Bulletin

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Canadian Radiation Protection Association
Association canadienne de radioprotection

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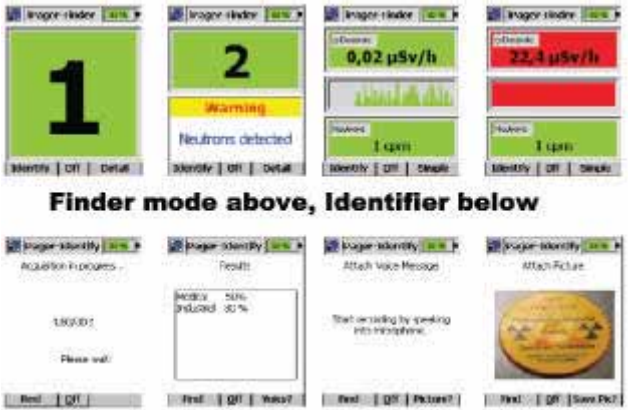

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Prospectus

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; honourary 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.

CRPA-ACRP Secretariat

PO Box 83
Carleton Place, Ontario K7C 3P3

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fax: 1-888-551-0712

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website: www.crpa-acrp.ca

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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Features / Articles

Cover photo: The collage on the front cover features photographs from the 2009 CRPA conference in Montreal. On the left, a session in the main auditorium; centre, Jean-Yves Fiset, keynote speaker; top right, the the Cyberknife (photo courtesy of www.accuray.com); and bottom right, Hoa Ly, our banquet photographer, with CRPA Director Valerie Phelan and Sandu Sonoc, CRPA President-Elect. For more photographs, see page 10.

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President's Message / Message du Président

photo by J D Howell

Nous sommes au milieu de l'été lorsque j'écris ces lignes; j'espère que vous avez tous eu l'occasion de relaxer avec votre famille et vos amis et peut-être aussi reprendre la lecture du dernier *Bulletin* là où vous l'aviez laissé.

L'excellente conférence à Montréal est encore fraichement présente dans les pensées de ceux qui ont eu la chance de pouvoir y assister. Les organisateurs ont offert un programme scientifique intéressant et un programme social et d'hospitalité bien réussi dans un endroit superbe. Ils méritent non seulement notre appréciation pour leur bon travail, leur temps et l'énergie investie, mais également nos félicitations pour l'excellent résultat.

Malgré que je me sente encore comme le « petit nouveau » en ce qui a trait aux affaires de l'Association, je suis choyé d'avoir les conseils et le support de Gary, notre président sortant, Liz, notre secrétaire compétente, ainsi que l'enthousiaste CA constitué d'un intéressant mélange d'expérience et de nouveaux visages. Le temps passe toutefois rapidement et je suis déjà rendu à 2 mois de mon mandat d'un an. Aïe!

Je suis heureux de rapporter que des progrès ont déjà été faits pour former un groupe de travail afin de faciliter le retour de la communauté de la radioprotection sur les questions règlementaires. Peu après la conférence à Montréal, durant laquelle le sujet a été soulevé et identifié comme une priorité pour l'année qui vient, le personnel de la division des substances nucléaires et appareils à rayonnement de la CCSN a entreprit un dialogue encourageant avec nous. Le CA a eu une première discussion sur le sujet et développe présentement une proposition détaillée pour la téléconférence qui aura lieu en septembre. Restez à l'écoute cet automne pour plus de nouvelles (et pour l'appel de volontaires!).

Concernant les autres nouvelles de l'Association, le comité des nominations a un nouveau président. Debbie Frattinger a accepté de prendre le poste laissé vacant par Ray Ilson (en espérant qu'il se tourne vers un poste élu). Merci à Ray et Debbie pour leurs services passés et futurs.

Cet été fut intéressant et rempli d'événements dans notre industrie, avec des hauts et des bas qui, sans aucun doute, ont affecté plusieurs d'entre nous.

Le Canada (et la majorité de la planète) est présentement en pénurie d'isotopes médicaux due à l'arrêt prolongé du réacteur NRU de Chalk River, une pénurie qui sera bientôt exacerbée par l'arrêt du réacteur de Petten. Cette situation affecte plusieurs membres de l'ACRP qui supportent l'industrie, de l'étape de la production jusqu'à l'administration aux patients dans les hôpitaux de la

suite à la page 37 . . .

It's the middle of summer as I write this, and I hope you have all been able to find some time to relax with family and friends and perhaps catch up on reading the most recent edition of the *Bulletin*.

The excellent conference in Montreal is still fresh in mind for those of us who were lucky enough to attend. The organizers provided an engaging scientific program and a highly successful social and hospitality program in a wonderful venue. They not only deserve our appreciation for all the hard work, time, and energy they invested but also our congratulations for the great outcome.

Although I'm still feeling very much the "new guy" with respect to Association business, I am fortunate to have the advice and support of Gary, our past president, Liz, our very able Secretariat, and an enthusiastic Board, with a good mix of experience and new faces. Time is, however, ticking by and I am already two months into my one-year term. Yikes!

I am happy to report that good progress has already been made on establishing a working group to facilitate regulatory feedback from the radiation safety community. Soon after the Montreal conference, during which this issue was identified and discussed as a priority for the coming year, staff in the NSRD division of the CNSC initiated some encouraging dialogue with us. The Board has had a preliminary discussion on this matter and is developing a detailed proposal for discussion at our September teleconference. Stay tuned for more news (and for calls for volunteers!) in the fall.

In other Association news, the nominations committee has a new chair. Debbie Frattinger has agreed to take over the post from Ray Ilson, who is stepping down (hopefully with an eye to running for an elected position). Many thanks to Ray and Debbie for service past and future.

This summer has been an interesting and eventful time in our industry, with some ups and downs that are no doubt affecting many of us.

Canada (and most of the world) is currently experiencing a significant shortage of medical isotopes due to the prolonged outage of the NRU reactor at Chalk River, a shortage that is about to be exacerbated by the planned maintenance outage of the Petten reactor. This situation is affecting many of our CRPA members who support the industry from the production stage through to the end use

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Editor's Note/ Message du rédacteur en chef

Ma carrière professionnelle en radioprotection a vraiment débuté au congrès annuel de l'ACRP à Ottawa en 1998, même si j'étais présent au congrès de Victoria, un an plus tôt. En effet, le cadre enchanteur de l'endroit m'invitait alors à la contemplation plutôt qu'à la participation ! À Ottawa, par contre, j'ai commencé à prendre et à partager des notes sur différents sujets touchant la radioprotection. Le partage des connaissances, l'échange d'idées et la formation constituant des activités importantes pour les professionnels de l'ACRP, il n'est pas surprenant de constater que le congrès annuel de l'association constitue un moment privilégié pour ses membres. Le congrès de cette année a su faire honneur à cette longue tradition de qualité, qui fait de l'ACRP une organisation incontournable en matière de radioprotection au Canada.

Vous qui lisez ces lignes, n'avez-vous jamais eu l'occasion de participer à l'un de ces congrès ? Si ce n'est pas le cas, il faudra vous reprendre à Edmonton en 2010 ! Sachez simplement que les participants de Montréal ont eu l'occasion, notamment, de prendre part à des formations gratuites en scintillation liquide, de suivre un cours de rappel fort apprécié sur le transport des marchandises dangereuses et même de préparer leur examen de certification ACRP-E. Bien entendu, la cinquantaine de présentations scientifiques au menu avait de quoi régaler les experts en radioprotection les plus difficiles à satisfaire. Et si vous n'étiez pas tout à fait comblé, le banquet gastronomique des Saveurs du monde a probablement su assouvir votre soif d'apprendre. Je m'en voudrais de taire la contribution fort appréciée des organismes de réglementation tels la Commission canadienne de sûreté nucléaire et Santé Canada, qui ont profité de l'occasion pour échanger sur des aspects réglementaires et obtenir des commentaires précieux de la part des experts sur le terrain.

Le présent *Bulletin* revient donc sur ce congrès avec la mission de vous y convier en mai prochain. Le thème de Montréal, *Les performances humaines en gestion des risques*, a d'ailleurs permis d'accueillir les présentations de premier niveau de Jean-Yves Fiset, conférencier invité et expert en facteurs humains, de Chris Clement (CIPR) et de quelques délégués représentant le CRSO américain dont la participation apportait un volet international au congrès. Le code 35 de Santé Canada portant sur la radiologie, ainsi que quelques présentations sur l'industrie nucléaire et sur les radiations non ionisantes, complétaient le tableau. Elles ont su captiver leur public attentif.

Grâce à ses congrès organisés partout au pays, l'ACRP peut aussi tenir compte des réalités locales. La rencontre

suite à la page 23 . . .

My life as a radiation safety professional really began at the annual CRPA conference in Ottawa in 1998. I had attended the previous year's annual conference, but it was held in Victoria, and the beautiful scenery was more conducive to contemplation than participation! In Ottawa, I started taking notes and sharing my ideas about various topics related to radiation safety. It was there that I realized that sharing knowledge, exchanging ideas, and training are important activities for CRPA professionals. Not surprisingly, then, the annual conference is special for attendees, and the May 2009 conference in Montreal was no exception to this long tradition of high-quality conferences, a tradition that makes CRPA the undeniable leader in the field of radiation safety in Canada.

Have you ever attended an annual CRPA conference? If not, your next chance is in Edmonton in 2010! If you weren't at the Montreal conference, you missed the opportunity to attend a free training session on liquid scintillation, to take a much-appreciated refresher course on the transportation of dangerous goods, and to prepare for your CRPA(R) registration exam. And, without doubt, the main course—some 50 outstanding scientific presentations—was enough to please the most demanding radiation safety specialists. For those whose appetites were still not sated, the gastronomic offerings of *Saveurs du Monde* probably fit the bill! You also missed the popular contributions of regulatory organizations such as the Canadian Nuclear Safety Commission and Health Canada, which took advantage of the opportunity to discuss regulatory aspects and get valuable comments from experts in the field.

