



**Journal of Nuclear
Materials Management**

JNMM 1991 Annual Meeting Review

Technical Working Group and Committee Updates

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Annual Safeguards Round Table

Guest: Llewellyn King

Publisher, The Energy Daily

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**SARP: A Safeguards Accounting
and Reports Program**

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Improving IAEA safeguards

One of *JNMM's* main purposes is to publish technical articles. Libraries and members consider the issues worth keeping because they contain information not available elsewhere. The Annual Meeting Programs Committee decided that it should select one of the papers in the *Journal* as an example of excellence. Consequently, there is one technical paper in this issue which will also be published in the Annual Meeting *Proceedings*.

Our members have been following the revelations of the IAEA inspection teams, which have been instructed by the United Nations Security Council to locate and remove or destroy all materials and equipment in Iraq which might be used to produce weapons of mass destruction. The extent of the Iraqi program to produce enriched uranium and nuclear explosives is considerably greater and more advanced than had previously been anticipated. This has stimulated many people around the world to consider how such surprises might be prevented in the future. This re-examination of the strengths and weaknesses of international safeguards is of great interest to INMM members. New approaches probably will call for new or different technologies, and INMM members should be involved in assessing the alternatives.

In this connection, the discussions at the Fourth Review Conference of the Nuclear Non-Proliferation Treaty (NPT) may be especially relevant.

The review conference took place in Geneva, Aug. 20 to Sept. 14, 1990. Eighty-four of the signatories to the NPT attended. China, France, Argentina, Brazil, Israel and South Africa sent observers. There was far more widespread agreement on the important issues than had been the case previously. One reason for this was that the participants were beginning to think seriously about preparing for 1995, when the future of the NPT must be

decided. Other issues were the Iraqi development, postponing ratification and the end of the Cold War. A final declaration describing the conclusions agreed upon was not issued, because Mexico and a few others demanded that nuclear weapon tests be terminated before 1995, while the United States and the United Kingdom would not accept this conclusion. However, all of the other important agreements are described in the draft final statement.¹⁻³

The most significant safeguards proposal, stimulated by concern about Iraq, was recorded as: The conference "urges the Agency (IAEA) not to hesitate to take full advantage of its rights, including the use of special inspections as outlined in paragraphs 73 and 77 of INFCIRC/153" in the event of "questions arising about the commitment to the non-proliferation objectives of the treaty of any State Party." This suggestion would have important impacts on future IAEA responsibilities and activities. INFCIRC/153, which defines the Agency's approach to safeguards for NPT states, emphasizes verification of a state's system for nuclear material control and accounting. The new proposal would authorize the Agency to determine whether or not a state was complying with its NPT commitment to abstain from obtaining nuclear explosives. There is the question as to how the Agency might decide that such special inspections should be performed, which has both political and technical implications. There is a need to estimate what resources might be needed to perform such special inspections and to determine how implementing the proposal might affect the present approach to safeguards for NPT states.

There was widespread agreement that nuclear supplier states should more widely agree on a list of sensitive materials and technologies, supply them only to NPT states and notify the IAEA of such transfers. Although agreement

states are to notify the Agency of transfers of uranium concentrates, it was noted that INFCIRC/153

does not authorize the Agency to verify it until it has been converted to UF₆ or UO₂. Such proposals involve both political and technical considerations.

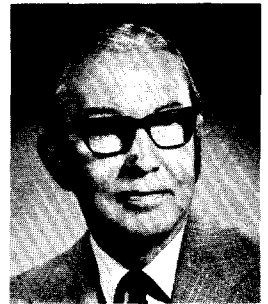
Other safeguards issues on which there was wide agreement include: (1) an appeal to the governing board to provide resources adequate to ensure effective safeguards, (2) suggestions that the Agency might develop more efficient inspection approaches (such as randomized inspection) and (3) a proposal that the IAEA should apply safeguards in nuclear weapon states to nuclear materials and facilities which may be transferred from military to civilian use.

The IAEA has been studying how to improve the efficiency of its safeguards procedures for years. It is now studying the advantages, limitations and possible means to implement the more revolutionary proposals. Member states that are interested in improving the effectiveness and expanding the scope of IAEA safeguards are also studying the political and technical issues. These subjects will be of great interest to INMM members.

*Dr. William A. Higinbotham
Brookhaven National Laboratory
Upton, New York U.S.A.*

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1. *Draft Final Declaration of the 4th Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons. NPT/CONF/IV/DC/1/Add.2 and Add.3(A), 12-13 Sept. 1990. Available from the IAEA.*
2. *David Fischer and Harald Muller: The fourth review of the Non-Proliferation Treaty, in the SIPRI Yearbook 1991, Oxford University Press, 1991.*
3. *Leonard S. Spector and Jacqueline R. Smith: Treaty Review: Deadlock Damages Non-proliferation, Bulletin of the Atomic Scientists, pp. 39-44, Dec. 1990.*



INMM stands for success

The past year has been another successful one for the Institute. A part of this success results from the leadership of the Executive Committee and the organization of OMSI (newly christened The Sherwood Group), our management company. But much of the success of INMM is a result of the dedication of the many volunteers from our membership.

Once again, as we return to New Orleans for our annual meeting, the Technical Program Committee and the Technical Working Groups have put together a comprehensive and diverse program that reflects the growing interdisciplinary interest of our membership. It includes more than 200 contributed papers organized into 33 sessions. In addition to our usual sessions on physical protection, international safeguards, materials control and accounting, and waste management, we are adding a second session on arms control-treaty verification (our first arms control session last year was very popular), two sessions on transportation and a session on environment, safety and health.

The Technical Working Groups have continued to carry out the educational and information exchange goals of the INMM by conducting several excellent workshops this year. The workshop on "Assessing Safeguards Performance," which was postponed from November because of budget uncertainties, was held in March and attracted 82 participants. A new workshop on "Mass Measurements: Principles and Practices" drew 103 attendees and several commercial sponsors. An important regular workshop, "Spent Fuel Management VIII," had 145 attendees.

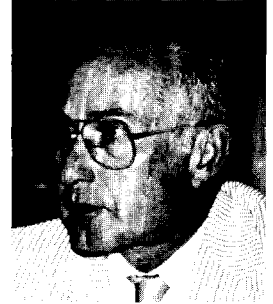
Membership continues to fluctuate around 725, but, for some reason, is not as big as might be expected from the large attendance at the Institute's annual

meetings. Perhaps Charlie Vaughan, the new chairman of the Membership Committee, can help change this statistic — or at least help us to understand it.

JNMM, the Institute's technical journal, appears to have turned the corner. It is attractive, well respected and provides an excellent forum for technology transfer in the nuclear materials management community. The many contributed papers, more than half of which are written by non-members, cover a wide range of interests. While not fully self-supporting (and not expected to be), *JNMM*'s financial base is improving as a result of a number of new subscribers and advertisers.

Financially, the Institute — while it doesn't have large reserves — continues to be solvent and relatively stable. Although the Executive Committee and INMM headquarters made several difficult decisions this year to achieve a balanced budget, we seem to be doing OK — especially given the rather severe budget uncertainties that many of us faced at the beginning of the year.

As you most likely are aware, last year the Long-Range Planning Committee recommended that INMM consider modifying our structure to facilitate more fully integrating transportation and waste management (elements of nuclear materials management that have been part of our logo from the beginning) and perhaps other special interests into the Institute's programs. The Executive Committee, after much discussion at each of its meetings since then, is still struggling with how best to achieve this goal. Although this seems like a long time, such a move could have an important effect on the INMM and warrants careful consideration. Perhaps by this time next year there will be a proposal



ready for membership ballot.

Once again, the success of the Institute depends on you, the members. I urge you to take an active part.

Darryl B. Smith
Los Alamos National Laboratory
Los Alamos, New Mexico U.S.A.

Note: For a complete report on the activities of the Institute of Nuclear Materials Management, you may request a copy of the INMM Annual Report or board meeting minutes. Contact Laura Rainey, INMM, 60 Revere Dr., Suite 500, Northbrook, IL 60062 U.S.A.; (708) 480-9573.

Technical Working Group: Radioactive Waste Management

The following summarizes the activities of the Technical Working Group (TWG) on Radioactive Waste Management over the past year for the period July 1990 through June 1991.

- The TWG continued to provide INMM co-sponsor representation on the Steering Committee for the 1991 International High Level Radioactive Waste Management Conference, which was held April 28 to May 3, 1991. Members attended organizational meetings for this conference and will participate in the organization of the next conference, which is scheduled for Spring 1992.

- The TWG successfully organized and held the INMM Spent Fuel Management Seminar VIII at Loew's L'Enfant Plaza Hotel in Washington, D.C. on Jan. 16-18, 1991. There were approximately 145 persons in attendance, and the seminar earned about \$10,000 (after expenses) for the TWG.

- Planning is under way for the INMM Spent Fuel Management Seminar IX. This annual seminar is scheduled for Jan. 15-17, 1992 at Loew's L'Enfant Plaza Hotel in Washington, D.C. Topics of discussion have been determined, and potential speakers are being contacted.

- The TWG organized the Waste Management Session of the 1991 INMM Annual Meeting held July 28-31, 1991 at The Fairmont in New Orleans, La. The Waste Management Session included four different sub-sessions — Waste Management Systems and Technology; Spent Fuel Burnup Measurements; Transportation/Waste Acceptance Infrastructure; and a Panel on Material Control and Accountability for Spent Fuel.

*E. R. Johnson, Chairman
E. R. Johnson Associates Inc.
Oakton, Virginia U.S.A.*

Technical Working Group: Transportation

The week of July 29 to Aug. 2, 1991, in New Orleans will be remembered as a significant milestone in transportation activities: The Institute of Nuclear Materials Management (INMM) 32nd Annual Meeting sponsored a transportation session chaired by Larry G. Blalock, Department of Energy (DOE)-Washington; the Contractor Traffic Managers Association's (CTMA) 27th Annual Meeting included a presentation by Darryl B. Smith (INMM chairman); the U.S. DOE conducted its annual Field Office Traffic Managers meeting; the U.S. DOE held a Transportation Safety Committee meeting; and plans were formulated to present an INMM Transportation Technical Working Group workshop in 1992, the first one of its kind.

Transportation professionals attend these meetings to discuss diverse issues, develop networking contacts, exchange ideas and interact with DOE personnel. Darryl Smith issued a personal invitation to DOE Traffic Managers and to CTMA members to attend the INMM Annual Meeting while in New Orleans.

The INMM has evolved from emphasis upon nuclear material control and accountability to safeguards and security, physical protection and radioactive waste management. In addition, new plateaus of membership have been attained. With the attention being given to transportation, it is anticipated that membership will continue to increase.

As the INMM evaluates its membership structure and determines its future course of activities, DOE Traffic Managers and CTMA members could be a positive addition.

*Francis M. Kovac, Chairman
Oak Ridge National Laboratory
Oak Ridge, Tennessee U.S.A.*

Technical Working Group: Materials Control and Accountability

The Technical Working Group for Materials Control and Accountability sponsored two technical workshops "Assessing Safeguards Performance" and "Mass Measurements: Principles and Practices."

"Assessing Safeguards Performance," co-chaired by Mike Ehinger, MMESI Oak Ridge National Laboratory, and Fran Davis, Westinghouse Savannah River Site, was held March 25-28, 1991 at the J.W. Marriott Hotel, Atlanta, Ga. The workshop provided participants with a background in the principles of materials control and accounting. Each day of the workshop included a few formal presentations in the morning concerning a specific aspect of materials control and accounting with the bulk of the day reserved for detailed discussion in small groups with summary sessions at the conclusion of the day. The three-day workshop covered analytical measurements with the focus of presentations on non-destructive assay techniques, bulk measurements, error propagation, containment and surveillance techniques applied to material control. An important contributor to the success of this format was a proposed facility description. The mixed oxide facility description served as a basis for the breakout groups to develop design criteria needed to meet material control and accountability requirements. The workshop, rescheduled from the original November date as a result of federal budget uncertainties, was attended by more than 75 participants.

"Mass Measurements: Principles and Practices," chaired by John Clark, Westinghouse Savannah River Site, was also held at the J.W. Marriott Hotel, Atlanta, Ga., April 25-28, 1991. The Mass Measurements workshop provided an excellent forum to discuss mass measurement problems, experiences, innovations and requirements between users, manufacturers, calibra-

tors and regulators.

The first day focused on the Process Measurement Assurance Program (PMAP) and covered requirements, installation, and measurement error determination and control. The second day included more than 15 technical papers covering calibration, design principles, measurement control and applications of mass measurements. The workshop included vendor exhibits, workshop sessions and visits to local facilities. An important aspect of the success of the workshop was the active participation of instrumentation manufacturers and vendors and the resulting interaction with users, calibrators and regulators.

Suggested Initiatives, Activities and Workshop Topics for the MC&A Technical Working Group

In conjunction with the Safeguards Performance Workshop, a luncheon meeting was held to discuss possible new initiatives, activities and workshop topics for the Materials Control and Accountability Technical Working Group. The meeting, attended by more than 20 INMM members, resulted in the following suggestions:

- I. Proposed Initiatives
 - A. Bring together safeguards, environmental, safety and QA communities.
 - B. Greater INMM involvement in the environmental waste characterization area to help tie safeguards community with the ES&H community.
 - C. Define INMM's role in safeguards training.
 - D. Expedite technology transfer to industry.
- II. Organizational Issues
 - A. Need to get new people involved.
 - B. Registration fee deferral for members who help with program, keynote speakers.

