Bulletin

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Canadian Radiation Protection Association
Association canadienne de radioprotection

Student Corner
Leah Interviews Najah Fajurally, Student Paper Contest Winner

Book Review
An Introduction to Uncertainty in Measurement

Repatriation of High-Risk Radioactive Materials

Founders' Award *Goes to Stéphane Jean-François*

CRPA Statement *on the proposal by the Ontario Drinking Water Advisory Council to lower the Ontario drinking water quality standard by a factor of 350*

2010 Anthony J. McKay Student Paper Contest Winner
Development of an Activated Thulium Source for the in vivo *Measurement of Hg in Humans Using XRF*

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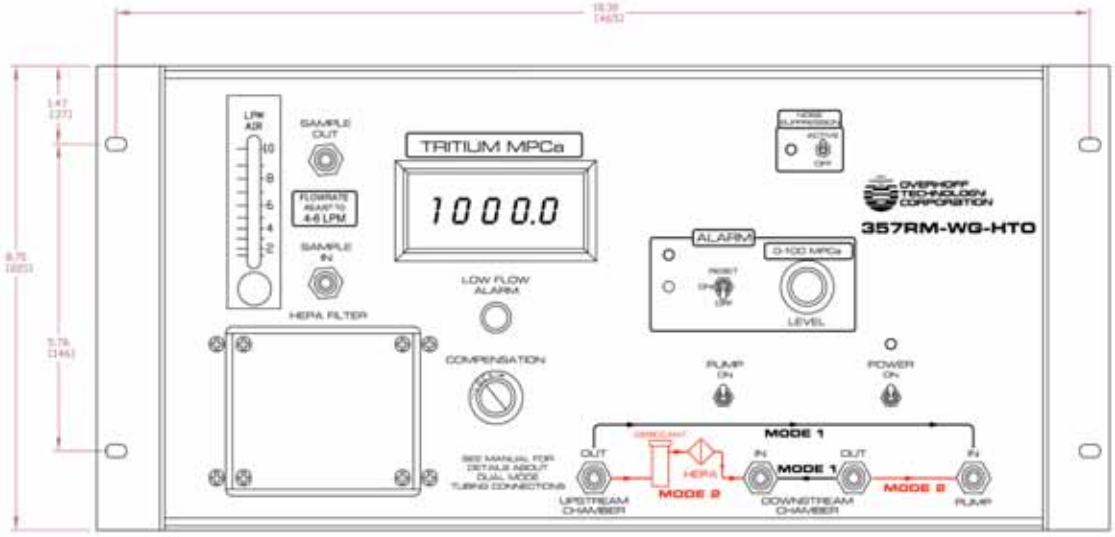

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Prospectus

The Canadian Radiation Protection Association (CRPA) was incorporated in 1982. The objectives of the association are

- to develop scientific knowledge and practical means for protecting all life and the environment from the harmful effects of radiation consistent with the optimum use of radiation for the benefit of all,
- to further the exchange of scientific and technical information relating to the science and practice of radiation protection,
- to encourage research and scientific publications dedicated to the science and practice of radiation protection,
- to promote educational opportunities in those disciplines that support the science and practice of radiation protection,
- to assist in the development of professional standards in the discipline of radiation protection; and
- to support relevant activities of other societies, associations, or organizations, both national and international.

The association publishes the *Bulletin* four times a year and distributes it to all members. Subscription rates for non-members, such as libraries, may be obtained from the secretariat.

Members of the association are drawn from all areas of radiation protection, including hospitals, universities, the nuclear power industry, and all levels of government.

Membership is divided into five categories: full members (includes retired members), with all privileges; associate and student members, with all privileges except voting rights; honorary members, with all privileges; and corporate members. Corporate membership is open to organizations with interests in radiation protection. Corporate members are entitled to have their name and address listed in each *Bulletin*, a complimentary copy of each *Bulletin*, a copy of the *Membership Handbook* containing the names and addresses of all CRPA members, reduced booth rental rates at the annual meeting, and reduced advertising rates in the *Bulletin*.

Application forms are available on the CRPA website or from the secretariat.

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Les objectifs de l'Association canadienne de radioprotection, dont les statuts ont été déposés en 1982, sont les suivants:

- Développer les connaissances scientifiques et les moyens pratiques pour protéger toute forme de vie et l'environnement des effets dangereux des radiations, et ce, d'une manière compatible avec leur utilisation optimale pour le bénéfice de tous;
- encourager les échanges d'informations scientifiques et techniques relevant de la science et de la pratique de la radioprotection;
- encourager la recherche et les publications scientifiques dédiées à la science et à la pratique de la radioprotection;
- promouvoir les programmes éducationnels dans les disciplines qui soutiennent la science et la pratique de la radioprotection;
- aider à la définition des normes professionnelles concernant la radioprotection, et
- soutenir les activités pertinentes des autres sociétés, associations, organisations nationales ou internationales.

Les membres de l'association proviennent de tous les horizons de la radioprotection, y compris les hôpitaux, les universités, l'industrie nucléaire génératrice d'électricité et tous les niveaux du gouvernement.

L'association publie le *Bulletin* quatre fois par an et le fait parvenir à tous les membres. Le prix d'un abonnement pour les non-membres, par exemple une bibliothèque, peut être obtenu auprès du secrétariat.

Les membres sont classés selon cinq catégories: membres à part entière (y compris les membres retraités), avec tous les privilèges; membres associés et étudiants, avec tous les privilèges sauf le droit de vote; membres honoraires, avec tous les privilèges; et membres corporatifs.

Les membres corporatifs ont droit d'avoir leur nom et leur adresse indiqués dans chaque *Bulletin*, de recevoir un exemplaire du *Bulletin*, de recevoir un exemplaire de l'annuaire de l'association contenant les noms et adresses de tous les membres de l'association, d'avoir un kiosque à tarif réduit lors des conférences annuelles, d'avoir un espace publicitaire à tarif réduit dans le *Bulletin.*

Les formulaires de demande d'adhésion peuvent être obtenus sur le site Web ou auprès du secrétariat.

Contents/Contenu

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Regular Columns / Contributions permanentes

Features / Articles

Cover Photo Dr. Gary Kramer, a senior research scientist at Health Canada, was presented with an Honorary Life Membership in the Canadian Radiation Protection Association (CRPA) by Dave Tucker, CRPA past president, at the annual conference in 2010. Gary's research on internal radiation assessment and protection, focusing on the accuracy of measurements made on individuals potentially contaminated by radioactive materials, has resulted in improved protection from radiation overexposure. Gary is a past president of CRPA and is currently serving as an executive council member for the International Radiation Protection Association.

Photo sur la couverture Lors du congrès annuel de 2010, Dave Tucker, ancien président de l'Association canadienne de la radioprotection (ACRP), a remis le titre de membre honoraire à vie de l'ACRP à Dr Gary Kramer, chercheur scientifique principal à Santé Canada. En ciblant l'exactitude des mesures prises sur les individus potentiellement contaminés par des substances radioactives, les recherches de Gary portant sur l'évaluation des rayonnements internes et la protection du corps humain contre ceux-ci ont permis d'améliorer la protection contre la surexposition au rayonnement. Ancien président de l'ACRP, Gary siège présentement au conseil d'administration de l'Association internationale pour la protection contre les radiations.

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President's Message / Message du Président

J'écris ce message quelques semaines à peine après le congrès annuel qui s'est tenu à Edmonton. L'année dernière au congrès de Montréal, lorsque Gary Hugues nous a tous invités au congrès 2010, il nous avait alors dit qu'à Edmonton la fin du mois de mai correspond au début du printemps. Certains parmi nous étaient sceptiques, et pourtant, lors de la première journée de notre rassemblement annuel nous avons bel et bien vu de la neige. Cependant, grâce à l'hospitalité du comité organisateur local ainsi qu'aux fameuses vestes de l'ACRP, nous avons été tenus au chaud tout au long de ce congrès relevé. Le congrès annuel et le *Bulletin* de l'ACRP étant les principales raisons de l'existence de notre association, le présent *Bulletin* est consacré au congrès 2010, dont le programme avait si belle apparence que l'on a proposé qu'il serve de modèle pour les prochains congrès. Je tiens à remercier tous les membres du comité organisateur local pour leur temps et les efforts déployés. J'étais heureux de nous y voir si nombreux et de participer au moment mémorable qu'a été le départ à la retraite de Tony MacKay (âgé de 95 ans), qui quittait son poste de président du comité des archives de l'ACRP.

Comme c'est l'habitude durant les assemblées générales annuelles de l'ACRP, nous avons remercié les membres sortants du conseil et avons accueilli les nouveaux membres. Je profite de cette occasion pour ajouter mes remerciements à ceux exprimés par Dave Tucker à l'endroit de Wayne Tiefenbach, pour son extraordinaire contribution au maintien de notre association à titre de trésorier pendant 12 ans. Je tiens également à remercier Valérie Phelan et Frank Tourneur pour leur travail à titre de directeurs, ainsi que Gary Wilson pour son exceptionnelle participation au conseil de l'association durant les sept dernières années au cours desquelles il a occupé les postes de président et de directeur. Je suis certain que chacun d'eux continuera d'être actif au sein de notre association. Le nouveau conseil d'administration est composé de nouveaux visages et de membres expérimentés. Reflétant les changements observés de par le monde, c'est la première fois, depuis que je suis membre de l'association, que la moitié des participants aux réunions du conseil sont des femmes.

Le nouveau conseil mettra tous les efforts nécessaires afin de poursuivre le travail de nos prédécesseurs et, comme il se doit, tentera d'accomplir de nouvelles tâches. Considérant la nature bénévole de notre association, nous ne pouvons accomplir notre travail sans votre soutien continu. Nous sommes donc ouverts à toute nouvelle idée. Je considère que les comités de l'ACRP sont extrêmement importants. Ils offrent à chacun des membres la chance de contribuer à l'association. J'invite donc tous les adhérents à devenir membre d'au moins un comité. Lors

suite à la page 39 . . .

I am writing this message only a few weeks after the annual conference in Edmonton. When Gary Hughes at the Montreal conference presented the invitation for the conference in Edmonton, he told us that in Edmonton, late May is early spring. Some of us were skeptical, but on the first day we saw snow. However, thanks to the hospitality of the local organizing committee and to the famous CRPA vests we had a great conference and were kept warm at all times. The annual conference and the CRPA Bulletin are the main reasons for our existence as an association. This issue of the CRPA Bulletin is dedicated to the 2010 Edmonton conference. The conference program looked great and it was proposed that it be used as a template for future conferences. I want to thank all members of the local organizing committee for their time and effort. I was happy to see many of us there and to be part of a memorable moment: the retirement of Tony MacKay (at the age of 95) from the function of the Chair of the CRPA archives committee.

As usual during the CRPA annual general meeting we thanked those members of the board who were leaving and we welcomed the new members. I want to take this occasion to add my thanks to Dave Tucker's and commend Wayne Tiefenbach for his extraordinary contribution to the well-being of our association in his capacity as treasurer for 12 years. I also want to thank Valerie Phelan and Frank Tourneur for their work as directors and Gary Wilson for his exceptional contribution to the association as the former president and director: he was a member of the board for seven years. I am sure that all will continue to be active members of our association. The new board of directors is a mixture of new faces and some more experienced members. As an expression of the changes we see in our world, it is the first time, since I became a member of the association, that half the participants at the board meetings will be women.

The new board will make every effort to continue the successful work of our predecessors, and, as it should always be, will try to accomplish new tasks. As a volunteer association, we cannot accomplish our duties without your continued support and we welcome new ideas. I consider the CRPA committees extremely important in offering the opportunity to contribute to the association. I invite every member of the association to become an active member of at least one committee. At the annual meeting we discussed new ideas to improve the nomination process.

continued on page 39 . . .

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Editor's Note / Message du rédacteur en chef

De la ville d'Edmonton, je ne connaissais que les célèbres Oilers et leur dieu vivant, Wayne Gretzky. C'est donc avec plaisir que j'ai entrepris mon pèlerinage annuel afin de rencontrer mes collègues du panthéon de la radioprotection dans le cadre du congrès de l'ACRP. En 2010, le plaisir était encore plus grand puisque l'association s'aventurait hors des sentiers battus pour baptiser une ville qui n'avait encore jamais reçu une assemblée de fidèles de la protection radiologique. Comment aurais-je pu, en tant qu'apôtre du rayonnement, manquer un congrès dont le thème est « Aider le professionnel de la radioprotection »? Mon âme de professionnel a toujours besoin d'aide. Sauvez mon âme!

C'est dans cet esprit (de bottine) que j'ai découvert Edmonton, ou plus précisément, son très célèbre centre d'achat pharaonique, qui permet, en marchant dans un univers climatisé, de se rendre du quartier chinois au Bourbon Street, en passant devant un morse savant, quelques animaux exotiques et des baigneurs aguerris bravant une piscine à vagues. J'ai aperçu tout ça avant de retrouver mon hôtel, le FantasyLand, qui nous accueillait pour un nouveau congrès relevé.

Malgré le nom de l'hôtel, qui m'a valu des commentaires dubitatifs de la part de mes supérieurs, ce congrès n'avait rien de fantaisiste. Stuart Hunt, Trevor Beniston et leur équipe vous le confirmeront. D'ailleurs, Trevor a travaillé sur le programme scientifique jusqu'à la toute dernière minute, devant même composer avec plusieurs annulations! Chapeau, Trevor, les participants n'y ont vu que du feu! Encore une fois, le programme nous a permis d'échanger des vues sur la radioprotection et les sciences connexes. Pendant trois jours, nous avons pu apprécier 33 présentations et quatre ateliers de qualité.

Si le milieu hospitalier était sous-représenté en 2010, le secteur industriel a pris la relève, témoignant de la diversité du rôle du professionnel en radioprotection. C'est que, Edmonton est l'endroit par excellence pour présenter la gammagraphie industrielle et les nombreux défis en radioprotection qui découlent, par exemple, d'une source gamma portative de 37 TBq exposée dans un champ par -40 °C ou à plus de 33 °C, dans une usine bondée d'entrepreneurs venus participer à un arrêt planifié par une grande raffinerie.

Encore une fois cette année, l'ACRP a pu compter sur le soutien indéfectible de la CCSN qui a animé des présentations attendues sur ses activités réglementaires, notamment sur l'aspect plus médiatisé du réacteur NRU de Chalk River. Oui, Peter (Fundarek), message reçu, la CCSN n'est pas responsable de la production-même de ces radioisotopes. Il ne faut donc pas la blâmer pour la pénurie mondiale...

Lorsqu'on parle de soutien indéfectible, cela inclut aussi les exposants, qui étaient à nouveau réunis dans

suite à la page 37 . . .

I was familiar with Edmonton for its illustrious hockey team, the Oilers, and the team's living god, Wayne Gretzky. It is always a pleasure to set out for my annual CRPA pilgrimage to meet with my colleagues from the radiation protection pantheon. In 2010, the pleasure was all the greater as the association decided to stray off the beaten path to spread the word to a city that had not hosted the annual radiation safety mass before. And in any case, how could an apostle of radiation safety like me possibly miss a conference titled "Aiding the radiation protection professional"? My professional soul is always in need of assistance! Lord have mercy!

So it was in this frame of mind that I discovered Edmonton—or more accurately its famous colossal shopping mall, where I strolled from Chinatown to Bourbon Street, encountering a walrus, several exotic animals, and seasoned swimmers braving the wave pool on the way to my hotel: the FantasyLand, this year's conference host.

