999, all classified computers at these weapons labs were shut down for two weeks for security upgrades and worker training.
- Every DOE site with a national security mission ceased work activities on August 3 for the entire day to participate in a program of security awareness and training. These stand-downs have increased awareness and improved the Department's security practices.

(Left to right) Government Liaison Committee Chair James Lemley, Closing Plenary Speaker General Eugene Habiger, INMM President Debbie Dickman, Closing Plenary Speaker Michael Rosenthal, and Government Liaison Committee Vice Chair Amy Whitworth.

- In addition to these stand-downs and to keep the concept of security in front of our employees, we established a broad-based poster campaign with posters that are changed monthly and designed to capture employees' attention and remind them of their security responsibilities. It is a simple thing yet one that serves to constantly remind employees to be ever mindful of their responsibilities.
- In further support of the enhanced security education and awareness campaign, we have thus far published nineteen Crosstalk Papers. Crosstalks are a means of describing issues that may have departmentwide implications. They provide certain background material, describe observations and lessons learned, and make specific recommendations addressing an issue. While not directive in nature, they provide yet another mechanism to raise the level of awareness concerning issues of concern involving security and emergency operations.

We also actively solicit feedback from our employees on our policies and procedures. This provides the input necessary to ensure that our policies remain relevant.

This education and awareness campaign will continue as we begin our next campaign in October. But this campaign will also look inward as we work toward improving the technical capabilities of our security professionals throughout the country. Doing this will not only enhance their effectiveness, but also foster a greater sense of pride in fulfilling their critical responsibilities.

So the Secretary sets the standard with his demonstrated commitment. We then train and educate our employees about the responsibilities associated with having a clearance and access to classified and otherwise sensitive material. What is the missing element? Enforcement. In accordance with federal law and departmental policies, we must ensure when our security procedures are violated, those who are found to be responsible must be held accountable. To do otherwise undercuts the entire concept of ownership and personal responsibility.

So these are the three necessary components for instilling a sense of ownership that leads to satisfying our security responsibilities:

- Commitment from the top;
- Education and awareness; and
- Meaningful enforcement.

A Proper Balance

At the Department of Energy, it is crucial that we achieve a sense of balance between science and security. These two are not and should not be mutually exclusive. In this regard, the department is firmly committed to maintaining its ability to conduct collaborative research and enhance its role in the scientific research community. We have to do this. Our ability to fulfill our mission depends on it.

DOE has taken great strides to ensure the proper balance between science and security. For example, we recently issued a new badge policy to be followed by sites throughout the complex. In doing so we adopted a concept whereby different clearance levels are indicated by different color badges. In other words a Q clearance is indicated by a blue badge, an L clearance badge is yellow, and so forth. As part of this policy, a visitor from a foreign country is issued a red badge along with the name of the country indicated on the badge. From a security standpoint this policy makes perfect sense. Different color badges allow for easier identification of an individual's access authorization not only by security personnel, but also by other employees as a normal course of business.

Now to some in our scientific community, this new policy was a problem; particularly as it relates to the identification of foreign nationals. As we have discussed, much of the work performed by scientists at our laboratories is collaborative in nature with significant participation by their colleagues from other countries. Consequently, when you are trying to build a sense of team, distinguishing team members by country can create barriers. We listened to their concerns and developed a compromise. We identified 16 facilities throughout the complex where

there are no operations involving classified interests. We then authorized the use of a single badge at these facilities that makes no distinction as to an individual's nationality. This is what I mean when I refer to a proper balance. Security interests can still be protected while not harming the teamwork necessary for scientific advancement.

Sometimes this balance is driven by other interests. For instance, while the department recognizes the need for international collaboration, Congress has a very real concern over DOE's ability to track and control visitors from so-called sensitive countries to our three weapons laboratories, Los Alamos, Sandia, and Lawrence Livermore. Accordingly, legislation was passed last year that imposes a moratorium on visitors from these countries until such time as DOE, the FBI, and the CIA certify that the foreign visits and assignments program at these three laboratories provides the necessary controls to ensure the protection of national security assets. The legislation did allow for secretarial approval for specific visits on a case-by-case basis, thereby leading to the establishment of a rigorous approval process. This process incensed some scientists in the field; but as the requirement is currently law, the department must comply. This is one instance where Headquarters is truly not the evil empire perceived by some in the field. But once again this comes back to our ability to regain the trust of the Congress that we, in fact, are protecting the national security assets entrusted to our care. Once we demonstrate this to the Congress and the American people, we will once again earn that trust.

Security and International Collaboration

Change has not come easily, however. It rarely does. We tend to get comfortable with the way things are and how we conduct our activities. We could not and should not make change for its own sake. Rather we should do so in a manner that is systematic in approach and takes into consideration the role of security in the larger context of the DOE mission.

When we first started to make changes, there was considerable concern raised by many within our scientific community that some of our policies were too restrictive, particularly as they relate to allowing access to facilities by our foreign colleagues.

The badges I spoke of earlier being just one example. Some believed that the restrictive nature of these policies would stifle international collaboration, harm the morale of foreign nationals currently conducting research, and hinder recruiting and retention efforts at our laboratories. I heard many of these concerns firsthand as I traveled throughout the country and visited our DOE sites. I spoke with hundreds, if not thousands, of scientists working at our national laboratories. I came away from these visits much heartened by the dedication of these individuals. The concerns raised caused debate among our best and brightest which is good and served to better our goal of integrating security into daily program activities.

In keeping with the concept of maintaining a proper balance between science and security, Secretary Richardson requested the Secretary of Energy Advisory Board to form a working group to review the Department's Foreign Visits and Assignments Program. This working group would assess the balance between national security and science as it pertains to international collaboration and the access afforded to our colleagues from other countries. The Foreign Visits and Assignments Program administers the policies and procedures related to foreign nationals at the Energy Department laboratories and other facilities.

After a two-month review, the Board found that the benefits of international collaborations at the Department of Energy's national laboratories make it essential to the scientific and technological strength of the United States. This is clearly evident in the work in which many of you are involved. The success of your work requires meaningful international collaboration.

In publishing its findings, the Secretary's Advisory Board stated that foreign national visitors and assignees can safely have managed access to DOE's laboratories and other facilities without compromising classified information.