This *Bulletin* covers several aspects of the 2009 conference, with the goal of convincing you to attend the May 2010 conference. The theme of the Montreal conference, "Human Performance in Risk Management," featured first-rate presentations by Jean-Yves Fiset, the keynote speaker and an expert on human factors; the ICRP's Chris Clement; and delegates representing the North American Campus Radiation Safety Officers (CRSOs), which added an international dimension. Presentations on Health Canada's Safety Code 35 (radiology), the nuclear industry, and non-ionizing radiation completed the day and captivated the attentive audience.

The advantage of holding conferences across Canada is that it gives the association an opportunity to focus on

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2009 CRPA CONFERENCE

May 23 to 29, Montréal, Quebec

1. A happy winner, Past President Pauline Jones receives the Founder's Award from CRPA President Dave Tucker
2. Raphael Durocher and Vik Tathe from Energy Solutions, one of our vendors
3. Matthew Howland shakes hands with Tony MacKay after receiving his award for winning the student paper contest
4. Lou Champaign entertaining us during an impromptu music session
5. Lois Sowden-Plunkett, University of Ottawa, explaining radiation safety management
6. The CRPA Board (Jeff Sandeman, Liz Krivonosov, Dave Tucker, Valerie Phelan, Sandu Sonoc, Wayne Tiefenbach, Frank Tourneur, Petra Dupuis, Brian Gaulke and Gary Wilson)
7. Gary Kramer winning an iPod from Canberra
8. Joe Vincelli and Ali Shoushtarian at the banquet
9. Attendees in one of the two exhibitor's rooms
10. Jag Mohindra, one of the conference training experts, talking about nuclear reactor design
11. Attendees waiting for the "Taste of the World" Banquet

There are more pictures from the 2009 CRPA conference in the Conference Proceedings

Montréal

Co-op Studies

A stepping stone to an exciting future

by Maliha Altaf

From left to right: Sarah McNeil was hired by MDS Nordion to work as a student surveyor; Patrick Steadman worked at Health Canada's Medical X-ray and Mammography division, and Maliha Altaf has just completed an eight-month co-op work term with the Ottawa Hospital.

Student Corner has a guest columnist for this issue!

Maliha Altaf is a medical and health physics student (class of 2011) from McMaster University. She has just completed an eight-month co-op work term with the Ottawa Hospital and has now (temporarily) made the leap back into student life.

Co-op terms are a stepping stone to an exciting future. They help students apply the theory they learned during their academic terms, give them an opportunity to discover and develop future career interests, teach them about work ethics and professionalism, and provide them with experiences they can put to use in future careers and other circumstances. Maliha interviewed two of her Medical and Health Physics classmates—Sarah McNeil and Patrick Steadman, who were also working in Ottawa—to learn more about their co-op experiences. For this column, she has briefly summarized those discussions and written a summary of her own co-op term.

Sarah McNeil was hired by MDS Nordion to work as a student surveyor, and she was involved in several projects throughout her work term. Her main project entailed recalibrating a waste-bag monitor; the objective was to ensure the proper disposal of waste, particularly given the amount of activity found in the bags. Her daily responsibilities included checking the fields in different locations of the building and monitoring packages leaving the building, through readings (using a meter), to ensure they met appropriate transport indexes. Her favourite part of the job was performing weekly thyroid scans on employees to check for any iodine uptake. These scans help keep staff members safe and Sarah was delighted to be part of the process. She found the work most exciting, though, when unexpected tasks arose, such as spending time with the health physicist surveying an old reactor in order for it to be disabled. Sarah enjoyed her co-op experience because she was always learning something new.

For his co-op term, Patrick Steadman worked at Health Canada's Medical X-ray and Mammography division (part of the Consumer and Clinical Radiation Protection Bureau), which is located in the Radiation Protection Building (RPB) in Ottawa. His main project was to set up and document a thermoluminescent (TL) dose algorithm and operating procedure; the document is designed to teach a new user how to use TL dosimeters and how to maintain the proper technique to accurately measure the dose for a study. Along with this project, Patrick learned about and operated other dosimetry methods, including optically stimulated luminescence and metal-oxide semi-conductor field effect transistors. Over the course of his work term, Patrick learned about Health Canada's role in radiation protection, as well as Ottawa's cancer radiation treatment facility, participated in X-ray machine inspections, and attended the 2009 CRPA conference in Montreal. Being immersed in a radiation research and regulatory environment that was comprised of all facets of radiation protection was the most enjoyable aspect of his co-op term. Overall, his experience taught him a great deal about the medical and health physics field and his goal is to become part of the radiation protection team. He is well aware that, without McMaster's co-op program, he would never have grasped the scope, influence, and pace of development of radiation protection within Canada so quickly.

Maliha Altaf spent her co-op term, which began in January 2009, at The Ottawa Hospital's Radiation Safety and Health Physics (RSHP) department, where she worked with a small team comprised of radiation safety officers and medical health physicists. Her main project was to create a handbook that provides hands-on knowledge and references that RSHP employees can use on a day-to-day basis. She also participated in many short-term projects—such as creating tags that describe how to use the various types of equipment, working with the thyroid inter-comparison program, writing a quality indicator report, and providing hands-on spill

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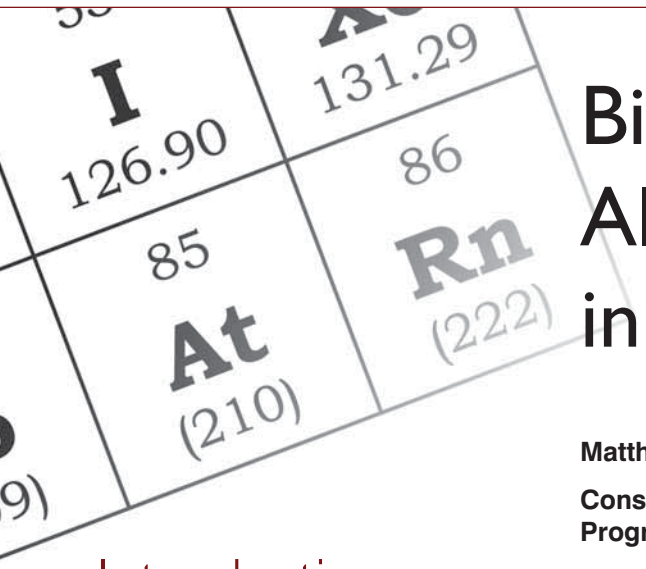
Résumé

Maliha Altaf est étudiante en physique médicale et en radioprotection (promotion 2011) à l'Université McMaster. Elle revient temporairement à la vie étudiante après avoir participé à un programme d'une durée de huit mois à l'hôpital d'Ottawa.

Nous l'avons invitée à collaborer au présent numéro du Bulletin afin qu'elle nous raconte son expérience du programme d'enseignement coopératif de médecine et de radioprotection de l'Université McMaster et celle de ses deux collègues de classe. Elle décrit le projet principal assigné à chacun et qui devait se terminer durant le programme, nomme certaines des autres expériences de travail valables qu'elles ont connues, et nous dévoile les parties favorites du programme pour chacun des participants. Pour les trois étudiantes, l'expérience du programme d'enseignement coopératif a confirmé leur décision d'étudier dans le domaine de la radioprotection et a soutenu leur enthousiasme quant à leur choix de carrière.



Biological Effects of Alpha Particle Exposure in Human Monocytic Cells

Matthew Howland & Vinita Chauhan

Consumer and Clinical Radiation Protection Bureau, Product Safety Program, Health Canada

Introduction

Naturally occurring α(alpha)-radiation is ubiquitous in the environment, its primary source being radon gas. ^{222}Radon is a decay product of ^{226}Radium and ultimately of ^{238}Uranium, both of which are found in soil and rocks and can accumulate in enclosed areas and underground mines. Epidemiological studies conducted among uranium mine workers and using animals have found a strong positive correlation between exposure to radon and an increase in the development of lung cancer (Darby et al., 2005; Kennedy, Gray, Denman, & Phillips, 2002; Samet et al., 1991; Stather, 2004). These studies have triggered considerable concern about similar effects on the general population (Neuberger & Gesell, 2002) and, over the past decade, have prompted several investigations into the effects of residential radon exposure and the risk of lung cancer. The results of these studies have yielded mixed data, with some studies suggesting a positive association between radon levels and lung cancer, and others showing equivocal or negative results (Samet & Eradze, 2000). More recently, combined analysis of data from residential radon case-control studies have shown a measurable risk of lung cancer at radon levels as low as 100 Bq/m^3 (Darby, Hill, & European Collaborative Group on Residential Radon and Lung Cancer, 2003; Krewski et al., 2005).