Despite the name of the hotel, which earned me several raised eyebrows and skeptical comments from my bosses, there was nothing fanciful about the conference. Just ask Stuart Hunt, Trevor Beniston, and their team. Trevor worked on the scientific program until the last minute, even coping with several cancellations. Well done, Trevor. None of the participants noticed anything amiss. Once again, the program allowed for meaningful exchange on radiation protection and the science that goes with it. Over three days, we had 33 quality presentations and four workshops to sink our teeth into. And while the hospital sector was under-represented in 2010, the industrial sector took up the slack, demonstrating the diversity of possible roles for radiation protection professionals. Edmonton was the perfect place to present industrial radiography and the many radiation safety challenges that go along with a portable gamma source of 37 TBq exposed to temperatures from –40° C to over 33° C in a plant filled with contractors participating in the planned shutdown of a major refinery.

This year, as always, CRPA could rely on the unflagging support of the CNSC, which once again delivered much-anticipated presentations on its regulatory activities, including those at the NRU reactor at Chalk River extensively covered by the media. Yes, Peter (Fundarek), we got the message—CNSC is NOT responsible for the production of these radioisotopes, so we should not be blaming you for the worldwide shortage...

And speaking of unflagging support, I must also mention the exhibitors gathered, as usual, in one big room to

continued on page 39 . . .

Repatriation of High-Risk Radioactive Materials

by Lois Sowden-Plunkett

In the late 1950s, the Department of Physics at the University of Ottawa acquired one 2 Curie (74 GBq) Plutonium-239 Beryllium (PUBE) source and two 250 milliCurie (9.25 GBq) Americium-241 Beryllium (AMBE) source. At the time, the thrust of research was the characterization of neutron properties; in later years, these substances were used in undergraduate teaching laboratories. However, by 2006, the frequency of use no longer justified the acceptance of the associated risk, and the decision was made to dispose of them. This process took three years to complete due to the complexity of regulatory requirements and the logistical hurdles to be overcome. It came to a successful conclusion on October 21, 2009.

AMBE source

Regulatory Requirements

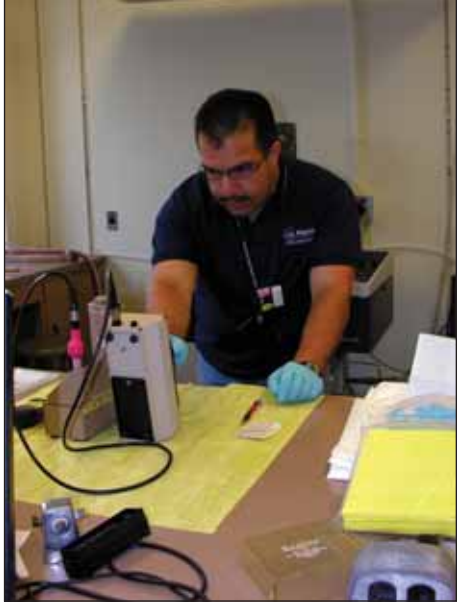
Because these radioisotopes are associated with terrorist acts, such as the detonation of RDD (radiological dispersal devices)/ dirty bombs and fissile reactions of plutonium, their disposal is highly regulated. In Canada, the depository for radioactive materials is the AECL-Chalk River Laboratories, and the University's initial intent was to transfer the radioisotopes there. However, this plan was thwarted by the absence of source-characteristic documentation and the lack of certified transport packaging. Subsequently, it was determined that these sources qualified for inclusion under the U.S. Off-Site Recovery Project (OSRP), which is administered by the Los Alamos National Laboratory (LANL) under the authority of the U.S. National Nuclear Security Administration.

Visiflux II Neutron Howitzer apparatus containing the PUBE source

Neutron measurement of the PUBE source

Agencies Regulating the Transport of Radioactive Materials

The transport of radioactive materials in North America is regulated by a number of agencies. In Canada, these include the Canadian Nuclear Safety Commission, the Department of Foreign Affairs and International Trade, Transport Canada, the Canada Border Services Agency, Environment Canada, the Royal Canadian Mounted Police/CSIS, and various provincial and municipal bodies. In the United States, the Nuclear Regulatory Commission, the Department of Energy, the Department of Transport, the Environmental Protection Agency, the Federal Emergency Management Agency, the Department of Homeland Security, and the Centers for Disease Control and Prevention are the oversight agencies. In addition, the requirements of two international agencies, the International Atomic Energy Agency and the International Civil Aviation Authority, must be met.



Preparation activities are prescribed with equipment performance being assessed and checks and double checks occurring on all tasks and materials

Removing the PUBE from the Neutron Howitzer, concrete blocks act as a shield against neutron exposure

Challenges

From the very start of the process, numerous obstacles were confronted. These can be broadly summarized as documentation recovery, regulatory requirements, and parallel approval procedures. Regardless of which agency was involved, a number of issues had to be dealt with, including the following:

- Characterization and certification of the PUBE and AMBE sources
- Documentation of origin licensing
- Packaging and transportation logistics security
- Emergency response plan
- Public relations (perception vs. reality of risk).

To complicate matters further, the authorization of one agency was dependent upon the approval and support of another agency.

Special Form Capsules

Certification records for the PUBE and AMBE sources could not be located, so special form capsules had to be used to guarantee their containment, even under extreme conditions. Because these capsules would be sealed for eternity, they had to be engraved with the source serial number, as well as radioisotope and reference identification.

It took three attempts to select a container type that was certified by the U.S. government, the International Atomic Energy Commission, and the Canadian Nuclear Safety Commission.

Special form capsules had to be used to guarantee PUBE and AMBE containment, even under extreme conditions.

Certified Shipping Containers

Among the largest hurdles to be overcome was determining which type of shipping container was to be used and having it certified in Canada. Although the chosen container was certified by both the U.S. government and the International Atomic Energy Commission, it still had to undergo the Canadian Nuclear Safety Commission's certification procedure. The difficulty was that even though the certification criteria were known, the testing results were not available and obtaining this critical information was time-consuming.

In the end, it took three attempts to select a container type. The first attempt was aborted when the proposed container was removed from use by the U.S. government, while on the second occasion, the U.S. government refused to accept the

continued on page 12 . . .

Repatriation of High-Risk Radioactive Materials

. . . continued from page 11

Security was tight at all stages of the transportation process. The source capsules were sealed with a torque screw that fractured off, leaving a smooth surface that allowed no penetration. The capsules were then bolt-sealed in a drum, enclosed in LANL specialized security tape, and sealed with LANL securing cable.

Résumé

Entre 2006 et 2009, l'Université d'Ottawa a entrepris de se défaire de ses quantités non désirées de Plutonium-239 et d'Americium-241, la désintégration de ces éléments ne se faisant pas naturellement. Comme leur élimination ne fut pas possible, il a été convenu de rapatrier ces substances aux États-Unis, et le processus s'est terminé en octobre 2009. L'article résume les défis à surmonter ainsi que le processus ayant mené à la réussite du projet. Malgré les nombreux enjeux identifiés en cours de processus, les défis principaux étaient l'obtention de la caractérisation et de la certification des sources, ainsi que la documentation sur l'origine des radioisotopes. Vint ensuite le défi de déterminer, puis de localiser, le type de contenants appropriés pour transporter les substances. Puisqu'il s'agissait d'un envoi international, il fallait respecter les exigences réglementaires du Canada et des États-Unis. En outre, les permis et approbations devaient être obtenus de la part de multiples agences. (Cet article ne vise qu'à donner un aperçu de l'envergure des enjeux à considérer et des problèmes à affronter. L'auteure se fera un plaisir de partager ses expériences en plus grand détail avec tout individu ou entreprise devant entreprendre un projet semblable.)

suggested container. Finally, on the third attempt, the proposed container met all of the stakeholders' needs.

Security

Security was engaged at all stages of the process. Lockout procedures were put in place while the PUBE and AMBE sources remained in storage, and direct access to the sources was restricted to the radiation safety professionals from ORM (Operational Risk Management) and LANL. Designed to be impregnable, the source capsules were sealed with a torque screw that fractured off, leaving a smooth surface that allowed no penetration of the capsule. The capsules were subsequently bolt-sealed in a drum, enclosed in LANL specialized security tape, and then sealed with LANL securing cable.

Transport Logistics

The first transport challenge to be encountered was locating a company that was both certified to ship this material and willing to travel internationally. After an exhaustive search, a contract was signed with Jade Inc. This carrier, which was known and approved by LANL and the U.S. Department of Transport, held the necessary security certificates and driver security clearances.

Throughout the process, the final destination of the sources was under constant revision. This resulted in route-planning activities being constantly rewritten, which, in turn, significantly impacted the carrier's journey through the United States. Because the U.S. Nuclear Regulatory Commission does not regulate all states and because a Memorandum of Understanding (MOU) authorizes some "Agreement States" to be self-regulating, route notification to state agencies was in constant flux. The question of whether the PUBE and AMBE sources travelled together or independently also had significant ramifications. Each scenario required a total review of the regulations to identify which requirements remained and which were applicable to each source.

Emergency response plan requirements also had to be met, and the plan had to be approved to ensure the needs of each nation were met.

In July 2009, the University of Ottawa was informed of the final destinations: the AMBE source would go to Texas; the PUBE source would be sent to New Mexico. This decision would have facilitated the shipment of the AMBE source since, rather than being restricted to land travel, it could now be transported to Texas by cargo aircraft (with a 24-hour delivery). In the end, however, the carrier refused the shipment (as was its prerogative) and rerouted it as an exclusive shipment by ground. Although all of the required documentation was available to clear customs, one last hurdle was encountered: the shipment was stopped at a commercial way station in the United States. Because the way-station agent was not well informed about the transport of radioactive materials, it took LANL involvement to have it released. Two days later it arrived in Texas at NSSI Inc. (an agent for LANL); subsequently the decision was made to forward the sources to New Mexico.

The lessons learned from the AMBE shipment were applied to the PUBE shipment, which followed in October.

continued on page 31 . . .

Readers' Corner / Coin des lecteurs

Readers' Corner is where you get to share your ideas and opinions or to comment on something we have published in the *Bulletin*. Send your letters to the CRPA Secretariat at secretariat2007@crpa-acrp.ca.

Le Coin des lecteurs vous permet de partager vos idées, d'émettre votre opinion ou encore de donner votre commentaire au sujet d'une publication antérieure du *Bulletin*. Prière d'envoyer vos lettres au Secrétariat de l'ACRP à secretariat2007@crpa-acrp.ca.

NEWS

by **Christopher Clement**, CHP, ICRP Scientific Secretary (sci.sec@icrp.org)

INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

In the years leading up to completion of ICRP *Publication 103*, ICRP undertook two massive worldwide consultations, aided by many local, regional, and international workshops. This tradition continues with ICRP seeking comments on our draft documents through open consultation via our website (www.icrp.org). At the time of writing, two draft ICRP documents are undergoing public consultation: one on transfer parameters for Reference Animals and Plants, and another on radiological protection education and training for healthcare staff and students. Although the consultation periods for these specific documents will likely be over by the time you read this, do keep an eye on the ICRP website for opportunities to comment on other draft ICRP reports.

If you are looking for another way to learn more about the work of ICRP and to interact with members of ICRP, look no further. ICRP is now planning a symposium on the System of Radiological Protection to be held during the week of October 24, 2011, in the Washington D.C. area. This will be the first ICRP event of this type, and participants from around the world will be most welcome to attend. Mark your calendars now! Details will follow in the months to come.

As usual, this edition of ICRP NEWS also includes information on the latest publications of ICRP. Abstracts of the two most recent appear here. These will likely be of interest to two very different groups, one dealing with radiological protection in existing exposure situations, and the other dealing with prevention of accidental exposures from new radiation therapy technologies.

Résumé

La Commission internationale de protection radiologique (CIPR) recherche des commentaires sur des ébauches de documents (voir son site : www.icrp.org), et les lecteurs sont encouragés à vérifier régulièrement le site Internet de l'organisation afin d'y retrouver les documents que l'on peut consulter. Par ailleurs, la CIPR planifie son premier symposium majeur sur le système de radioprotection qui aura lieu dans la région de Washington D.C. pendant la semaine du 24 octobre 2011. D'autres détails suivront au cours des prochaines semaines. Les deux dernières publications des annales de la CIPR sont la *Publication 111* de la CIPR : *Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency*, et la *Publication 112* de la CIPR : *Preventing Accidental Exposures from New External Beam Radiation Therapy Technologies*.

Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency

(ICRP Publication 111)

In this report, the Commission provides guidance for the protection of people living in long-term contaminated areas resulting from either a nuclear accident or a radiation emergency. The report considers the pathways of human exposure, the types of exposed populations, and the characteristics of exposures. Although the focus is on radiation protection considerations, the report also recognises the complexity of post-accident situations, which means addressing all the affected domains of daily life, i.e., environmental, health, economic, social, psychological, cultural, ethical, political, etc. The report explains how the 2007 Recommendations apply to this type of existing exposure situation, including consideration of the justification and optimization of protection strategies, and the introduction and application of a reference level to drive the optimization process. The report also considers practical aspects of the implementation

continued on page 14 . . .

Preventing Accidental Exposures from New External Beam Radiation Therapy Technologies

(ICRP Publication 112)

Disseminating the knowledge and lessons learned from accidental exposures is crucial in preventing re-occurrence. This is particularly important in radiation therapy—the only application of radiation in which very high radiation doses are deliberately given to patients to achieve cure or palliation of disease.

Lessons from accidental exposures are, therefore, an invaluable resource for revealing vulnerable aspects of the practice of radiotherapy, and for providing guidance for the prevention of future occurrences. These lessons have successfully been applied to avoid catastrophic events with conventional technologies and techniques. Recommendations, for example, include the independent verification of beam calibration and independent calculation of the treatment times and monitor units for external beam radiotherapy, and the monitoring of patients and their clothes immediately after brachytherapy.

continued on page 14 . . .

Application of the Commission's Recommendations

. . . continued from page 13

of protection strategies, both by authorities and the affected population. It emphasizes the effectiveness of directly involving the affected population and local professionals in the management of the situation, and the responsibility of authorities at both national and local levels to create the conditions and provide the means favouring the involvement and empowerment of the population. The role of radiation monitoring, health surveillance, and the management of contaminated foodstuffs and other commodities is described in this perspective. The Annex summarizes past experience of long-term contaminated areas resulting from radiation emergencies and nuclear accidents, including radiological criteria followed in carrying out remediation measures.

Preventing Accidental Exposures

. . . continued from page 13

New technologies are meant to bring substantial improvement to radiation therapy. However, this is often achieved with a considerable increase in complexity, which in turn brings opportunities for new types of human error and problems with equipment. Dissemination of information on these errors or mistakes as soon as it becomes available is crucial in radiation therapy with new technologies. In addition, information on circumstances that almost resulted in serious consequences (near misses) is also important, as the same type of events may occur elsewhere. Sharing information about near misses is thus an important complementary aspect of prevention. Lessons from retrospective information are provided in Sections 2 and 4 of this report.

Disseminating lessons learned for serious incidents is necessary but not sufficient when dealing with new technologies. It is of utmost importance to be proactive and continually strive to answer questions such as 'What else can go wrong?' 'How likely is it?' and 'What kind of cost-effective choices do I have for prevention?' These questions are addressed in Sections 3 and 5 of this report.

Section 6 contains the conclusions and recommendations. This report is expected to be a valuable resource for radiation oncologists, hospital administrators, medical physicists, technologists, dosimetrists, maintenance engineers, radiation safety specialists, and regulators. While the report applies specifically to new external beam therapies, the general principles for prevention are applicable to the broad range of radiotherapy practices where mistakes could result in serious consequences for both patient and practitioner.