III. Suggested Activities

- A. On-site workshops.
 1. On-site INMM workshops at facilities to provide attendees access to advanced technologies and operational situations.
 2. Integrated test facility at Oak Ridge to focus on safeguards utility of process control indicators in a NRTA approach.
 3. NDA instrument-specific workshop (short duration) attended by users, manufacturers and regulators. User groups for particular topics, types of measurements, (i.e. shufflers).
- B. Training.
 1. Statistics course.
- C. Technical issues
 1. Define role of accounting in materials accountability.
 2. Promote unified look at safeguards and security.

IV. Suggested Workshop Topics

- A. Performance testing.
 1. Performance testing workshop (set-up, organizing, validating).
 2. Review of field implementation of performance testing. Understand distinction between compliance and performance-based testing (examples, institutional impact and results).
- B. Measurements.
 1. Duct holdup measurement information seminar.
 2. Neutron methods, shuffler technology workshop.
 3. Measurement control, standards development, organization of standardization.
- C. Material surveillance.
 1. Material surveillance workshop site experience from operations, internal audit, OSE inspections.

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ANSI N14 Committee Updates

The Annual N14 Meeting was held on April 24, 1991, in Germantown, Md. N14 Management Committee meeting minutes and revisions to the N14 Procedures Manual were mailed to individuals on the N14 roster.

It was decided to hold an Annual Meeting of the N14 Committee in October or November 1991 in the Washington, D.C. area. Organizations that would be invited to send representatives and a speaker to the Annual Meeting are:

- American Association of State High-way and Transportation Officials (AASHTO),
- Contract Traffic Managers Association (CTMA),
- Commercial Vehicle Safety Alliance (CVSA),

- Hazardous Materials Advisory Council (HMAC),
- Chemical Manufacturers Association (CMA), and
- Conference of Radiation Control Protection Directors (CRCPD).

Also discussed was the possibility of coordinating meetings with INMM's Annual Meeting. This was attempted in the past, and it was felt that there was not enough interest in INMM programs to draw the N14 members to the meeting. The INMM is trying to develop more involvement in the transportation areas. N14 will look at this meeting possibility again, but not for the 1991 meeting.

A letter summarizing activities related to the N14 scope change was

sent to ANSI, with copies to N14 members. The N14 membership approved changing the scope to include non-nuclear hazardous wastes and mixed wastes in April 1989. After additional study, the Ad Hoc Committee has recommended that the scope change be for hazardous materials, which would include hazardous wastes and mixed wastes. This will require another ballot by the N14 Committee.

The ANSI N14 subcommittee work on development of a numerical model for thermal evaluation of UF₆ cylinders is in process. Final approval to start testing has not been received. Dr. Shin Park attended an IAEA technical meeting on fire testing, and a trip report has been issued.

A risk-benefit analysis for the transport of bare 10- and 14-ton cylinders containing UF₆ less than 1.0% ²³⁵U by Battelle Northwest Laboratories is still awaiting FY 91 funds.

Plans to revise the Standard Matrix for Light-Water Reactor Spent-Fuel Transportation are in process.

The former Chair of N14, Roger Waite, was presented a plaque from N14 for his 67 years of involvement as a professional engineer and 50 years with the standards organization. Information was also submitted to ANSI on Roger's accomplishments in nomination for the ANSI Meritorious Award. In April, the ANSI award for Roger was presented at the annual ANSI Awards Banquet in Washington, D.C.

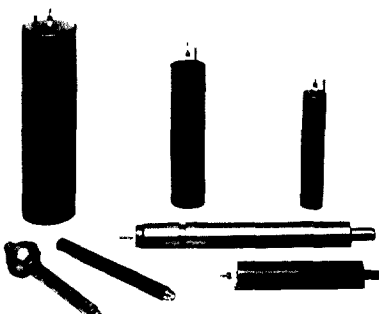
The N14 chair, a member of the Nuclear Standards Board, was recently appointed to be vice chair of the Nuclear Standards Planning Committee.

Highlights of N14 standards development are:

- ANSI N14.1 -1990 — *Packaging of Uranium Hexafluoride for Transport* was approved by ANSI on June 21, 1990 and is available from ANSI.

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INMM 5.1 Analytical Chemistry Laboratory Measurement Control Subcommittee

• ANSI N14.2 — *Tiedowns for Transport of Fissile and Radioactive Containers Greater Than One-Ton Truck Transport* is continuing preparations for a draft document for Writing Group approval. The committee expects to have the draft completed by Oct. 1, 1991.

• ANSI N14.6 — *Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials*, standard must be revised or reaffirmed in 1991. George Townes, BE Inc., and chair of N14.6, is obtaining N14.6 Writing Group consensus. It appears that this standard will not require revision and will only be updated. He has prepared a Project Initiation Data Sheet for submission to ANSI.

• ANSI N14.7 — *Guide to the Design and Use of Shipping Packages for Type A Quantities of Radioactive Materials*, work continues on this draft as it is being re-evaluated including the selection of a new Writing Group chair.

• ANSI N14.9.2 — *Packaging of Nuclear Power Plant Radioactive Processed Wastes for Transportation* is currently inactive.

• ANSI N14.19 — *Ancillary Features of Irradiated Shipping Casks*, this standard must be revised or reaffirmed in 1991. Planning on this activity has started.

• ANSI N14.23 — *Design Basis for Resistance to Shock and Vibration of Radioactive Material Packages Greater Than One-Ton in Truck Transport*, work on this draft is continuing within the Writing Group. A technical report which will be the basis for the draft standard has been completed.

• ANSI N14.24 — *Barge Transport of Radioactive Materials* seeks a new

chair of the Writing Group. An extension to revise or reaffirm this standard to Jan. 31, 1992 has been received from ANSI.

• ANSI N14.25 — *Tiedowns for Rail Transport of Fissile and Radioactive Material Containers*, has received no activity.

• ANSI N14.26 — *Fabrication, Inspection, and Preventative Maintenance of Packaging for Radioactive Materials*, work has started on preparation of a draft document.

• ANSI N14.27 — *Carrier and Shipper Responsibilities and Emergency Response Procedures for Highway Transportation Accidents Involving Truckload Quantities of Radioactive Material* must be revised or reaffirmed in 1991. Planning on this activity has started.

• ANSI N14.30 — *Design, Fabrication and Maintenance of Semi-Trailers Employed in the Highway Transport of Weight-Concentrated Radioactive Loads*: the Writing Group has completed a revised draft along with a letter of explanation for the changes. Balloting was completed on June 1, 1991. Ballots and comments are currently being reviewed.

*John W. Arendt, Chairman
Oak Ridge Associated Universities
Oak Ridge, Tennessee U.S.A.*

The Chairman of the INMM 5.1 Subcommittee has been notified by the American National Standards Institute (ANSI) of the publication of the Subcommittee's standard N15.51-1990 Nuclear Materials Measurement Control Program — Analytical Chemistry Laboratory. This standard was approved for publication on Oct. 22, 1990, and is available from ANSI by calling (212) 642-4900.

The INMM 5.1 Subcommittee is soliciting a few new members to complement its current membership. Activities under consideration are:

- all phases of measurement control in analytical chemistry laboratories,
- sampling of materials for measurement purposes, and
- "Target Value" methodology related to measurements of nuclear materials for accountancy and safeguards verification purposes.

Potential members with expertise and interest in these areas are invited to discuss their potential participation in INMM 5.1 with the chairman by calling (708) 972-2449 or writing to U.S. Department of Energy, DOE Field Office-Chicago, 9800 S. Cass Ave., Argonne, IL 60439 U.S.A. ; Fax (708) 972-2361.

*Charles E. Pietri, Chairman
U.S. Department of Energy
Argonne, Illinois U.S.A.*

Impressions from a new INMM member

Several surprises were awaiting me when I joined the INMM in June, just prior to the 32nd Annual Meeting in New Orleans. Earlier this year, I was fortunate to have been involved in a project whose subject seemed appropriate for presentation at that meeting, so I responded to the call for papers. I had been looking for a couple of years for the professional organization which was most closely aligned with my personal needs and experience. I had already been impressed with the caliber of people I've worked with who were INMM members, and when my paper was selected for presentation, I knew I had found the organization for which I had been searching.

I arrived in New Orleans confident in my ability to make a good presentation, yet mildly intimidated by the overwhelmingly impressive credentials of the members of the INMM as a whole. The Preliminary Program for the Annual Meeting read like an international Who's Who in the nuclear arena. The paper presentation went well enough, but other impressions surpassed my paper as memorable events.

The first surprising impression came when I took advantage of the open invitation to all meeting attendees and sat in on the Executive Committee's meeting Sunday morning. The meeting itself impressed me with the sincere interest the officers of the Executive Committee have in improving the Institute to better serve the needs and desires of its members. The unexpected revelation was that, excluding those directly involved with the Executive Committees' activities, I was the only person of the remaining attendees who was present that morning.

The most shocking impression occurred at the Awards Dinner. When Darryl Smith asked all new members to stand, I quickly sprang from my chair to see my kindred newcomers to the

INMM. Imagine my surprise when I saw nearly 500 seated faces smiling back at me. I think I may have seen one other person standing on the opposite side of the ballroom, but given the number of people who said I was the only person they saw standing I suspect I may have mentally transformed one of the waiters into a new member in desperate hopes of having someone with whom to share the unanticipated attention. Fortunately, Darryl diverted attention from my solitary predicament by asking all INMM members to stand.

This highlighted yet another unexpected (albeit much less personally traumatic) impression: nearly a third of the room was still seated! A portion of those remaining in their seats can be accounted for as members who had consumed sufficient quantities of food and spirits so as to be unable to hoist themselves to an upright position. However, the questionnaires completed at dinner that night revealed that 34.8 percent of the respondents were indeed not INMM members.

The significance of these surprise impressions, as described below, should be relevant to all members of the Institute as well as to any non-members with the motivation to be reading this issue of *JNMM*:

The opportunity to contribute and directly influence the future of the INMM is there, virtually begging to be taken. I feel fortunate to have attended the Executive Committee's meeting, for I was immediately welcomed and given the opportunity to work with the three subcommittees on membership, communications and professional recognition. I worked on the Annual Banquet questionnaire, and must take the blame for its title. Dennis Mangan explained at the dinner that "C.A.S." stood for Captive Audience Survey, and was abbreviated for the enjoyment of INMM members from MC&A, DOE,

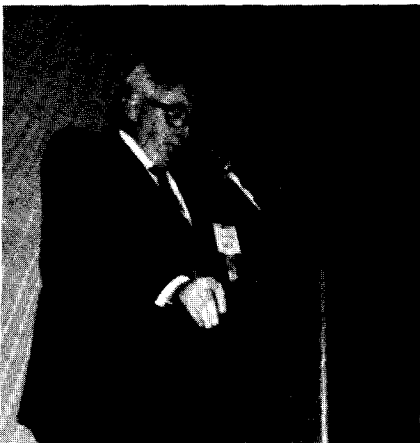
NRC, SNL and others who would appreciate the use of a TLA (Three Letter Acronym).

If I were truly the only new member in New Orleans, that should trouble existing members enormously. The Executive Committee is concerned about membership being down to 719 members from last year's level of 758 and the previous year's level of 823. One reason the survey was circulated at the Annual Banquet was to determine why non-members had not yet joined the INMM. Many responded that they simply had not been asked! It is not the sole responsibility of committee members to solicit new members — it should be the objective of each and every INMM member to actively seek out new members who can strengthen the Institute. Natural attrition will occur in any organization and can be offset only by actively recruiting new members.

Llewellyn King, speaking at the Plenary Session, cited what he called the "graying" of the nuclear industry as a whole, and astutely observed from the assemblage before him that the INMM must fairly represent a cross section of that industry. This highlights the need for the INMM and its members to begin *now* in an effort to attract new members and assimilate them into the infrastructure of the Institute. Only by doing so can the continuity of the organization be assured. The INMM offers a splendid opportunity for the interaction necessary if future generations of nuclear industry personnel are to carry forward and hopefully improve upon the impressive legacy established by the pioneers of atomic power.

Michael R. Chritton
Senior Engineer
BE Inc.
Barnwell, South Carolina U.S.A.

Below, conference attendees enjoy visiting one of the exhibit booths.



Left, Llewellyn King speaks at the Plenary Session. King is publisher of The Energy Daily. Above, a reception in the exhibit hall provided INMM conference attendees the chance to catch up with old friends and make new ones.

1991 INMM Annual Meeting, New Orleans, Louisiana

As events around the world are growing in global importance, issues surrounding the nuclear power industry such as proliferation, international safeguards, verification and transportation are receiving increased scrutiny by an international public. This year's INMM Annual Meeting focused not only on those issues, but Plenary Session speaker Llewellyn King, publisher of *The Energy Daily*, *Defense Week* and *Environment Week*, addressed how the industry has fared under the media's microscopic lens.

Nearly 600 attendees listened to King capsule the media's role in creating the nuclear power industry's public persona. King also outlined the difficulties which the press faces when reporting on such a technical and intricate industry. King's vantage of nearly 21 years in reporting on energy topics, including nuclear, coal, petroleum and electric power, painted a

broad view of the energy industry and gave credence to the belief that the industry needs to keep the public better informed of the benefits of nuclear power.