The Department of Energy is a science-based agency for which scientific research and development provide the foundation for advances essential to the Department's four missions: science, national security, energy, and environmental quality. The Department of Energy is this nation's, and indeed the world's, largest supporter of research and development in the physical sciences and engineering. Despite their considerable size, however, the Department's laboratories conduct only 1 to 2 percent of the world's research and development. Thus, their ultimate effectiveness rests on their continued ability to learn from the other 98 to 99 percent of research and development activities conducted elsewhere in the United States and abroad by industry, universities, and governments.

Without question, the Department benefits greatly from communication and collaboration with scientists and engineers conducting the balance of the world's research. Collaborations speed up the scientific process, enhance understanding, and allow nations to pool their resources and fund projects too costly for one nation to bear.

Examples of successful collaborations are found throughout the Department of Energy. As evidenced by the work in which many of you are involved, DOE works in concert with other federal entities and actively participates in U.S. government arms control interagency working groups, providing technical input and helping ensure that DOE security interests are protected. We have established high priorities for involvement on several major U.S. government initiatives, to include the revision of the Physical Protection Convention, the U.S./Russian/IAEA Trilateral Initiative, Cooperative Threat Reduction, and START III.

Recognizing that most of these initiatives have been the subject of papers and expert discussion throughout your meetings this week, I will not revisit their specifics or the level of involvement by the Department of Energy. Suffice it to say, however, the interaction among international colleagues in each of these programs is the critical component of success.

Nuclear Materials Management

The Department of Energy has long recognized the importance of the work in which each of you is involved as it relates to the worldwide security of nuclear materials. Conversely, we understand that the successful implementation of these programs will necessarily affect U.S. domestic security. Our jobs are to ensure that the negative effects are minimized and to leverage your efforts in a fashion that can strengthen security at DOE facilities.

We will continue to have multifaceted involvement in the initiatives you discussed this week. Specifically, we will continue to be involved in system development, to include participation in departmental and interagency working groups, and through service on U.S. delegations to international meetings. We support the planning and implementation of all of the activities involved in these initiatives, providing expert advice in the areas of physical security, protective forces and material control and accounting. We will also continue to participate in technical discussions among the interested parties, serve as liaison to official negotiations, and assist the affected DOE sites on matters of classification, security plan development and preparation for visits by foreign nationals. We will continue to take an active role in national-level initiatives involving DOE facilities, particularly as they intersect with the security of our most sensitive assets. I remain confident that through proper coordination and continued expert collaboration, the United States can fulfill what the interrelated missions of reducing the worldwide nuclear threat and protecting our domestic nuclear secrets from falling into the wrong hands.

Ensuring the protection of critical assets entrusted to our care while allowing the exchange of cooperative research with our international colleagues is a significant challenge. We are confident, however, that a proper balance can be achieved.

Conclusion

Since the beginning of the Manhattan Project we have had some two million people work on our nuclear weapons program. Of this number, only a handful have failed their country in upholding the national security secrets we entrusted to them. Some might argue that even a handful is too many. Yet, I will tell you that when you are dealing with people you have to recognize the fact that sometimes human frailties lead to system failures.

We cannot possibly guard against every threat. An individual who decides to take a classified document out of a security area; a cleared employee who releases classified information at a seminar without authorization; or even an armed protective force officer who decides to discharge his weapon while standing post. Can we absolutely prevent these incidents from occurring? The answer is no. We cannot control or alter the threats to the security interests entrusted to our care. What can be controlled, however, is our ability to plan and respond to threats, should they ever materialize.

These past few weeks have brought numerous allegations about the nature of security at the Department of Energy. Some have made for interesting television sound bites. I am the first to admit when criticism is warranted and have said so many times with regard to some of the allegations directed at the department and its security program. Some of these most recent criticisms, however, have been off the mark in that they only tell part of the story. I believe the Congress and the American people need to know that the Department of Energy has made tremendous strides over the past year in our efforts to upgrade security. During this time frame, we have initiated a number of measures to enhance security throughout the complex.

Despite these enhancements, however, as the events at Los Alamos indicate, much work remains. As in the past, we will continue to learn new lessons, and we will respond quickly and decisively to these lessons. This has manifested itself most recently in light of the events at Los Alamos and the subsequent enhanced security measures directed by Secretary Richardson.

And through it all we must and will continue to drive home a sense of ownership and personal accountability among our employees who are charged with handling our most sensitive material. I believe this, and I know the Secretary believes it as demonstrated by the support he has given me over the past year on the numerous initiatives we have instituted. Incorporating this mindset into the daily operations of every individual within the department remains a significant challenge; yet one we will accomplish.

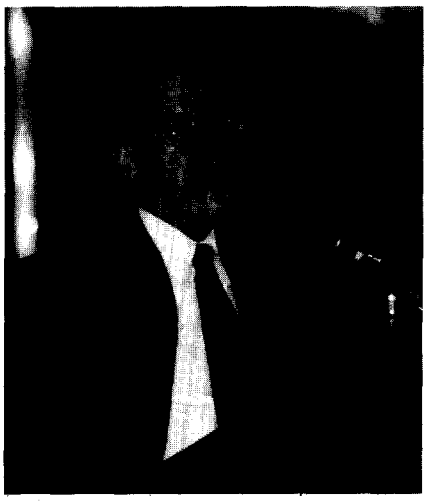
The 2000 NPT Review Conference: An Assessment

Remarks by Michael D. Rosenthal, U.S. Department of State

Michael Rosenthal is director of the Office of Multilateral Nuclear Affairs in the Nonproliferation Bureau of the U.S. Department of State. MNA provides advice and policy recommendations on nuclear nonproliferation issues concerning the International Atomic Energy Agency, the Nuclear Nonproliferation Treaty, nuclear weapon free zones, and the Fissile Material Cutoff Treaty. For example, Rosenthal's office seeks to strengthen the IAEA safeguards system. It develops safeguards and other verification and transparency concepts related to the Administration's nuclear nonproliferation initiatives, including a global cutoff treaty.

Prior to his current position, Rosenthal was chief of the Nuclear Safeguards and Technology Division in the U.S. Arms Control and Disarmament Agency, which he joined in 1977. He served with the IAEA in the Department of Safeguards from 1981 until 1986 under a personnel transfer arrangement. Rosenthal represented the United States in Main Committee II at the 1990, 1995, and 2000 NPT conferences. He headed the U.S. delegation to the first Preparatory Committee meeting for the 1995 NPT Review and Extension Conference, and served as the U.S. representative during the negotiation by the Nuclear Suppliers Group of the arrangement to control nuclear-related, dual-use commodities. Rosenthal also served at ACDA as the chief of the International Nuclear Affairs Division.