Stéphane Jean-François Receives Founders' Award

by Leona Page, *Bulletin* Deputy Editor

Résumé

Le prix Founders est présenté aux membres de l'ACRP qui ont apporté une contribution remarquable à l'association. Cette année, le prix a été remis à Stéphane Jean-François. En plus d'assumer le rôle de rédacteur en chef du Bulletin, il siège actuellement aux comités de communication et des nominations, ainsi qu'au comité éditorial. Dans le passé, il a aussi siégé comme responsable de la radioprotection, de même qu'aux comités de traduction et des déclarations publiques. Stéphane est particulièrement apprécié en raison de son énergie et de son enthousiasme sans limites, ainsi que pour son objectif inébranlable de faire du Bulletin la source principale de connaissances scientifiques en radioprotection au Canada.

The Founders' Award was presented to Stéphane Jean-François by Leona Page at the 2010 CRPA conference.

The Founders' Award is presented for outstanding contributions toward the enhancement of the Canadian Radiation Protection Association. This year, one of the *Bulletin*'s own was recognized!

It might be easier to ask what Stéphane has NOT been involved in. He was the president of the CRPA in 2008, and besides being the current chief editor of the *Bulletin*, he now serves on the Communications, Editorial Board, and Nominations committees. In the past, Stéphane served on the RSO, Translation, and Positions Statements committees. He has even reportedly had his say on the Student Affairs committee. Stéphane was also co-chair of scientific programs for the CRPA 2009 conference in Montreal, while continuing to serve the association as its past-president.

Having worked with Stéphane on the *Bulletin*, I know he is most appreciated for his tireless energy and enthusiasm related to all things "CRPA." Stéphane—in person, on a conference call, or over email—is always ready to share his wisdom and encourage a healthy, balanced exchange of information and opinion.

One of Stéphane's not-so-secret goals is to establish the *Bulletin* as the premier Canadian resource for scientific knowledge related to radiation protection. Stéphane is quick to recruit members for the *Bulletin*'s Editorial Board, solicit submissions, and share his own professional and personal insights in order to reach out across the CRPA membership. In addition to preparing the quarterly editor's message, Stéphane has also penned his own submissions to summarize association activities.

As reported by our Secretariat, Stéphane is "the kind of CRPA member that last year drove in all the way from Montreal to Ottawa just to count election ballots, in order to make sure that everything was done reasonably and fairly."

From my personal experience with the CRPA, I cannot think of anyone who has done more than Stéphane to enhance the reputation of CRPA nationally, to encourage participation in CRPA activities, to advance the role of the CRPA through the *Bulletin* and conference, and to promote the merits of CRPA membership!

Canadian Radiation Protection Association Statement

On the proposal by the Ontario Drinking Water Advisory Council to lower the Ontario drinking water quality standard by a factor of 350

April 12, 2010

Résumé

Le rapport de 2009 du Ontario Drinking Water Advisory Council recommande que les normes de qualité de l'eau potable en Ontario pour le radionucléide tritium soient abaissées par un facteur de 350. Le fait de se fier à la méthodologie recommandée par la U.S. National Academy of Sciences (NAS) pour l'évaluation des risques de l'exposition à des produits chimiques carcinogènes a suscité cette recommandation. Règle générale, la méthodologie d'évaluation du risque de la NAS n'est pas appliquée en cas de rayonnement ionisant ou dans des situations où l'exposition est dominée par des sources naturelles, comme dans le cas du rayonnement ionisant. L'Association canadienne de radioprotection s'oppose au changement recommandé pour quatre raisons : il n'y a pas de fondement scientifique quant à la diminution proposée; la méthodologie qui a mené à la recommandation n'est pas appropriée; l'adoption de la valeur recommandée n'engendrerait pas d'amélioration considérable au niveau de la sécurité publique puisque les niveaux de radionucléides de sources artificielles dans l'environnement sont déjà gérés par les règlements canadiens sur la radioprotection; et un changement radical de la sorte, accompagné de l'implantation de la nouvelle valeur, causerait sans doute une préoccupation publique non fondée. Par conséquent, l'Association canadienne de radioprotection croit qu'il n'est pas nécessaire de réduire la norme de qualité de l'eau potable en Ontario, ni sa teneur en radionucléide tritium, et encore moins la valeur actuelle de 7 000 becquerels par litre, en contraste avec le maximum de 20 becquerels par litre recommandé par le Ontario Drinking Water Advisory Council.

Summary

The Ontario Drinking Water Advisory Council has recently recommended[1] to the Ontario Minister of the Environment that the Ontario drinking water quality standard for the radionuclide tritium be lowered by a factor of 350. The recommendation has not been prompted by a finding of an increase in the risk associated with the ionizing radiation from tritium but rather from the reliance on the methodology recommended by the U.S. National Academy of Sciences (NAS) for the assessment of risks due to exposure to carcinogenic chemicals. The NAS risk-assessment methodology is not generally applied to ionizing radiation, nor is it generally applied to situations where exposure is dominated by naturally occurring sources, as in the case of ionizing radiation.

The Canadian Radiation Protection Association[2] opposes the recommended change for four reasons:

- There is no scientific basis for the proposed decrease, the methodology that led to the recommendation is not appropriate
- Adoption of the recommended value would not lead to any significant improvement in public safety because environmental levels of radionuclides from man-made sources are already managed through Canadian radiation protection regulations
- Such a radical change and implementation of the new value would likely cause unwarranted public concern.

Accordingly, the position of the Canadian Radiation Protection Association is that there is no need for a reduction in the Ontario drinking water quality standard for the radionuclide tritium and, in particular, for the reduction from its present value of 7,000 becquerels per litre to the value of 20 becquerels per litre recommended by the Ontario Drinking Water Advisory Council.

The nature of exposures of members of the public to ionizing radiation

Exposures to ionizing radiation are effectively and appropriately managed through an approach that focuses on the damaging agent—that is, the amount of radiation being absorbed in a person's body (the radiation dose). The radiation dose is of importance when possible effects of radiation on human health are of concern, as it links directly to health risk. In the case of tritium, it is the radiation from the radioactive decay of tritium to helium, rather than the chemical nature of tritium or helium, that is important.

The total radiation dose that individuals absorb from all sources of ionizing radiation—day in and day out, mostly from natural sources (which include naturally occurring tritium) and from medical exposures—can be expressed in terms of microsieverts. This quantity reflects the different effectiveness of different types of radiation that are absorbed and is a practical and quantitative measure of risk to health, based on epidemiological and laboratory study results over many decades.

The total radiation dose that each individual member of the public absorbs in a year ranges widely, depending on the natural radiation background where that person lives, on medical exposures undergone, and on how much the person travels, particularly by air. The value can range from about 1,000 microsieverts to 5,000 microsieverts or more. Hence, any radiation doses from human activities are added to the background radiation, which varies from person to person by up to several thousand microsieverts per year.

1 Report and Advice on the Ontario Drinking Water Quality Standard for Tritium. Prepared for the Honourable John Gerretsen, Ontario Minister of the Environment, Ontario Drinking Water Advisory Council, 2009.

2 The Canadian Radiation Protection Association is a professional organization that supports the development and implementation of radiation safety programs in industry, medicine, research, and the environment through scientific inquiry, public involvement, and interaction with local, provincial, federal, and international authorities.

The physical nature of ionizing radiation is such that at an annual dose of 1,000 microsieverts, any cell in the body experiences just fewer than one radiation "event" on average each year. The distribution of interactions between ionizing radiation and body tissues is therefore quite different from that between chemicals and tissues, where, even at very low concentrations, the interactions are spread throughout tissues and are continuous.

The management of risks from exposures to ionizing radiation resulting from human activities therefore needs to be undertaken in a situation where the dominant radiation dose from ionizing radiation is from natural (and medical) sources, where the risks to be managed are from small increments in radiation doses above the background level, and where the spatial and temporal characteristics of the interaction that radiation has with body tissues are quite different from those of chemicals.

The current approach in Canada to managing risk from radiation

In epidemiological studies that have looked for the effects of radiation on health, the lowest radiation dose at which an increased incidence of radiation-induced cancer in a large population can be significantly detected is 100,000 microsieverts. Estimates of the likelihood of effects on health at lower doses and, in particular, when doses are extended over time (as with the public doses of interest here) must rely on laboratory studies. The evidence from these studies is clear: for such doses, the likelihood of any detrimental effects on health is either small or may be zero. Laboratory studies have even shown that small radiation doses may, in some circumstances, have a beneficial protective effect.

Nevertheless, the basic model applied in radiological protection is that the likelihood of a detrimental effect on health is proportional to the magnitude of the dose. This conservative model is the basis for methodology proposed by the International Commission on Radiological Protection (ICRP) for the assessment and management of risks from exposure to ionizing radiation.[3] The methodology has been widely accepted and adopted by regulatory and public safety agencies around the world. The key features of the methodology are that industrial and commercial facilities that use or process radioactive materials or produce radiation have to be managed so that no member of the public may receive a radiation dose above a limit of 1,000 microsieverts in any year from the totality of all such facilities and, moreover, that doses to the public should be as low as reasonably achievable (ALARA) below this limit, economic and societal factors being taken into account. This is the approach that is used by the Canadian Nuclear Safety Commission, the federal agency responsible for the regulation of nuclear energy in Canada, including environmental releases of radionuclides such as tritium.

The practical way of implementing these requirements is to apply emission limits to each particular industrial or commercial facility, taking into account all activities in any particular area. A limit is set taking into account all the routes by air, water, food, and direct radiation by which any member of the public can be exposed to, and hence receive a radiation dose from, the totality of all radionuclides and all radiation. In practice, the actual permitted totality of values of emissions derived on this basis corresponds to a maximum radiation dose to any member of the public that is well below the annual dose limit—by how much, depends on the circumstances of the facility.

This approach to regulation is practical because of the extensive and quantitative knowledge base that has been built up on how radionuclides are dispersed in the biosphere, on the radiation doses to members of the public that result from direct irradiation from the dispersed radionuclides (*external radiation*), on the biokinetic behavior of radionuclides in water, air, and foodstuffs that might be taken in by members of the public (*internal radiation*), and on the relative biological impact of the different types of ionizing radiation. The radiation emitted when most radionuclides decay can reach body tissues, whether the radionuclide is inside or outside the body, just as can radiation from sources such as X-ray devices. Hence, both external and internal radiations are always assessed. For some radionuclides, the radiation emitted when the radionuclide decays is sufficiently weak that the radiation only reaches body tissues if the decay occurs in the body.

The radionuclide tritium is an example of the latter: radiation from the decay of tritium is only absorbed in the body when tritium is taken into the body from food, water, or air. The relationships between the radiation doses from tritium and the amounts of tritium in air, water, and foods are well known, and there is no new information that indicates significant underestimation of the radiation doses. The physical nature of the radiation from the radioactive decay of tritium is similar to that from X-rays and gamma radiation. Although there is a range in relative biological effectiveness across these radiations from weak X-rays to higher energy gamma radiation, because the radiation from the tritium decay is within this range, the range is sufficiently small that the ICRP and regulatory agencies do not distinguish between the relative effectiveness of these different radiations.

Accordingly, radiation dose from the radioactive decay of tritium that is taken by a member of the public is just one component of any assessment of radiation dose attributable to any facility. There is nothing that points to a need for the radiation doses from the radioactive decay of tritium that may be emitted by industrial or commercial facilities to be singled out and regulated any differently from radiation doses absorbed from all other radionuclides and radiation sources.

As a result of this kind of comprehensive radiation regulation, the maximum annual dose that any member of the public receives from radiation added by industrial and commercial facilities is only a fraction of the annual dose limit for all those activities and, hence, is an even smaller fraction of any individual's total annual radiation dose.

Operators of such facilities have regulator-imposed triggers on emission levels that draw both their and the regulators' attention to any unusual increase in emissions, prompting remedial action well before any limit is approached.

3 This model and the key features of the protection methodology have been recommended by the ICRP for many decades. The most recent recommendations from the ICRP are: International Commission on Radiological Protection, *The 2007 Recommendations of the International Commission on Radiological Protection* (Oxford: Pergamon Press; *ICRP Publication 103*; Ann ICRP 37(2–4), 2008).

The role of the drinking water guide

In contrast to the facility-related management of radiation risks by way of monitoring emissions, a drinking water quality standard (often referred to as the drinking water guide, or DWG) for any particular radionuclide refers to a concentration of that radionuclide in just one of the pathways by which a member of the public can be exposed to that particular radionuclide. The DWG is not related to any particular source of emission of radioactivity, nor is any distinction made between natural or man-made sources of that particular radionuclide. In practice, concentrations of tritium in drinking water from the combination of natural and man-made sources are very small compared with the value of the current DWG, so that, although the DWG is not useful in regulating industrial and commercial activities that have tritium in their emissions, by and large, it does provide some reassurance to members of the public.

Unfortunately, the significance of any particular concentration of a radionuclide relative to the numerical value of the guide is often misunderstood. For example, the current value for tritium is 7,000 becquerels per litre of water. It is related to the annual dose limit for members of the public so that, if all the water consumed by an individual in a whole year has this concentration, then the radiation dose to that individual from all the tritium ingested would be about 100 microsieverts. This dose is 10% of the regulatory limit for radiation doses that can be added to background radiation by industrial and commercial activities. An observation of a concentration of tritium in one daily sample that is close to the value of the DWG is easily mistaken by members of the public as indicating an acutely dangerous situation; it is not realized that only if the total annual consumption of water was at this concentration would the radiation dose approach 10% of the regulatory limit for members of the public.

The proposed change to the drinking water guide

The Ontario Drinking Water Advisory Council has now recommended that the Ontario drinking water quality standard for the radionuclide tritium be lowered by a factor of 350. This recommendation was not prompted by any finding of an increase in the risk associated with the ionizing radiation from tritium but by reliance on the methodology recommended by the U.S. National Academy of Sciences (NAS) for the assessment of risks arising from exposure to carcinogenic chemicals.[4]

As noted above, the physical nature of exposures to ionizing radiation differs from that for chemicals, and the exposures of the public to ionizing radiation are dominated by naturally occurring sources. The NAS risk-assessment methodology has been applied when individual exposures include exposure to carcinogens from naturally occurring sources, but the methodology is not appropriate for situations where exposure to a carcinogen is dominated by the naturally occurring sources.[5] We believe that application of the NAS methodology to this exposure scenario involving ionizing radiation is not justified, and we consider that the value of the DWG for tritium should not be based on such novel applications of the NAS methodology, particularly when this methodology yields a result that is so dramatically different from that obtained from the more widely accepted ICRP methodology.

Implementation of the suggestion to lower the drinking water guide for tritium by the factor of 350 to 20 becquerels per litre would result in measured concentrations from natural and man-made sources in many water bodies being more than 10% of the new guide value and more than 50% in parts of some water bodies. The annual radiation dose to an individual, for whom water with 20 becquerels per litre was their sole source of water for the year, would be about 0.3 microsieverts; this is equivalent to about 2–3 hours of natural background radiation, a few minutes of cosmic rays when flying at cruising altitude across Canada, and very small compared with the differences in radiation doses experienced by individual members of the public in their everyday living.

This lowered value for the drinking water guide would bring no improvement in public safety, which is well handled through the radiation protection regulations. More important, since the magnitude of emissions from all regulated facilities fluctuates—though well within permitted values—the lowered value of the drinking water guide might well result in unwarranted public anxiety and unnecessary actions on the part of government agencies and facilities in responding to an anxiety that had been prompted by radiation doses of only a fraction of a microsievert.