Radon is an inert, colourless radioactive gas that is derived from the decay of uranium through thorium and radium and continues to decay to radioactive bismuth and polonium through α-particle decay (National Research Council [NRC], 1999). Radon has a half-life of 3.8 days, its concentration in the atmosphere varying, depending on the place, time, and meteorological conditions. It enters buildings from different sources, includ-

Résumé

Des preuves récentes d'un grand nombre d'études en épidémiologie effectuées sur des travailleurs en exploitation minière d'uranium ont démontré que les particules α (alpha) produites par la progéniture de radon provoquent la carcinogenèse des poumons. Pour mieux comprendre le mécanisme moléculaire provoquant ces effets indésirables, des expériences ont été conçues pour étudier la provocation et la réparation des cassures double brin (CSB) et le dégagement de chimiokines pro-inflammatoires de cellules de sang périphérique exposées aux rayonnements α. Les cellules humaines monocytoïdes de sang périphérique (THP-1) ont subi des rayonnements sur six disques électroplaqués de ^{241}Am, dont l'activité s'élevait en moyenne à 68 kBq. Des cultures cellulaires ont été exposées à des rayonnements α en doses de 0 à 2.14 Gy (débit de dose = 0,85 Gy/h). Des cultures alpha-exposées et non exposées ont été cultivées, et les granules de cellules ont été analysées pour déterminer les diverses extrémités. La détection des cassures de brin d'ADN a été évaluée par essai de la comète alcalin. Les surnageants de la culture cellulaire ont été évalués pour déterminer la présence d'une série de chimiokines humains (RANTES, CXC-IP10, IL-8, CXC9/MIG et CC12/MCP-1) par cytométrie en flux à l'aide de microbilles ; le dommage et la réparation subséquente de l'ADN ont été évalués en examinant la formation de γ-H2AX aux sites de CSB d'ADN. Les cellules irradiées avec des particules α variant entre 0,27 et 2.14 Gy démontraient des augmentations statistiquement importantes, proportionnelles à la dose administrée ($p < 0,05$) en formation γ-H2AX, où la dose la plus élevée de provoquait une augmentation presque décuplante chez γ-H2AX. L'essai de la comète n'a révélé aucun dommage notable à l'ADN suite au rayonnement des cellules avec des doses peu élevées (de 0,25, de 0,50 et de 0,75 Gy) relatives au contrôle des cellules, possiblement en raison de la provocation des mécanismes de réparation d'ADN. La détection de sécrétions de chimiokines proinflammatoires dans le médium de culture cellulaire démontre des effets dose-réponse linéaires avec des augmentations statistiquement importantes observées suite à la dose la plus élevée d'exposition aux chimiokines IL-8, RANTES et CXC-IP10. Ces résultats indiquent que le rayonnement a provoque des effets biologiques qui pourraient être compensés en partie par l'activation des processus de réparation cellulaire.

ing soil, rocks, water supplies, natural gas, and building materials. Radon particles decay to a series of solid progeny, which then form into small molecular clusters that can attach to aerosols in the atmosphere. When inhaled, these progeny can settle in lung tissue, whereas the radon gas is mostly exhaled. Inhaled radon and its progeny are absorbed by cells into the bronchial airways and deposited in the lung epithelium. Furthermore, their small size and fat solubility allows them to enter the bloodstream and become deposited in the body (Bowie & Bowie, 1991).
The majority of the energy deposited in biological systems is from the emitted α-particles, which produce a high density of ionization and deliver a large amount of localized energy—about 10–50 cGy. This level of energy is sufficient to cause permanent genetic damage. At the level of DNA, α-particles cause large clusters of multiple ionizations within the DNA and in adjacent molecules, resulting in severely damaged localized sites (Goodhead, 1994; Goodhead & Nikjoo, 1989). Over the years, a great deal of evidence has emerged about the biological effects on cell and animal models and in humans exposed to α-particles. An earlier study conducted by Lutze, Winegar, Jostes, Cross, and Cleaver (1992) showed that freely replicating episomes in human cells exposed to radon gas underwent mutagenic changes, including large deletions involving many thousands of base pairs. Cytogenetic end points such as micronucleus frequency and chromosome aberration formation were also found to increase after exposure to radon and radon progeny, as compared to γ-exposures in both animals and in vitro studies (Jostes, 1996). Furthermore, aberrations in lymphocyte chromosomes and chromosomal instability have been found in the bone-marrow cells of people exposed to radon (Bowie & Bowie, 1991). More recent studies of human lymphocytes have shown increased complexity of chromosome aberrations with exposure to α-particles (Anderson et al., 2007); some of these studies have examined cytokines and apoptosis associated genes and the potential for inflammatory response from α-particle exposure. Exposures of human lung fibroblast cells to low dose α-particle irradiation (3.6–19 cGy) have resulted in the up-regulation of the interleukin-8 (IL-8) gene and protein expression as determined by northern blotting and by ELISA (enzyme-linked immunosorbent assay), respectively (Narayanan, LaRue, Goodwin, & Lehnert, 1999).

In the present study, human-derived monocytic cells were first exposed to α-particles emitted from ^{241}Am electroplated discs and then analyzed quantitatively for the repair of double strand breaks (DSB) using phosphorylated H2AX foci. DSB formation induces the phosphorylation of the tumour-suppressor protein, histone H2AX, and this phosphorylated form, known as γ-H2AX, forms foci at DSB sites. In addition, the alkaline comet assay was employed to measure the amount of DNA damage in relation to the dose of radiation received. Cell-culture supernatants were also tested for pro-inflammatory chemokine production.

Materials and Methods

Exposure and Harvesting

Human-derived peripheral blood monocytic THP-1 cells, obtained from the American Type Culture Collection (ATCC, Manassas, VA, U.S.), were maintained in a humidified incubator at 37°C, 5% CO2, 95% air in 75 cm^2 tissue-culture flasks (Costar, Cambridge, MA, U.S.). The cells were grown to confluence for 2 to 3 days in RPMI1640 medium, containing 10% fetal bovine serum (FBS) (ATCC). The cells were harvested in 35-mm dishes, consisting of inner and outer plastic sleeves and a pierced cap (Chemplex Industries, Palm City, FL, U.S.). Two Mylar membranes (Chemplex Industries), each 2.5 µm thick, were sandwiched between the two sleeves and stretched tightly across the bottom opening. A total of 8.0 x 10^5 cells/dish were seeded into each dish, with 2 mL of culture media containing 100 units/mL of penicillin and 100 µg/mL of streptomycin. The cells were cultured to about 90% confluency, then exposed to α-particle radiation at doses ranging from 0 (control) to 2.14 Gy, using ^{241}Am electroplated discs with an activity level of 68.0 kBq ± 3% at a dose rate of 0.85 Gy/h. The cells were harvested either immediately after exposure (alkaline comet assay) or 30 minutes post exposure (γ-H2AX). Five independent experiments were conducted for the comet assay and four were conducted for the H2AX assay. Cell viability was assessed from a 30 µL aliquot, both prior to exposure and immediately after exposure, at all doses by the dual-stain viability assay (Strauss, 1991).

Dosimetry

The dosimetry of the exposure system was modelled using the GEANT4 Monte Carlo tool kit. The cells were maintained in tissue-culture flasks with a surface area of 75 cm^2 (T75) and a canted neck with ventilated caps (VWR, Mississauga, ON, Canada). In order to render an environment suitable for α-exposure, the cells were cultured in thin, Mylar-based plastic dishes (MD), which α-particles are able to penetrate. The MD consisted of a three-piece plastic sleeve: inner and outer sleeves, with a pierced cap that fit tightly to the dish (Chemplex Industries, Palm City, FL, U.S.). Two Mylar membranes (Chemplex Industries), each 76.2 mm in diameter and 2.5 µm thick, were placed across the bottom opening of the inner sleeve. The outer sleeve was then slid over the membranes, leaving the membranes sandwiched between the two sleeves and stretched tightly across the bottom opening. The MD pieces were autoclaved in loosely sealed glass jars at 121°C for 25 minutes and were then left to cool to room temperature before the dish was put together. The energy of the α-particles directly incident on the nuclei of the cells was a distribution of energies with a mean of 3.33 ± 0.11 MeV and the average linear energy transfer was 154.8 ± 4.7 KeV/um. These values being calculated from the geometry discussed above.

H2AX Phosphorylation Assay

H2AX phosphorylation was assessed using flow cytometry, according to the following protocol. Thirty minutes following exposure, cell suspensions (500,000 per sample) were washed and fixed with 4% formaldehyde (Fisher Scientific, Hampton, NH, U.S.) and incubated for 15 minutes on ice. The cells were then washed and re-suspended in 1 mL cold (-40°C), 70% methanol (Fisher Scientific) and stored at -40°C for at least overnight and up to two weeks. Subsequently, 1 mL of cold TBS (Triphosphate Buffered Saline, 0.0154 M Trizma Hydrochloride [Sigma-Aldrich Canada, Oakville, ON], 0.5 M NaCl [Fisher Scientific], pH 7.4) was added to each sample, mixed well, centrifuged (8 min, 400 x g, 4°C), and re-suspended in 1 mL of cold TBS Serum Triton (TST, 96% TBS, 4% FBS [Sigma-Aldrich], 0.1% Triton X-100 [Sigma-Aldrich]). The samples were incubated on ice for 10 minutes, centrifuged (5 min, 400 x g, room temperature), and re-suspended in 200 µL of anti-γ-H2AX-FITC (Fluorescein isothiocyanate) antibody (Upstate Biotechnology, Waltham, MA, U.S.) that was diluted 1:500 in TST. After a 2-hour incubation period on a shaker platform at room temperature, 1 mL of TBS with 2% FBS was added. The samples were then centrifuged (5 min, 400 x g, 4°C) and re-suspended in 300–400 µL TBS with 2% FBS. Just prior to analysis by flow cytometry, 2 µL of 1 mg/mL propidium iodide (PI) was added to each sample.

Flow Cytometry Analysis

For flow cytometry analysis, data acquisition was set to analyze 20,000 cells on forward scatter (FSC) versus side scatter (SSC). The γ-H2AX response was measured by assessing the increased level of intracellular fluorescence characterized in the cells, as determined by the X-geometric mean (channel number) of the γ-H2AX positive cells. The cell-cycle distribution was assessed by examining the distribution of the area of the PI signal. All samples were analyzed on a BD FACSCalibur flow cytometer (BD Biosciences, San Jose, CA, U.S.).