Before joining ACDA, Rosenthal was assistant professor of physics at Swarthmore College. He received his Ph.D. in physics from Cornell University and has a B.A. from Wesleyan University. He is a fellow of the American Physical Society.



Michael D. Rosenthal

Introduction

The NPT is the centerpiece of the nuclear nonproliferation regime. With 187 parties, it is almost universal—only Cuba, India, Israel, and Pakistan are nonparties. The Treaty is reviewed, in accordance with its terms, every five years. Although the reviews take place in accordance with the terms of the Treaty, the nature of the review process itself is decided upon by the parties to the Treaty. For example, the effort to reach agreement on a final document at review conferences is one such decision. The last review conference, in 1995, did not reach agreement on a final document, although it did make a decision, strongly supported by the United States, to extend the Treaty indefinitely. The 1995 also established a strengthened review process.

This strengthened review process was used for the 2000 NPT Review Conference. It began in 1997 and consisted of three meetings of the preparatory committee in 1997, 1998, and 1999. Although it did agree on all of the procedures necessary for the review conference, it did not make any substantive recommendations, one of the goals that had been agreed upon for the strengthened review process.

This was one reason why when Secretary Madeleine Albright addressed the sixth NPT review conference on the day it opened, April 24, few believed that the conference would agree on a final document. Indeed, most predictions not only dismissed that prospect but were decidedly more gloomy. For many, the NPT did not seem to be working.

The United States had another view. As stated by the Secretary in the U.S. plenary statement, the United States believed that the decision in 1995 to extend the Treaty indefinitely was a "gift to our children—and ourselves," a gift that safeguarded this indispensable agreement, the NPT, for all nations, all people, for all time. Further, she said, "the United States believes that any fair reading of the record will affirm that the Nonproliferation Treaty is doing its job."

In this regard, the Secretary cited the Treaty's success in fostering peaceful uses of the atom; pointed out that the international community had responded with a single, clear voice to nuclear testing in South Asia; noted the need for a fair and balanced discussion of middle east issues; and expressed strong support for the IAEA, its new strengthened safeguards system, and its role in the DPRK and Iraq. She also highlighted the remarkable progress in nuclear disarmament since the Cold War's end.

The outcome of the conference, in which more than 150 parties participated, demonstrated that the United States is not alone in this view of the importance of the NPT. It was clear from national statements throughout the conference that NPT parties recognize the vital role of the Treaty, notwithstanding ongoing concerns about issues related to its implementation. But surprisingly, the conference went further and on May 20 adopted by consensus a document that reviewed the operation of the Treaty and set forth future steps that could strengthen its operation. It is an important signal of the strength of the NPT that countries with widely varying views on nuclear disarmament and regional issues could find common ground.

In the consensus document, the parties emphasized the importance of universal adherence to the NPT and of strict compliance with its terms, noted the crucial role of IAEA safeguards in enforcing the Treaty's undertakings, endorsed steps that would lead to further reductions in nuclear weapons and would promote the irreversibility of the nuclear disarmament process, and stressed the key role of the Treaty in encouraging the peaceful application of nuclear techniques to build prosperity for all.

Secretary Albright said, as the conference opened, that, working together, the parties to the NPT can help to build a world that is safer and more secure for all peoples. The constructive cooperation and leadership that led to the consensus document has indeed contributed importantly to this objective.

What Did the Conference Achieve?

Overall, the parties reaffirmed the NPT's continued importance to global security. It is all the more significant that this consensus was reached at a time of much upheaval on nonproliferation and nuclear disarmament. Many are concerned about the future of the CTBT, NMD, and the START process as well as proliferation concerns around the world such as:

- The Democratic People's Republic of Korea's nuclear and missile programs;
- Iran's WMD and missile programs;
- India's and Pakistan's pursuit of nuclear and missile programs with few signs of restraint and with tensions and mistrust between them at dangerous levels; and
- Iraq's continued defiance of United Nations Security Council resolutions and its exclusion of international inspectors.

Nonetheless, NPT parties clearly said that there is a way forward and that the NPT is an indispensable element of moving ahead.

What did conference conclude?

NPT parties remain convinced that the spread of nuclear weapons undermines international security and that the NPT has a vital role in preventing that spread. It was also very clear that NPT parties do not believe that India and Pakistan can or should be accorded the status of nuclear weapon state under the NPT; that they should in fact not be accorded any special status whatsoever as a result of their nuclear tests; and NPT parties remain firm in their conviction that India and Pakistan should meet the measures set forth in UNSCR 1172.

Support for universal adherence to the NPT also remains strong and Cuba, Israel, India, and Pakistan were urged to join as non-nuclear-weapon states. The conference recognized the importance of the Middle East peace process in contributing to the goal of a Middle East free of nuclear weapons and other weapons of mass destruction and the need for full compliance was a major theme. Participants stressed that preservation of the Treaty's contribution to peace and security is dependent on strict observance of its provisions.

There is strong support for maintaining a moratorium on nuclear test explosions and for continuing efforts to bring the CTBT into force. Further nuclear reductions under the START process were endorsed, as was the need to preserve and strengthen the ABM Treaty. Among the dominant themes related to nuclear disarmament was the importance of resuming negotiations at the Conference on Disarmament in Geneva on a fissile material cutoff treaty. Disappointingly, another CD session has passed with no sign of progress. Irreversibility of the nuclear disarmament process was stressed, particularly as it related to the disposition and verification of nuclear material removed from military programs. There was much support for transparency, diminishing the role of nuclear weapons in security policies, and concrete measures to reduce the operational status of nuclear weapons systems, where such steps would promote international stability and the security of all states. The UK initiative on verification was welcomed. It was recognized that the further development of verification capabilities was necessary in order to achieve a nuclear weapon free world. Finally there was the reaffirmation by the nuclear weapon states, stated as "an unequivocal undertaking," of their commitment to the total elimination of their nuclear weapons leading to nuclear disarmament to which all states are committed under Article VI.

The conference final document also drew conclusions in a number of areas directly relevant to INMM in the areas of IAEA safeguards, fissile material controls, and physical protection.