Conclusion

The Canadian Radiation Protection Association has concluded that there is no need for a reduction in the Ontario drinking water quality standard for the radionuclide tritium from its present value of 7,000 becquerels per litre to the value of 20 becquerels per litre recommended by the Ontario Drinking Water Advisory Council. The risk methodology adopted by the ODWAC is not generally applied to ionizing radiation, nor is it applied to situations where exposure is dominated by naturally occurring sources, as is the case with ionizing radiation.

A large reduction such as that proposed by the ODWAC would not improve public safety and would put the standard at a level that corresponds to a tiny fraction of the range of radiation doses received by members of the public in their day-to-day living. The reduction would likely lead to unwarranted concern by the public and unnecessary actions by government agencies and facility operators. Exposures to ionizing radiation are effectively and appropriately managed through an approach that focuses on the damaging agent—the amount of radiation being absorbed in a person's body. The present system of radiological protection in Canada is well developed, and it is supported by an extensive quantitative knowledge of the behavior of radionuclides in the biosphere and the effects of radiation on health and is consistent with practices internationally. The radioactive decay of tritium is just one source of radiation, and there is no imperative that indicates it should be treated in any way other than as one contributor to the radiation doses that may be received by members of the public as a result of emissions from industrial and commercial facilities.

4 *Risk Assessment in the Federal Government: Managing the Process*, Commission on Life Sciences, U.S. National Research Council, National Academy Press, 1983.

5 See, for example, *Review of the EPA's Draft Framework for Inorganic Metals Risk Assessment*, U.S. Environmental Protection Agency Science Advisory Board, EPA-SAB-06-002, 2006.

Stuart Hunt at the conference opening

The conference bell is handed off to CRPA 2011 Ottawa co-chairs Gary Kramer & Chris Clement

Kathy Hughes & Kim Beniston

CRPA Secretariat, Liz Krivonosov.

Stuart Hunt and outgoing Archivist, Tony MacKay

Dr. Phil Currie, keynote speaker

Jim Outos, Gary Kramer, Jessica Lasiak, & Ralph Bose

Leah Shuparksi, Mike Delorme, Chantal Medri & Nick Sion

Ralph Bose, Kuppusamy Nandakumar, Jag Mohindra & Peter Fundarek

CRPA Archives Booth: Lamri Cheriet, Stéphane, Tony MacKay & Steve Batters

Lamri Cheriet, Dave Tucker, Michael Grey, Stéphane Jean François & Frank Tourneur

Annual Conference / Conférence annuelle
May 23-26, 2010 / 23 au 26 mai 2010
Edmonton

Conference participants catching up in the Exhibitor area

Corrie Doyle at the CIRSA Booth

Stuart Hunt Booth

Gamble Technologies booth

Mirion Technologies booth

Energy Solutions Booth

Radiation Measurement Systems booth

banquet entertainment

Skeeter Seier, Kari Toews, Mike Longinov, Ray Ilson & Leona Page

Kim Beniston & Donata Chaulk Explain a poster

Joe Cortese, Chris Malcolmson & Nick Sion

Allison Hicks enjoys some time at the West Edmonton Mall

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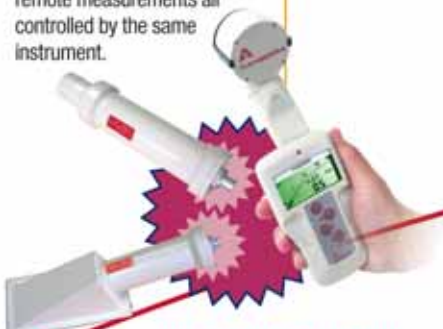

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Leah Shuparski interviews Najah Fajurally, Student Paper Contest Winner

Leah Shuparski (right) presenting the Anthony J. MacKay Student Paper Contest Award to this year's winner, Najah Fajurally.

Vani Ranganathan, Tanya Neretljak, Leah Shuparski, and Najah Fajurally beside CRPA Banner at this year's conference in Edmonton.

Najah Fajurally completed her MSc in medical physics at McMaster University and is now employed at Candesco Canada. She won this year's Anthony J. McKay student paper contest, which was based on the project she completed under Dr. David Chettle for her master's degree. The project focused on the development of an activated thulium source whose gamma-ray energy is just above the K absorption edge of mercury, which would allow for the possibility of detecting mercury in-vivo. The next step in the process is to find a thulium foil of higher purity that might allow the new method to be tested on patients.

I interviewed Najah on Skype two days before her MSc defence. This is an excerpt from our chat.

Hi Najah! Congratulations on winning the Anthony J. McKay student paper contest. Tell me a bit about your project and the paper you submitted.

My paper basically describes my master's project, which I completed at McMaster University under the supervision of Dr. David Chettle. The project focused on the development of an activated thulium source whose gamma-ray energy is just above the K absorption edge of mercury, which would allow for the possibility of detecting mercury in-vivo. Activation of the thulium foil was carried out at the McMaster Nuclear Reactor. The X-rays it emits were filtered by Cu, while the beta particles were stopped in a low Z source holder such as graphite. The W collimator in which the source holder was placed was also optimized in order to decrease the detection limit of mercury.

Have you been able to test your new method on patients?

Definitely not yet. In our paper, we concluded that we need a thulium foil of higher purity in order to do so. The activated foil product contained tantalum impurity, which creates a high background underneath the characteristic mercury X-rays and thus adversely affects the detection of mercury. So the next step for this project is to find a thulium foil that has a higher purity and a much lower tantalum content.

Did you find that aspect of research frustrating—working on this project for years only to conclude that you needed a different starting material?

Yes, it was a bit frustrating, but when an experiment doesn't work, it does not mean that it is a failure. Although in theory everything should work perfectly, this may not be the case experimentally, which is often the case when doing research in new areas. Despite not getting the result I wanted, I have nevertheless been able to identify the reason for not detecting mercury. At the same time, I have developed the optimum source filtration, source holder, and optimized tungsten collimators for different kidney depths. Therefore, the development of this new source of radiation has turned out to be quite challenging. But, by applying these design solutions to a new thulium foil of higher purity, we expect to have a positive result for the detection of mercury.

Résumé

Najah Fajurally a terminé sa maîtrise en sciences avec spécialisation en physique médicale à l'Université McMaster et travaille maintenant auprès de Candesco Canada. Elle a remporté le concours de publication étudiante Anthony-J.-McKay de l'année courante, après avoir écrit sur un projet qu'elle a terminé sous la supervision de Dr David Chettle pour sa maîtrise. (Son manuscrit est publié à la page 23 du présent numéro du Bulletin.) Le projet se concentrait sur la création d'une source de thulium activée, dont l'énergie de rayons gamma est légèrement plus élevée que le taux de discontinuité d'absorption K du mercure, ce qui rendrait possible la détection du mercure in vivo. La prochaine étape du processus consiste à trouver des feuilles de thulium à un taux de pureté plus élevé, ce qui pourrait permettre d'effectuer des essais de la nouvelle méthode auprès de patients. Leah, notre collaboratrice, a interviewé Najah sur Skype deux jours avant que celle-ci ne défende sa maîtrise en sciences. Voici un extrait de leur conversation.

You are about to defend your master's thesis, you've just won the Anthony J. McKay student paper contest, and you're off to the CRPA 2010 conference soon. What do you plan to do afterward?

I was quite fortunate to meet so many people in the nuclear industry while I was at the Canadian Nuclear Association conference. I also had the opportunity to meet with Candesco employers, which led to a job for me.

continued on page 23 . . .

Welcome to Ottawa in the springtime!

CRPA 2011 will be held at the Westin Ottawa, perfectly situated steps from Parliament Hill, the historic Byward Market, the Rideau Canal, and attached to the Rideau Centre mall. The Tuesday evening banquet will be in the spectacular Grand Hall of the Canadian Museum of Civilization, overlooking the Ottawa River and across to Parliament Hill.

Ottawa has so much to offer! Visit world-class museums, stroll along the historic Rideau Canal, shop in the Rideau Centre and Byward Market, or enjoy the outdoors in nearby Gatineau Park.

CRPA 2011, Ottawa
Mark it on your calendar now!

Bienvenue à Ottawa au printemps!

L'ACRP 2011 aura lieu au Westin Ottawa qui est attenant au Centre commercial Rideau et qui est situé à quelques pas de la Colline du Parlement, du canal Rideau et du marché historique By. Le banquet aura lieu mardi soir dans la Grande Galerie spectaculaire du Musée canadien des civilisations, d'où l'on peut voir la rivière des Outaouais et les édifices du Parlement.

Ottawa a beaucoup à offrir! Visitez des musées de renommée mondiale, flânez le long du canal Rideau, visitez les boutiques et magasins du Centre Rideau et du marché By ou profitez du plein air, à proximité, dans le parc de la Gatineau.

ACRP 2011, Ottawa
Inscrivez-le à votre agenda dès maintenant!

CRPA-ACRP
8 - 12 Mai
2011
May 8 -12
OTTAWA

Photos courtesy Ottawa Tourism.

CANADIAN RADIATION PROTECTION ASSOCIATION

ASSOCIATION CANADIENNE DE RADIOPROTECTION

Conference Call for Proposals

The Conference Committee, currently working with Halifax (2012) and Sherbrooke (2013), is inviting interested parties to submit expressions of interest for annual conferences beyond 2013. Anyone wishing to submit a proposal should contact me and I will forward a copy of both the Conference Proposal Guide and the Conference Planning Guide

Pauline Jones, Conference Committee Chair
Ph 902-494-2055 • email pauline.jones@dal.ca

Appel aux propositions pour la conférence

Le comité organisateur de la conférence, qui travaille actuellement avec Halifax (2012) et Sherbrooke (2013, invite les parties intéressées à soumettre une lettre d'intérêt pour les conférences annuelles suivant l'an 2013. Les parties désirant soumettre une proposition devraient me contacter afin que je puisse leur faire parvenir une copie du Guide des propositions de conférence ainsi que le Guide de planification des conférences.

Pauline Jones, présidente du comité organisateur de la conférence
Tel (902) 494-2055 • couriel pauline.jones@dal.ca

Development of an Activated Thulium Source for the *in vivo* Measurement of Hg in Humans Using XRF

By Bibi N. Fajurally and David R. Chettle

Department of Medical Physics and Applied Radiation Sciences, McMaster University

Résumé

Cette étude cible le développement d'une nouvelle source de rayonnement (170Tm) pour mesurer in vivo le niveau de Hg dans les reins par fluorescence X en vue d'évaluer l'exposition en milieu de travail intégrée dans le temps. Puisque les rayons Eγ du 84,25 keV émis dépassent légèrement la discontinuité d'absorption K du mercure à 83,10 keV, on s'attend à ce que la limite de détection du Hg s'améliore, comparativement à l'utilisation antérieure de 88,04 keV en rayons γ émis par 109 Cd. L'activation d'une feuille de thulium a été effectuée au réacteur nucléaire McMaster par réaction 169Tm (n, γ) 170Tm. Une réaction 170Tm émet aussi des rayons X K Er, Yb et Tm devant être filtrés par 2,69 mm de Cu afin de diminuer la dose du patient et le taux de comptage dans le détecteur HPGe. Les particules β énergétiques aussi émises par 170Tm ont été arrêtées par un porte-source en graphite spécialement conçu, permettant ainsi une émission minimale de rayonnement de freinage, ce qui peut augmenter le continuum d'arrière-plan dans le spectre. Le blocage de déchets radioactifs de cette source empêche aussi les fuites de rayonnements et permet la manipulation sécuritaire de 170Tm. Certaines simulations ont été effectués selon le code Monte Carlo (J. O'Meara) afin d'optimiser la collimation et de réduire la quantité minimale détectable de Hg. Le porte-source était contenu dans un collimateur W fait sur mesure, qui a été utilisé pour effectuer des expériences XRF sur des molécules fantômes de Hg sous format de rétrodiffusion. Au cours de l'activation des feuilles de thulium pures à 99,9 %, on a constaté que celles-ci contenaient du tantale à près de 0,4 %, un élément qui subit la capture neutronique pour former 182Ta et émet ensuite des rayons γ énergétiques, affectant sérieusement la détection de Hg. Nous sommes maintenant à la recherche d'une feuille de thulium de plus grande pureté pour remédier à ce problème.

Abstract

This study is focused on the development of a new source of radiation, namely ^{170}Tm, for *in vivo* measurement of Hg in kidneys by X-ray fluorescence to assess time-integrated exposure to that toxic metal especially in occupational settings. With ^{170}Tm, the E_γ of 84.25 keV emitted is just above the K absorption edge of mercury at 83.10 keV, and hence it is expected there will be an improvement in the detection limit of Hg compared to the previously used 88.04 keV γ rays emitted by ^{109}Cd. Activation of a thulium foil was carried out at the McMaster Nuclear Reactor using the ^{169}Tm(n, γ) ^{170}Tm reaction. ^{170}Tm also emits Er, Yb, and Tm K X-rays and these had to be filtered by 2.69 mm of Cu in order to decrease patient dose as well as the count rate in the HPGe detector. The energetic β^- particles also emitted by ^{170}Tm were stopped by a specially designed graphite source holder so that there was minimal emission of bremsstrahlung radiation that could increase the background continuum in the spectrum. This source encapsulation also prevented radiation leakage and allowed ^{170}Tm to be handled safely from a radiation protection perspective. Some simulations were run using the Monte Carlo code written by J. O'Meara (1998) so as to optimize the collimation and decrease the MDL of Hg. A W collimator was then custom-made to house the source holder and perform XRF experiments on Hg phantoms in a backscatter geometry. Nevertheless during activation of the 99.9% pure thulium foil, the thulium foil was found to contain almost 0.4% tantalum, which undergoes neutron capture to form ^{182}Ta that emits energetic γ-rays, thus seriously affecting the detection of Hg. Presently a thulium foil of higher purity is being sought in order to overcome this problem.

Introduction

Mercury is a toxic heavy metal with no known benefit for human physiology. Occupational exposure is primarily due to elemental metallic mercury, which is a dense silvery liquid at room temperature and is highly volatile. Of the inhaled vapour, 80% diffuses to the blood and since it is lipid soluble, it is easily transferred to different organs such as the brain, liver, and cortex of the kidney. In the cells, the mercury vapour is converted to Hg^{++}, which is the toxic form of mercury and inhibits the biological activity of protein (Asano et al., 2000). After inhalation of mercury vapour, mercury is retained in the kidney (Kazantzis, 1970) and can even lead to renal failure (Zalups, 2000). The central nervous system is also affected and neurological as well as behavioural symptoms can occur at high mercury levels (WHO). Exposure to mercury vapour is usually determined by urine

Interview with Bibi Najah Fajurally

. . . continued from page 21

What is the most valuable lesson you learned from attending the CNA conference and other, similar conferences?

The whole conference was an incredible experience for me and for everyone who attended it. I got a taste of all the different jobs in the nuclear field and met several people in the nuclear industry, which broadened my network. I can definitely say that the CNA and other similar conferences are a must for students who are graduating since many prospective employers can be found at them. These conferences also enable students to attend many interesting lectures given by knowledgeable and experienced persons and so remain updated on the latest news in the nuclear field.