In addition to King's panoramic view, attendees heard from the largest number of international safeguards speakers the Institute has ever assembled at its Annual Meeting. International safeguards began each session on Monday and Tuesday with topics ranging from implementation and support programs to spent fuel conditioning and storage to summaries of the past, present and future of international safeguards. The latter session had the highest attendance of all of the international sessions, indicating the keen interest of meeting participants in this subject.

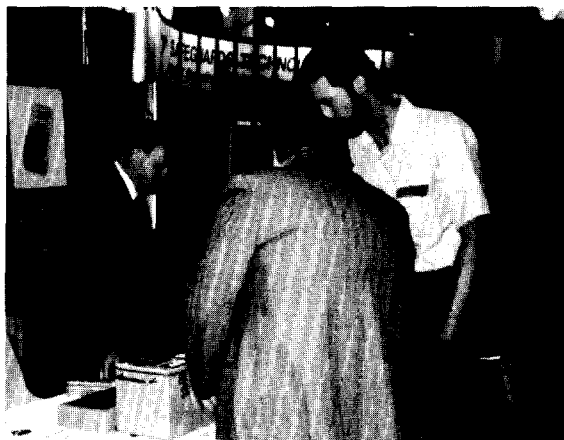
The Programs Committee increased the number of sessions to create more time slots to explore transportation

planning and activities. Thomas Pollog, U.S. Department of Energy (DOE) session, focused on explaining the DOE's development of the Federal Waste Management System to accept spent nuclear fuel, while Scott Vance, Battelle Pacific Northwest Laboratory, discussed the Delivery Commitment Schedule (DSC) currently being implemented.

For the second year in a row, Joe Endoste's session on Arms Control was a sellout — more than 60 attendees. (Joe complains that it would be even higher if the session did not compete with another highly attended session — International Safeguards. I plan to test his theory by rearranging these sessions next year!) A notable surprise this year was our first session exclusively devoted to Environmental Safety and Health (I do not know why I did not expect it), also with 60 participants — more competition for Joe. The



Left, Cohu Electronics sponsored a booth in the exhibit hall. Bottom left, Carleton Bingam, U.S. DOE, received the 1991 Distinguished Service Award. Bottom right, the leaders in safeguards products and services were represented at the conference.



real winner this year, however, was Jim Tape's Materials Control and Accountability session with standing room only — 140 attendees. Do I perceive a renewed interest in this critical but not well-understood and appreciated subject?

This year, the number of sessions increased to 33 from the 29 sessions INMM hosted in 1990, as 224 papers were presented. Other figures to note: registrants totaled 716 including family members, 86 were international attendees, 12 posters were presented and 19 technical exhibitors displayed booths at the New Orleans Fairmont Hotel.

Planning has already begun for the 1992 Annual Meeting in Orlando, Fla. On the basis of your comments from this Annual Meeting, the Programs Committee intends to provide additional sessions on Quality Assurance, Transportation and Measurement

Technology for Environmental Restoration and Waste Management.

Thanks go to the 142 speakers who contributed their abstracts on disk. This continues to increase the INMM headquarters staff's efficiency in producing the conference publications. Although nearly one-third of the papers had to be manually input, we believe the disk submittal process is our best solution for reducing INMM costs and improving INMM headquarters' efficiency in producing the meeting publications by saving many hours of typing and proofing. We look forward to receiving disks from *all* speakers next year. The *Speakers' Manual* is being revised to provide clearer instructions for submitting abstracts on disks and in the preparation of the final paper for publication in the *Proceedings*.

We added something new this year. On the basis of some independent

comments (and some subjective review by a few Committee members), one of the "better" meeting papers was selected for publication in this issue of *JNMM*. We may publish a few more but would like to hear your comments on this practice and on potential candidates as soon as possible.

Once again, the teamwork of the Technical Program Committee, INMM headquarters staff and the countless others who contributed time and energy to the conference has made it a success. See you in Orlando next July.

*Charles E. Pietri, Chairman
INMM Technical Program Committee
U.S. Department of Energy
Argonne, Illinois U.S.A.*

Japan Chapter

The activities of the Japan Chapter of INMM for 1990-1991 were highlighted for the Annual Meeting.

1. New Officers Elected for Japan Chapter

The following officers were elected for the FY1991-1992 and approved at the 41st Executive Committee Meeting held Sept. 20, 1990, in Tokyo.

Chair	Mitsuho Hirata, Nuclear Safety Technology Center
Vice Chair	Yoshinobu Seki, Mitsubishi Material Corp.
Treasurer	Hiroshi Okashita, Japan Atomic Energy Res. Inst.
Secretary	Takeshi Osabe, Japan Nuclear Fuel Co. Ltd.
Members-At-Large	Reinosuke Hara, Seiko Instrument Inc.; Hiroyoshi Kurihara, Power Reactor and Nuclear Fuel Development Corp.; Yuzuru Motoda, Nuclear Material Control Center; Nobuo Ishizuka, Japan Atomic Industry Forum

2. Executive Committee Meetings

Four meetings of the Executive Committee of the Japan Chapter (40th - 45th) were held at the NMCC Headquarters in Tokyo from July 1990 to July 1991.

Main topics discussed and adopted were as follows: the chapter's plan of activities for 1990-91, financial status, planning reports and the 12th Japan Chapter Annual Meeting and banquet.

At the 41st Meeting, Hiroyoshi Okashita was elected as program chair of the 12th Annual Meeting of the Chapter.

3. The 12th Annual Meeting

The 12th Annual Meeting was held in Tokyo on June 6, 1991. A total of 172 people participated in the meeting: 71 members of the Japan Chapter and 101 non-members. The program of the

meeting was as follows:

Plenary Session

Chair — M. Hirata
Chair of Japan Chapter
Nuclear Safety Technology Center

Opening Address

H. Okashita
Program Chair of the Japan Atomic Energy Research Institute

Chairman's Address

M. Hirata

Invited Lectures

The New Significance and Role of the NPT

H. Ohta, Ministry of Foreign Affairs

Today's Business Strategies of Germany After Unification

H. Hassel — Compagnie Europeenne de Combustibles (CERCA-NUKEM)

Development of Nuclear Fuel Cycle Technology and PNC's Role

T. Ishiwatari — Power Reactor and Nuclear Fuel Development Corp.

Technical Sessions

Session I — Measurement Technology

Chair — Y. Shinohara
Mitsubishi Material Co.

Development of the Accurate Volume Measurement System in the Plutonium Conversion Development Facility

T. Hosoma, S. Takahashi, Y. Maruishi — Power Reactor and Nuclear Fuel Development Corp.

Preparation of Common LSD Spike for Operator and Inspectorates

S. Irinouchi, Y. Tsutaki, T. Ohuchi, T. Hatanaka, Y. Satoh, K. Yasu, M. Tohmine — Nuclear Material Control Center; N. Doubek — IAEA

Development of Automatic Spent Fuel ID Number Reader (I) — Outline of Development

S. Tanabe, H. Kawamoto, K. Fujimaki, A. Kobe — Japan Nuclear Fuel Service Co. Ltd.

Development of Automatic Spent Fuel ID Number Reader (II) — Image Processing Techniques
K. Kubo, H. Mizuguchi, T. Miyazawa, S. Gotoh — Toshiba Co. Ltd.

Development of Automatic Spent Fuel ID Number Reader (III) — Ultrasonic Imaging Techniques
T. Omote, T. Yoshida, M. Senoh, T. Takeuchi — Hitachi Ltd.

Session II — Safeguards System

Chair — K. Kaieda
Japan Atomic Energy Research Inst.

Basic Study of Safeguards System for Laser Isotope Separation Facility (III) — Simulation Analysis of IRMPDP with Consecutive Reactions

T. Okamoto — University of Tokyo; M. Ohya — Century Research Center; H. Nishimura — Japan Atomic Energy Research Inst.

A Grouping for New or Improved Safeguards Approaches

K. Ikawa — Japan Atomic Energy Research Inst.

Development of Safeguards Effectiveness Assessment and Evaluation Methodology

H. Nishimura — Japan Atomic Energy Research Inst.

The Safeguards Systems at the Plutonium Fuel Production Facility

S. Seki, Y. Yamamoto, K. Matsuyama, I. Aoki, S. Takahashi — Power Reactor and Nuclear Fuel Development Corp.

Improvement of Safeguards for Fast Reactor "JOYO"

Y. Hashimoto, Y. Yoshihara, K. Tomura, M. Koyama — Power Reactor and Nuclear Fuel Development Corp.

Session III — Material Accountancy

Chair — A. Kobe
Japan Nuclear Fuel Service Co. Ltd.

Left, welcoming remarks by Dr. M. Hirata, chair of the Japan Chapter of INMM. Below, H. Ohta, from the Japanese Ministry of Foreign Affairs, speaks at the session chaired by Dr. Hirata.



Nuclear Material Control System in a Postirradiation Facility

M. Urata, I. Yuhara, K. Yamashita, K. Yanai – Nippon Nuclear Fuel Development Co. Ltd.

A Study of Accuracies of Inventory Estimation in Pulsed Columns

I. Kobayashi, S. Masuda, M. Kikuchi, Y. Sato – Nuclear Material Control Center; M. Nabeshima, Y. Kojima – Sumitomo Metal Mining Co. Ltd.

NRTA Development Status in Tokai Reprocessing Plant

H. Kondo, E. Ohmori, N. Miura, H. Hirano, H. Saitoh, H. Komatsu, T. Hayakawa – Power Reactor and Nuclear Fuel Development Corp.

Bar Code Application to Nuclear Material Accountancy

S. Usui, H. Sano – Japan Nuclear Fuel Co. Ltd.

Session IV – Inspection and Containment/Surveillance

Chair – M. Koyama

Power Reactor and Nuclear Fuel Development Corp.

Application of UNCL at LEU Fabrication Plants

N. Eda, T. Iwamoto, T. Someya – Science and Technology Agency; R. Kurokawa, M. Aoki, T. Niiyama, Y. Hirato – Nuclear Material Control Center

Joint Use of NDA Instruments at LEU Fabrication Plants

T. Someya, N. Eda, T. Iwamoto – Science and Technology Agency, R. Kurokawa, M. Aoki – Nuclear Material Control Center

Application Principles of C/S Measures in the Safeguards Criteria

Y. Yokota, M. Kikuchi – Nuclear Material Control Center

Reliability Test of CASDAC System (I)

K. Koyama, Y. Yamamoto
Japan Atomic Energy Research Inst.

Session V – Generic Issue with Nuclear Deployment – Waste Management, Safeguards, and Public Acceptance
Chair – K. Tsutsumi

Nippon Electronics Co. Ltd.

Confirmation Technique of LLW

M. Yoshida – Nuclear Safety Technology Center

History of Safeguards at the Spent Fuel Receipt and Storage Area in the Tokai Reprocessing Plant (TRP)

T. Hayakawa, T. Nakai, K. Terunuma – Power Reactor and Nuclear Fuel Development Corp.

A Review on the Enquete Result of Student in a University

Y. Seki – Mitsubishi Material Co.

Business Meeting

Chair – Y. Seki

Mitsubishi Material Co.

Special Lecture

Main Role of the Nuclear Material Control Center

Y. Motoda – Nuclear Material Control Center

Business Report

T. Osabe, Secretary

Planning Committee Report

T. Osabe, Chairman of Planning Committee

Financial Report

H. Okashita, Treasurer

Awards

Closing Address

Y. Seki

The banquet was held after the 12th Annual Meeting of the Chapter.

Copies of the *Proceedings* (in Japanese) of the 12th Annual Meeting of the Japan Chapter are available from T. Osabe upon request.

4. Membership

Membership of the Japan Chapter as of July 25, 1991 totaled 156 members, increasing since June 1990. Members are from the following organizations:

Scientific Institution	60
University	7
Electric Utilities	7
Industries	73
Government	3
Journalists	1
Others	5

Sixth Annual INMM Safeguards Round Table

July 1991

New Orleans, Louisiana U.S.A.

Llewellyn King

*Publisher
The Energy Daily
Washington, D.C.*

William A. Higinbotham

*Consultant, Brookhaven National Laboratory
Upton, New York
Technical Editor, JNMM*

Darryl Smith

*Los Alamos National Laboratory
Los Alamos, New Mexico
Chairman, INMM*

It has been INMM's policy for the past several years to interview the plenary speaker following his or her presentation at the annual meeting in a more relaxed and informal atmosphere. This year, we were privileged to meet with Llewellyn King, editor/publisher of The Energy Daily, to discuss matters of significant interest to INMM members and their colleagues. We talked about King's perspective on the news media and its impact on world affairs, the global status of nuclear power, non-proliferation matters, the role of the IAEA in a changing nuclear world and a host of other fascinating subjects. I hope JNMM readers will enjoy Llewellyn King's provocative interview laced with wit, sensibility and insight.

— Charles Pietri

HIGINBOTHAM: Is there anything that we did not hear in your speech that we ought to get into the *Journal*?