The conference recognized that IAEA safeguards are a fundamental pillar of the nuclear nonproliferation regime and their important role in nonproliferation, nuclear disarmament, and nuclear cooperation. The conference noted with satisfaction that, since 1995, twenty-eight states have concluded NPT safeguards agreements with IAEA, twenty-five of which have been brought into force. But the conference also noted that fifty-one states parties to the Treaty have yet to bring into force comprehensive safeguards agreements, and it urged them to do so as soon as possible. The conference reaffirmed the fundamental importance of full compliance with the provisions of the Treaty and the relevant safeguards agreements, and it noted two instances of concern—DPRK and Iraq.

The conference reaffirmed that the implementation of NPT safeguards agreements should be designed to provide for verification by the IAEA of the correctness and completeness of a state's declaration so that there is a credible assurance of the non-diversion of nuclear material from declared activities and of the absence of undeclared nuclear material and activities.

The conference noted the Part I measures endorsed by the IAEA Board of Governors in June 1995 for strengthening and making more efficient the safeguards system.

The conference also fully endorsed the measures contained in the Model Protocol (INFCIRC/540 (corrected)), which was approved by the IAEA board of governors in May 1997.

In this regard, the conference:

- Welcomed the fact that since May 1997, the IAEA Board of Governors has approved additional protocols to comprehensive safeguards agreements with forty-three states and that twelve of those additional protocols are currently being implemented;
- Encouraged all states parties to conclude additional protocols as soon as possible and to bring them into force or provisionally apply them as soon as possible; and
- Recommended that the director general of IAEA and the IAEA member states consider ways and means, which could include a possible plan of action to promote and facilitate the conclusion and entry into force of such safeguards agreements and additional protocols.

The conference noted the high priority that IAEA attaches to integrating traditional nuclear material verification activities with the new strengthening measures and looked forward to an expeditious conclusion of this work.

The conference noted the important work being undertaken by IAEA in the conceptualization and development of integrated safeguards approaches, and encouraged continuing work by IAEA in further developing and implementing these approaches on a high-priority basis.

The conference noted the conclusion drawn by the Board of Governors of IAEA that the proliferation risk with regard to neptunium is considerably lower than that with regard to uranium or plutonium and that at present there is practically no proliferation risk with regard to americium; and expressed satisfaction at the recent decisions of the IAEA Board of Governors enabling IAEA monitoring of the production and transfer of separated neptunium and reporting when appropriate on the availability of separated americium.

The conference noted the considerable increase in the Agency's safeguards responsibilities since 1995. It further noted the financial constraints under which the IAEA safeguards system is functioning and called upon all states parties, noting their common but differentiated responsibilities, to continue their political, technical, and financial support of IAEA in order to ensure that the agency is able to meet its safeguards responsibilities.

Regarding the management of excess fissile material, the conference:

- Underlined the importance of international verification of nuclear material designated by each nuclear-weapon state as no longer required for military purposes that has been irreversibly transferred to peaceful purposes;
- Supported recent unilateral offers and mutual initiatives to place excess material under appropriate IAEA verifi-

cation arrangements; and

- Said that nuclear materials designated by each of the nuclear-weapon states as no longer required for military purposes should as soon as practicable be placed under IAEA or other relevant verification.

In this regard, the conference:

- Noted the agreement between the Russian Federation and the United States to convert in Russia 500 metric tons of high enriched uranium from Russia's nuclear weapons to low enriched uranium for use in commercial reactors;
- Welcomed the conversion to date of over 80 metric tons of HEU in the framework of this agreement;
- Recognized the affirmation by presidents of the Russian Federation and the United States of the intention of each country to remove by stages approximately 50 metric tons of plutonium from their nuclear weapons programs and convert it so that it can never be used in nuclear weapons;
- Urged the completion and implementation of the Trilateral Initiative between the United States of America, the Russian Federation and the International Atomic Energy Agency; and
- Supported development of arrangements by all nuclear-weapon states to place excess fissile material under international verification and for the disposition of such material, to ensure that such material remains permanently outside of military programs.

The conference noted the paramount importance of effective physical protection of all nuclear material and called on all states to maintain the highest possible standards of security and physical protection of nuclear materials. It urged adherence to the convention on the Physical Protection of Nuclear Material, welcomed discussions on the need to revise the Convention, and supported the recommendations on physical protection contained in INFCIRC/225/Rev.4 (corrected).

Expressing concern about the illicit trafficking of nuclear and other radioactive materials, the conference urged all states to introduce and enforce appropriate measures and legislation to protect and ensure the security of such material, and welcomed the activities in the fields of prevention, detection and response being undertaken by IAEA in support of efforts against illicit trafficking.

Carrying Forward the NPT Agenda

Although this is a partial reflection of what was agreed, this is a broad and rich agenda. There is much to be done. The United States is continuing its efforts to pursue the measures spelled out in the final document.

We will continue our efforts to support a strong IAEA safeguards system, and the United States fully supports the integration of IAEA INFCIRC/540 and INFCIRC/153. As did the final document, the United States gives high priority to this. As we proceed, though, we must understand clearly what to expect in a number of areas. First is cost. While cost neutrality is an important goal, the cost of safeguards should be determined by the cost of effective safeguards. Cost neutrality should not be a boundary condition for implementation, and integrated safeguards should not be viewed as a vehicle for solving safeguards budget problems. The second area is how quickly integrated safeguards can be implemented. The conference looked forward to the expeditious conclusion of the Agency's work. So does the United States. The Secretariat has estimated that development of the conceptual framework for integrated safeguards, including the safeguards approaches will not be completed before the end of 2001 and that some fifteen months of actual experience in implementing the additional protocol in a state will be needed before integrated safeguards can be applied in the state. We support fully the Secretariat in avoiding hasty decisions on integrated safeguards. Clearly, there is much to be done, and we will continue to support the IAEA's efforts.

We are working diligently to complete a model agreement under the Trilateral Initiative that will provide for IAEA verification of the irreversible removal of excess fissile material from defense programs. But, we are not waiting for that to place excess material under IAEA verification. In total, some 90 metric tons of the total U.S. excess materials inventory of approximately 226 metric tons is either already under inspection or has been committed by the United States for inspection in the future. Twelve metric tons of HEU and plutonium are already under safeguards at three storage facilities. The IAEA has also independently verified the down blending of HEU at both the Portsmouth gaseous diffusion plant and the BWXT facility in Virginia, including 3.7 MT at Portsmouth. BWXT is currently under contract to downblend 50 metric tons of material. This down blending began in 1999.