Alkaline Comet Assay

The modified alkaline comet assay was performed as described previously (McNamee, McLean, Ferrarotto, & Bellier, 2000). The cells were exposed to α-radiation, and immediately after exposure, 50,000 cells were mixed with agarose (1%) in PBS at 37°C in a 1:10 dilution. The gels were cast on Gelbond strips (Mandel Scientific, Canada), using gel-casting chambers, and then placed into a lysis buffer (2.5 M NaCl, 0.1 M tetra-sodium EDTA, 10 mM Tris-base, and 1% (v/v) Triton X-100, pH 10.0), after which the gels were rinsed with distilled water, incubated in an alkaline electrophoresis buffer for 30 minutes at room temperature, and electrophoresed at 20 V for 20 minutes. They were subsequently rinsed with distilled water and placed in 1 M ammonium acetate for 30 minutes, then soaked in 100% ethanol for 2 hours, dried overnight, and stained with SYBR Gold (1/10,000 dilution of stock from Molecular Probes, Eugene, OR, U.S.) for 45 minutes. Comets were visualized at 220X magnification, and DNA damage was quantified, using the tail-moment parameter (i.e., the distance between the barycenter of the head and the tail of the comet multiplied by the percentage of DNA within the tail of the comet), ratio (% of DNA in the tail), comet length, and tail length. A minimum of 50 cell comets were analyzed for each sample, using ALKOMET Version 3.1 image analysis software.

Cytokine Analysis

Twenty-four hours post exposure, cell-culture supernatants (2 mL) from each treatment group were lyophilized overnight and then reconstituted in 300 µL of culture media. The samples were then centrifuged at 500 x g for 5 minutes to remove any sediment. Following that, the cytokine concentrations were quantified, using the BD Human Chemokine Kit Cytometric Bead Array (CBA) assay (BD Biosciences), and analyzed on a BD FacsCalibur flow cytometer (BD Biosciences).

Statistical Analysis

Statistical differences ($p \leq 0.05$) between treatment groups and control groups were determined by a repeated-measures design one-way ANOVA with Dunnett's multiple comparisons post hoc testing. Comet data were presented as mean ± SEM of five independent experiments, γ-H2AX data as mean ± SEM of four independent experiments, and cytokine data as mean ± SEM of six independent experiments.

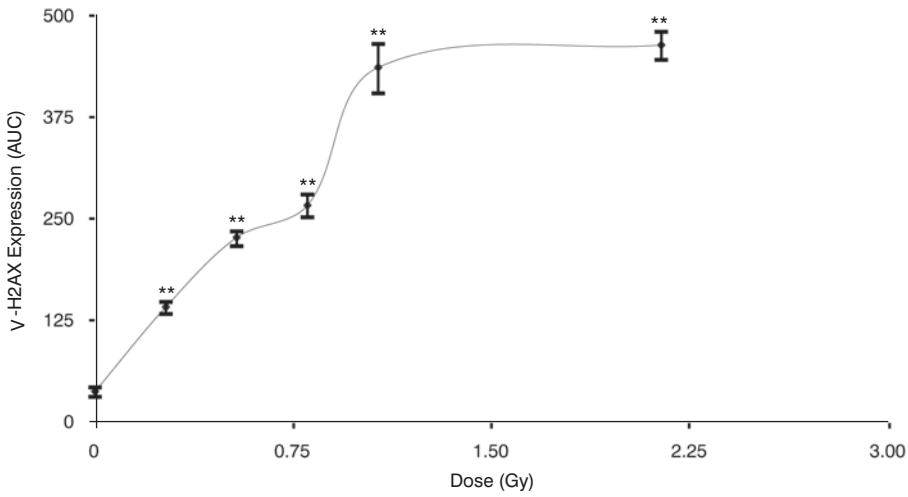


Figure 1: γ-H2AX expression at various doses. Data are presented as means ± SEM with n = 4 biological replicates. ** represents $p \leq 0.01$ statistically significant difference from the control. A linear trend was observed up to 0.50 Gy ($R^2 = 0.96$; line not shown).

Results

Cellular Viability

To assess the overall integrity of the cells, cell viability and cell number were measured following all exposure conditions. The results indicated that α-radiation at all doses and time points tested did not cause any significant effects on cellular viability. The cells remained 95–99% viable, and no statistically significant decreases in cell number were observed following α-particle irradiation (data not shown).

H2AX Phosphorylation

An immunocytochemical assay using antibodies capable of recognizing histone H2AX phosphorylated at serine 139 (γ-H2AX) was employed to assess DNA damage and repair following the exposure of monocytic cells to α-radiation. To determine the optimal time point for γ-H2AX expression, a time-course experiment was conducted up to 120 minutes post-irradiation with 1 Gy of α-radiation; γ-H2AX induction was found to peak at 30 minutes (data not shown). Therefore, for all experiments, γ-H2AX was assessed 30 minutes post-irradiation. To ensure that any increases in γ-H2AX in our treatment groups were not related to increases in DNA content as a result of the cell-cycle phase, the DNA content of the cell pellets was measured, and it was found to remain constant for all sample treatment groups. Monocytic cells exposed to α-radiation at various doses showed a dose-responsive increase (Figure 1) up to 1.07 Gy of irradiation, at which point expression reached a plateau. Statistically significant responses were obtained at all doses tested ($p \leq 0.05$) relative to the unirradiated control treatment group. At the highest dose (2.14 Gy), approximate10-fold increase in γ-H2AX was observed relative to the control sample.

Table 1: DNA damage parameters for comet assay were determined following irradiation of monocytic cells to gamma (^{137}Cs) and α-radiation (^{241}Am). Data are presented as means ± SEM from n = 5 biological replicates for α-exposures and n = 3 biological replicates for γ-exposures. * represents $p < 0.01$ statistical difference compared to the relative control.

Radiation Type	Dose (Gy)	Ratio	Moment	Comet Length	Tail Length
α	0	0.09 ± 0.03	1.31 ± 0.50	47.9 ± 12.2	24.1 ± 9.9
	0.25	0.09 ± 0.02	1.13 ± 0.30	48.0 ± 9.5	24.5 ± 7.6
	0.50	0.10 ± 0.03	1.45 ± 0.70	55.1 ± 7.5	30.3 ± 5.8
	0.75	0.11 ± 0.03	1.53 ± 0.50	57.0 ± 11.2	32.1 ± 9.1
γ	0	0.20 ± 0.05	2.10 ± 0.40	42.0 ± 2.6	21.4 ± 3.1
	4	0.30 ± 0.06	5.14 ± 1.90*	73.8 ± 5.5*	47.7 ± 5.6*
	8	0.45 ± 0.01*	10.7 ± 0.7*	75.3 ± 1.7*	49.7 ± 1.8*

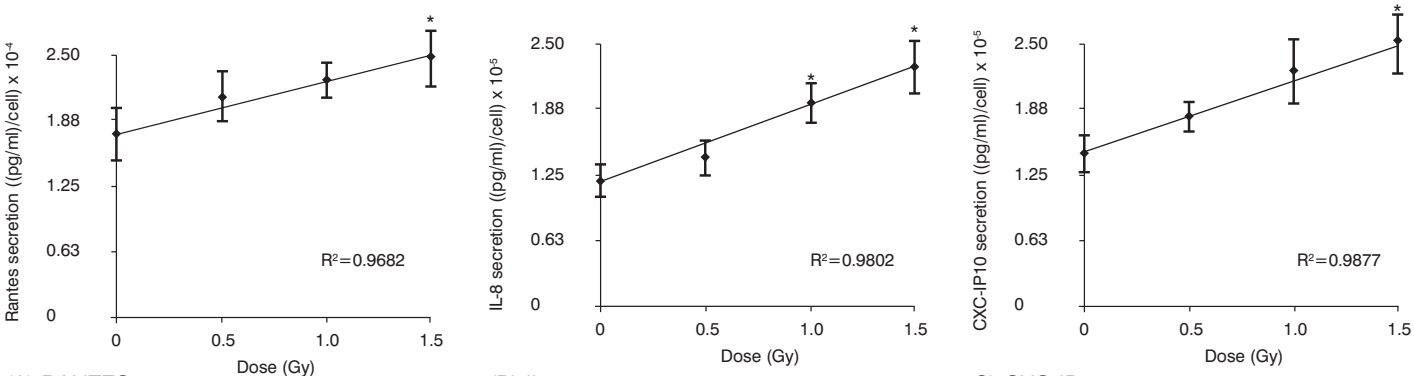
Alkaline Comet Assay

The ability of α-particle exposure to elicit DNA strand breaks was assessed in human monocytic cells using the alkaline comet assay. DNA damage was assessed in the cell cultures immediately after exposure to between 0 and 0.75 Gy α-particle radiation. DNA damage was quantified in a minimum of 50 cells, using tail ratio, tail moment, tail length, and comet length as measures of DNA damage. Alpha-irradiation did not result in statistically significant DNA damage by any of the four parameters at doses of 0.25, 0.50, and 0.75 Gy (Table 1). However, a positive control that comprised cells exposed to 4 and 8 Gy of γ-radiation did produce statistically significant increases in single and DSBs ($p \leq 0.05$), compared to the control.

Cytokine Production

The protein levels of RANTES, CXC-IP10, IL-8, CXC9/MIG, and CC12/MCP-1 were monitored in cell-culture supernatants for all samples, using a multiplex cytometric bead array assay, and were quantified by flow cytometry. Of the four chemokines tested, only RANTES, CXC-IP10, and IL-8 could be detected in the culture media of THP-1 cells (Figure 2); CC12/MCP-1 and CXC9/MIG were below the threshold of detection. The secretion of RANTES into the cell-culture media was found to be 10-fold higher in comparison with

Figure 2: Secretion levels following exposure to various doses of α-radiation. Data are presented as means ± SEM with n = 6 biological replicates. All graphs show linear trends with $R^2 \geq 0.95$.



(A) RANTES (B) IL-8 C) CXC-IP10

* represents a $p \leq 0.05$ statistical difference compared to the control.