KING: I think you are not going to see an immediate change in nuclear or its situation. I think we are going to go on through a longer period of people being in love with paper reactors; the reactor that isn't built. It is always sexier — the reactor that does not exist. I think we are going to get a lot of that. The environmental community will always go for the non-existing technology rather than the existing

Dennis Mangan

*Sandia National Laboratory
Albuquerque, New Mexico
Vice Chairman, INMM*

Charles Pietri

*Chicago Operations Office
U.S. Department of Energy
Argonne, Illinois
Technical Chairman, INMM Annual Meeting*

Walter Kane

*Brookhaven National Laboratory
Upton, New York
Contributor, JNMM*

one. One of the things that is interesting is that we have seen considerable decline in the pure solar advocacy. The aim no longer is pure solar energy, because we threw a lot of money at solar, deployed a lot of solar and found its limitations. We knew about the problems when we did it, but we did it and we found its limitations. It has uses, but disperse usage is probably its forte. This will probably get cheaper, but they are not going to beat the basic limitations. You are not going to get more sunshine from a square meter than that which shines on a square meter, no matter how wonderful the sun is on the surface of a square meter.

We take electricity for granted. We have taken it for granted since World War II. I grew up in Africa, and I remember when electricity was a luxury, and it was wonderful. There were candles, hurricane lamps and the highly pressurized lamps that were dangerous and smelled terrible. This was not an easy way to live. And there was no larger a thing than the arrival of electricity.

Nothing contributes more to human life than electricity, with the possible exception of water. Nothing that is delivered to the home contributes more. And the fact is that now water is almost certainly pumped by electricity, so it is far better. Electricity's role in responding to the human condition is absolutely stunning. It also delivers geometrically because it is much nicer to have the appliances and

climate control when you are in your 80s than in your 20s. What electricity does for people increases in its value as they age. But because we have made electricity so plentiful and so inexpensive, we have forgotten its luxury aspects and we think of it as a necessity, an entitlement. The public thinks of it as being the rotating system of endlessly elastic use as we drop in more things. There is electricity, why do you need a nuclear bomb?

The electric utility industry is going to be in a tremendous difficulty when it tries to form a new power grid because of concern over electromagnetic fields. People will not turn the television off and will not stop using the hair dryer but will say, "Do not put that line through my county, or my state. Find another way." This is a huge area of scientific dispute, and a very difficult one to deal with when you start dealing with the ecological data. You can argue forever. The people who have done some of the work on micromagnetic fields are looking into actual illness in order to say to the EPRI that illnesses supposedly caused by electromagnetic fields are not proven. But if childhood leukemia and cancer are proven to be caused by electromagnetic fields, these are really terrible diseases. I do not think we should be dishonest about it. While it is a scientific downfall, it is going to be very difficult for the utilities to go and say that the benefit of this line far exceeds the risk or even the disease that could be generated by this line.

Even if such effects were proven, there is the other aspect of it — not having electricity. Parents of small children, and small children are said to be the ones most vulnerable, are not going to allow high-transmission lines to go through anymore, scientifically proved or otherwise. This is how we get into difficulties. We will tolerate that which we feel we control totally. We will put the same child in an automobile. There is a very definite risk the child will be killed in an accident, but we feel we control it. We do not. We do not control the driver in the next car. We do not control anything about it. But we feel we control it, and people will take enormous risks if they feel they control the risks. We have an attitude in our society now that things must be risk-free.

PIETRI: Regardless of the cost.

KING: Regardless of the cost. I think it is a great tragedy that people on Long Island are paying more for their electricity while Shoreham is probably the best-engineered civilian nuclear power plant on Earth — the most studied, the most analyzed, the most measured — and yet it's not allowed to deliver. At the same time, that area has two of the busiest airports in the world. I just flew down to Long Island on Saturday. We have got Kennedy and La Guardia, and high-density at both of them, and yet Shoreham does not operate.

The most dangerous thing is when you get the scientific myths of disinformation picked up by politicians. It just

sounds like heroic stuff to Dukakis and Cuomo — it plays well. It is dishonest. I suspect they know it is dishonest. I am sure that Cuomo, who is a very smart man, has access to enough smart people in his own state agencies not to be deluded that he is doing purely political things at the expense of his constituents.

The danger is that we are going to be so hamstrung by this fear ethic that we as a nation, the United States, are going to lose our place in the world. People are going to be flooding out of the country for medical treatment, and all these things that are intrinsically ours. We would not have computers deployed if they had been through this sort of scrutiny. We would not have aircraft if they had been through this sort of scrutiny.

Technology will evolve like radar. If you had said to people in the 1920s that one day we will have 400-seat aircraft flying over New York City, people would have said, "You are out of your mind!" This is too dangerous, because they would not see the development of high-tensile alloy, radar, radio communication, the huge electronic envelope that surrounds the modern airliner. You cannot take this linear look into the future, because it is going to be wrong.

When a nation ceases to be prepared to take a risk, then it is going to begin to lose its footing in a competitive world where other nations will take risks.

PIETRI: You made a point this morning about the electrification of India. I do not think from their perspective that they are looking at the downside of nuclear. Everything is up. In fact, I heard that one of the most effective means of birth control in India is TV.

KING: I heard that from Rajiv Gandhi.

PIETRI: Maybe that is where it came from.

KING: I met him, and we got along quite well. I said to him, "How are you going to deal with all this"? He said, "The answer is electricity." The linear examination, including the linear examination of the environment, does not produce a good result. But if you make decisions based on that linear examination, you are bound to come up with bad decisions. We would not, if we had known the cost in lives, have put the railroads through. We would probably not have built the interstate highway system. We would never have developed most of those things that have been a huge benefit because some people would have been plundered. You have got to be prepared — and it sounds like a terrible thing — for the fatalities that come with human exploration. We were prepared when we sent sailing ships to the end of the Earth. We were prepared when we sent land explorations to the end of the Earth. Suddenly we are not prepared to take any risks at all because people derive political power from arousing public

fear. And yet the risks continue and they multiply. I believe we did ourselves an immense disservice under the Carter administration where we sort of gave proliferation to the world. We said we are going to be morally correct and it does not matter what happens.

I had a big argument with Joe Nye about this, who maintained that the only way at that time that we could see, in fact, probably the only way to control proliferation, was for the United States to set an example. Then we could try to control international trade. When Carter said, "We are not going to reprocess," he invited everybody else to do so, saying it was too dangerous for us to do. There was a sort of table of proliferation we advanced an order of magnitude by refusing to do it ourselves. And I think it is shocking that we basically said, "You can reprocess, but we are not going to." There is no evidence that these unilateral actions have any effect in the world whatsoever. The greatest deterrent to proliferation is the fact that the technology to make a weapon is harder than anyone believes. I debated with a 16-year-old boy here who ran around and said he could make a nuclear weapon. In one of the great acts of stupidity and conceit on my part I went to debate him in front of a girls school. [Laughter] Here was a good-looking kid in a turtleneck sweater, and there I was in a three-piece suit looking like the nuclear industry incarnate. And he went on about how he could make a nuclear weapon in his basement. Well Saddam Hussein couldn't do it in his basement, and General Zia couldn't do it in his, but this kid could.

The best articulate argument I heard about making bombs in your basement was by Tom Clark, former GE lobbyist in Washington. He told me that when Owen Teague — "Tiger Teague" — was head of the Science Committee, he was reading all this about the 16-year-old who could build the nuclear weapon in his garage. Tom went to see him and Tiger said, "Tom, can he do it?" Tom took the light bulb out of the lamp beside him and said, "Do you think he could make this in his basement?" An ordinary light bulb. And that is quite a good point. [Laughter] It is saying that this is not done easily because most of the countries who are on the list would have done it. I believe South Africa was very close. I do not believe they did explode that thing down in the southern hemisphere. Israel I think has one. I think Brazil, Argentina, certainly Pakistan, we know Iraq, many others have tried. It is all in the literature. They do not have to invent anything, it's basically engineering. But they haven't succeeded. The trick of the whole nuclear world is not to have another Chernobyl. It was a real terrible accident and it hasn't affected the opinion in the United States deeply because we were already conditioned to believe the Russians would mess it up. But in the rest of the world, which is not so conditioned, particularly in Europe, the affect has been incredible.

PIETRI: As an American, I had not realized that until I talked to a lot of the Europeans.

KING: Not just in Europe, but also Japan, where of course, they had fallout; a serious contamination. The size of the public impact was like your Three Mile Island, which did not affect them back then. But Chernobyl put back nuclear quite enormously as a generating source. It is no good saying it was a badly designed reactor and it was done under a dreadful regime. It was catastrophic and was as bad as the worst predictions of a nuclear accident. You can not start telling people about containment and things like that because it is too complex.

HIGINBOTHAM: At the start of your talk you said the momentous treaty is about to be signed. Then you said, "But that is not going to solve all the world's problems. We are going to have difficult situations all the time." I just wondered if you could say a little more about what you expect. You are referring to something urgent with the treaty that is about to be signed in the Soviet Union.

KING: I think there is some misunderstanding. It is irrelevant in a way because the Soviet Union is so disintegrated.

HIGINBOTHAM: Well that is true, recognizing it as something that has happened, right?

KING: The difficulties are had even with the Soviet Union for us to get a total inventory. We have the weaponry: where it is deployed, who really controls it, how much of it is controlled by dissident republics or dissident parts of the military in those republics.

PIETRI: The political system is disintegrating, but how is it militarily? Is the military still unified?

KING: Unified as I understand it — and this is not an area where I pretend to be an expert — in that the Russians control the Red Army. There is a limit to which non-Russian officers can rise in the Red Army. You will not find a lot of Ukrainians, or officers of lesser republics, at a very high level in the Red Army.

HIGINBOTHAM: The other question is; What impact will putting a ceiling on vertical escalation have? Isn't this going to have some useful impact on trying to control horizontal proliferation?

KING: I do not see it. I honestly do not see how the control of vertical proliferation is going to inhibit horizontal proliferation. The people who want to proliferate horizontally want a big bang quickly. They wanted a uranium bomb or an atomic bomb, but they are not looking for one

large complex, and the Arabs want one to drop on Israel. It is that simple.

The Israelis have one, or want one to prevent that from happening. The South Africans wanted one to drop on black Africa if they were threatened by a major land war from their front line states. South Africa is changing. The power corrupts, and you have a lot of power when you have nuclear weapons. The potential is that nuclear weapons built in Argentina would be used either against Chile or Brazil. And likewise, Brazil would use them on Chile or Argentina. These countries are not all that friendly to each other. I think, and I certainly do not know, but I think horizontal proliferation is going to continue and I do not think that the treaty with the Soviet Union is going to affect us. But what I fear is that we will fail to continue to work on the safety of nuclear weapons. I believe that we will greatly reduce our effort for political [reasons], or the money for it will not be there, and we would [otherwise] make tremendous strides with detonators and all sort of things to make these weapons safe in storage and handling. I suspect there will be less emphasis on that.

What do you think Darryl? You obviously do not agree with me.

SMITH: That is conceivable. My feeling is that it is one thing that is clearly becoming more important. Although, since we do not have to spend a lot of money making mortars or weapons, we can afford to scale back.

KING: I say that proliferation will become more important and that does not have anything to do with the treaties or the Russians. It has to do with clear efforts by Saddam Hussein to get a nuclear weapon, which is why I think it is now a critical matter for our intelligence agencies, way ahead of the IAEA, to say what is going on with any international regime that will do this. This is some sort of pre-emption, which means a new doctrine in our attitudes regarding sovereign states, in which collectively the nuclear club says, "If you do this, then we will come and take them out." That is a momentous concept. We did not take out the Iraqi reactor, the Israelis did — the original one in which they were probably trying to breed plutonium. We, by and large, did not believe that that is what they were doing. Our intelligence was very poor. Daily we learn how poor our intelligence was about what was happening on the ground in Iraq. Therefore, what can be happening elsewhere?

I spent some time in Pakistan, and certainly, they did not tell me they were building a reactor. But clearly the empirical evidence that they were trying to build a nuclear weapon was stunning. We chose to warn them as we once chose to warn Iran. I think, in that way, we have been very easy on the Pakistanis.

I had a conversation with General Zia before he was killed by an accident, and he knew a lot about this. There are not many politicians who would know a lot of details

about nuclear power and nuclear weapons. But Zia did and he did not get it because he was intellectually curious about it. Pakistan very definitely tried very hard to get a nuclear weapon, probably not to drop on India as the tension between India and Pakistan is real and not real. Both sides say they are from the same stock. There are more Muslims in India than there are in Pakistan. Any Arab or Islamic country which gets a weapon becomes a potential leader of all Islamic countries. Certainly Zia and people like him saw the power of the Ayatollah without a weapon. This means a spiritual leader within any Islamic country — since he has a proven weapon or can convince the world that he has a weapon — becomes immediately the potential leader of all Muslims in the world, to make a common front against the infidel. What we have seen with the employment of our scientific resources over the years is there are two dangerous things. One is politicians. The other is technology. First is when [the politicians] fall in love with technology. The second is that they fall out of love with it as with the nuclear airplane and a nuclear rocket.

HIGINBOTHAM: I am so glad we got rid of the nuclear airplane.

KING: I am glad too. There was a period of great enthusiasm for it. There was great enthusiasm for a nuclear rocket, and then they fell out of love with it. Then there was a period of unbelievable enthusiasm for the civilian nuclear power in the simple days of the Atomic Energy Commission. The nuclear bomb was not always regarded as a terrible weapon. As to being terrible, I mean Goldschmidt always said, "Remember that we named the atom after what we regarded was a fun thing." This was an advance, not a retreat. Nuclear weapons would then provide the stability, and then all of these good things.