The United States assumes that the downblending activities will become subject to the verification arrangements of the Trilateral Initiative once they are in place. In the interim, the IAEA continues its verification of the down blending of HEU to LEU in the United States under the U.S.-IAEA safeguards agreement.

The United States and Russia have initialed and will soon sign a plutonium disposition agreement that commits each side to dispose of 34 metric tons of weapon plutonium and to make it subject to bilateral and international verification.

We are participating actively in discussions related to strengthening the physical protection convention. The United States believes that the convention should be strengthened by changing its scope so as to cover nuclear material in civil domestic use and storage.

Conclusion

All parties can take pride in the accomplishment of the 2000 NPT Review Conference. Despite predictions of failure before the conference, after thirty years the NPT has emerged stronger than ever. By adopting a consensus final document, the Nuclear Nonproliferation Treaty parties reinforced in very strong terms the vital role of the Treaty in advancing the security of all nations.

It defies expectation that so many nations could reach agree-

ment on any one issue, let alone the number and variety of issues we had before us. And yet, they did. Reflecting their view of the importance of a strong NPT, the participants at the 2000 NPT Review Conference conducted their work in the best spirit of cooperation, compromise, and consensus. This is the common ground on which our future dialogue must rest. Together, the parties crafted an important consensus document that will guide the work of the international community for many years. If followed wisely, this guidance will help us to maintain and strengthen the IAEA safeguards system and improve the management of nuclear materials worldwide.

Chapters

Central Chapter

Another successful meeting was held June 6 at the Y-12 Visitors Center by the Committee to reorganize the Central Chapter of INMM. Six members attended and discussed having a fall meeting in late October in Oak Ridge. Michael Whitaker said he would help Debbie McNeilly and John Wachter with planning. Several locations for the meeting were suggested.

Larry Satkowiak, Teresa Reed, and Uri Gat will help with the technical program for the meeting.

Tatum Fowler and Chris Pickett will work on advertising the event locally and at the Central Meeting.

There was an agreement to form an election committee to obtain candidates for all Central region offices so that elections can be held in the near future. More volunteers are needed to support this effort.

Chris A. Pickett
Chair, Central Chapter
Oak Ridge Laboratory
Oak Ridge, Tennessee U.S.A.

Pacific Northwest Chapter

The annual chapter summer barbecue was held September 14 at Leslie Groves Park in Richland, Washington. As usual, this event was a big success with a large turnout. The Issue of Resolution for Art Waligura from the INMM was given to his son.

The chapter held a successful spring dinner meeting April 20, 2000. The speaker was Gary Kodman. He spoke on current issues involving the Safeguards and Security Review in DOE.

The chapter continued its long-time support of various community activities. Members participated in the DOE-sponsored Science Bowl in February and the Mid-Columbia Regional Science and Engineering Fair. The chapter donated $100 to each organization this year. The PNW Chapter also supported the Tri-City Technical Council.

Brian Smith
Chair, Pacific Northwest Chapter
Pacific Northwest National Laboratory
Richland, Washington U.S.A.

Southeast Chapter

A special dinner meeting of the Southeast chapter of INMM was held June 27, 2000. Honored guests were Jean Aragon, Jean Lefebvre, and Dirk Schriefer, who were representing the IAEA on a visit to the Savannah River Site. Representatives from DOE headquarters and the Nuclear Regulatory Commission were also present.

Obed Cramer
Chair, Southeast Chapter
Consultant
Augusta, Georgia U.S.A.

Japan Chapter

The Japan Chapter is co-sponsoring the Third INMM/ESARDA Workshop on Science and Modern Technology for Safeguards. A planning meeting was held in November in Tokyo with representatives of the INMM, the Japan Chapter, and Korean Chapter, who discussed the overall program and the budget plan.

The Japan Chapter has 143 regular members and 19 sustaining members.

Shyunji Shimoyam
Chair, Japan Chapter
Japan Atomic Power Co.
Tokyo, Japan

Vienna Chapter

The Vienna Chapter continued its participation as an active chapter of the INMM during the 1999-2000 fiscal year. The Vienna Chapter currently has 58 members. The Chapter Executive Committee held bimonthly planning meetings. Luncheon meetings were held in November and April. The guest speakers included John Carlson, director general, Australian Safeguards and Non-proliferation Office.

Jaime Vidaurre-Henry
Chair, Vienna Chapter
IAEA
Vienna, Austria

Korea Chapter

The Korean Chapter's fifth Executive Committee Meeting was held in Taejon on June 23, 2000.

The representatives of Korean Chapter for the 41st INMM Annual Meeting were selected.

On September 1, the Korea Chapter plans to hold elections for its four chapter officers and two members at large. On September 10, the votes will be tabulated and the sixth Korea Chapter Executive Committee Meeting will be held.

Byung-Koo Kim
Chair, Korea Chapter
KAERI
Taejon, Korea

Obninsk Regional Chapter

Obninsk Chapter members were deeply involved in the organization and preparation of the Second International Conference on Nuclear Materials Accounting, Control, and Physical Protection that was held May 22-26 by the State Scientific Center of RF Institute for Physics and Power Engineering. Conference sponsors were RF Minatom, the U.S. Department of Energy, the American Nuclear Society, the Russian Nuclear Society, and INMM.

Continued on page 60

Committee and Technical Division Reports

Membership Committee Report

As of June 30, 2000, INMM has:

- 690 Regular Members
- 84 Senior Members
- 28 Fellows
- 3 Student Members
- 19 Emeritus Members
- 29 Sustaining Members
- 1 Honorary Member

Total Membership: 854

The goal of the Membership Committee is to provide quality service to INMM members. The Membership Committee is composed of Nancy Jo Nicholas (chair), Roy Cardwell, Jill Cooley, Bob Curl, Vince DeVito, Al Garrett, Michelle Kazanova, Larry Kwei, Bruce Moran, Takeshi Osabe, Don Six, and Scott Vance. Key services provided by the Membership Committee include:

- issuing the annual membership directory;
- reviewing and approving new member applications;
- coordinating a reception for new and new senior members at the annual meeting;
- overseeing the yearly membership renewal program; and
- administering the Senior Membership Program.