CXC-IP10 and IL-8. Overall, a linear dose-response effect was observed, with statistically significant increases in chemokines observed at the highest dose tested (1.5 Gy), with the exception of IL-8—its concentration was found to have increased in cell-culture supernatants following 1.0 Gy of α-radiation.

Discussion

Recent animal-based and epidemiological studies have shown radon inhalation as the second-highest cause of lung cancer after smoking (Frumkin & Samet, 2001). Inhaled radon and its progeny are absorbed by cells into the bronchial airways and deposited in the lung epithelium, where they easily enter the bloodstream to induce toxic effects. Since radon-induced carcinogenesis has been studied mainly through epidemiological investigations, well-controlled in vitro and in vivo experiments are needed to provide further insights into the biological mechanisms underlying radon exposure-induced adverse effects.

In this study, blood monocytic cells were examined, based on the critical role they play in the body's defence against foreign substances. Various biological end points were examined, including DNA damage induction and repair, cellular viability, and chemokine secretion. Homeostatic imbalances in any one of these end points could result in a compromised cellular system, leading to carcinogenesis. Because DNA is well known as a critical target for the biological effects of radiation, DNA damage was examined, using two methods: the highly sensitive γ-H2AX assay and the alkaline comet assay.

H2AX is a histone variant that is ubiquitously expressed throughout the chromatid structure. Numerous studies have shown that DNA damage that results in the induction of DSB induces the phosphoryalation of H2AX at serine 139. The phosphorylated form of this histone, known as γ-H2AX, can be detected with an immunocytochemical assay that utilizes antibodies that recognize γ-H2AX. This type of assay has become the standard for both the detection of DNA damage and its repair (Takahashi & Ohnishi, 2005). In this study, the optimal time point of γ-H2AX expression was found to be 30 minutes post-irradiation. Monocytic cells dosed with α-radiation ranging from 0–2.14 Gy showed a linear response in the induction of γ-H2AX up to 1.07 Gy (0.50 to 1.07), after which the expression of γ-H2AX reached a plateau, conceivably due to the low dose rate of α-exposure. For the highest dose, the time course of exposure was approximately 2.4 hours; therefore, the amount of γ-H2AX observed over the 2.4-hour mark depended upon the rate of phosphorylation of H2AX and the rate of dephosphorylation as repair progressed. This study, and others, have shown that γ-H2AX appears within minutes of the induction of DSB, increasing with time up to 30 minutes and then decreasing as the DSB are repaired (Antonelli et al., 2005; Pilch et al., 2003; Rogakou, Boon, Redon, & Bonner, 1999; Rogakou, Pilch, Orr, Ivanova, & Bonner, 1998). It follows that the amount of γ-H2AX observed in cell cultures after a longer exposure at a low dose rate would be less than the amount observed after acute exposures of the same dose. The cells will reach steady-state equilibrium between the amount of DNA being damaged and the amount of DNA being repaired. Only one other study has examined the formation and repair of DSB after exposure to α-radiation. That study used γ-H2AX as an indicator of damage in Chinese hamster cells, and the researchers were able to show a linear dose-response curve up to 1 Gy of α-radiation, followed by a slight decrease but not a plateau in γ-H2AX induction at the higher dose (Leatherbarrow, Harper, Cucinotta, & O'Neill, 2006). This discrepancy was likely the result of the dose rate used for exposure, as their study employed an α-source with a dose rate of 1–2 Gy/min.

The alkaline comet assay was employed to assess DNA damage in the current study because, under alkaline conditions, all single-strand DNA breaks can be detected regardless of whether they result from DNA double-strand lesions, original single-strand breaks, or abasic sites. Monocytic cells exposed to α-radiation (dose rate 0.85 Gy/h) at a dose of 0.25, 0.50, and 0.75 Gy did not show any significant increase in DNA damage following irradiation. However, our γ-irradiated control (dose rate 1 Gy/min) showed significant DNA damage at 4 and 8 Gy of irradiation. These results are similar to a study conducted by Rössler et al. (2006), in which no significant effects on DNA damage were observed using the alkaline comet assay in confluent human gastric cancer cells exposed to ^{241}Am (α-emitter); DNA damage was only detectable at doses of >2 Gy. The lack of DNA damage detected by the comet assay in this study was probably due to the low dose rate for α-exposure (0.85 Gy/h). It has been shown in C3H10T1/2 cells that the repair kinetics response in cells is a biphasic response. The fast component of repair occurs in the first two hours after irradiation; a slow component repairs the residual breaks within 24 hours (Banáth, Fushiki, & Olive, 1998; Nocentini, 1999). At a low dose rate (0.85 Gy/h), most of the DNA damage that has occurred will be repaired by the end of the exposure, a finding that is supported by the γ-H2AX data that show a strong induction of DNA repair mechanisms at low doses of radiation.

Chemokines are a family of low molecular weight, pro-inflammatory cytokines, which bind to G-protein coupled receptors. They function primarily in chemoattraction and activation of specific leucocytes in various immuno-inflammatory responses. Recent studies have shown them to be key components in cancer, involved in the neoplastic transformation of cells (Arya & Patel, 2003). In our study, we evaluated the production of a number of chemokines after the exposure of cells to α-radiation. Of the five chemokines tested, only three responded to the α-radiation. Although the three responsive chemokines (RANTES, IL-8, and IP-10) showed a linear dose-response trend, significant changes were only observed at the highest dose tested (1.5 Gy), with the exception of IL-8, which also showed significance at the medium dose. Interleukin-8 is a chemokine that is known to be up-regulated by a stressor response, and it is recognized as a potent chemoattractant and activator of neutrophils, lymphocytes, and basophils. Researchers have found that activated leukocytes (c to k) can produce and release large amounts of reactive oxygen species (ROS) and toxic granules (i.e., myeloperoxidases), leading to excessive inflammation (Caricchio, McPhie, & Cohen, 2003). Narayanan et al. (1999) showed that α-exposed human normal fibroblasts induced increases in production of IL-8 in parallel with elevated production of ROS. Such production of IL-8 induced by α-particles may contribute to an inflammatory response in the lower respiratory tract.

Summary

It has been shown here that α-radiation causes significant biological effects in terms of DNA damage and chemokine release. However, it is evident that, at a low dose rate of α-exposure such as would occur in a physiological setting, most of the DNA damage is repaired by the recruitment of repair proteins. This is indicated by the induction of γ-H2AX at low doses and a corresponding lack of DNA damage in the comet assay. Although significant differences were observed in chemokine secretion, the in vivo biological effects of these differences are unclear. Although chemokines have been shown to be beneficial, inducing proliferation, differentiation, and cell death (Yarilin & Belyakov, 2004), these chemokines can also strongly activate inflammatory responses and cell death in various tissues, including the lung. Thus, with both beneficial and negative consequences, in vivo models are warranted to better understand the risks associated with low dose rate α-particle irradiation, such as occurs through radon gas inhalation. ■

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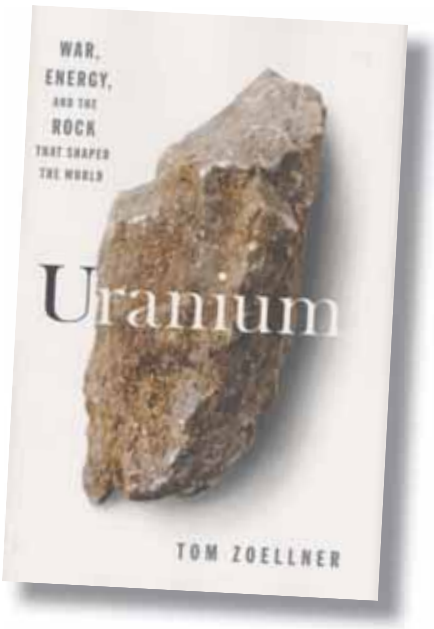
Uranium

War, Energy and the Rock that Shaped the World

Tom Zoellner (London: Viking Penguin, 2009)

review by Michael Grey
Candesco Research Corporation, Burlington, ON



Tom Zoellner is a reporter for the *San Francisco Chronicle* who has an interest in geology, among other things. His first book, *The Heartless Stone: A Journey through the World of Diamonds*, looked at diamond mining and marketing; his second book was a biography of Paul Rusesabagina (whose story was subsequently told in the film *Hotel Rwanda*), which he co-authored with Rusesabagina. In his latest book, *Uranium: War, Energy and the Rock that Shaped the World*, he takes a selective look at uranium mining, particularly in Africa, the United States, and Australia.

Résumé

Le nouveau livre de Tom Zoellner, *Uranium: War, Energy and the Rock that Shaped the World*, est constitué d'une série de vignettes faciles à lire qui portent surtout sur l'histoire de l'extraction minière de l'uranium en Afrique, aux États-Unis et en Australie. Zoellner raconte les débuts de l'industrie au 16e siècle en Bavière, jusqu'à la découverte de la radioactivité et de la fission nucléaire, la création de la bombe atomique, la prospection minière de l'uranium aux États-Unis et en Australie, et le boom actuel en extraction minière de l'uranium. Il décrit également les répercussions de la recherche et de l'extraction minière de l'uranium au Congo et au Niger, ainsi que le lien entre le Niger et la guerre actuelle en Iraq. Ce livre s'adresse aux personnes ayant un certain intérêt pour l'histoire de cet aspect de l'industrie nucléaire mais ne comblera pas les plus exigeants.