It was not until a while later that a whole intellectual world, primarily Europe, decided that the greatest threat to humanity was nuclear weapons. In fact, it was an immense stabilizer to mutually ensure against destruction. It is hard to say this because people think we are really mad. But I have no doubt that in many instances, including Berlin and Cuba, all sorts of disputes would have led to a land war in Europe without nuclear weapons. Nuclear weapons have been the most amazing stabilizing umbrella in a very difficult international period. An absolute sustention between ourselves and another continue to force an equal power relationship. You really do not use it. The threat of aerial nuclear weapons is the threat and not the use. The use is a diminishing thing, and the possession is a strengthening thing. So I think in nuclear, horizontal proliferation is going to be tried very seriously by all sorts of people. As soon as you get the power block in the country or in the region they are going to go to a nuclear weapon. There is no sovereign head of state who likes the fact that we say, "You do not really trust us."

MANGAN: In your speech you referred to the IAEA as a successful multinational organization, yet they have taken serious criticism in the press because of the Iraqi incident. Do you see the role of the IAEA changing as this horizontal proliferation popularly exists?

KING: I see that its primary detection function would probably pass to the CIA. The CIA technology and some old fashioned espionage intelligence is what is needed, and the IAEA cannot do that. The IAEA works in a regimen of agreement. Why I do not think they are a very successful organization is that there are not many international organizations that would work well. It is the only United Nations agency that has not gone off the deep end, and there have been consistent efforts to plunder it. There is what is called "The Great 77," now around 107 countries, that say wait a minute, this is a United Nations agency. Let us plunder it for the spoils of international bureaucracy as UNESCO was plundered, World Health Organization and every other world renowned United Nations agency. Given that, it is a tribute to the United States and Soviet Union that the IAEA has held together and not become a political football in the General Assembly. I think that it is incapable of preventing proliferation. It is an enormously effective agency when people are operating within the NPT.

SMITH: Should the intelligence activities of the CIA and its counterpart in the Soviet Union be shared with the IAEA?

KING: That is a very complicated situation. If people believe that their information is so personal that it requires a unilateral corrective action — as in the Israel/Iraq case — I do not believe in the situation of them sharing because they expose that information to a forum in which it can be vetoed. We would not share the information we have on the Israel nuclear threat with the IAEA. We would not do it. Politically it is not possible, and strategically we would not conceive of it at all. If, however, a country's acts started a weapons program that looks as though it would come to fruition — and their country could slaughter any other country — we might share that information because we would not want to act unilaterally.

My suspicion is that we did not report on Pakistan because we considered all the issues of notice, particularly in Afghanistan. Basically, I think they will not share all the intelligence. I think it unlikely in most cases that they were sharing with the IAEA, unless it was a situation like Iraq and Kuwait, where there is a remarkable international consensus. The number of international consensuses we have seen has been very small.

I think the European Community, as much as it is capable of speaking with a unified security voice, will become an important player. The reason for this is they all had long and deep relations with their former colonies. The French

and their African colonies, the British and African colonies, the Dutch and Asian colonies — all have deep and long-established lines of communication and of espionage. So it is highly likely that a former colonial power knows more about many of these nations that are potential proliferators. The collective voice of the European Community is going to become more and more important. It does not always have a collective voice, but it is increasing.

There is a whole new thing happening in the nuclear world that we have never seen, which is an excitement about super-nationals. I am excited about putting away the fratricide of Indonesian warfare of about 3,000 to 4,000 years. It is going to make the European nations a major player because its countries have such deep penetration of most of the Third World countries that were former colonies. I think the trick is to keep the IAEA doing what it is doing to shield it from the General Assembly's design to get its hands on it.

There are different standards for Iraq than there would be for Japan. And there would be a different standard for Israel. If some country, to the best of our knowledge today, is a nuclear power but political changes arise, they will want to deal with it on a case by case basis. But the only way to stop it is through severe military restraint. The history of sanctions is terrible. Sanctions do not work, and nothing concrete can be achieved by sanctions. We have blockaded Cuba for years and we have driven down the standard of living, but that has not succeeded in unseating the object of our antagonism. We have not even succeeded in doing that in Iraq. People suffer. Military actions are the way you stop it — or the fear of military action. Some things have happened in the world in the past ten years that have made the threats of the major powers more believable. It was widely perceived that none of the liberal democracies would fire a shot in anger off to Vietnam. Particularly, the United States. But since then we have had Panama and Grenada and Iraq. The British have had the Falklands. All of these tragic things which should have been avoided. But the good that comes out of them is the evidence that the nuclear powers are not hidebound and that they do have the political will to prosecute armed intervention should they deem it necessary. This was not clear after Vietnam, that we would ever do anything like that or that the British would sail all the way to the Falklands for a few sheep. What resulted, that is probably beneficial, is that now we boldly gain more confidence in our military and nuclear technology because it is the last line of defense against proliferation.

It is very difficult to believe a country such as Italy — the want for common nuclear weapons — because when you become a nuclear power you also become a nuclear war zone. In fact there is too much to lose. It is very difficult to believe that any of the European countries, including Britain and France with their nuclear capacity, would ever seriously contemplate an exchange of nuclear weaponry.

They are very small countries with relatively small land areas, and they are city-states. England has become a city-state called London, France has become a city-state called Paris. They cannot sustain the damage on their cities. Even in the way they could sustain it in the conventional bombing of World War II, the concentration of everything is now in their capital cities.

In World War II, when the Allies wiped out Dresden it wasn't the end of Germany. The German bombers knocked out Coventry and a large part of London. But these countries cannot survive on the provincial cities anymore so they cannot make their major cities the prime target. That is not true of the United States or Australia. It's not true of large land mass countries. But it is true of small countries, particularly if they have a good transportation system.

We in the West have not learned to deal with Islam at all. We in the West have decided religion is not a factor in international organizations. When *Time* magazine ran that cover that said "Is God Dead?" it was a declaration that God was dead in the West. But God was doing fine in the East. It will be many generations before religious fanaticism disappears in Islamic countries. Therefore, they would have a desire to have a weapon.

MANGAN: You are obviously predicting that we will have a nuclear energy rebirth.

KING: I think it will come.

MANGAN: Yet you sat there and we all shook our head yes, as we get older and older in our profession we are not being replaced by anybody. Does this not create serious problems? How do we go about resolving this?

KING: You are losing the young talent, you are not getting it. It's going into computers or something else. It's what happens gradually. In the 1960s, the stars of the society were hairdressers, and you lost your basic engineering. Lost it. Nobody went into heavy engineering. That was dirty and boring. You went into dress design, hair dressing and show business, and technology was in computers and telecommunications. Not until the time that we collectively decide to build some nuclear power plants, and it will not be decided by your friendly neighborhood utility because that is madness. Shoreham proved the madness of that. No freestanding electric utility can take the risk of changing the public policy once it has committed itself to the investment of enormous amounts of funding — that we have legislation indemnifying that plant from any change in public policy once the extent requirements in the beginning of the processes are met, the licensing part as well. Not that it will come along later with prudence or with evacuation.

What I think is a possible scenario is that as we move toward the end of the century, we are going to have severe

supply problems in specific areas. The system is very stretched — on the east coast, in Florida and in California, where we do not have the inter-ties or the common reliance. We cannot get the power down out of Canada. Once you have a serious dislocation, or truly troublesome rolling brownouts, then I think the climate will be right for an imaginative solution to the next paths. I suspect it will look like this. It will go by consortium, probably of suppliers. For argument's sake, let's say Westinghouse. A utility anywhere in its regions, but it will be essentially the power producer and a Wall Street house and it will have to be indemnified against changes in public policy, nothing else, or we will have a problem. There is a history of federal government indemnifying U.S.D. projects. In that circumstance, it will be built. Once the public becomes truly convinced that its electricity supply is in danger, I think it changes the life of nuclear because it is extremely confusing to the public. Electric acid is too dangerous. The whole nuclear world is saying this, and the electric utility industry is a terrible spokesperson for itself because it has coal, and natural gas and nuclear. Instead of saying clearly the benefit we frequently and resoundingly view as the best way to generate electricity, they say nuclear is good, coal is good, gas is good. This is like Macy's and Gimbel's saying, "Macy's and Gimbel's, two great stores." It does not work. But the utility industry has never been prepared for the furor it will bring down to tell the public that coal is a terrible fuel. It is bad to mine, burn and transport, and it kills about 250 people yearly in direct fatalities, plus all the health-related fatalities that must run into the tens of thousands from miners and transportation workers, plus what it does to the general environment.

But the utilities will not come out and say you are forcing us to do a bad thing. However, one believes that at some point this will become a self-evident choice. Whereas technology is proliferating and changing everything, there is nothing in sight that looks like a black box that will churn out electricity benignly. It hasn't happened. And it is hard to explain to the public that technological evolution is not symmetrical. We can cure all infectious diseases, yet we cannot cure the common cold. We can extend the end use applications of electricity. We can vastly reduce consumption and indeed change the function, but we do not know another way to make it easily and in a reasonable quantity. In the 19th century, it was boiling water driving the turbines. There are better turbines; we get hotter water, but we have not changed anything. The real problem of nuclear power is that it is 21st century technology of the reactor hooked onto 19th century technology outside the reactor, which is mostly plumbing, and everybody knows that plumbing does not work and it leaks. And for all our efforts, we cannot get a steam generator that does not rupture. We cannot get the chemistry in the water right. But there is nothing in sight that suggests a radical change of the black box generation. There is nothing novel like fiber optics in

sight. It is indeed a 19th century process, and all they are trying to do is boil the water better. And there is nothing else around. We have looked at MHD, we have looked at direct conversion many times and we have not seen it. It looks as though we have to boil the water.

SMITH: We have been looking at things on a global scale. Closer to home, have you been watching what is going on in DOE? Do you have any comments on the current change in emphasis?

KING: I think that health and safety has run away with the department.

SMITH: I think that would be the feeling of all of us here.

KING: The driver is not energy. The driver is health and safety and remedial action. I feel that the emphasis is not right now. But I believe that the secretary has gone as far as he can without beginning to hurt the fabric of what he has got, which is the lab and tag contractors who run those facilities, and the archipelago which is the DOE. It is not the forrestal building. It is the archipelago. The archipelago is more important than the central island. I knew that there were going to be problems when the Admiral told me he was going to do it like Rickover. His legend has outlived the time. You have got to live in today's world. You cannot go back. Trying to be Rickover has destroyed more people. It destroyed Milt Shaw; he tried to be Rickover.

I used to talk to Rickover, and people who were affected by him were deeply affected by him. He was a bully and a visionary. He was a lot of things. And Watkins came in quite determined to emulate him. Watkins made a considerable mistake when he started to attack both the bureaucracy in Washington and the contractors. He was somehow in wonderment of the lab system and at the same time keen to beat it up on the health and safety issue to an extent that he is paralyzing it. That is what is happening there. Because of the health and safety emphasis, the department is not looking at its primary portfolio, which is energy, or its secondary portfolio, which is refuse. We are not seeing anything about energy. And we always hear about health and safety and this pursuit of excellence. But as you get this kind of team dynamic, you do not get excellence because there is too much fear involved with it.

People are too worried that the Tiger Team is coming and actually, God help me, pulling shut the glass on the front door. You do not get excellence like that. The excellence was oddly enough in the much maligned Atomic Energy Commission. You would go out at 11 o'clock at night and every light would be on at the Atomic Energy Commission. Everyone would be working because they were so excited about what they were doing. Not because a Tiger Team was coming, but because everything was working and it was the place to be. It was incredibly

exciting. It did not matter that you were getting government wages, you were on the frontier of science. The reactors were working. Scientific technology was going on at a phenomenal pace. The feeling was that which produced excellence. You do not get excellence from policemen. And I think Watkins has gone too far with the policeman thing. It's time that he said, "The Tiger Team has done a wonderful job, and it is time for a new order." The only problem with the Admiral — and he is a very smart man — is that he is stuck in transmission. It is kind of hard to get a word in there.

Rickover is someone who, if you took something of the historical view of him, really hurt nuclear. He was too much of a force in it for too long. He brought up a whole generation of engineers who were not qualified for the real world. They were qualified for the quasi-military role, where you could be imperious, and it worked.

We are now having generations of people in various disciplines who do not know much about Admiral Rickover. I will tell you my Rickover story. I have only got one. He used to call me and say "You do not understand. You know who this is? Well, you do not understand. Goodbye." And he would hang up. [Laughter]

I introduced the chairman of the National Coal Association to Rickover once, and the Admiral said "It's a great fuel, but I want you to hold it right there because I want to get Mr. Hershey of the *New York Times* to hear this." He grabbed Hershey and said, "Yes, Mr. Hershey, I want you to hear what I have to say. I was just saying that coal is a marvelous fuel, but you cannot mine it, transport it or burn it without killing a lot of people." [Laughter]

HIGINBOTHAM: In journalism there is a better structure for disinformation than for information.

KING: That is partly true in the nuclear field. The amount of information in a 15-minute television segment, which is a long segment, is very slight. In *New Technology Week*, we liked something on "60 Minutes." It was a whole segment that must have been 13 minutes, but it filled about one and a fourth pages of *New Technology Week*. There was nothing in it. I used to write for the BBC, and we would have to condense into a few sentences a SALT treaty, or something like that. The other thing about television — and I am no better than anyone else, and I watch the crap on it too, [Laughter] is that it does something else. It presents — even when it is at its best — information that is disassociated from everything else.