Ten applications for Senior Membership were received this year. The Membership Committee evaluated them against the strict requirements for Senior Membership and recommended to the Executive Committee that all ten applicants be awarded senior status. The Executive Committee concurred with this recommendation. This year's new seniors are:

- John Carlson
- Berry Crain
- James Griggs
- Cathy Key
- Mark Killinger
- William Knauf
- Ruben McGilvary
- Steve Mladineo
- Martha Williams
- Ken Ystesund

The Membership Committee chair has begun a Members News page (see page 55) in *JNMM* to highlight member activities.

Nancy Jo Nicholas
Chair, Membership Committee
Los Alamos National Laboratory
Los Alamos, New Mexico, U.S.A.

Fellows Committee

The Fellows Committee received two nominations for 2000 Fellows and recommended them to the Executive Committee. Both were approved. The new fellows are Jim Tape and John Arendt.

The committee also has developed an automated database of addresses of Fellows but a great deal of work remains on this project. Fellows who attended the Fellows Luncheon at 41st INMM Annual Meeting were asked to provide up-to-date information for this project.

Obie P. Amacker, Jr.
Chair, INMM Fellows Committee
Pacific Northwest National Laboratory
Richland, Washington, U.S.A.

International Safeguards Division

In the past year, the INMM International Safeguards Division met four times — at the INMM 40th Annual Meeting in July 1999; in conjunction with the INMM Japan Chapter Meeting in November 1999 in Tokyo; in May 2000 in conjunction with the 22nd ESARDA Annual Meeting in Dresden, Germany; and at the INMM 41st Annual Meeting in July 2000. The theme of all these meetings was the IAEA's Integrated Safeguards System and the associated new protocol — the merging of INFCIRC/153 with the new INFCIRC/540. As in past ISD meetings, the discussions were very frank and open.

In the Dresden meeting, the theme was the key elements that would support the implementation of the new system and its attendant protocol. This includes cooperation, communication, patience, consensus, cost evaluation, the impact of the new system on existing Regional Systems, and the need for a new mentality in the safeguards community.

It was recognized that many factors must be considered in the introduction of the variety of changes current under the IAEA's new system, as well as the vast array of new technology that may support these changes. It seems quite clear that the meshing of the new system with the old system, and full implementation of the new system will be a challenge for all parties and require a very cooperative atmosphere.

Planning continues for the Third Joint INMM/ESARDA Workshop on Science and Modern Technology for Safeguards, to be held in Tokyo, in November 13–16, 2000. Some forty papers will be presented and we are expecting more than one hundred participants.

Cecil Sonnier
Chair, International Safeguards Division
Jupiter Corp.
Albuquerque, New Mexico, U.S.A.

Materials Control and Accountability Division

In the July 1999 report of the MC&A Division, I reported that we were exploring the idea of co-hosting a workshop on the new DOE MC&A order (DOE Order 474.1) and the associated MC&A Acceptance Criteria. The DOE Office of Safeguards and Security would be our co-host.

The objectives of the workshop would be to provide an orientation for DOE contractors on the new MC&A order and the Acceptance Criteria; share contractors' experiences incorporating the new order requirements into their MC&A plans; and share ideas on resolving difficulties implementing the new requirements.

Progress in developing the Acceptance Criteria has been slow, and

contractors are just now adapting to the new order. Thus far, no firm plans have been made for the workshop.

However, there was a meeting of the MC&A Quality Panel in February 2000. Considerable interest was expressed in developing objectives statements for all of the requirements in the MC&A order. Although there was discussion of incorporating acceptance criteria into the guide, it was felt that this should occur after completing the objectives development task. Anyone interested in providing input, should contact their representative on the MC&A Quality Panel.

The MC&A Division met Sunday, July 16, at the INMM Annual Meeting to review the status of the objectives development task and discuss the path toward a future revision of the MC&A Order.

Dennis Brandt
Chair, Materials Control and Accountability Division
Los Alamos National Laboratory
Los Alamos, New Mexico, U.S.A.

Nonproliferation and Arms Control Division

This has been another busy year. The annual meetings continue to benefit from extensive interest in the area and the number of sessions continues to increase. Last year saw the integration of many papers on U.S.-Russian safeguards-related activities into the relevant INMM divisions, particularly the MC&A and Physical Protection divisions. We co-sponsored a number of sessions as well, and this was true for the 41st Annual Meeting also, particularly with the International Safeguards Division.

A special session was held at the 1999 Annual Meeting on "U.S.-Russian MPC&A Lessons Learned." It involved an invited panel of U.S. and Russian speakers, governmental and non-governmental. Audience participation was encouraged and very interesting, extensive, candid discussions were held.

For two years the division members had been discussing holding a workshop and this came to fruition on April 26, 2000, in Washington, D.C. The workshop was titled "U.S.-Russian Nuclear Security: Programs and Prospects," and was co-sponsored by the Carnegie Endowment Nonproliferation Project. I want to thank Jon Wolfsthal of Carnegie and Steve Mladineo of Pacific Northwest National Laboratory for their help in making this workshop a success. There were four panels, two devoted to weapons knowledge proliferation and two devoted to materials and weapons protection, control and accountability.

Sen. Pete Domenici spoke during the luncheon.

Beyond traditional media coverage of the event, a videotape was made, including interviews with a number of panel speakers, by the Center for Defense Information. A documentary is apparently in production on the broad subject of Russian nuclear security issues, and segments will be included from our workshop!

This year's Annual Meeting had many sessions devoted to Nonproliferation and Arms Control topics, with a very heavy dose of weapons dismantlement transparency. Beyond that there are interesting sessions on HEU transparency, plutonium disposition, MPC&A and regional proliferation concerns, to name a few.

I plan to step down this year as division chair. Since the inception of the division in 1992, we have experienced much growth and progress. I am already three years beyond my initially planned, five-year tenure. New professional responsibilities make this necessary now. It has been a wonderful experience working with the INMM, with the Headquarters support staff, and with the membership, whose support and participation make it all worthwhile.

C. Ruth Kempf
Past Chair, Nonproliferation and Arms Control Division
Brookhaven National Laboratory
Upton, New York, U.S.A.

Packaging and Transportation Division

The U.S. Department of Energy has selected the INMM to host the 13th International Symposium on the Packaging and Transportation of Radioactive Material also known as PATRAM 2001. PATRAM 2001 will be held at the Chicago Hilton and Towers, September 3-7, 2001. To get details on the symposium and receive registration information, visit the PATRAM web site on www.patram.org.

Billy Cole
Chair, Packaging and Transportation Division
JAI Corp.
Fairfax, Virginia, U.S.A.