Thanks for your time, Najah!

and blood samples but due to the rapid rate at which urine is eliminated from the body and blood is replaced, these methods of mercury analysis do not reliably indicate the total body burden. X-ray fluorescence is an alternative technique for biological monitoring since it is non-invasive and rapid and reflects chronic mercury exposure (Block & Shapiro, 1981). It also exposes the patient to a very small radiation dose and is a sensitive method of detecting low levels of mercury accumulated in the kidneys. A new source-excited XRF which consists of an activated thulium foil has been suggested by Grinyer (2008). The aim is to lower the minimum detection limit (MDL) of mercury and have an optimized system which can be routinely used to follow up with people occupationally exposed. With ^{170}Tm, the 84.25 keV γ-ray emitted is just above the K absorption edge of mercury and so provides a favourable condition for increasing the yield of Hg K X-rays. Since ^{169}Tm has a high thermal neutron cross-section of 105 barns, a reasonable length of time is required to produce a desired activity. Moreover, ^{170}Tm has a fairly long half-life of 128.6 d and so it is a good source both for economic and calibration reasons. When its activity has been reduced to below the optimum level required for XRF, the same source can be reactivated again. ^{170}Tm is better compared to ^{109}Cd as the exciting source, as can be seen from the results of the Monte Carlo simulation using O'Meara code in figure 1. Moreover, the photoelectric absorption cross-section for ^{170}Tm is 7.80 cm^2/g, and is thus larger than that of ^{109}Cd at 6.96 cm^2/g (XCOM, n.d.). For ^{109}Cd and ^{170}Tm in a backscatter geometry, the Compton peaks are produced at 65.5 keV and 63.4 keV respectively. Hence there is a reduced Compton background underneath the Hg K X-rays in the latter case and the Compton peak is at an energy level well away from the Hg K X-rays.

Experimental procedure

Activation of the thulium foil

A thulium foil (99.9 % purity from Espi Metal) of 6 mm diameter and 0.10 mm thickness was placed in a high density polyethylene vial and sent through the RABBIT system of the McMaster Nuclear Reactor (MNR) to be irradiated. Using (2), the irradiation time, *t*, was calculated to be 9 min to obtain a ^{170}Tm of 1.85 MBq.

The neutron activation equation is given by (Turner, 2007):

$$A = \frac{\theta\, m \phi\, N_A\, \sigma (1 - e^{-\lambda t})}{M} \qquad (1)$$

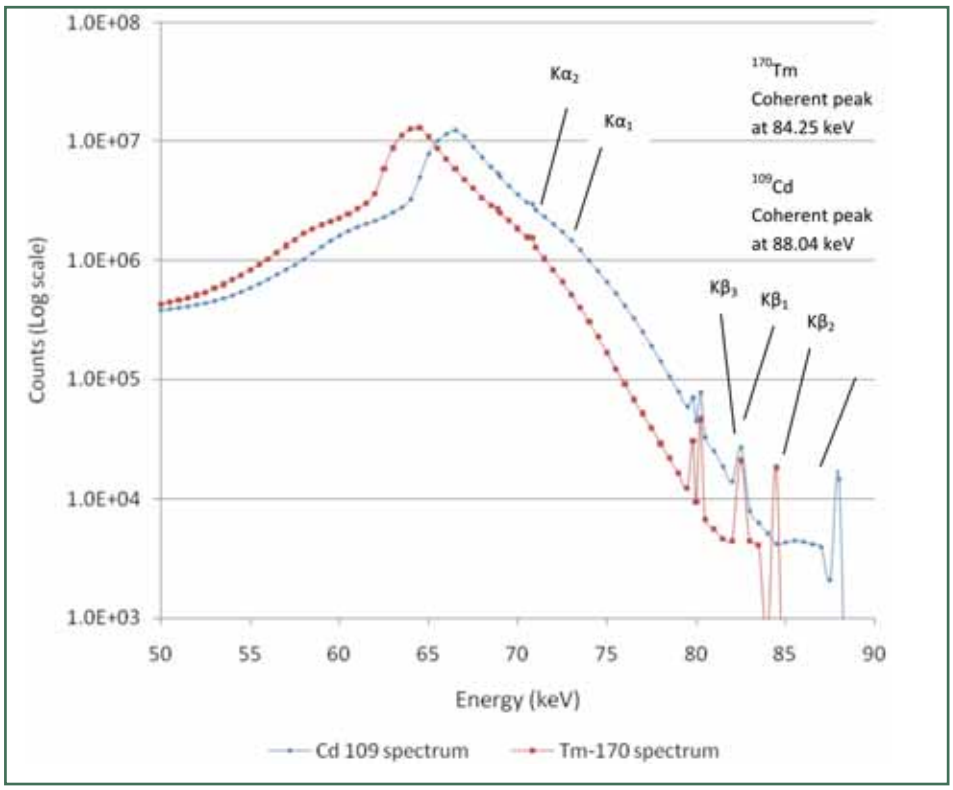

Figure 1: Difference between ^{109}Cd and ^{170}Tm spectrums for the detection of Hg K X-rays

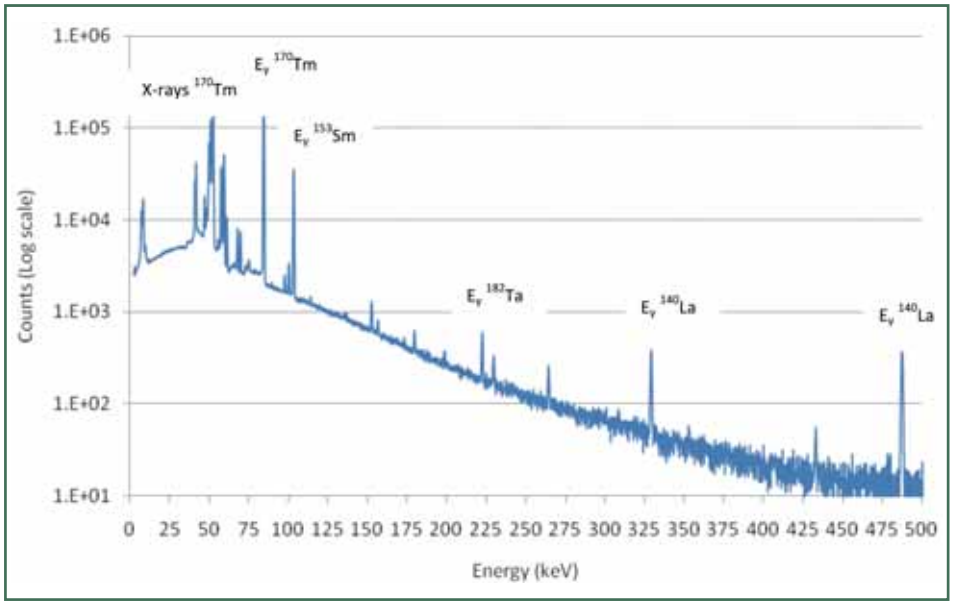

Figure 2: Thulium spectrum, with the major peaks identified

Where:

- *A* is the activity of the Tm-170 obtained immediately after irradiation (in Bq)
- θ is the isotopic abundance of Tm-169 (100%)
- *m* is the mass of the Tm-169 sample
- Φ is the neutron flux at the MNR (5 x 10^{12} neutronscm^{-1}s^{-1})
- N_A is Avogadro's number (6.02 x 10^{23} atoms/mole)
- σ is the cross-section of the neutron capture reaction (105E^{-24} cm^2 for ^{169}Tm)

- M is the atomic mass of Tm-169 (168.93 g)
- $\lambda = \ln 2 / T_{1/2}$ with $T_{1/2}$ = 128.6 days for Tm-170

Rearranging (1)

$$t = -\frac{1}{\lambda}\ln\left(1 - \frac{AM}{\theta\, m\phi\, N_A\, \sigma}\right) \quad (2)$$

Afterwards, the sample was left to decay as there could have been formation of short-lived radioisotopes. The activated sample was then measured using a planar HPGe detector. An EG&G ORTEC 92X spectrum Master spectroscopy system was connected to the detector for data acquisition and the Maestro software was used to analyze the data. Figure 1 shows the spectrum acquired after thulium irradiation.

Absolute determination of activity

It was important to determine the induced activity since the time of irradiation has been calculated by assuming a constant thermal neutron flux. Using (3), the activity, *A*, of the thulium was determined (Debertin, 1988).

$$A(Bq) = \frac{N_{net} C}{f_\gamma\, \varepsilon_{abs}\, t_1} \quad (3)$$

Where:

- ε_{abs} is the absolute peak efficiency of the detector
- N_{net} is the net counts under the photo-peak of 84.25 keV
- t_1 is the live time
- f_γ is the emission probability of the Eγ emitted by Tm-170 (i.e., 2.5%)
- C is a correction factor due to self-absorption within the source and attenuation in the HPGe detector crystal and Be window. This was calculated to be 1.33.

The activity of Tm-170 was thus found to be (2.25 ± 0.22) MBq.

Quantification of ^{153}Sm and ^{182}Ta impurities in the thulium foil

From the spectrum shown in figure 2, it was found that the foil had impurities, identified to be ^{153}Sm, ^{182}Ta, and ^{140}La. The latter ($T_{1/2}$ = 1.678 d) is present as 180 ppm, from the certificate of analysis of the thulium foil. ^{153}Sm and ^{182}Ta were quantified by using the comparator method. Samples of samarium and tantalum atomic absorption standard solution and a thulium sample were irradiated simultaneously in the MNR. The standards and thulium were then measured in the same source-detector distance configuration and for the same length of time.

The concentration of the sample, $C_{σαμ}$, is (Verma, 2007):

$$C_{sam} = C_{std}\frac{W_{std}\, A_{sam}}{W_{sam}\, A_{std}} \quad (4)$$

Where the subscripts '*std*' and '*sam*' stand for standards and sample respectively. *W* and *A* represent their weights and activities. The impurity levels of ^{153}Sm and ^{182}Ta in the thulium foil were calculated to be (88 ± 8) ppm and (3832 ± 230) ppm respectively.

Characterization of the activated thulium foil

Figure 3 shows the unfiltered ^{170}Tm spectrum after ^{153}Sm and ^{140}La decay, while figure 4 represents only the region containing the X-rays and E of ^{170}Tm. The labeled X-ray peaks are then explained in *Table 1: K and L X-rays emitted by ^{170}Tm and ^{182}Ta* (ESTAR, n.d.)

There was production of Er, Yb, and Tm K X-rays as the foil was thick enough to cause self-excitation of the source. Since ^{170}Tm is also a beta emitter, it produces a continuous bremsstrahlung spectrum from very low energies up to $E_{μαξ}$ of 968 keV, with the intensity being greater for the lower beta energies and decreasing up to $E_{μαξ}$. The beta radiation also

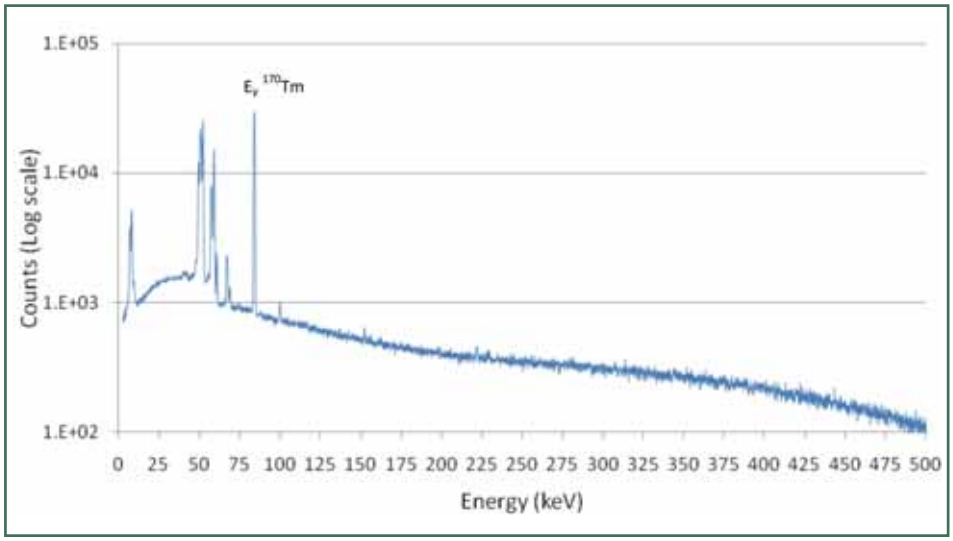

Figure 3: Unfiltered thulium spectrum

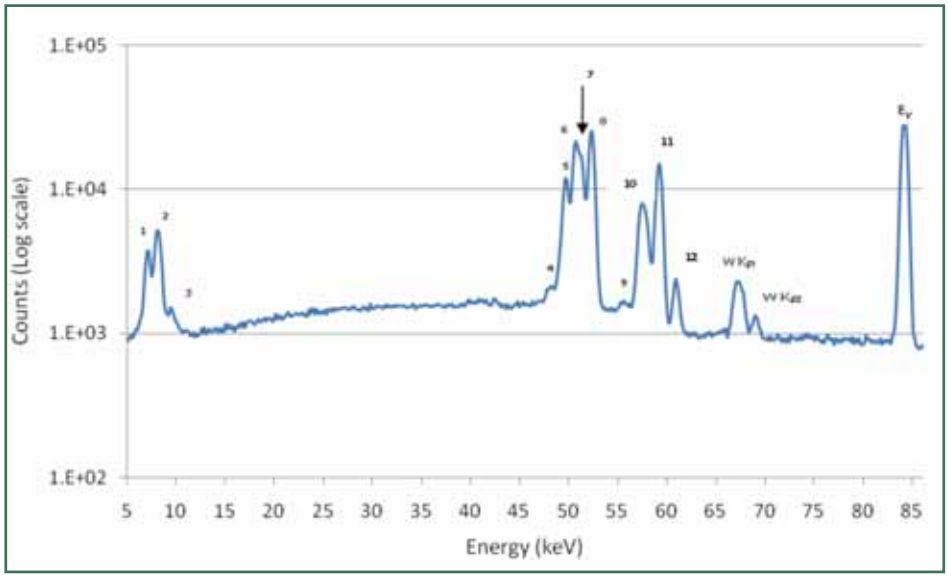

Figure 4: Spectral distribution of the K and L X-rays as well as the Eγ of ^{170}Tm

Table 1: *K and L X-rays emitted by ^{170}Tm and ^{182}Ta* (ESTAR, n.d.)

Peak no	Origin of peaks	Energy (keV)	Intensity per 100 k-shell vacancies (%)
1	^{170}Yb $L_{\alpha1}$	7.42	8.30
2	^{170}Yb $L_{\beta1}$ / W $L_{\alpha1}$ (from Ta^{-182})	8.40 / 8.40	5.4 / 9.7
3	^{170}Yb $L_{\gamma1}$ / W $L_{\beta1}$	9.78 / 9.67	0.99 / 6.5
4	^{170}Er $K_{\alpha2}$	48.22	27.0
5	^{170}Tm $K_{\alpha2}$ / Er $K_{\alpha1}$	49.77 / 49.13	27.2 / 47.5
6	^{170}Tm $K_{\alpha1}$	50.74	47.4
7	^{170}Yb $K_{\alpha2}$	51.35	27.2
8	^{170}Yb $K_{\alpha1}$	52.39	47.2
9	^{170}Er $K_{\beta1}$ / ^{170}Er $K_{\beta3}$	55.67 / 55.48	9.77/5.06
10	^{170}Tm $K_{\beta1}$ / Er $K_{\beta2}$ / W $K_{\alpha2}$ (from Ta^{-182})	57.51 / 57.14 / 57.98	9.86 / 3.28 / 27.4
11	^{170}Yb $K_{\beta3}$ / ^{170}Yb $K_{\beta1}$ / W $K_{\alpha1}$ (from Ta^{-182})	59.16 / 59.38 / 59.32	5.18 / 9.99 / 47.0
12	^{170}Yb $K_{\beta2}$	60.96	3.38

Table 2: *Calculated thicknesses of materials to stop $\beta_{\mu ax}$ of ^{170}Tm*

β filter	Y	CSDA range (g/cm²)	Thickness from CSDA range (mm)
Graphite	3.22E-03	0.4797	2.82
Polyethylene	2.55E-03	0.4014	4.32

caused excitation of K X-rays of the tungsten collimator material as shown in figure 4.