It is in no organized framework. Television is not geared to any historical marker. Even when you watch "Henry VIII," you do not know when Henry VIII fit in. I think even when it is being educational, it is educational without framework. So that kids who are educated almost entirely on television, without their parents input, do not have any sort of cohesive idea of events. I think one of the most

frightening things I heard was that in Israel they had a test on the Holocaust. The question about the Holocaust was mainly this: "When was the Holocaust?" The majority of the kids thought it was in the last century. They have taught it thoroughly, but they haven't geared it to any historical marker.

HIGINBOTHAM: It seems that there is another thing that we guarantee, and that is that there is so much stupid advertising that nobody believes what they see anyhow.

KING: That may be beneficial. [Laughter] We have raised the standards of skepticism.

SMITH: One comment about television that I think is very typical is [its involvement with] the civil rights movement in various countries in the last couple of decades. We've often had television critics who have withstood savage attacks by security forces and police against demonstrators that 50 years ago would have been hushed up. No one would have heard about it.

KING: That is television's great triumph. The advertising is its downside. Its upside is that if we had television in the Civil War, after the first few bloody battles we would have stopped and there would be no United States. There would be a confederacy. We would not have put up with the horror. And I suppose it has brought horror in our time. It changed the course of the Vietnam War. In that sense I think it has done much.

It has done much in the disintegration of communism because we were getting in television signals. In Finland there is a supermarket chain whose television commercials can be received in Estonia. The Estonians lodged a diplomatic complaint with the Finns that this was propaganda because (the Estonians said) everyone knew there was not that much food in the supermarket. [Laughter] So in that sense television has had a stunning effect. I mentioned in my talk about what it does when you take it into a village. It is amazing. It raises expectations very, very fast. It changes them very fast. Its impact is tremendous.

SMITH: What is your prospective of television coverage of the Gulf War now?

KING: I think it was very poor in that we were very marshalled by the military.

SMITH: Was it managed too much?

KING: Absolutely, it was appallingly managed. We (at King Publishing Group) did not send anybody over there because we called over there, and when we heard what we could do, we said what is the point. Had we seen the Iraqi civilian casualties, which were very large, we would have been less euphoric about it. Saddam is still there, he hasn't even been taken. One of the fellows who was covering the

war for ABC worked with Ralph Nader on his anti-nuclear movement, and he said "I was wrong." He was overwhelmed by the weaponry. One of the problems the military had was this attitude that our weapons would not work because of sand in the turbines of the M1. Again, you get into these very difficult issues of technology. As with [military] nuclear, civilian nuclear is hard to follow. You try following the military because you do not know the bottom line. The testing means nothing. The bottom line is you go to war. The British learned the melting point of aluminum from the Falklands. They all know the melting point; they learned it. But it took combat to bring it home.

A guy started lecturing me on the excellence of American weaponry. He said "You have got it all. It is the best in the world, and we know because we have used it. You do not know because you haven't used it." It is very, very difficult. We, at *Defense Week*, I suppose are responsible for the difficulties of the DIVAD. Anyway, it became a big story and they had file footage on television. They had these rounds missing the target and exploding. Barbara Walters came back on after the file footage and said "Anyone can see that it missed the target and it also blows up." Well, of course — it is a defensive weapon. You do not want live rounds. It has got to self-detonate. You are not going to have a defensive weapon shoot live rounds all around your perimeter. But how are you going to explain that to Barbara Walters, who has just seen a film of what she thinks does not work? Well, surely you cannot expect people to know an enormous amount. There is too much to know, in a sense. The days when someone could read every book written are gone.

PIETRI: So how do you portray actual information then, when the people who are delivering that information do not have the knowledge, the expertise even, to make judgments.

KING: I think you just get on with it. It is very difficult. I do not think there is any clean, easy solution to it. As our society gets more complex, there are always people attacking some aspect that they are not familiar with — and sometimes correctly. [It happened] when we did have Three Mile Island, and a Bhopal, when things do go grievously wrong. I am sure if you had talked to Exxon about the safety of their tankers the day before the *Valdez*, they would have said, "We have the best safety systems on tankers, the best captain." And then the oil spilled, and the media is blamed by the oil companies.

I will tell you a story. Charles diBona is the chairman of the American Petroleum Institute and he did not like what we wrote in the *Energy Daily* about the *Valdez*. Our story was true because the delegate of British Petroleum had told it to me. All the other oil companies were deeply upset with Exxon after the spill because of the cost of ANWR. Charles was going on about the media and what was going on. And

I said, "Charlie you have got one thing wrong," and he said, "What is that?" I said, "We did not spill the oil, Exxon did."

He had been so involved in the process that the initial insult of an industrial accident had been forgotten. And the messengers were being shot. Certainly, every time you get into that type of an incident it is overplayed by the media. And if it deals with the hypothetical struts which I talked about, fear, groundless, free-floating anxiety is plentiful. We take a certain risk when we drive an automobile, and every aspect of life is not risk-free. The most dangerous thing is what we are doing in the food industry now, when you have crazy people going around who want every piece of fish inspected as it is caught. Impossible. And they say we will not contemplate benefits.

Ellen Haas runs a group called *Public Voice for Food Policy*. She gave a speech at one of our conferences and said, "I do not want to hear about benefits, we are only discussing risks." Well that is not absolutely illogical. But it is hard to counter that quickly because given the facts, maybe we should just discuss the risk unless you have enough general knowledge or common sense to realize that the risk is an inherent part of existence. We will not tolerate risk in nuclear that we will tolerate in almost anything else.

My own belief is that if the public understood how the air traffic control system works, it would not fly. Or if you

took [a flight] go in and discuss it. I went into Nantucket on Saturday, and it was a very bad day and a lot of people were in this small airport. Planes were missing the approach and the fact that maybe that is how airplanes are controlled and how they operate routinely gave me the idea that we ought to have hearings and debate this.

But with the extraordinary intellectual honesty of the nuclear business, we have welcomed the anti-nuclear activists. We have institutionalized their presence to discuss things that are extremely difficult. And because of the same intellectual honesty, we have never said it is risk-free technology. We have only said it as we know it.

The thing that makes nuclear quite different from everything else is the caliber of the talent in the business. And there is no business that I know about where you can find as many extraordinary minds as you can in the nuclear business. The electric utility business is a boring, tired, unimaginative, unexciting business. The only time it probably was exciting was when it was coupled with nuclear because they interacted with some talented people in the nuclear navy and in law schools in order to deal with their problems. It lifted the industry up. I like to talk to nuclear people because I know they will understand it. That is why it is tragic that we are not getting the intake of young talent into the business.

Llewellyn King was born in southern Rhodesia, now Zimbabwe, in 1939. He dropped out of high school when he was 16 and went into journalism. He has worked as a foreign correspondent in Africa for a variety of international publications, including Time magazine and United Press. Later, he moved to London where he worked on Fleet Street for four years. In 1963, he came to the United States and was employed by the New York Herald Tribune. In 1965, he started the first women's liberation magazine called Women Now, but it was not a financial success and he moved to Washington to the Daily News. Later he joined the Washington Post as an assistant editor.

For three years, King served as a Washington editor for McGraw-Hill. In 1973 he started the Energy Daily. He now publishes — in addition to the Energy Daily — Defense Week, World Food & Drink Report, New Technology Week, Environment Week, Inside DOT & Transportation Week and Food & Drink Daily, one of the first newsletters to be delivered overnight by fax.

King has appeared on many television programs, including the "Today Show," "Meet the Press," "WorldNet" and most recently as guest commentator on "The Nightly Business Report." King also has been published in hundreds of newspapers and magazines around the world. He lives in Virginia and is an avid horseman and pilot.

SARP: A Safeguards Accounting and Reports Program

■
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ABSTRACT

Under POTAS Task D.80, "Development of a Computerized System to Satisfy Safeguards Record and Reporting Requirements in Member States with Small to Medium Nuclear Activity," the Technical Support Organization (TSO) of Brookhaven National Laboratory (BNL) has produced a computer code which will maintain and generate at-facility safeguards accounting records and generate International Atomic Energy Agency (IAEA) safeguards reports based on accounting data input by the user at a Power Reactor Facility. The code is based on a State System of Accounting for and Control of Nuclear Material (SSAC) for light-water-moderated, off load refueled power reactor facilities. Database structure is suited to this type of computerized system, and dBaseIII+ programming language has been used, compiled with Clipper. The program is designed to be user-friendly, to make extensive use of menus and graphics and to run on an IBM PC (or compatible) with color monitor.

I. INTRODUCTION

The Safeguards Accounting and Reports Program (SARP) is a software system designed for use by operators of nuclear reactor facilities under safeguards applied by the International Atomic Energy Agency (IAEA) based on the provisions of the Nuclear Non-Proliferation Treaty (NPT). It is to be used to maintain nuclear materials accounting documents and records or to generate reports for the IAEA. It is expected that the program will be most useful to those states, party to the NPT, whose facilities at present maintain hard copy records, who send hard copy reports to the IAEA and who have no computerized system(s) for safeguards accounting at their facilities to perform their safeguards accounting on an IBM PC (or compatible) computer. Because of the design of the program, it will allow them to generate their IAEA reports essentially automatically. All records and reports are stored as files in the computerized system; printouts of all records, documents and reports can be made as well.

This software was developed by the Technical Support Organization (TSO) at Brookhaven National Laboratory under Task D.80 of the U.S. Program of Technical Assistance to IAEA Safeguards. The model facility and model safeguards accounting regime used in development of the software were those described in IAEA Department of Safeguards Publication STR-1651. Updates to IAEA report formats and additional information about actual fuel movements expected at reactor facilities were obtained in consultation with IAEA staff.

The system consists of a database foundation with additional codes for user interface, file management and printing. The program was written in the dBaseIII+ database language and compiled by using the Clipper compiler. It follows guidelines given in the IAEA Safeguards Information Treatment PC Systems Development Handbook (Draft). Menus guide the user throughout, and the amount of user-entered data has been minimized through extensive provision of default values for as many data items as possible. A tutorial is included in which the user is led through the functions of the system's major segments: initialization, accounting transactions, record printout, report printout, archival of a material balance period and corrections (see Figure 1 for the SARP main menu). The tutorial assumes that the user is completely familiar with IAEA safeguards and with nuclear materials accounting, record keeping and reporting as implemented at the facility.

Main Menu	
1	- Tutorial
2	- Initialization
3	- Accounting Transaction Selection
4	- Record Printout
5	- Concise Note Preparation and Report Printout
6	- Archival of a Material Balance Period
7	- Corrections
Q	- Exit Program
Please select your option	

Figure 1 — SARP Main Menu

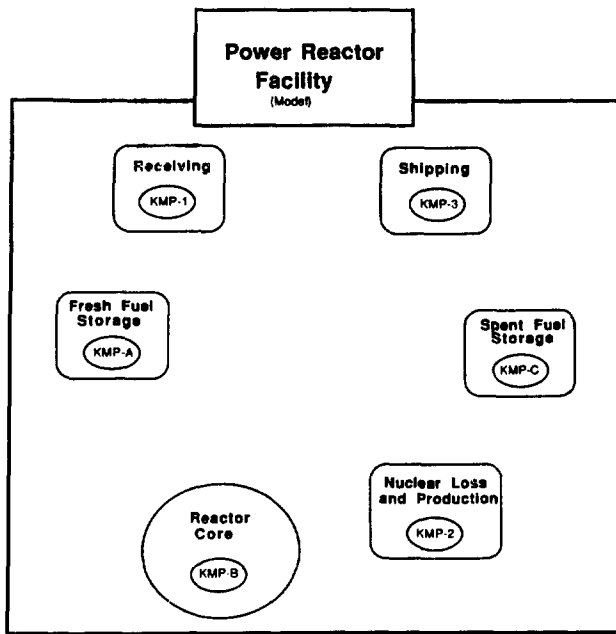


Figure 2
Power Reactor Facility Model Used for SARP

The minimum computer hardware required for SARP is an IBM PC (or compatible) computer with at least 512K bytes of RAM, a hard disk, one floppy disk drive, a color monitor and a printer. Although the program will run on an 8088-based (XT-class) computer, an 80286- (AT class) or 80386-based computer is recommended; a math co-processor (8087/80287/80387) is not required.

The program is documented in a *User Manual*² and a *Technical Reference Manual*.³

II. THE SARP SYSTEM

The SARP system (including its built-in tutorial) initially consists of 37 files; as data are entered into the system, more files may be created. The actual executable code is contained in a single file, SARP.EXE, while the remainder of the files comprise the database operated on by the program.

The model facility for which the code is designed is shown in Figure 2.

Specifically, the system can:

1. Allow user input of safeguarded nuclear material accounting transaction data representing "movements" of nuclear material at the facility.
2. Keep track of all such accounting information in a database.
3. Generate nuclear material accounting records for the facility, both database files or standard ASCII files (diskette) and hard copy.

4. Generate IAEA Safeguards Reports (i.e., the Material Balance Report, Inventory Change Report and Physical Inventory Listing), both as database files or standard ASCII files (diskette) and hard copy.

A. Tutorial features

The tutorial allows the user to become familiar with the operation of the program before beginning to use it for actual safeguards information. It assumes that the user is familiar with basic IAEA nuclear materials accounting and reporting practices and procedures but assumes essentially no prior computer experience. The tutorial operates in exactly the same way that the program does in actual operation, except that the data entered during the tutorial process are not saved to the database files. For each subject in the tutorial, the same data entry and data summary screens which are displayed in actual operation are displayed to the learning user, and he or she is prompted to enter the appropriate information. If incorrect or inappropriate data are entered, the program will display a message indicating that this is the case and will supply an example of the correct data.