Waste Management Division

The Waste Management Division hosted the INMM Spent Fuel Management Seminar XVII, January 12-14, 2000, at the Mayflower Renaissance Hotel in Washington, D.C. The seminar was a huge success with the approximately 160 people attending. They included representatives of utilities, vendors, government and international agencies, regulators, national laboratories, consultants, and the press. The representation was also international, including the U.S., Canada, Japan, Korea, Spain, France, the United Kingdom, Germany, Austria, Hungary, and the Czech Republic.

The 18th Spent Fuel Management Seminar, scheduled for January 2001, will be held at the Willard Hotel in Washington, D.C.

E. R. Johnson
Chair, Waste Management Division
JAI Corp.
Fairfax, Virginia, U.S.A.

INMM Welcomes Ukraine and Urals Chapters

Two new chapters have joined the Institute of Nuclear Materials Management since the 2nd International Materials Protection, Control, and Accounting Seminar in Obninsk, Russia, in May.

One of the new chapters is the Ukraine Chapter, in Kiev, Ukraine. The charter members of this chapter are:

- Alexander Scherbachenko
- Sergiy Kondratov
- Yevgeniy Dikov
- Alexander Yuspin
- Volodymir I. Kysyshekuk
- Dmitry Bazarov
- Victor Garrilyuk
- Elena Zaderyaka
- Oleksandr Dvoyeglazov

The other new chapter is the Urals Chapter, in Snezinsk, Russia. The charter members of this chapter are:

- Victor V. Belov
- Dmitry V. Bukin
- Yuri I. Churikov
- Sergey V. Gagarinov
- Nikolai V. Sakharov
- Yuri A. Skryabin
- Gennady S. Tsygankov
- Vitaly I. Zuez

Both chapters were presented with an engraved plaque and INMM banner to commemorate their establishment at the Awards Banquet at the 41st INMM Annual Meeting in New Orleans, Lousiana, in July. The Urals Chapter's plaque and banner were presented to Victor Kazachenkov from VNIITF in Snezinsk, where many of the charter members are employed. The Ukraine Chapter's plaque and banner were presented to Greg Shepard of Los Alamos National Laboratory who delivered them to the chapter members on a trip to Kiev in late July. Shepard read a short statement from the new chapter members expressing their enthusiasm and their interest in working closely with other INMM chapters in the future.

Both chapters are in the process of writing their bylaws and constitutions and organizing their elections.

Debbie Dickman
INMM Past President

Author Submission Guidelines

The *Journal of Nuclear Materials Management* is the official journal of the Institute of Nuclear Materials Management. It is a peer-reviewed, multidisciplinary journal that publishes articles on new developments, innovations, and trends in safeguards and management of nuclear materials. Specific areas of interest include physical protection, material control and accounting, waste management, transportation, nuclear nonproliferation/international safeguards, and arms control and verification. *JNMM* also publishes book reviews, letters to the editor, and editorials.

Submission of Manuscripts: *JNMM* reviews papers for publication with the understanding that the work was not previously published and is not being reviewed for publication elsewhere. Papers may be of any length.

Papers should be submitted in *triplicate*, **including a copy on computer diskette.** Files should be sent as Word or ASCII text files only. Graphic elements must be sent in TIFF format in separate electronic files. Submissions should be directed to:

Dennis Mangan
Technical Editor
Journal of Nuclear Materials Management
60 Revere Drive, Suite 500
Northbrook, IL 60062 USA

Papers are acknowledged upon receipt and are submitted promptly for review and evaluation. Generally, the author(s) is notified within 60 days of submission of the original paper whether the paper is accepted, rejected, or subject to revision.

Format: All papers must include:

- Author(s)' complete name, telephone and fax numbers and E-mail address
- Name and address of the organization where the work was performed
- Abstract
- Camera-ready tables, figures, and photographs in TIFF format only
- Numbered references in the following format:
  1. F.T. Jones and L.K. Chang. "Article Title," *Journal* 47(No. 2):112–118 (1980).
  2. F.T. Jones, *Title of Book*, New York: McMillan Publishing, 1976, pp. 112–118.
- Author(s) biography

Peer Review: Each paper is reviewed by two or more associate editors. Papers are evaluated according to their relevance and significance to nuclear materials safeguards, degree to which they advance knowledge, quality of presentation, soundness of methodology, and appropriateness of conclusions.

Author Review: Accepted manuscripts become the permanent property of INMM and may not be published elsewhere without permission from the managing editor. Authors are responsible for all statements made in their work.

Reprints: Reprints may be ordered at the request and expense of the author. Order forms are available from the Institute's office, 847/480-9573.

DOE Fines Savannah River Contractor

The U.S. Department of Energy fined Westinghouse Savannah River Co. $220,000 in July and issued a preliminary notice of violation for violations of DOE rules at the department's Savannah River Site in Aiken, South Carolina. The penalty stems from a September 1999 incident in which eight workers were accidentally exposed to plutonium, one in excess of the regulatory limit.

According to the DOE, the exposure was preventable and Westinghouse management knew of the problems with radiological controls and event response from a similar worker exposure at the site in 1996.

The workers were exposed to plutonium at the plant's FB-Line Facility while preparing plutonium storage containers for transfer to another on-site location. A defective weld in one of the containers allowed plutonium to be released. Although the exposure did not cause any immediate health consequences for the workers and no long-range consequences are anticipated, one worker's exposure was over the federal limit.

DOE investigators say several factors contributed to the accident including:

- Effective processes were not in place to ensure the integrity of the welds on storage cans. While weld leak testing performed on the storage can involved did not identify a significant defect, the operators who performed visual weld inspections were not formally trained or qualified for weld inspection.
- Work and event response activities did not follow approved procedures, including inadequate radiological monitoring for the work being done. A required contamination survey of the plutonium storage cans was not performed before the operator handled them. Required radiological surveys were not immediately performed on the highly contaminated operator who exited the vault after the incident. At least one worker who was not present during the accident was cross-contaminated as a result.
- Management did not ensure that effective design features such as adequate ventilation were in place to ensure possible exposures were as low as possible.