The book begins with the author recounting his visit to the Shinkolabwe mine site in the Congo. Most of the uranium used in the Hiroshima bomb came from this mine, which is now abandoned. At the height of its production, some of the worst abuses in the history of mining occurred at Shinkolabwe, abuses that now form part of what is known as "King Leopold's Legacy" in the Congo (as described in Adam Hochschild's 1998 book *King Leopold's Ghost: A Story of Greed, Terror, and Heroism in Colonial Africa*). Zoellner follows this vignette with a review of the history of uranium mining from its beginnings in the Ore Mountains of Bavaria in the 16th century through to the discovery of radioactivity and nuclear fission, before returning to the Congo to describe the effort to obtain uranium for the Manhattan Project and the development of the atomic bomb. He then details the postwar uranium-prospecting craze that took place in the American West and the eastern-bloc uranium mining done in both Czechoslovakia and East Germany. He also looks at the nuclear weapons programs in India, Pakistan, and Israel.

In a following chapter, the author moves on to Australia to describe prospecting in the Northern Territory, the beginnings of the Ranger mine near Mount Brockman in the Kakadu National Park, and the creation of the Australian "Three Mines Policy." In the penultimate chapter, Zoellner looks at uranium mining in Niger, Africa, and its association with the war in Iraq in the context of Joseph Wilson's U.S. mission to Niger and the political scandal following the "outing" of his wife, Valerie Plame. He also comments on the nuclear weapons program in Iran. The last chapter, entitled "Renaissance," is devoted to the development of uranium mining from the post "Three Mile Island" lethargy through the current boom, which is told, in part, through the search for uranium in central Asia.

There is, however, virtually no discussion in this book of the civilian uses of nuclear energy and surprisingly little mention of uranium mining in Canada, beyond a few brief references to Canadian participation in the "Uranium Club" in the 1970s and the activities of some junior mining companies on the Vancouver Stock Exchange in the days before Bre-X. Also surprisingly, the author devotes very little space to the commercial aspects of the uranium mining industry or to environmental concerns such as tailings management.

This 293-page book is a quick read as it tends to be a collection of vignettes, which is ideal for reading on the GO Train. The book will most likely appeal to those with some interest in the history of this aspect of the nuclear industry, but it will not satisfy those seeking a complete history of uranium mining. The book's few technical errors, which will be immediately obvious to a knowledgeable reader, do not seriously detract from the flow of the story. ■

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A VISIT
To a Radiation Therapy Department

by Lysanne Normandeau

During the CRPA conference in Montreal, 40 conference delegates accepted an invitation to tour the radiation therapy department of the Centre Hospitalier de l'Université de Montréal (CHUM). On Tuesday night of the conference, they arrived at the Notre-Dame campus of CHUM to see our new therapy machine, the CyberKnife—the first one to be installed in Canada. After first enjoying a buffet provided by our sponsor Accuray, manufacturer of the CyberKnife, they listened to a short presentation (in case they hadn't heard enough presentations during the day) on our department.

CHUM's radiation oncology department is one of the largest in Canada, with a yearly volume of 5,000 patients, a staff of 20 radiation oncologists, about 100 technologists, and 22 medical physicists. As well as having a leading-edge equipment pool, the department has nine accelerators, two tomotherapy units, two high dose-rate brachytherapy units, the Cyberknife, and equipment for simulation and treatment planning.

The delegates then visited four areas of the department; in each department, radiation therapy technologists and medical physicists explained the different modalities of treatments.

At the PET CT unit, Charles Martel explained how the images from the CT and the PET are combined and used to plan a cancer treatment with accuracy. He demonstrated the respiratory gating process that takes into account movements of the thorax during image acquisition.

Judging from the comments we overheard on the bus back to the hotel at the end of the visit, the tour was appreciated. Aimée Lauzon, who helped organize the tour, and I were happy to take this opportunity to contribute to the conference in Montreal and to share with delegates part of our working environment. We also want to thank the volunteers from the radiotherapy staff who guided the tour.

The final stop on the tour gave delegates a chance to see the department's new acquisition, the Cyberknife, a non-invasive, robotic stereotactic radiosurgery system. Dominic Béliveau-Nadeau and Deborah Pascale explained how this sophisticated machine is used for the ablation of a lesion, using radiation (6 MV photons) with precise 3D geometrical location, and how it tracks, detects, and corrects for movements with respiratory gating and image guidance for each field of treatment. To learn more about this machine, take a look at Aimée Lauzon presentation in the conference proceedings.

(Above) The group's third stop was at the bunker that houses one of the high-energy linear accelerators that is used to treat patients. There, the delegates listened to Eliane Albert and Nasser Djennaoui describe the machine and the multi-leaf collimator and explain the treatment procedures.

(Left) Denise Comeau and Renée Larouche were the enthusiastic guides to the brachytherapy suite and described the instruments and software used for permanent implants and high dose rate brachytherapy.

Le congrès de Montréal a permis à une quarantaine de participants de visiter le service de radio-oncologie du Centre hospitalier de l'Université de Montréal (CHUM), qui se classe parmi les plus importants services de radio-oncologie du Canada, avec un volume annuel de 5 000 patients et une équipe composée de 20 radio-oncologues, de 100 technologues et de 22 physiciens médicaux.

En arrivant sur le campus Notre-Dame, les participants ont d'abord dégusté un buffet offert par AccurayMC, commanditaire de l'activité et manufacturier de la véritable vedette de la visite : le CyberKnife®. Cet appareil est la plus récente acquisition d'un équipement d'avant-garde incluant neuf accélérateurs, deux unités de tomothérapie, deux unités de curiethérapie à haut débit de dose, ainsi que de l'équipement de simulation et de planification de traitement.

Les délégués ont visité les quatre aires de travail du service en écoutant les explications de technologues en thérapie et celles de physiciens médicaux. Charles Martel a ainsi expliqué le fonctionnement du TEP et le recours aux images pour planifier des traitements, alors que Denise Comeau et Renée Larouche ont guidé les délégués avec enthousiasme dans les chambres de curiethérapie. Par ailleurs, Eliane Albert et Nasser Djennaoui ont expliqué le fonctionnement d'un accélérateur linéaire à haute énergie.

Le clou de la visite est indéniablement le Cyberknife®, un système de radiochirurgie robotisé, non évasif et stéréotaxique. Dominic Béliveau-Nadeau et Deborah Pascale ont expliqué le fonctionnement de cette machine sophistiquée qui utilise un rayon photonique de 6 MV comme scalpel. Aimée Lauzon a d'ailleurs présenté cet appareil aux membres de l'Association lors d'une conférence au congrès.

Les délégués ont apprécié la visite organisée par Aimée Lauzon et Lysanne Normandeau, qui contribuaient, à leur façon, à la réussite du congrès de Montréal.

Editor's Note/ Message du rédacteur en chef

. . . continued from page 9

local, as well as national, issues. At the 2009 Montreal conference, delegates from across Canada were able to learn about Quebec's breast-cancer screening program, technical dosimetry cases in medical imaging, the radon situation, the radiation safety challenges successfully handled by certain Canadian universities, and, thanks to a facility tour organized by CHUM, the Cyberknife, yet another innovation in radiation oncology treatment. Lysanne Normandeau's summary of the CHUM tour is included in this issue.

Conference participants also had the chance to hear from the new generation in radiation safety, embodied by Matthew Holland; his winning entry in the CRPA student contest is reproduced in its entirety in these pages. As well, in this issue, new CRPA member Aimée Lauzon shares her photos and thoughts on attending her first CRPA conference, letting you see for yourself that if you can only attend one event, the CRPA conference is not to be missed; Mike James presents the regulatory requirements for RSOs; and Jean-Pierre Gauvin and Joe Vincelli report the minutes of an important meeting of registered CRPA(R) members.

CRPA members have not been forgotten: the results of a recent survey on CRPA services are also included in this issue. We will be publishing survey results regularly to encourage discussion and participation.

Finally, our dedicated columnists—Leah, Emélie, and Mike—continue their excellent work in this special Montreal 2009 issue of the *Bulletin*. We hope you enjoy it. Once again, I invite you to send us your comments and to use this tool to communicate your scientific knowledge to your fellow members.

Happy reading!

Stéphane Jean-François, Eng., M. Env., CHP
Chief Editor, CRPA *Bulletin*

. . . suite de la page 9

de 2009 a présenté le programme québécois de dépistage du cancer du sein, quelques cas techniques de dosimétrie en imagerie médicale, la situation du radon au Québec, les défis en radioprotection relevés avec brio par certaines universités canadiennes, sans oublier le dévoilement d'une autre innovation dans le traitement médical de radio-oncologie avec le *CyberKnife*, dont la visite des installations était une heureuse initiative du CHUM. On trouvera un résumé de cette visite par Lysanne Normandeau dans les pages du présent *Bulletin*.

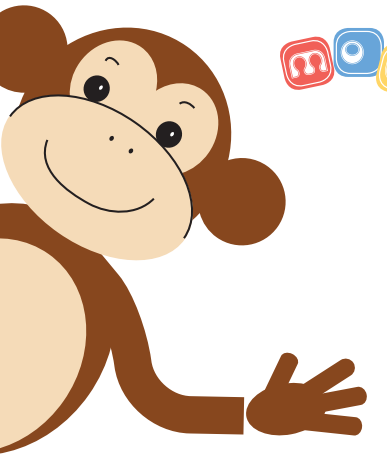
Les congressistes de cette année pouvaient aussi apprécier la relève en radioprotection, incarnée par Matthew Holland dont la contribution gagnante au concours étudiant de l'ACRP est reproduite intégralement dans nos pages. Les images et le témoignage d'un nouveau membre de l'ACRP, Aimée Lauzon, vous permettront de constater que notre congrès annuel est l'activité à ne pas manquer si votre emploi du temps ne vous permet qu'une seule participation du genre. Mike James nous présente les exigences réglementaires pour les responsables en radioprotection. Une rencontre importante entre membres enregistrés ACRP-E a eu lieu, et nous en publions ici le compte-rendu, tel que rapporté par Jean-Pierre Gauvin et Joe Vincelli.