The characteristics X-rays have to be filtered off to decrease patient dose and the number of incident photons interacting with the detector as these can lead to saturation. The energetic beta particles also need to be stopped so that there is minimal generation of bremsstrahlung radiation which can increase the background continuum in the spectrum. In turn, an optimum composite filter had to be chosen to remove the beta radiation and X-rays preferentially from the spectrum.

Filtration of characteristics X-rays

Copper filters were used as they were readily available in the lab. The aim was to filter the X-rays without overly reducing the intensity of the 84.25 keV E_γ so that the sensitivity of the system would not decrease. A good compromise was to calculate the Cu thickness so that the ratio of the transmitted intensity of E_γ to that of the most intense K X-rays, i.e., ^{170}Yb $K_{\alpha1}$ at E = 52.49 keV, from figure 4, was 50.

From the attenuation law for X and gamma rays:

$$T = \frac{I}{I_o} = e^{-(\mu/\rho)\rho x} \qquad (5)$$

Where T is the transmission of the photons after going through the filter

- μ/ρ is the total mass attenuation with coherent scattering
- ρ and x are the density(8.96 g/cm³ for Cu) and thickness of the attenuator respectively.
- Let T_1 and T_2 be the transmitted intensity of the E_γ to 52.49 keV X-ray respectively.
- Since $\left(\frac{\mu}{\rho}\right)_{Cu}$ are 2.30 cm²/g and 0.674 cm²/g at 52.49 keV and 84.25 keV respectively,
- $T_1 = \exp-(2.30*8.96*x)$
- $T_2 = \exp-(0.674*8.96*x)$

Solving for x in the above equations, when the ratio of T_1 / T_2 is 50, gives a Cu thickness of 2.69 mm.

Filtration of beta radiation

The β-ray filter should preferably be made of a low Z material because otherwise there would be production of significant bremsstrahlung radiation. For calculating the thickness of this shield, a conservative estimate was used whereby no self-absorption of the beta particles in the foil was considered. Hence the maximum β energy of 0.968 MeV emitted by ^{170}Tm was used. Table 2 gives the possible absorbers which were used, their radiation yield, Y, as well as their thicknesses, calculated using the CSDA range (ESTAR, n.d.).

Design of source holder

In order to prevent leakage of radiation and excitation of W K X-rays with bremsstrahlung generated by β, it is of utmost importance to shield the source before it is placed in the tungsten collimator used in the XRF experiments. The source holder was made of either graphite or high-density polyethylene (HDPE) as shown in figure 5 so that all the energetic beta radiation from thulium could be stopped, with minimal emission of bremsstrahlung. The thickness of the wall and lid was 4.50 mm, chosen as a conservative estimate and to allow an extra margin for uncertainty. Once the foil was activated, it was allowed to decay under shield. Afterwards, it was quickly transferred to the basic container using long tweezers and the lid affixed. The procedure took place behind Perspex and lead shield to minimize β and γ dose to the personnel. Hence the basic container and the lid made up the entire source-holder assembly.

Collimator design

The purpose of the W alloy collimator is to restrict the size of the radiation beam for exciting small regions within the body or water tanks such as the kidney or the phantom and so reduce the background. It is also used to prevent direct exposure of photons in the detector. Figure 6 illustrates the custom-made W collimator and its source holder, which were designed to contain the graphite or the HDPE housing the activated thulium foil. Using the Monte Carlo code written by O'Meara et al (1998), the optimized collimator length to detect Hg in a 1 cm depth kidney was found to be 3.5 mm. The collimator diameter was kept fixed at 6.0 mm. A copper disc of 20 mm diameter and 2.69 mm thickness was then glued at the exit of the collimator to filter off the X-rays emitted by ^{170}Tm.

Testing XRF of Hg K X-rays using ^{170}Tm of 37 MBq

The ^{170}Tm source-excited Hg XRF system is given in figure 7. The spectrum shown in figure 8 was then acquired for a live time of 2000 s.

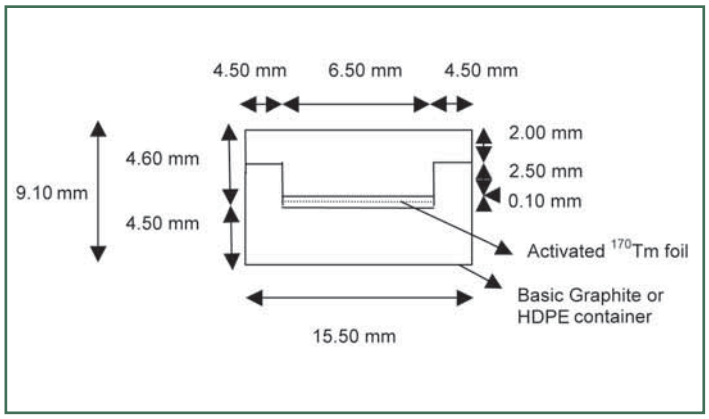

Figure 5: Thulium source holder

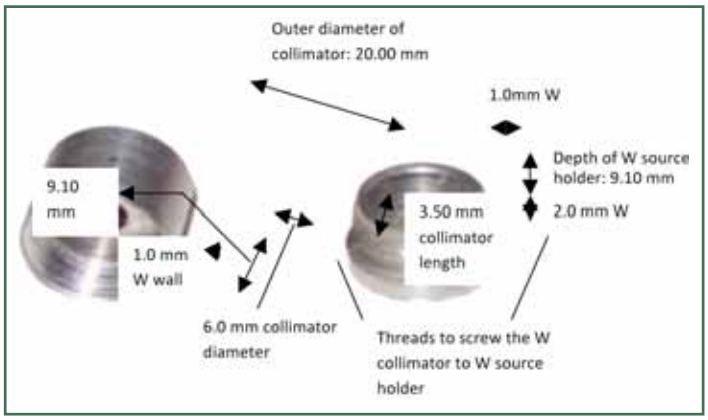

Figure 6: W collimator and its source holder

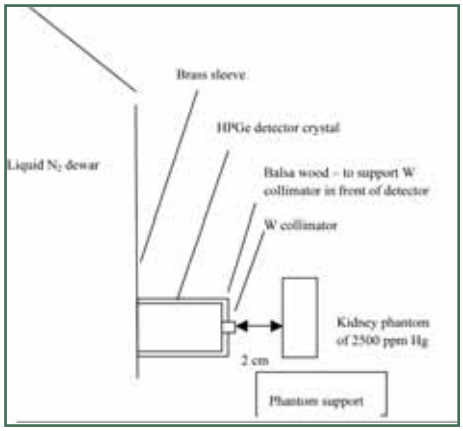

Figure 7: Experimental set up to verify XRF of Hg

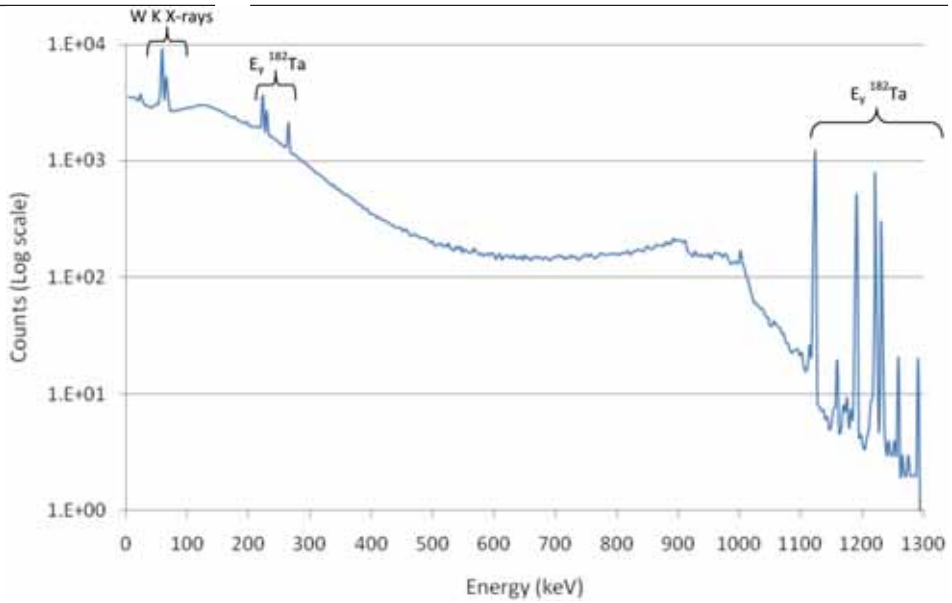

Figure 8: Spectrum showing high Eγ from ^{182}Ta and W K X-rays

Results and Discussion

There are several problems which can arise due to the presence of the impurities in the activated thulium foil, as given in section 2.2. Since ^{140}La and ^{153}Sm have short half-lives they can be allowed to decay under shield for at least 1 week.

On the other hand, ^{182}Ta has a half-life of 114.5 d, which is of the same order of magnitude as that of ^{170}Tm. Therefore, it is not worth waiting for it to decay as the ^{170}Tm will be decaying at the same rate. Moreover, ^{182}Ta emits intense gamma rays which will contribute unnecessary patient dose. The E_γ of 100.11 keV (I_γ = 14.10%) from ^{182}Ta can produce Compton scatter in a 180^0 geometry at an energy of:

$$E_{\gamma'} = \frac{E_\gamma}{1+\frac{E_\gamma}{0.511}(1-\cos\theta)} = 71.93\,\text{keV}$$

Hence the Compton scatter of the 100.1 keV line could be an important interference for detecting Hg $K_{\alpha 1}$ at 70.82 keV.

As shown in figure 8, there was generation of high intensity W K X-rays and ^{182}Ta gamma rays as well as a large bremsstrahlung continuum which resulted in a considerable reduction of the Compton peak and meant the Hg K X-rays could not be identified.

One potential reason for the high background continnum is that the intense γ-rays of ^{182}Ta (at 1121.3 keV – 34.9%, 1189.1 keV – 16.3%, 1221.4 keV – 27.0%, 1231.04 keV – 11.4%) are poorly attenuated by the 2 mm W collimator. Moreover, these energetic photons have caused the excitation of the W atoms, thus resulting in the production of high intensity W K X-rays.

Conclusion and Future Research

Tantalum is usually present in thulium metals as Ta containers are used during the separation process of rare earth metals. Hence thulium of higher purity, such as 99.99%, and which has a lower Ta impurity has to be sought to overcome the above problems. Also the collimator should be made of a material whose characteristic X-rays are well separated from Hg K X-rays. Tungsten is not the ideal candidate as it emits W $K_{\beta 2}$ of 69.07 keV (I = 3.58 keV) and which is very close to the k $_{\alpha 2}$ of Hg. A good option is tantalum as it emits K X-rays not close to Hg K X-rays. As it has a density of 16.65 g/cm^3, it will also be able to attenuate the photons incident on the detector. Eventually, for the purpose of the XRF experiment, a higher source activity of about 6 GBq would be required. This activity was chosen so that it would be almost the same as the 1 GBq ^{109}Cd source used previously in the XRF of Hg and consisting of the planar HPGe detector system (Grinyer, 2008).

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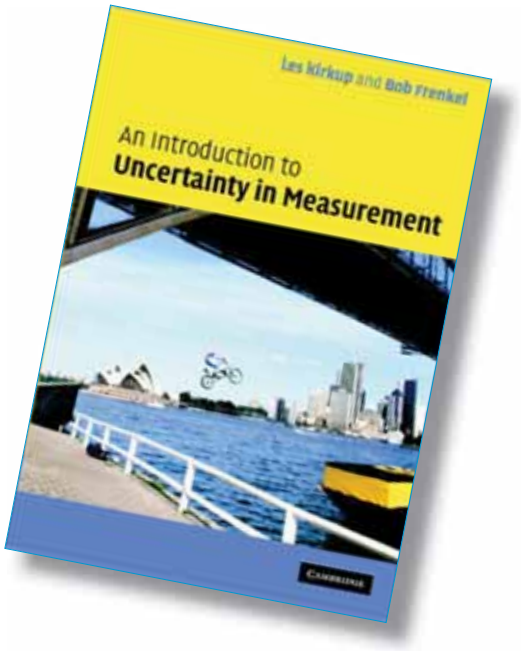
Berkeley National Laboratory Atomic Data:

continued on page 30 . . .

An Introduction to Uncertainty in Measurement

Using the GUM (Guide to the Expression of Uncertainty in Measurement)

L. Kirkup & R. B. Frenkel (Cambridge, UK: Cambridge University Press, 2006)



review by Michael Grey
Candesco Corporation,
Burlington, ON

Résumé

Les auteurs de *An Introduction to Uncertainty in Measurement* ont su aborder l'incertitude de mesure sans que la présentation ne soit simpliste ou lourde. L'ouvrage, l'un des meilleurs sur le sujet, débute par une brève discussion sur l'importance de l'incertitude, suivie par des notions de terminologie et de mesures fondamentales; les concepts de base en incertitude et en statistique; des problèmes d'erreurs systématiques, différentes des incertitudes aléatoires; le calcul des incertitudes par la méthode GUM; le théorème central limite, qui justifie l'hypothèse d'une distribution normale; et l'échantillonnage d'une distribution gaussienne, thème peu touché. Viennent ensuite les degrés de libertés, et une discussion sur la loi de t et la formule Welch-Satterthwaite, qui estime les degrés de liberté. Enfin, quatre études de cas sur l'application de la méthodologie GUM bouclent l'ouvrage.

Ce manuel convient généralement au premier cycle universitaire, quoique son niveau fluctue légèrement. Deux importantes omissions sont à souligner toutefois : les auteurs illustrent bien l'importance des programmes d'AQ/CQ en laboratoire pour réduire l'incertitude, mais aucune section du livre ne les aborde; et on mentionne peu les budgets d'incertitude, bientôt une norme pour évaluer et réduire celle-ci. Les lecteurs auront avantage à compléter leur lecture avec d'autres ouvrages introductifs.

Les Kirkup is currently an associate professor at the University of Technology in Sydney, Australia, specializing in high performance liquid chromatography, while Bob Frenkel is a senior experimental scientist in electrical standards at the Australian National Measurement Institute. Both have been involved in developing and delivering training on GUM methodology to scientists and students.

Although this book isn't perfect, it is the best introductory reference on the subject that I have found to date.

The acronym GUM refers to the *Guide to the Expression of Uncertainty in Measurement*, which was originally developed by the *Bureau International des Poids et Mesures* (BIPM) and first published in 1981. The 1995 edition of the guide was subsequently adopted as ISO/IEC Guide 98-3. In 1997, the Joint Committee for Guides in Metrology (JCGM) was created to develop and revise GUM, and a corrected edition is now available as JCGM 100:2008. The JCGM is also developing a number of supporting documents, two of which have been published:

- JCGM 101 (Evaluation of Measurement Data – Supplement 1 to the *Guide to the Expression of Uncertainty in Measurement* – Propagation of Distributions Using a Monte Carlo Method), also published as ISO/IEC Guide 98-3-1
- JCGM 104 (Evaluation of Measurement Data – An Introduction to the *Guide to the Expression of Uncertainty in Measurement*), also published as ISO/IEC Guide 98-1.