Continuous Radiation Monitor Deployed in Irish Sea

The Radiological Protection Institute of Ireland in cooperation with the International Atomic Energy Agency and the Environmental and Heritage Service of Northern Ireland deployed an experimental buoy in the northwestern Irish Sea in August. It is equipped with a radiation detector capable of continuously measuring radioactive contamination in seawater. The detector is particularly suitable for measuring cesium-137, a radionuclide that is discharged from the reprocessing facility at Sellafield, United Kingdom. The buoy also carries instruments for measuring physico-chemical parameters such as current velocity, salinity, and temperature.

The measurements will be transmitted daily to the IAEA's Marine Environment Laboratory in Monaco and relayed to the RPII's laboratory in Dublin.

The project is scheduled to last a year and will provide information on the performance of this new technology in field conditions. It will also provide important data on the circulation of cesium-137 in the northwestern Irish Sea.

Impact Statement on Sodium Bonded Spent Nuclear Fuels Released

Electrometallurgical technology is the preferred alternative for treating spent nuclear fuel from the Experimental Breeder Reactor-II at Argonne National Laboratory-West near Idaho Falls, Idaho, the U.S. Department of Energy announced in July.

The department's selection of a preferred alternative, which comes after eighteen months of analysis and public input, was contained in the Final Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel.

Copies of the final EIS summary or the complete EIS are available on the DOE website at http://nuclear.gov or by calling 877/450-6904.

Release of Materials from DOE Facilities Suspended

Secretary of Energy Bill Richardson in July suspended the release of potentially contaminated scrap metals for recycling from Department of Energy nuclear facilities. The suspension is part of a new policy aimed at ensuring contaminated materials are not recycled into consumer products and at improving the department's management of scrap materials from nuclear weapons facilities.

The DOE is also initiating a feasibility study on the possibility of recycling steel from decommissioned facilities into waste containers or other items needed by the DOE.

Richardson announced steps to improve record keeping and reporting as well as acceleration of the department's program to collect some types of commercially owned radioactive sources that are no longer in use. Sealed radioactive sources are used in a variety of measurement, calibration, and other activities. These sources can pose significant risks to steelworkers and the public if abandoned or disposed of illegally. DOE has responsibility under the Low-Level Waste Policy Act of 1985 to dispose of them properly.

New Section to Highlight the Careers and Achievement of INMM Members

The INMM Membership Committee is preparing to expand the New Member section of the *Journal* to a whole page on member news. Articles highlighting the careers and achievements of INMM members will be featured. But we will need input from the membership to accomplish this.

If you know of some news worth highlighting about the career of one of our members, such as a promotion or an award, contact any member of the membership committee (see box below for E-mail addresses), and we will include it in "Member News."

We are very excited about this new section of the Journal. Please let us know your thoughts on this new section.

Nancy Jo Nicholas
Chair, INMM Membership Committee

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October 9-11
Plutonium 2000 — International Conference on the Future of Plutonium, SAS Radisson, Brussels, Belgium. Sponsors: European Nuclear Society, the American Nuclear Society, the Russian Nuclear Society, and the Atomic Energy Society of Japan. Contact: Vincent Schryvers, BNS, Ravenstein Street, 3 — 1000 Brussels, Belgium; E-mail, Pu2000@belgonucleaire-be.

October 22-25
Communicating Nuclear Issues, Wyndam Cleveland Hotel, Cleveland, Ohio, U.S.A. Sponsor: Nuclear Energy Institute. Contact: Linda Hertzog, NEI; phone, 202/739-8026.

November 13-16
Third Workshop on Science and Modern Technology for Safeguards, Tokyo, Japan. Sponsored by INMM and ESARDA. Contact: INMM, 60 Revere Drive, Suite 500, Northbrook, IL 60062 U.S.A.; 847/480-9573, fax: 847/480-9282; E-mail, inmm@inmm.org; Website, http://www.inmm.org.

January 10-12, 2001
Spent Fuel Management Seminar XVIII, Willard Inter-Continental Hotel, Washington, D.C. U.S.A. Sponsor: Institute of Nuclear Materials Management. Contact: INMM; phone, 847-480-9573; Website, http://www. inmm.org.

June 10-14, 2001
ASTM 13th International Symposium on Zirconium in the Nuclear Industry, Annecy, France. Sponsor: ASTM Committee B-10 on Reactive and Refractory Metals and Alloys. Contact: Gerry Moan, AECL, 2251 Speakman Drive, Mississauga, Ontario, Canada L5K 1B2; 905/823-9060, Ext. 3232; E-mail: moang@aecl.ca.

June 25-28, 2001
National Space & Missile Materials Symposium, Monterey, California. Sponsor: Air Force Research Laboratory. Contact: Pat Sisson; phone, 973/254-7950; E-mail, psisson@anteon.com; Website, http://www.usasymposium.com.

July 15-19
42nd INMM Annual Meeting, Renaissance Esmeralda Resort, Indian Wells, California. Sponsor: Institute of Nuclear Materials Management. Contact: INMM; phone, 847/480-9573; fax, 847/480-9282; E-mail, inmm@inmm.org; Website, http://www.inmm.org.

September 3-7, 2001
PATRAM 2001, Chicago, Ill., U.S.A. Sponsors: U.S. Department of Energy, in cooperation with the International Atomic Energy Agency. Hosted by the Institute for Nuclear Materials Management. Chicago Hilton and Towers. Contact: INMM, 847/480-6342.

November 12-16
ANS/ENS Winter Meeting, Marriott Wardman Park Hotel, Washington, D.C., U.S.A. Sponsors: ANS, ENS, and NEI. Contact: Steve Mladineo, 202/646-7868.

Chapters

Continued from page 48

About 350 specialists from Russia, the United States, the United Kingdom, Australia, South Korea, Egypt, Kasakstan, Belorussia, Georgia, Latvia, and the IAEA took part in this event. There were 154 papers presented during the conference, 48 of them were poster presentations. Representatives of universities and special training centers discussed the problems and future of education and training of MPC&A specialists. Full proceedings of the conference will be released this fall and will be available at http://mpca.ippe.obninsk.ru.

Gennady M. Pshakin
Chair, Obninsk Regional Chapter
Obninsk Russia

Northeast Chapter

The Northeast Chapter sponsored a luncheon meeting at the U.S. Department of Energy in Washington, D.C., in April featuring a presentation by Khidir Hamza, physicist and senior fellow of the Institute for Science and International Security, and David Albright, president of ISIS. The presentation addressed Iraq's clandestine nuclear weapons development program as it existed before and after the Persian Gulf War.

Ken Sanders
Chair, Northeast Chapter
Washington, DC U.S.A.

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