En outre, puisque l'ACRP est aussi à l'écoute de ses membres, nous publions les résultats d'un sondage récent portant sur les services de l'association. Nous prendrons l'habitude de publier les résultats des sondages pour encourager la discussion ou la participation à ceux-ci.

Finalement, nos chroniqueurs dévoués, Leah, Emélie et Mike, poursuivent leur excellent travail et complètent ce numéro spécial du *Bulletin*, Montréal 2009. Nous espérons que vous l'apprécierez. Je vous invite encore à nous faire part de vos commentaires et à utiliser notre publication pour transmettre vos connaissances scientifiques à nos membres.

Bonne lecture !

Stéphane Jean-François, Eng., M. Env., CHP
Rédacteur en chef, *Bulletin* de l'ACRP.



A summary of the recent Survey Monkey results
Sommaire des résultats du dernier sondage avec survey monkey

Survey Monkey, an online survey tool, is now used by CRPA to take the pulse of its membership. In March 2009, certain administrative questions were asked and just over a hundred of our members answered the call. Following is a summary of what they had to say.

Tradition is strong within CRPA; a strong majority of members want to keep the annual conference in the Spring. We note, however, that new technologies are gaining popularity with our membership, and a preference for e-format is gaining ground. The website is the preferred forum for conference abstracts and the membership handbook (but we still see a significant number who value the paper copy of the handbook). It seems we share a big chunk of our membership with the Health Physics Society, but the diversity of our membership is reflected in the many other associations our members identified themselves as being a part of. Finally, some employers pay for CRPA membership fees, but most of you pay for membership out of your own pocket!

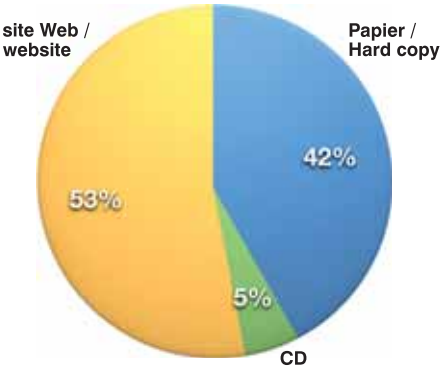
We want to thank everyone who participated in this survey!

L'ACRP utilise désormais l'outil en ligne « Survey Monkey » pour tâter le pouls de ses membres. En mars 2009, nous avons posé certaines questions administratives avec cet outil et environ une centaine de membres ont répondu à l'appel.

Nous avons pu constater que la tradition est forte à l'ACRP. Ainsi, une grande majorité de membres désire conserver la période de la fin du printemps pour participer au congrès annuel. Par contre, on remarque que les nouvelles technologies font leur entrée chez nos membres, puisque le format électronique gagne du terrain. En effet, notre site internet est apprécié pour ses recueils de communications des congrès annuels et l'annuaire des membres. Toutefois, on remarque que le papier demeure un mode de présentation apprécié. Bien que la Health Physics Society accueille une grande partie de nos membres, la polyvalence de ces derniers s'observe par leur appartenance à plusieurs autres organisations. Enfin, bien que quelques employeurs payent votre inscription à l'ACRP, vous êtes plus nombreux à la payer de votre poche.

Un grand merci à tous les participants du sondage.

Annuaire / Membership Handbook



Dans quel format désirez-vous recevoir l'annuaire des membres ? (Choisissez une réponse)

What is your preferred method of receiving the membership handbook? (Choose 1)

117 members ont répondu / members responded

Sur papier / Hard copy	49
Sur CD / CD	6
Section 'Membres seulement' du site Web / Members-only section of the website	62

Communications de la conférence / Conference proceedings

Dans quel format désirez-vous recevoir le recueil des communications du congrès ? (Choisissez une seule réponse)

In what format would you prefer to receive the conference proceedings? (Choose 1)

116 members ont répondu / members responded

Sur DVD / DVD	51
En ligne / Online	65

Conférence / Conference

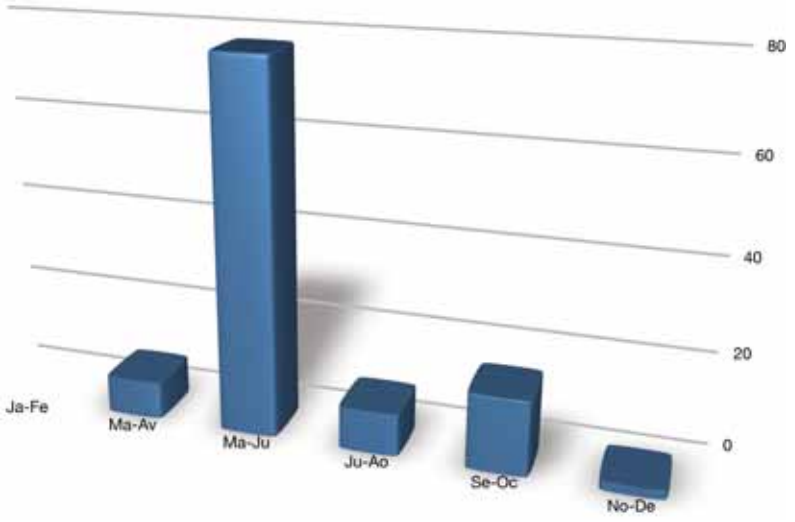
À quel temps de l'année préférez-vous assister à la conférence annuelle? (Choisissez une seule réponse)

What are your preferred months to attend an annual CRPA conference? (Choose one)

113 members ont répondu / members responded

Ja-Fe	0	Ju-Ao	9
Ma-Av	8	Se-Oc	16
Ma-Ju	78	No-De	2

À quelle période de l'année préférez-vous participer au congrès annuel ?
What month should we hold the annual CRPA conference?



Adhésion / Membership Fee

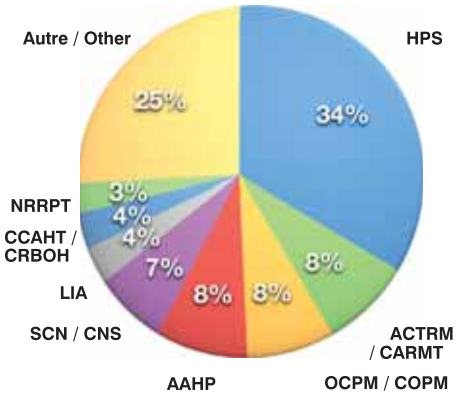
Qui paie votre adhésion ?

Who pays your membership fee?

120 members ont répondu / members responded

Vous-même / You	63
Votre employeur / Your employer	57

Autres associations / Other associations



Dans un effort visant à établir nos priorités de liaison avec d'autres associations, l'ACRP aimerait connaître le pourcentage de ses membres qui sont également membres d'autres associations ou groupes professionnels. De quelles associations ci-dessous êtes-vous membre ? (Choisir toutes les réponses qui s'appliquent.)

In an effort to prioritize our liaison with other associations, the CRPA would like to know the percentage of our membership that also belong to other professional groups or associations. Which of the following are you a member of? (Choose all that apply)

75 members ont répondu / members responded

Health Physics Society (HPS)	48
Association canadienne des technologies en radiation médicale (ACTRM) / Canadian Association of Medical Radiation Technologists (CAMRT)	11
Organisation canadienne des physiciens médicaux (OCPM) / Canadian Organization of Medical Physicists (COPM)	11
American Academy of Health Physics (AAHP)	12
Société nucléaire canadienne (SNC) / Canadian Nuclear Society (CNS)	10
Laser Institute of America (LIA)	5
American Board of Industrial Hygiene (ABIH) / Canadian Registration Board of Occupational Hygienists (CRBOH)	5
National Registry of Radiation Protection Technologists (NRRPT)	4
Autre / Other	36

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.
4. La soumission d'un manuscrit implique qu'il n'est pas considéré ailleurs pour publication. Une fois sa publication acceptée dans le Bulletin, il est essentiel d'obtenir le consentement du rédacteur en chef avant qu'un manuscrit, ou toute partie d'un manuscrit, puisse être publié ailleurs sous le même format.
5. Les auteurs sont invités à soumettre des manuscrits à tout moment au cours de l'année à

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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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Été ..... 15 avril
Automne ..... 15 juillet
Hiver ..... 15 octobre

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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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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.
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Summer ..... April 15
Fall ..... July 15
Winter ..... October 15

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General Impressions of a New CRPA Member

by Aimée Lauzon, Centre hospitalier de l'Université de Montréal (CHUM)

This article contains subjective material that may not be suitable for everyone. Open-mindedness is advised! :o)

Résumé

En tant que nouvelle membre de l'ACRP, Aimée Lauzon vous guide dans son périple au congrès annuel de Montréal. Veuillez noter que, selon le propre aveu de l'auteure, ce texte comporte des passages subjectifs pouvant ne pas convenir à tous. L'ouverture d'esprit du lecteur est donc conseillée. Madame Lauzon perçoit l'ACRP comme un rassemblement de professionnels en radioprotection de partout au Canada et elle se sent privilégiée d'en faire partie. Plus souvent qu'autrement, l'enthousiasme des premières rencontres la réveille au petit matin. En outre, le défi de donner une conférence et d'organiser une visite des installations de radio-oncologie la stimule doublement. Bien qu'elle ait eu hâte à l'Assemblée générale annuelle de l'ACRP, elle en fut déçue, les membres du Conseil d'administration ne s'étant pas présentés convenablement. Par ailleurs, la tenue de la réunion manquait de suivi en ce qui concerne les documents présentés. Heureusement, Mme Lauzon présente des solutions qui, parions-le, seront prises en considération par le nouveau CA de l'ACRP.

Let me first introduce myself. I completed my graduate studies in December 2008, and I am presently working full-time as a medical health physicist in close collaboration with Lysanne Normandeau. I have always been involved in extra-curricular activities, such as the dramatic arts, tutoring, student associations, and team sports.