I read *An Introduction to Uncertainty in Measurement* as part of a search for an introductory reference on the subject that I could include in an appendix on uncertainty in a new CSA Standard. I read several books and manuals on uncertainty, but most of them were either too simplistic or as overwhelming as GUM itself. Kirkup and Frenkel's book was one of the few that managed to find a middle ground. Their book opens with a brief discussion of the importance of uncertainty, which is followed by introductory chapters on measurement fundamentals and terminology. The fourth chapter introduces the basic concepts of uncertainty, the fifth describes

some fundamental statistical concepts, and the sixth is devoted to the problem of systematic errors, which are treated differently than random uncertainties. Chapter 7, "Calculation of Uncertainties," delves into the details of GUM methodology; the formalism in this chapter can be daunting but the underlying approach is not significantly different from the method I was taught in first-year university. The Central Limit Theorem, which justifies the common assumption of normal distribution, is introduced in Chapter 8, and a very short chapter on sampling a Gaussian distribution follows it. The next chapter is devoted to degrees and freedom and a discussion of both the t-distribution and the Welch-Satterthwaite formula, which can be used to estimate the number of degrees of freedom. Chapter 11, the final chapter, provides four case studies on the application of GUM methodology.

Although this book isn't perfect, it is the best introduction I've found to date. The material is presented at an undergraduate level, but individual sections fluctuate from the high-school senior level to the senior undergraduate level. Readers might want to supplement this book with Stephane Bell's "A Beginner's Guide to Uncertainty of Measurement (*UK National Physical Laboratory Measurement Good Practice Guide*, No. 11, Issue 2, with amendments, March 2001) and with "The Expression of Uncertainty and Confidence in Measurement" (*United Kingdom Accreditation Service Guide*, M3003, Issue 2, January 2007). A copy of GUM would also be a useful companion.

Finally, in my opinion, the book has two serious omissions. First, although the authors give several good examples of the importance of laboratory QA/QC programs in identifying and reducing uncertainty, no section in the book is devoted to QA/QC programs. Second, there is only a brief mention of uncertainty budgets, which seem to be becoming a standard tool for assessing and reducing uncertainty. (Several issues ago, I reviewed Gordon Gilmore's *Practical Gamma-Ray Spectroscopy*, which does present an uncertainty budget for the calibration of a gamma-ray spectrometer.).

CRPA members are drawn from all areas of radiation protection, including hospitals, universities, the nuclear power industry, and all levels of government. Membership is divided into five categories: full members (includes retired members), associate and student members, honourary members, and corporate members.

Application forms are available on the CRPA website (www.crpa-acrp.ca) or from the secretariat (secretariat2007@crpa-acrp.ca).

Les membres de l'ACRP proviennent de tous les horizons de la radioprotection, y compris les hôpitaux, les universités, l'industrie nucléaire génératrice d'électricité et tous les niveaux du gouvernement. Les membres sont classés selon cinq catégories: membres à part entière (y compris les membres retraités), membres associés et étudiants, membres honoraires, et membres corporatifs. Les formulaires de demande d'adhésion peuvent être obtenus sur le site Web (www.crpa-acrp.ca) ou auprès du secrétariat (secretariat2007@crpa-acrp.ca).

Repatriation of High-Risk Radioactive Materials

. . . continued from page 12

Arrival at Los Alamos

Photos above are of the Off-Site Source Recovery Project, taken from the LANL website with permission.

The PUBE shipment arrived at the Los Alamos laboratory on October 21, 2009, without incident and without student, public, or media concern. The containers holding the PUBE source were enclosed in drums in a TRUPACT-II, a cylindrical waste container that is 10 feet high and 8 feet in diameter. This cylindrical container has a stainless-steel skin over a 10-inch layer of polyurethane foam, which surrounds two internal, nested containers. The waste drums carrying the sealed source were then transferred to New Mexico's Waste Isolation Pilot Plant for long-term storage.

Actual Cost of Disposal

Initial cost estimate for disposal to AECL	$ 500,000.00
Incurred cost for transfer to LANL Engagement under the OSRP meant most costs were incurred by the U.S. Government	- $ 10,833.32
Cost savings to the University of Ottawa	**$ 489,166.68**

Bioassay sample above the internal investigation level at your facility

by Emélie Lamothe, Health Physics Specialist

Welcome back. I trust you had a nice relaxing summer. If your garden is like mine this year, your cornucopia runneth over. Canning and pickling will surely increase your sweating and liquid consumption. And what could be a better lead-in to last issue's question?

Last Issue's Question

While reviewing bioassay sample results, you found a 70 µCi/L result, which is above the internal investigation level at your facility. What can you say about the tritium biological half-life for this worker?

Some data:

Day	Bioassay Result (MBq/L)
0	2.9E+06
1	2.3E+06
2	1.8E+06
3	1.4E+06
4	1.1E+06
5	9.1E+05
6	7.2E+05
7	5.7E+05
10	2.9E+05
14	1.1E+05
16	7.2E+04
20	2.8E+04
30	2.8E+03

Answer

Within a few hours of an uptake, tritium in the form of tritiated water (HTO) will be evenly distributed throughout the body's fluids and will be cleared from the body with the same turnover rate as water. A person's biological half-life for tritium will vary significantly due to variations in bodily excretion rates, environmental temperature and humidity levels, and fluid intake.

At any given time, the amount of HTO remaining in the body can be calculated as follows:

$$N(t) = N_0 e^{-\lambda t} \quad (1)$$

where

N0 = initial amount taken into the body

λ = the biological elimination rate (s-1), which can be calculated as

$$\lambda = \left(\frac{0.693}{t_{1/2}} \right) \quad (2)$$

and t1/2 is the biological half-life.

Working with equations (1) and (2), we can now calculate the biological half-life of HTO as follows:

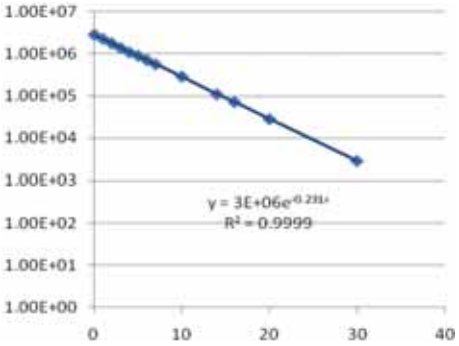
$$\frac{N(t)}{N_0} = e^{-\lambda t}$$

$$-\ln\left(\frac{N(t)}{N_0}\right) = \left(\frac{0.693}{t_{1/2}} t\right)$$

$$t_{1/2} = \left(\frac{(0.693\, t)}{\ln\left(\frac{N(t)}{N_0}\right)} \right) \quad (3)$$

For the bioassay results given above, equation (3) gives a t1/2 of about 3 days, which is shorter than the typical 10 days for tritium.

Another way of determining the biological half-life is to plot the data on semi-log graph paper.



In this particular case, the time (x-axis) at which the original concentration (y-axis) has decreased by one-half is about 3 days.

This issue's question

A CNSC inspector is coming to your site. Whose Thermo Luminescent Dosimeter (TLD) should the inspector wear?

Have fun! Remember, this column's for you. Send your answers and suggestions for future issues to the CRPA Secretariat or eslamothe@hotmail.com.

Activated Thulium Source

. . . continued from page 27

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Les résultats d'un échantillon d'essai biologique dans vos installations dépassent le niveau d'investigation interne

par Emélie Lamothe, spécialiste en radioprotection

Bonjour et bienvenue à nouveau. J'imagine que vous avez eu un bel été reposant? Si votre jardin ressemble au mien cette année, votre corne d'abondance déborde. La mise en conserves et la concoction de marinades augmenteront sans doute votre production sudorifique et votre consommation de liquides. Je ne pourrais trouver meilleure introduction à la question du dernier numéro.

Réponse

Dans les quelques heures suivant une incorporation, le tritium sous forme d'eau tritiée (HTO) sera distribué également dans les fluides corporels, puis éliminé au même rythme que l'eau. La période radioactive biologique du tritium varie énormément d'un individu à l'autre en raison de variations dans les taux d'élimination corporelle, la température de l'environnement, les niveaux d'humidité et la consommation de liquides.

Le montant de HTO encore présent dans le corps peut être calculé à n'importe quel moment, en utilisant la formule suivante :

$$N(t) = N_0 e^{-\lambda t} \quad (1)$$

où

N0 = le montant original absorbé par le corps,

λ = le taux d'élimination biologique (s-1), pouvant être calculé comme ceci :

$$\lambda = \left(\frac{0{,}693}{t_{1/2}} \right) \quad (2)$$

et t1/2 représente la période radioactive biologique.

En travaillant avec les équations (1) et (2), nous pouvons maintenant calculer la période radioactive biologique de HTO comme ceci :

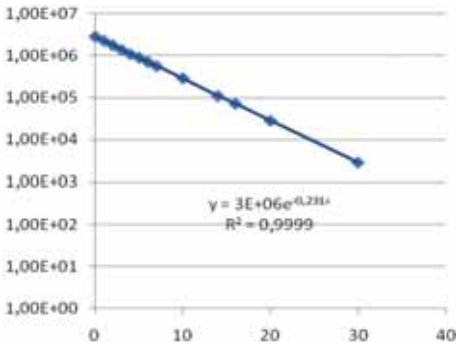
$$\frac{N(t)}{N_0} = e^{-\lambda t}$$

$$-\ln\left(\frac{N(t)}{N_0}\right) = \left(\frac{0{,}693}{t_{1/2}} t\right)$$

$$t_{1/2} = \left(\frac{(0{,}693\, t)}{\ln\left(\frac{N(t)}{N_0}\right)} \right) \quad (3)$$

Pour les résultats d'essai biologique ci-dessus, l'équation (3) donne une valeur t1/2 d'environ trois jours, ce qui est plus court que la valeur typique d'environ dix jours pour le tritium.

Une autre façon de déterminer la période biologique consiste à marquer les données sur du papier à réglure semi-logarithmique. Dans ce cas en particulier, le temps (axe des x) nécessaire pour que la concentration originale (axe des y) diminue de moitié est d'environ trois jours.



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Question du dernier numéro

Aujourd'hui, les spéculations vont bon train au sujet du type de réacteur qui sera construit au site Darlington de l'OPG. Les arguments abondent, qu'ils soient en faveur des trois designs potentiels ou qu'ils s'y opposent. Tous ces designs on cependant un élément commun : l'utilisation de combustible d'uranium légèrement enrichi. Par conséquent, quelle serait l'activité spécifique d'un kilogramme de combustible d'uranium enrichi à 5 % (aussi connu sous l'appellation « combustible légèrement enrichi ») ?

Quelques données :

Jour	Résultat de l'essai biologique (MBq/L)
0	2,9E+06
1	2,3E+06
2	1,8E+06
3	1,4E+06
4	1,1E+06
5	9,1E+05
6	7,2E+05
7	5,7E+05
10	2,9E+05
14	1,1E+05
16	7,2E+04
20	2,8E+04
30	2,8E+03

Question du présent numéro

Un inspecteur de la CCSN vient évaluer votre site. À qui appartient le dosimètre thermoluminescent que l'inspecteur devra porter?

Amusez-vous! Souvenez-vous que cette rubrique s'adresse à vous! Envoyez vos réponses et vos suggestions pour les prochains numéros au secrétariat de l'ACRP ou encore faites-les-moi parvenir par courriel à l'adresse eslamothe@hotmail.com.

Contributors

David R Chettle is associate dean of Science, Research, and External Relations, as well as professor in the Department of Medical Physics and Applied Radiation Sciences at McMaster University. His research interests include the development of methods to measure trace elements, such as lead, strontium, aluminum, mercury, manganese, cadmium, and potassium in humans.

David R. Chettle est doyen associé du département des sciences, de la recherche et des relations extérieures, ainsi que professeur du département de physique médicale et des sciences appliquées en rayonnements à l'université McMaster. Ses intérêts en matière de recherche comprennent l'élaboration de méthodes pour mesurer les microconstituants comme le plomb, le strontium, l'aluminium, le mercure, le manganèse, le cadmium et le potassium, chez l'homme.

Chris Clement, a certified health physicist, has worked in radiation safety since the 1980s, first on environmental restoration projects, then with the Canadian Nuclear Safety Commission, where he was the director of radiation protection when he left in 2008. He is currently the scientific secretary of the International Commission on Radiological Protection.

Chris Clement, expert de radiophysique médicale sanitaire agréé, travaille en radioprotection depuis les années 1980, d'abord dans des projets de restauration environnementale, puis avec la Commission canadienne de sûreté nucléaire, où il portait le chapeau de directeur de la radioprotection à son départ en 2008. Aujourd'hui, il occupe le poste de secrétaire scientifique de la Commission internationale de protection radiologique (CIPR).

Najah Fajurally completed her MSc in medical physics at McMaster University and is now employed with Candesco. She is the 2010 winner of the Anthony J. McKay student paper contest.

Najah Fajurally a terminé sa maîtrise en physique médicale à l'Université McMaster et travaille maintenant chez Candesco. Elle est la gagnante de l'édition 2010 du concours de manuscrits Anthony-J.-McKay.

Michael Grey is a senior analyst with Candesco Corporation in Toronto, Ontario, and past-president of CRPA.

Michael Grey est analyste principal chez Candesco Corporation de Toronto, Ontario, et ancien président de l'ACRP.

Leona Page has worked for the University of Manitoba Environmental Health and Safety Office since 1990, coordinating the radiation safety program. Leona has been a member of CRPA since 1991 and achieved her CRPA(R) in 2005. Leona is currently Deputy Editor of the *Bulletin* and is a new director on the CRPA Board.

Depuis 1990, Leona Page travaille pour le bureau de la santé et de la sécurité de l'environnement de l'Université du Manitoba comme coordonnatrice du programme de radioprotection. Leona s'est jointe à l'ACRP en 1991 et a obtenu sa désignation ACRP(R) en 2005. Elle est présentement rédactrice adjointe du Bulletin et nouvelle membre du conseil de l'ACRP.

Emélie Lamothe is a health physicist and member of CRPA. In her professional life, she has worked in the fields of research and development, dosimetry, QA, health and safety, and emergency preparedness.

Emélie Lamothe est spécialiste de radioprotection et membre de l'ACRP. Au cours de sa carrière, elle a travaillé dans les domaines de la recherche et du développement, de la dosimétrie, de l'assurance qualité, de la santé et sécurité en milieu de travail et de la protection civile.

After a year of living the working life at The Ottawa Hospital, Leah Shuparski is back at school, working on her MSc at McMaster University in health and radiation physics. If you see her looking distracted or confused, don't worry! She's just not used to coming home from school to find a pile of schoolwork waiting for her.

Après avoir travaillé pendant une année à l'Hôpital d'Ottawa, Leah Shuparski est de retour sur les bancs d'école pour sa maîtrise en santé et en physique des rayonnements à l'Université McMaster. Si vous l'apercevez et qu'elle semble distraite ou confuse, ne vous inquiétez pas! Elle n'est tout simplement pas habituée de revenir à la maison après les classes... pour mieux s'attaquer à la pile de travaux de recherche qui l'attend.

Lois Sowden-Plunkett is the assistant director of Radiation and Biosafety at the University of Ottawa. She has over 20 years of experience in radiation safety, in both research and management. Lois has been responsible for developing, implementing, and managing the radiation safety program at the University of Ottawa.

Lois Sowden-Plunkett est directrice adjointe, rayonnement et biosécurité, à l'Université d'Ottawa. Elle détient plus de 20 ans d'expérience en radioprotection au niveau de la recherche et de la gestion. Madame Sowden-Plunkett est responsable du développement, de la mise en œuvre et de la gestion du programme de radioprotection de l'Université d'Ottawa.

Submission Procedures

Authors submitting manuscripts for consideration are asked to follow these guidelines.