B. SARP organization and use

The inputs supplied by the user are data relating to accounting transaction entries normally contained in internal transfer documents (IT), inventory change documents (ICD), fuel assembly history cards (FAHC), general ledgers and subsidiary ledgers. In addition, data for the initial locations of fuel assemblies in the facility's fresh fuel storage, reactor core and spent fuel pond are used.

C. Initialization

The ideal time for this system to be installed and initiated would be at the beginning of a new material balance period, i.e., when all accounting books are current and IAEA reports have just been issued for the previous material balance period. A one-time Initialization procedure will be required in which the computerized system will be brought up to date; i.e., the data already kept in hard copy at the facility (mainly the general ledgers, subsidiary ledgers and fuel assembly history cards) will need to be entered by the user into the computerized system's general ledger database files, subsidiary ledger database files, fresh fuel map, reactor core map and spent fuel maps and fuel assembly history card database files. In this way, inventories can be started at their correct values for the new material balance period in which the computerized system will be maintaining the books. Initialization information is used by the system to configure various database files and reports and must be entered before any other operations are possible. The information required for initialization should be contained in the Facility Attachment and in the facility nuclear materials accounting records. The data items required for initialization of the SARP system are listed in Table 1.

Table I
Required Initialization Data

<ul style="list-style-type: none"> • Country code • Facility code • MBA code • Flow and inventory KMP codes • Dimensions of the fuel storage pond (number of rows and columns) • Starting and ending row and column for fresh fuel storage • Inventory of plutonium, uranium and isotope (U-235) in all KMPs • Batch identity, KMP and storage location for all fuel assemblies • Complete fuel assembly history card data for all fuel assemblies

D. Nuclear material movement — accounting transactions

Once the system has been “initialized,” it is ready to handle the accounting for day-to-day nuclear material movement at the facility. The main types of nuclear material flows that can occur at a facility are:

1. Receipt of fresh fuel assemblies.
2. Movement of fresh fuel from receiving to fresh fuel storage.
3. Movement of fresh fuel from fresh fuel storage to reactor core.
4. Irradiated fuel movement within the reactor core.
5. Spent fuel removal from reactor core to spent fuel storage.
6. Spent fuel transfer from storage to shipping.
7. Spent fuel shipment from the reactor facility.

Occasionally, faulty or unacceptable fuel assemblies may be received; in such cases, a transaction for movement from fresh fuel storage to shipping would be needed. Also, fuel assemblies that have already been in the reactor core may be returned to the core from temporary storage. Both these types of fuel movements are included as transactions in SARP.

The user must tell the system which of these transactions is occurring and then be prepared to input data needed for the accounting documentation pertinent to that transaction choice. Figure 3 shows the accounting transaction selection menu. Figure 4 shows the principal material flows and the corresponding accounting documentation requirements for each of the main transactions. The abbreviations used in Figure 4 are:

ICD-MT = inventory change document-material transfer

FAHC = fuel assembly history card

IT = Internal Transfer Document

KMP-A, B, C = Key Measurement Points A, B and C

These requirements are fulfilled by the accounting database program. The actual user input requirements are consid-

Accounting Transaction Selection	
1	- Receipt of fresh fuel assemblies
2	- Movement of fresh fuel from receiving to storage
3	- Movement of fresh fuel from storage to shipping
4	- Movement of fresh fuel from storage to reactor core
5	- Irradiated fuel movement within reactor core
6	- Spent fuel removal from core to spent fuel storage
7	- Spent fuel transfer from storage to shipping
8	- Spent fuel transfer from storage back to core
9	- Fuel shipment from the reactor facility
Q	- Return to main menu
Please select your Option or press [Esc]	

Figure 3

Accounting Transaction Selection Menu from SARP

erably fewer because one set of entries is often distributed to several different accounting record locations. For example, user-input data can be duplicated between inventory change document - material transfer and general and/or subsidiary ledger entries. When this occurs, the *program, not the user*, inputs the duplicate data in its proper place; a major goal of SARP is to limit the need for user input and to minimize data entry errors. Transfers and distribution of user input data are main functions of the software. In essence, the user input is the minimum amount of data necessary to complete the accounting documentation required for the transaction of the user's choice.

Regardless of the specific type of transaction selected, the process of entering transaction data is essentially the same: data entry screens are displayed with highlighted fields for all data needed, in which the user simply types the data and presses the “Enter” or “down-arrow” keys to move to the next data field. Where appropriate, the program supplies default values for data, which may be accepted simply by pressing the Enter or down-arrow keys. In most cases, the program will also display a screen showing a summary of the data just entered, allowing the user to either delete the data, keep them as entered or modify them by typing over the incorrect data. For transactions involving changes to ledger quantities, ledger data screens are displayed showing the user the results of the transaction just performed. If nuclear production or loss is involved, a screen showing an inventory change document recording that production or loss is displayed. If the transaction involves the reactor core or the fuel storage pool, the user is presented with graphical screens showing maps of fuel assembly locations in the core or pool after the transaction has been recorded.

The data entry process for transaction 1 (receipt of fresh fuel assemblies) is described in detail in the following section as an example of the transaction data entry process. Entry of data for other types of transactions is similar.

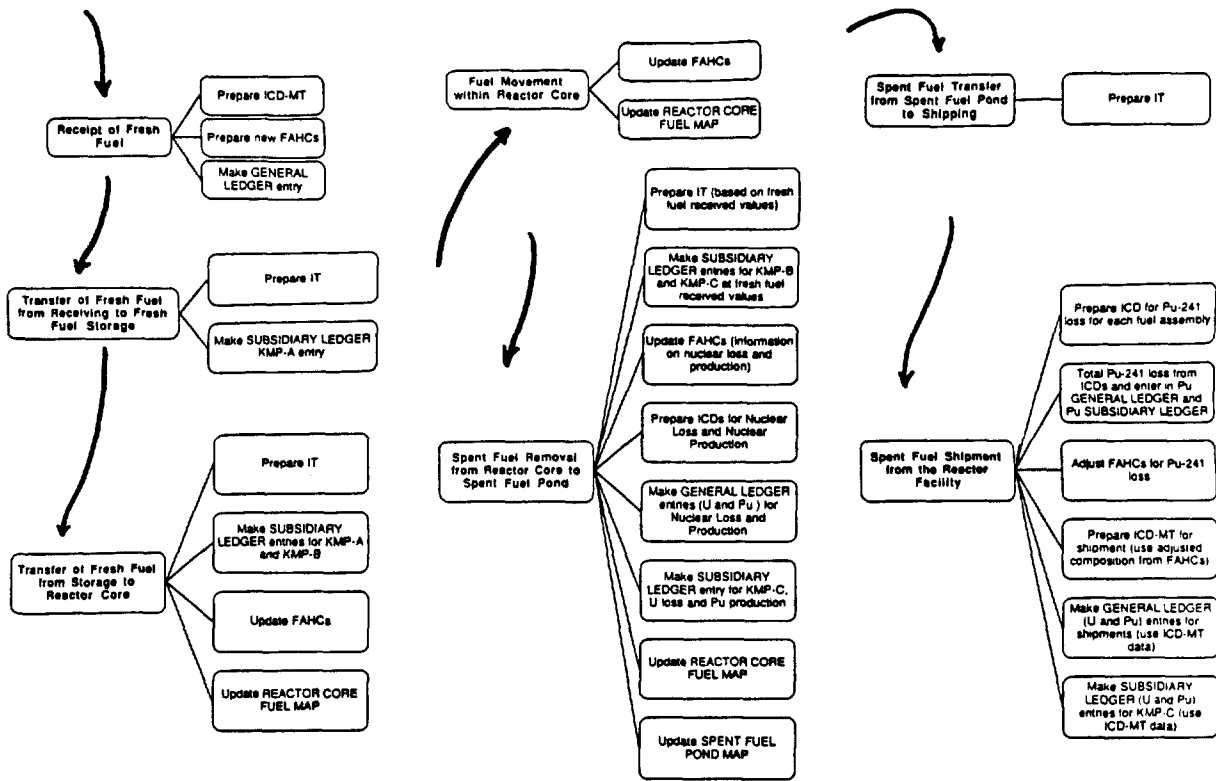


Figure 4

Principal Safeguarded Nuclear Material Movements at a Power Reactor Facility and Accounting Documentation for Each

Enter necessary data for transaction 1 — Receipt of Fresh Fuel
 Material Description: % Enriched Uranium Fuel Assemblies
 Mtl Code: Unit: G

Shipper: Address: MBA: Change Code: KMP Code:

Receiver: Reactor XXA Address: MBA: XXA1 Change Code: KMP Code: KMP-1

Doc. No. MT- 3 Notes:

Shipper-Receiver Difference: 0.00 Date Measured:
 Shippers values accepted

Shipping date Shipper Initials
 Receiving date: 90.12.07 Receivers Initials
 Preparers Initials

Figure 5

Fresh Fuel Receipt Data Entry Screen

Batch Identity	No. of Items	Ele. Code	Iso. Code	Element Weight	% Iso.	Iso. Weight
----------------	--------------	-----------	-----------	----------------	--------	-------------

Figure 6

Fresh Fuel Batch Data Entry Screen

Fuel Assembly History Card				
Date Received	90.12.07	ICD No. MT- 3		
Fuel Assembly No.	LKA-0101	12584 g U – 235		
As Received:	422405 g U			
Fresh Fuel Storage Location:				
Exposure History:				
<u>Period</u>	<u>Reactor Core Location</u>	<u>Date In</u>	<u>Date Out</u>	<u>Fraction Average Power</u>
1				
2				
3				
Average MWd/t:				
Nuclear Production:		g Pu		
Nuclear Loss:	g U	g U-235		
Fuel Content:	g U	g U-235	g Pu	
Spent Fuel Storage Location:				
Press any key to see the rest of this card				

Figure 7
Fresh Fuel Receipt FAHC Data Entry Screen

You have just received the following fuel assemblies.		
Is this correct?	Y	
Fuel Assembly	Weight of Uranium	Weight of Isotope U235
LKA-0101	422405	12584

Figure 8
Receipt Summary Screen

E. Transaction 1: The SARP procedure

Transaction 1 is selected to input data on receipt of fresh fuel assemblies from outside the facility. When the user selects this transaction, the program responds by displaying the fresh fuel receipt data entry screen shown in Figure 5. The screen is displayed with default values for certain items; the user may accept these values or change the values by typing the desired data over the default values. If a mistake is made during data entry, the up- and down-arrow keys may be used to move around the screen to correct data. When all data have been entered, the program responds by displaying the batch data entry screen shown in Figure 6.

The batch data entry screen is used for inputting data on the identity and content of each fuel assembly received. The user types in the requested data after which the program responds by displaying the fuel assembly history card for that assembly (example with default data entry completed shown in Figure 7). The user may then enter additional data on the fuel assembly if desired or may simply press the Enter key to accept the default values.

Once all data have been entered for all fuel assemblies, the program responds by displaying a receipt summary screen, shown in Figure 8. If all the data are correct, the user should press the Enter key while Y is displayed in the highlighted field. If any data are incorrect, the user should type N in the highlighted field and press the Enter key in order to correct the erroneous data. The program responds by displaying the correction screen shown in Figure 9. At this point, the user

may either delete the record (and re-enter the receipt data, starting over again), modify the record by changing the incorrect data or leave the record unchanged and accept it as is. In any case, once the user has made any desired changes, the program responds by displaying the general ledger summary screen shown in Figure 10. Once satisfied that all general ledger data are correct (or after noting any errors for capability discussed below), the user can press any key which causes the program to return to the transaction selection menu (Figure 3).

F. Fuel assembly locator maps

One of the features of the program is that when a transaction involves movement of fuel into or out of the reactor core, the program displays a map of the core such as that shown in Figure 11. The reactor core map screen is initially displayed with only the sector map and legend shown on the left side of the figure. The user is prompted to enter the number corresponding to the sector of the reactor core to be viewed. The program responds to sector selection by displaying the detailed sector map shown on the right side of Figure 11, with the identification numbers of the fuel assemblies in each location shown in that sector.

G. Facility record printout

The SARP system allows the user to select and print out any desired facility records, simply by choosing the type of record to be printed and then selecting the specific record(s)

Do you want to delete this record entirely, modify it, or leave it unchanged <D/M/L>?
 LKA-0101 422405 12584

Figure 9
 Fresh Fuel Receipt Batch Data Correction Screen

GENERAL LEDGER - URANIUM									
Facility:		Reactor XXA		MBA: XXA1		Element Code: E			
Material Description:		Enriched Uranium Isotope		Code: G		Unit: Grams			
		Receipts		Additions		Shipments		Removals	
Date	No	Elem. Iso.		Elem. Iso.		Elem. Iso		Elem. Iso.	
90.12.07	MT- 3	422405 12584		0 0		0 0		0 0	
		Inventory		Elem. Iso.					
		841883 25168							
Hit any key to continue - Return to transaction selection menu									

Figure 10
 General Ledger Summary Screen

of that type. All record selection is done by using menu choices and highlight bars, as is the case throughout.

H. IAEA reports printout

A principal output of the program is completed IAEA safeguards reports, i.e., materials balance reports (MBAs), inventory change reports (ICRs) and physical inventory listings (PILs). The output is diskette and hard copy.

The diskette files are standard dBaseIII+ files and/or standard ASCII files based on field information supplied by the IAEA. The hard copy format is identical with current IAEA report forms.