1. Submit manuscripts (in English or French) electronically as attachments (in Microsoft Word®).
2. Include the title of the paper, author(s) name(s) and affiliation(s), and email address to which correspondence should be sent.
3. Include an abstract of no more than 200 words and a biographical note of not more than 50 words for the author and any co-authors.
4. Submission of a manuscript implies that it is not being considered for publication elsewhere. Once accepted for publication in the *Bulletin*, consent from the editor must be obtained before a manuscript, or any part of it, may be published elsewhere in the same form.
5. Authors are invited to submit manuscripts at any time during the year to

Editor (c/o CRPA Secretariat)

ph: 613-253-3779
email: secretariat2007@crpa-acrp.ca

Deadlines

Materials must be received by the editor no later than the following dates:

Number 1 .....January 15
Number 2 .....April 15
Number 3 .....July 15
Number 4 .....October 15

Advertising

While advertisements are sought after and accepted to offset the production costs of the *Bulletin*, the newsletter is published primarily for, and on behalf of, CRPA / ACRP members. Therefore inclusion of advertisements is entirely at the discretion of the association. CRPA / ACRP reserves the right to reject, omit, or cancel any advertisements that are not in keeping with the professional nature of the *Bulletin* or in any other way inappropriate for our members.

Advertorials

Advertorials are a new advertising feature for the *Bulletin* and are available at the same rate as display advertising. If a client requires assistance with writing, editing, or production of their advertorial, these services can be negotiated with the production company responsible for producing the *Bulletin*. For more information, contact Michelle Boulton at michelle.com@shaw.ca.

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For rates, technical specifications, deadlines, and any information about advertising, contact the publishing office.

Michelle Communications
Ph: (306) 343-8519
Email: michelle.com@shaw.ca

Coming Events / Réunions à venir

What's Up? SPEAK OUT

Do you know of an upcoming event that might be of interest to your fellow CRPA members?

Send the event information to

secretariat2007@crpa-acrp.ca

and we can include it in the next issue of the *Bulletin*.

Bulletin

Canadian Radiation Protection Association
Association canadienne de radioprotection

The *Bulletin* is published four times per year and 400 copies are distributed to members. In addition, the newsletter is available by subscription to non-members, such as libraries. Corporate members are listed in each issue of the *Bulletin*.

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To place an ad in the *Bulletin*, email michelle.com@shaw.ca or phone 306-343-8519.

Remembering Geri Rowlatt, *Bulletin* Copy Editor

For those of you who have been paying attention to the *Bulletin*'s masthead over the past few years, you may recognize the name Geri Rowlatt. She has been lending her careful skill to copy editing the CRPA *Bulletin* for the past three years. We regret to announce that Geri passed away on September 12, 2010, after a brief battle with cancer. She will be greatly missed by the remaining members of the production team.

À la douce mémoire de Geri Rowlatt, réviseure en préparation de copie du Bulletin

Ceux et celles d'entre vous qui ont porté attention au bloc-générique du *Bulletin* au cours des dernières années auront sûrement reconnu le nom de Geri Rowlatt. Cette collaboratrice a prêté son œil critique à la préparation de copie du *Bulletin* de l'ACRP au cours des trois dernières années. Nous regrettons d'avoir à vous annoncer son décès, survenu le 12 septembre 2010, après une courte lutte contre le cancer. Les membres de l'équipe de production la regretteront profondément.

Michelle Boulton, Creative Director
Michelle Communications

Message du rédacteur en chef

. . . suite de la page 9

une grande salle, offrant leur expertise en radioprotection. Encore merci chers exposants, de bien vouloir présenter vos services aux congressistes qui repartent toujours avec de précieuses ressources et des instruments adaptés à la mesure de leurs projets en radioprotection!

Toujours soucieux d'encourager la relève, le comité du congrès de l'ACRP a accueilli les spécialistes de demain, dont notamment Bibi N. Fajurally, récipiendaire du prix Anthony-Mackay, qui présente dans nos pages l'article qui lui a valu ce prix. Je tiens également à féliciter notre collaboratrice Leah Shuparsky, que l'on retrouve dans le Coin des étudiants, et dont on a également souligné le travail en lui attribuant le prix Bulltizer 2010. Voilà une récompense bien méritée.

Le congrès annuel de l'ACRP est également l'occasion de faire avancer les affaires internes de l'ACRP et d'en présenter le résultat aux membres présents. Notre président sortant, Dave Tucker, a présidé une assemblée générale annuelle plutôt bien disciplinée, mais qui abordait néanmoins des sujets importants, comme la réforme de notre mode d'élection, ainsi que la conclusion judiciaire de certains détails administratifs liés à l'organisation du congrès de Montréal en 2009. Comme à chaque assemblée générale annuelle, le conseil d'administration a également renouvelé sa composition à Edmonton. Les résultats des élections étant publiés dans ces pages, on retiendra surtout que Wayne Tiefenbach tire sa révérence après de nombreux mandats au poste de trésorier mais continuera à siéger au comité des archives, tandis que notre président sortant Sunil Choubal remplacera Tony Mackay au poste d'archiviste. Les membres présents à l'AGA n'ont pas manqué d'applaudir le travail de Wayne, qui a tenu les cordons de la bourse de l'ACRP durant toutes ces années.

Les membres enregistrés en tant que « ACPR-R » se sont également réunis pour proposer une suite concrète aux activités de certification de l'ACRP et ont suggéré des dates butoirs pour la réalisation de certaines propositions issues de leur rencontre à Montréal en 2009.

Bien sûr, le programme social du congrès avait une saveur locale qui fut appréciée par les conjointes et conjoints de nos congressistes, qui ne se sont pas ennuyés et semblent avoir apprécié leur visite. Le Banquet annuel nous a réunis au Old Timer's Cabin, propriété historique de la Northern Alberta Pioneers and Descendants Association. Dans ce lieu chargé d'histoire relativement à la conquête de grands espaces, Dallas Arcand a, quant à lui, utilisé bien peu d'espace pour chanter et surtout danser avec de nombreux cerceaux. Vous avez pu voir cet athlète exceptionnel exécuter une « danse du cerceau » lors de l'ouverture des Jeux de Vancouver en début d'année. Je doute fort avoir pu l'imiter, compte tenu du diamètre des anneaux, de leur nombre sans cesse grandissant... et des délicieuses portions de bison que je venais d'ingurgiter!

La présente édition spéciale du *Bulletin* contient aussi un article sur la radioprotection rédigé par Lois Sowden-Plunkett, notre présidente élue, sans oublier nos rubriques composées par nos fidèles chroniqueurs, allant du « technico-littéraire » de Mike Grey aux « techno-colles » d'Émelie Lamothe.

Finalement, dans la présente édition, vous serez à même de lire la prise de position de l'ACRP au sujet du tritium et de l'eau potable en Ontario. Il y a longtemps que je mentionne que, de nos jours, le nerf de la guerre dans le débat nucléaire est la dangerosité du tritium. Une équipe de l'ACRP, chapeautée par Richard Osborne, remet les pendules à l'heure.

Donc, pour ceux qui ont participé au congrès, le présent numéro du *Bulletin* vous rappellera quelques souvenirs de cette agréable rencontre, et pour ceux qui l'auraient manqué, vous y verrez plutôt un avant-goût de la chaleur et du caractère des rencontres annuelles de l'ACRP, dont l'édition 2011 aura lieu au début mai dans notre capitale nationale, soit Ottawa.

Bonne lecture !

Stéphane
Rédacteur en chef, *Bulletin* de l'ACRP

Processus de soumission

Les auteurs désirant soumettre des manuscrits pour considération sont priés de suivre ces lignes directrices.

1. Soumettre les manuscrits (en anglais ou en français) par attachement électronique (sous format Microsoft Word®).
2. Inclure le titre de la communication, le(s) nom(s) et l'affiliation de l'(des) auteur(s) et l'adresse courriel à laquelle la correspondance devrait être envoyée.
3. Inclure un résumé d'un maximum de 200 mots et une note biographique d'un maximum de 50 mots pour l'auteur et tout co-auteur, s'il y a lieu.
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Le matériel doit être reçu par le rédacteur en chef au plus tard par les dates suivantes :

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Bien que les publicités soient recherchées et acceptées pour contrer les coûts de production du *Bulletin*, la lettre est d'abord publiée pour et au nom des membres de l'ACRP. Ainsi, le fait d'inclure des annonces demeure entièrement à la discrétion de l'association. L'ACRP se réserve le privilège de refuser, omettre ou annuler toute publicité qui ne serait pas pertinente à la nature professionnelle du *Bulletin* ou qui serait d'une manière quelconque inappropriée pour nos membres.

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Les articles publicitaires sont une nouvelle option de publicité dans le *Bulletin* et sont disponibles au même taux que les publicités par annonce. Si un client a besoin d'appui avec la rédaction, l'édition ou la production de son article publicitaire, ces services peuvent être négociés auprès de l'entreprise responsable de la production du *Bulletin*. Pour plus d'information, contactez Michelle Boulton à michelle.com@shaw.ca.

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Bulletin Editorial Board 2010-2011

I would like to take this opportunity to highlight some small changes on the *Bulletin* Editorial Board (BEB). Kirk Lamont is now replacing Merlin "Skeeter" Seier as the nuclear industry representative, and Kevin Bundy is replacing Chris Clement as CNSC representative. I would like to thank the exiting BEB members for their work and support of the *Bulletin* and to thank their replacements who are just joining our team. The BEB's function is to generate and validate quality articles for the *Bulletin*, and we certainly appreciate the expertise of the BEB members.

Please join me in welcoming Kirk and Kevin to the BEB.

Stéphane
Editor-in-chief, CRPA *Bulletin*

Le conseil d'édition du *Bulletin* 2010-2011

J'aimerais en profiter pour souligner des petits changements au conseil d'édition du *Bulletin* (CEB). En effet, Merlin «Skeeter » Seier remplace maintenant Kirk Lamont comme représentant de l'industrie nucléaire et Kevin Bundy remplace Chris Clement comme représentant de la CCSN. J'aimerais donc remercier les membres sortants pour leur travail et leur support au *Bulletin* et remercier leurs remplaçants pour reprendre le collier. Le conseil d'édition sert à générer et à valider des articles de qualité pour le *Bulletin* et nous apprécions l'expertise des membres du conseil.

Joignez-vous à moi pour accueillir Skeeter et Kevin au sein du CEB.

Stéphane
Rédacteur en chef, *Bulletin* de l'ACRP.

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President's Message / Message du Président

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de l'assemblée annuelle, nous avons discuté de nouvelles idées afin d'améliorer le processus de nomination. Une autre priorité sera d'accroître l'efficacité de notre travail en mettant en place un système de suivi des documents.

Grâce aux efforts du comité des communications, du conseil de l'ACRP et de tous les membres qui ont participé au débat lancé par Ralph Bose, nous avons maintenant un énoncé de mission : « Nous nous efforçons d'assurer l'utilisation sécuritaire des rayonnements en fournissant des connaissances scientifiques, de l'éducation, de l'expertise et des guides pour la radioprotection ». Nous devons quitter notre tour d'ivoire et informer davantage le public. Nous devons aussi rectifier les fausses perceptions répandues par les médias, qu'elles portent sur les rayonnements non ionisants ou qu'elles traitent de faibles niveaux de rayonnements ionisants. Il nous faut demeurer au fait des possibilités offertes par les nouvelles technologies et par Internet. Je reprends ici une suggestion faite par Stuart Hunt lors du congrès d'Edmonton, soit celle de tenter d'augmenter notre visibilité dans l'espace virtuel en créant un site Internet d'échange qui permettrait aux utilisateurs de soumettre et de partager de nouvelles histoires, photographies, articles et vidéos avec d'autres utilisateurs, ainsi qu'avec le grand public.

Sandu Sonoc
Président, ACRP

Another priority will be to increase the efficiency of our work by implementing a document-tracking system.

Thanks to the efforts of the Communication Committee, the CRPA board, and all members who participated in the debate started by Ralph Bose, we now have a mission statement: "We strive to ensure the safe use of radiation by providing scientific knowledge, education, expertise, and policy guidance for radiation protection." We need to leave our ivory tower, and to do more to inform the public and to fight the misconceptions that are spread through the mass media, especially those connected with low levels of ionizing radiation and in the field of non-ionizing radiation. We must keep up with the wonderful new possibilities offered by the new technologies and the World Wide Web. I associate myself with a suggestion made by Stuart Hunt during the Edmonton conference: We should try to increase our presence in virtual space, by establishing social news website communities that allow users to submit news stories, articles, videos, and pictures, and share them with other users and the general public.

Sandu Sonoc
President, CRPA

Editor's Note

. . . continued from page 9

offer their radiation protection expertise. Thank you, kind exhibitors, for presenting your services to conference attendees who always leave with valuable contacts and tools suited to the needs of their radiation safety projects!

With a view to encouraging the next generation of radiation safety professionals, the CRPA conference welcomed the specialists of tomorrow. This *Bulletin* includes the article by Bibi N. Fajurally that won the Anthony MacKay Student Paper Award. I would also like to mention that the work of our student affairs contributor, Leah Shuparsky, was awarded the 2010 Bullitzer—a well-deserved prize.

The annual CRPA conference is also an opportunity to advance internal CRPA business and to present the results to attending members. Outgoing president Dave Tucker chaired a rather orderly annual meeting, which covered important points such as the reform of our election procedure and the legal conclusion of certain administrative details in relation to the organization of the Montreal conference in 2009. New Board of Directors members were confirmed, as at all the annual general assemblies. The election results were published in the last issue, but we may note that Wayne Tiefenbach is stepping aside after many mandates as treasurer. Members in attendance at the AGM applauded Wayne's work controlling the CRPA purse strings all these years. This fact may go down in the CRPA archives that are now under the supervision of CRPA Past President Sunil Choubal.

Accredited members (CRPA-R) also met to propose a concrete follow-up to the CRPA certification activities and proposed deadlines for accomplishing some of the proposals stemming from the Montreal meeting in 2009.

The conference's social program, of course, had a local Western flavour; conference attendees' partners and spouses were kept busy and seemed to enjoy their visit to Edmonton. The annual banquet was held at the Old Timer's Cabin, a Northern Alberta Pioneers and Descendants Association historic property. In this history-laden atmosphere of the conquest of wide open spaces, Dallas Arcand made use of a much smaller space to sing and, most remarkably, dance with numerous hoops. You may have seen this renowned hoop dancer performing at the opening ceremony of the Vancouver Olympic Games at the beginning of the year. I very much doubt that I could have done half as well, considering the size of the hoops, how many there were, and, especially, the delicious meal of bison I had just enjoyed!

This conference edition of the *Bulletin* also includes a radiation protection article by Lois Sowden-Plunkett, our president-elect, as well as items by our faithful contributors, from Mike Grey's technical/literary column to Emélie Lamothe's technical stumpers.

Last but not least, in this Bulletin you will be able to read CRPA Position Statement on tritium in potable water in Ontario. I have been mentioning for a while that the sinew of war in the nuclear debate currently seems to have become tritium dangerousness. A CRPA working group, headed by Richard Osborne, sets the record straight.

So, for those of you who were there, this edition will remind you of the conference's highlights. For those who missed it, you will get a glimpse of the warmth and special character of the annual CRPA get-together. The 2011 edition will be held in Ottawa in early May.

Happy reading!

Stéphane
Editor-in-chief, CRPA *Bulletin*

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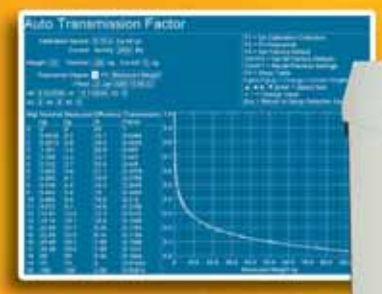

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