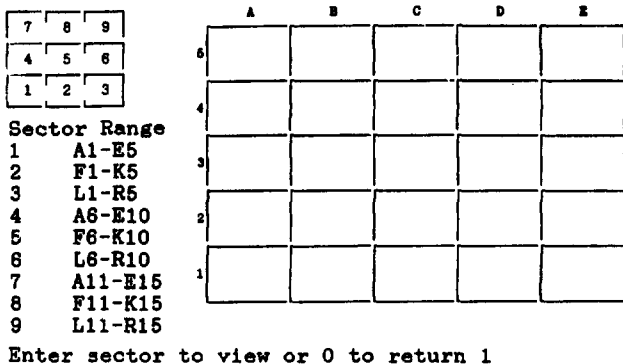


Figure 11
 Map of the Reactor Core

Printing of reports required to be submitted to the IAEA (MBRs, ICRs or PILs) and, optionally, preparation of concise notes explaining specific entries in the reports, are accomplished through the *concise note preparation and report printout* routine. ASCII files of printout choices are written to the /SARP/EXE directory on the user's hard disk and are named ICR.TXT, PIL.TXT, MBR.TXT or CNOTE.TXT as appropriate, depending upon the type of report being printed.

I. Archival of a material balance period

The SARP system provides the user with the ability to write a complete set of nuclear materials accounting data for a material balance period to floppy disk(s). This frees space on the user's hard disk and reduces the amount of data displayed, making the system easier to use. When the data are written to floppy disk, the ending physical inventory for the period automatically becomes the beginning inventory for the next period. The data are written in the form of dBase III+ database files, so they can be accessed and manipulated by any program capable of recognizing this format.

J. Corrections

In some cases, it may be necessary to correct transaction or initialization data previously entered into the SARP system. Corrections can be made at the time a transaction is performed, by using the verification screens displayed for most transactions. After-the-fact corrections on transactions must be made by using the program's built-in correction facility.

To make after-the-fact corrections, the corrections routine is used. The program organizes transaction data by transaction number (see Figure 3). In the corrections mode, for a transaction selected, the program responds by displaying a list of transaction records available in the system for correction. The user may select the record to be corrected, and the program responds by displaying the contents of the selected record and gives the user options for deletion, modification or returning as is.

III. SUMMARY

The SARP system provides states under INFCIRC/153-type (NPT) IAEA safeguards an easy-to-use, efficient way to keep records and prepare reports for light-water reactors. The system is well-documented and user-friendly. It includes a tutorial sufficient to allow a safeguards-experienced novice user learn easily how to use the system. Use of the SARP system should both reduce the burden on states under IAEA safeguards and improve the accuracy of data submitted to the IAEA, thus improving the effectiveness and efficiency of safeguards.

REFERENCES

1. "Detailed Description of the SSAC at the Facility Level for Light Water Moderated (off-load refueled) Power Reactor Facilities", R. J. Jones, E.V. Weinstock, and M. S. Lu, International Atomic Energy Agency Department of Safeguards STR-165, Vienna, March 1985.
2. "SARP: Safeguards Accounting and Reports Program User Manual", C. Ruth Kempf, Alan M. Bieber, Jr., and Joann Prizzi, ISPO-327, Technical Support Organization, Brookhaven National Laboratory, Upton, New York, December 1990.
3. "SARP: Safeguards Accounting and Reports Program Technical Reference Manual", C. Ruth Kempf, Alan M. Bieber, Jr., and Joann Prizzi, ISPO-328, Technical Support Organization, Brookhaven National Laboratory, Upton, New York, December 1990.

Alan Bieber Jr. received his B.A. from Yale University and his M.A. and Ph.D. from the University of Connecticut, all in archaeology. In 1975, following completion of his doctoral research at Brookhaven Laboratory, during which he performed neutron activation analysis of archaeological ceramics from the Middle East, Bieber joined the Technical Support Organization. Since that time, he has been involved in a wide range of projects in nuclear safeguards, security, information classification and arms control treaty verification. His recent professional activities include development of methods for evaluation of the effectiveness of IAEA safeguards, development of MC&A training materials and courses for DOE, and work on a PC-based system for arms control treaty verification.

Ruth Kempf received her two B.S. degrees in German and Chemistry, her Master of Science in radioanalytical chemistry and her Ph.D. in physical chemistry from Rensselaer Polytechnic Institute. After six years of work in nuclear waste management at Brookhaven Laboratory, she joined the Technical Support Organization in 1988. Kempf's recent work in addition to development of the SARP system has included other work in support of international safeguards and research in arms control treaty verification. Most recently, she has been serving as technical assistant to the U.S. Ambassador to the Conference on Disarmament.

New Line Introduced for Smaller Videoimagescope

A new small-diameter Videoimagescope has been added to a line of video remote visual inspection equipment by Olympus Corp., Industrial Fiber Optics Division. Designated as the Model IV8D3, it has a nominal probe diameter of 8 mm. Accordingly, the probe, which is equipped with a miniature CCD color chip camera in its tip, needs an access port of approximately 0.330 inch for insertion. The IV8D3 is ideal for inspecting the interiors of a wide range of equipment: gas turbines, boiler tubes, heat exchangers, castings and pipe work.

According to Olympus, the image provided by the new Model IV8D3 is brilliant and has high resolution. This has been achieved by the instrument's fiber optic light guide and the design of its distal tip CCD camera. The light guide efficiently transmits light from the light source to the tip to brightly illuminate the work area. The CCD camera has color dedicated pixels that provide high resolution and true color images in real time, without motion blur or rainbow effect.

Designed for easy handling, highly compact and portable, the IV8D3 comes in three probe lengths: 2 m (6.6 feet), 3.5 m (11.5 feet) 7.5 m (23 ft.).

For more information on Videoimagescopes, contact Olympus Corp. Industrial Fiber Optics Division, 4 Nevada Dr., Lake Success, NY 11042, or call (516) 488-3880.

New Glovebox Available

SAES Getters/U.S.A. Inc. and the Canadian Fusion Fuels Technology Project have entered into a collaborative agreement to jointly develop and market packaged tritium cleanup systems for glovebox atmospheres. The CFFTP-SAES Glovebox Cleanup System uses getter bed technology to remove tritium from inert gases,

typically argon or nitrogen, used in gloveboxes housing tritium systems.

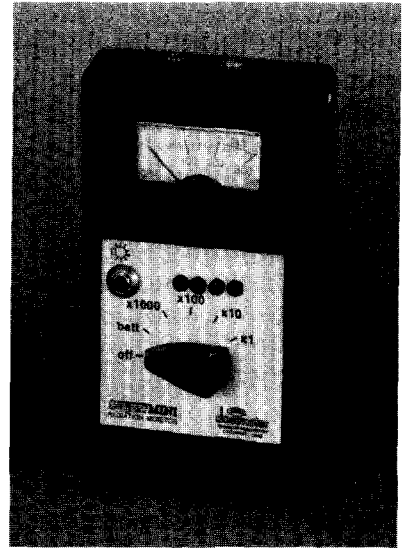
Designed to control glovebox tritium concentrations to less than 1 microcurie per liter, the system is intended for laboratory use and industrial applications. Gas recirculates through the cleanup system at flow rates up to 120 liters per minute. Tritium removed from the inert gas is stored on getter beds designed by CFFTP using patented SAES alloy getter material. Storage capacity is up to 5000 curies, which can be recovered from the getter beds for reuse.

Following the construction and testing of five engineering prototypes by Ontario Hydro's Research Division, SAES Getters/U.S.A. will manufacture and market a commercial version of the cleanup system. For more information, call Leigh Westin at (719) 576-3200.

New Technical Dictionary Released

RSA Publications has announced the publication of the *Dictionary of Health Physics and Nuclear Sciences Terms*, compiled by Rex J. Borders. A single-volume reference, the dictionary organizes the profusion of radiation protection terms and definitions into a concise, clear format. It contains more than 4,500 terms and definitions from 1962 to present, culled from many sources, including IAEA, ICRP, ICRU, NCRP, NRC, ANSI and IEEE. Handy appendices include acronyms, reference charts, tables of constants, SI units, the elements and more.

The dictionary is available through RSA Publications, a Division of Radiation Safety Associates Inc., 10 Pendleton Drive, P.O. Box 19, Hebron, CT 06248; phone (203) 228-0824, fax (203) 288-4402. Cost is \$95 plus shipping and handling (\$7.50 United States, Canada and Mexico; \$10 other countries).



DCA New Survey Meter Designed for Accuracy

Dosimeter Corp. of America's new Model 3500 radiation/contamination survey meter is designed for greater accuracy and ease of operation. The Model 3500's internal energy compensated detector measures X and gamma radiation from 0 to 3 R/hour and is housed in a lightweight, scratch-resistant ABS plastic case. Because of its compact size, streamlined shape and large selector switch, the Model 3500 can be easily operated with one hand, even while wearing gloves.

The Model 3500's meter employs a clean, readable linear scale design that virtually eliminates geotropism, so accurate readings may be obtained in any orientation. Simply by touching a button, you activate the display light to illuminate the meter in low light areas. The Model 3500's four separate ranges are independently calibrated to $\pm 15\%$, since each range has its own easily accessible calibration control, making calibration simple and accurate.

For more information, write or call Dosimeter Corp. of America, 11286 Grooms Road, Cincinnati, OH 45242-1428, (800) DCA-VALU.

November 19 – 21, 1991

Pollution Control Equipment Matchmaker and Seminar, London, England. *Sponsor:* U.S. Department of Commerce. *Contact:* Molly Costa, U.S. and Foreign Commercial Services, U.S. Department of Commerce, Room H2116, Washington, D.C. 20230; phone (202) 377-4231.

December 1 – 6, 1991

American Society of Mechanical Engineers 112th Winter Annual Meeting and Exposition, Atlanta, Ga. *Contact:* ASME Meetings Department, phone (212) 705-7795.

January 15 – 17, 1992

Spent Fuel Management Seminar IX, Washington, D.C. *Sponsor:* Institute of Nuclear Materials Management. *Contact:* Laura Rainey, INMM headquarters, phone (708) 480-9573.

February 10, 1992

National Symposium on Atomic Energy, Tokyo, Japan. *Sponsor:* Atomic Energy Society of Japan and 41 related societies. *Contact:* AESJ, No. 1-13, 1-chome, Shimbashi, Minato-ku, Tokyo 105, Japan, phone 03-508-1261.

March 2 – 6, 1992

Pathway Analysis and Risk Assessment for Environmental Compliance and Dose Reconstruction — The Second Course. *Sponsor:* Radiological Assessments Corp. *Contact:* CAPS Ltd., 1715 North Wells, #34, Chicago, IL, phone (312) 988-7667.

July 19 – 22, 1992

INMM's 33rd Annual Meeting, Orlando, Fla. *Sponsor:* Institute of Nuclear Materials Management. *Contact:* Laura Rainey, INMM headquarters, phone (708) 480-9573.

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Clement J. Rodden, director of the New Brunswick Laboratory of the Atomic Energy Commission (AEC) from its founding in 1949 until his retirement in 1970, passed away on July 20, 1991, in York, Maine, at the age of 89. Rodden is recognized as one of the pioneers of analytical chemistry of nuclear materials.

Rodden joined the National Bureau of Standards (NBS) in 1937, where his expertise in microanalysis greatly helped the analysis of nuclear materials prior to, and during, the Manhattan Project. Members of the nuclear material measurement community unanimously would agree that the appellation "Mr. Uranium" belonged to Clem Rodden.

He, with his colleagues from the NBS, answered the call of the AEC in 1949 to establish a laboratory in New Brunswick, N.J. to define the uranium assay values of ore shipments from the (then) Belgian Congo. Under Rodden's direction, the New Brunswick Laboratory (NBL), pioneered and maintained excellence in the measurement science of nuclear materials. The

NBL developed and transferred to other laboratories in the nuclear community improvements in measurement methods for uranium.

Rodden compiled and edited several still-used and frequently referenced compendia of analytical methods: *The Analytical Chemistry of the Manhattan Project*, *The Analysis of Essential Nuclear Reactor Materials*, and *Selected Measurement Methods of Plutonium and Uranium in the Nuclear Fuel Cycle*.

The NBL, under Rodden's direction, initially characterized the chemical and isotopic compositions of materials later to be certified by the NBS as Standard Reference Materials. The NBL also managed ongoing interlaboratory measurement comparison programs that served to demonstrate the consistency of uranium (and later plutonium) measurements throughout the complex.

Those who have followed Rodden, both at the NBL and at other laboratories of the nuclear community, recognize and are grateful for the legacy of excellence in the measurement science of nuclear materials that he provided.

ENGINEER

Safeguards Development Engineer

Battelle PNL located in Richland, Wash., is seeking an experienced Safeguards Development Engineer reporting to our Safeguards and Security Department. This position is responsible for the development and implementation of PNL's nuclear materials management program: the development of internal safeguard plans; incident investigation documentation; and conducting operational assessments.

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- Five—plus years of experience in the technical application of safeguards principles
- Excellent organizational skills and the ability to manage multiple tasks
- Working knowledge of safeguards computer applications
- Ability to receive Department of Energy security clearance

Richland is located in Southeastern Washington and offers all the amenities of small town living including affordable housing, rich recreational opportunities and an excellent climate. Battelle has operated the Pacific Northwest Laboratory for the Department of Energy for over twenty-five years, providing basic applied research into environmental restoration.

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