I now invite you to accompany me on my journey through this year's CRPA conference and learn my general impressions of it.

Before the conference

I perceive the CRPA as a gathering of radiation-protection professionals from across Canada and feel honoured to be part of the group. I greedily read my first *Bulletin*—and immediately decide to get involved in the translation committee. Since the next CRPA conference will take place right here in Montreal, it will be a great opportunity for me to learn more about radiation-protection issues, to meet new people, to get my career started . . . ! Okay, calm down (giggles).

I start preparing a paper I'm to present on the challenges of implementing new technologies in radiation oncology, in particular, the new Cyberknife system that our institution recently acquired. Lysanne then suggests the two of us organize a social event for the conference: a tour of the radiation oncology department. Great idea. Let's do it!

At the conference

Day 1 – I wake up at 5:00 a.m. I don't need coffee, I'm already so excited! I arrive at the Delta Hotel around 7:45 and get my name badge and conference schedule. During the day, I listen to fascinating talks from various speakers and lap up everything they say! I want to see all there is to see at the exhibitors' cocktail reception; I go to each booth and pick up a few goodies.

Day 2 – I wake up feeling even more excited than yesterday—I am giving my presentation this morning! Breathe in, breathe out . . .

Everything is under control during my presentation. I believe it went very well, and maybe no one noticed that English is not my mother tongue. The translation committee meets over the lunch break, and it's nice to put faces to names I've only seen in emails! Very nice to meet you. Another set of stimulating talks in the auditorium this afternoon.

Around 6:00 p.m., Lysanne and I begin to welcome people to the social event we have organized. I took care of the bus reservation, the buffet, and the sponsor. Everything went exactly as we planned! You can read the details in Lysanne's article in this issue of the *Bulletin*.

I leave at 9:00 o'clock. Wow, what a wonderful, successful day! I am really tired, yet so happy!

Day 3 – I wake up very early again. I think I'll go for coffee this morning.

More interesting and captivating talks again today—my brain is very stimulated by everything I hear and see. We get a break before the annual general meeting (AGM), but I can't wait for it to begin! I was president of my university's student association for two years, so I should be able to keep up. Documents are available on a table at the front of the auditorium; I'll consult them quickly before it starts. I might make an amendment here. Oh! There should be an interesting debate on that topic!

It's starting. Oops! The members of the board forgot to introduce themselves; I only know the names of half of them. Wait! You didn't present the reports of the different committees! Geez! I am so lost in these mixed-up papers. Am I the only one?

The banquet is tonight—good! The service and food at the Delta's Tour de ville are excellent, and the company is great! After dinner, everyone is invited to the Hospitality Suite. There's a band playing! Wow! What an exquisite evening! But I definitely have to do something about the AGM . . .

Day 4 – Another day of amazing presentations. The last item on my schedule is a continuing education session on the transportation of dangerous goods. But there was a misunderstanding; the session is given in French only. This is slightly uncomfortable for some...

After the conference – I still perceive the CRPA as a gathering of radiation-protection professionals from across Canada, and it means a lot to me. As for the conference, the presentations were outstanding and the evening events were great fun. However, I believe that the AGM could be conducted in a much better way. For example, I would suggest that the committee reports either be available prior to the conference or be presented at the meeting; that documents be stapled together in the

continued on page 28 . . .

CRPA(R) Special Meeting

A special meeting of the CRPA(R) was held on May 26, 2009, at the Delta Hotel in Montréal, QC. Following are the minutes from that meeting. The minutes of this meeting were written by Jean-Pierre Gauvin and Joseph Vincelli.

Present

CRPA(R) attendees: Lamri Cheriet, Jeff Dovyak, Petra Dupuis, Jean-Pierre Gauvin (acting chair), Sean Hunt, Ray Ilson, Pierre Lavoie, Leona Page, Valerie Phelan, Nathalie Ritchot, Eva Sailerova, Nick Sion, Sandu Sonoc, Diego Spertini, Dave Tucker, Joseph Vincelli, Gary Wilson. Non-CRPA(R) attendee: Steve Webster.

Résumé

Le 26 mai 2009 à l'hôtel Delta de Montréal se tenait une réunion spéciale concernant le programme d'enregistrement « ACRP-E ». Cette reconnaissance plus formelle des professionnels enregistrés remplace le modèle de certification et devient le seul titre professionnel offert par l'ACRP. Une motion en ce sens a été approuvée. Pour promouvoir cet enregistrement, il a été proposé d'en modifier la désignation par motion et c'est le titre de professionnel en radioprotection agréé, proposé par M. Gauvin, qui a été retenu. Pour administrer cet enregistrement, on a proposé de former un nouveau comité de quatre représentants élus, provenant des différentes régions du Canada. Après une discussion animée, on a adopté le modèle suivant par motion : le comité choisit son président et dispose d'un terme de trois ans. Des démarches visant à augmenter la visibilité du nouveau titre auprès de la CCSN constituent la dernière motion adoptée lors de cette réunion. Les résolutions adoptées devront obtenir l'aval du Conseil d'administration avant d'être appliquées.

Objective of Meeting

This special meeting was called by Jean-Pierre Gauvin, who proposed the following agenda:

1. Future of CRPA(R)
2. Title for CRPA(R)
3. Management of our Group
4. Representatives of CRPA(R)
5. Value to be added to CRPA(R) title

The agenda was accepted as submitted. There were 17 CRPA(R) members present, which constituted 43% of all CRPA(R) at the time of the meeting. The objective of the meeting was to make recommendations on the future of the CRPA registration of radiation safety professionals.

Future of CRPA(R)

Since the first CRPA(R) exam took place in 2005, little progress has been made in the recognition of the CRPA(R) title. The number of registered professionals has not expanded as initially predicted, which may be because the registration is only publicized as an entry-level certification.

The American Board of Health Physics already offers an advanced form of certification (CHP), whereas CRPA does not have the resources required to develop and conduct a certification system that is professionally equivalent to the CHP. However, the need for a Canadian advanced certification is questionable. As indicated during the meeting, because the CHP exam is based on international practices and guidance documents, the argument that the exam does not take into account the Canadian context appears to be unjustified. Therefore, Jean-Pierre Gauvin moved "to abandon the project of an advanced system of certification and to give more formal recognition to registered professionals CRPA(R), CRPA(R) being the only professional title to be offered by CRPA."

All present were in favour; motion carried.

Title for CRPA(R)

To promote greater recognition of the CRPA(R) title, it was proposed that the letters CRPA(R) be supplemented with a professional designation. Jean-Pierre Gauvin proposed using one of the following titles:

1. Registered Radiation Safety Practitioner
2. Registered Radiation Safety Professional
3. Registered Radiation Protection Practitioner
4. Spécialiste en radioprotection agréé
5. Professionnel en radioprotection agréé

All present were in favour of the title indicated in 2 and 5: Registered Radiation Safety Professional/Professionnel en radioprotection agréé.

Representatives of CRPA(R)

Since the CRPA's inception, its operating procedures and certification maintenance have been administered by the Board of Directors, with advice and recommendations from a special committee on registration. The members of the registration committee are currently selected by the Board members.

After considerable discussion on the best ways to achieve greater CRPA(R) member involvement, it was felt that the structure and membership of the registration committee should be changed. Therefore, it was proposed that

> all activities pertaining to CRPA(R) be reviewed by a committee of individuals elected by CRPA(R) members, through a mail or email ballot, and that such committee be composed of four representatives, one for the western provinces, Ontario, Quebec, and the eastern provinces. The term of office is to be three years[1] and the chair of the

1 Members who are already active on the committee may seek re-election for the remainder of their three-year term.

continued on page 33 . . .

L'exigence pour les RRP

Modification aux Règlements sur les installations nucléaires et l'équipement réglementé de Catégorie II

par Michael F. James, Commission canadienne de sûreté nucléaire

Canadian Nuclear Safety Commission

Commission canadienne de sûreté nucléaire

Tel qu'annoncé, on a proposé une modification aux règlements régissant les installations nucléaires de Catégorie II. Ces installations comprennent les accélérateurs linéaires médicaux, les appareils de curiethérapie à projecteur de sources télécommandé et les appareils de téléthérapie à source radioactive. La modification proposée et le Résumé de l'étude d'impact de la réglementation ont été publiés dans le numéro du 6 juin 2009 de la *Gazette du Canada, Partie I*, pour une période de consultation publique de 30 jours, soit du 6 juin au 6 juillet. Cette modification officialise la pratique utilisée pour n'accepter, tel un RRP, que les personnes qui ont réussi l'entrevue avec la CCSN.

Veuillez noter qu'au moment où vous lisez ces lignes, il est trop tard pour soumettre vos commentaires. Les explications ci-dessous peuvent tout de même être utiles aux titulaires de permis de Catégorie II.

Une brève description de la modification proposée a été soumise aux personnes concernées. On peut lire cette modification en ligne aux adresses suivantes :

- format HTML : www.gazette.gc.ca/rp-pr/p1/2009/2009-06-06/html/reg2-fra.html
- format PDF : www.gazette.gc.ca/rp-pr/p1/2009/2009-06-06/pdf/g1-14323.pdf

Maintenant que vous êtes assez effrayés par les intentions de la CCSN, je vais vous répéter que la seule conséquence de cette modification est d'officialiser la pratique actuelle : les nouveaux RRP doivent être approuvés par la CCSN, à la suite d'une entrevue. Sous la réglementation, ce processus deviendra une accréditation.

Qu'est-ce que cela signifie pour vous, les RRP actuels et futurs ? L'officialisation du processus inclut des dispositions dans la loi pour vous assurer que le processus est juste et équitable. La modification proposée permet qu'une personne qui est en désaccord avec la décision de la CCSN soit entendue. De plus, le processus est clairement défini : le personnel de la Commission ne peut arbitrairement modifier le processus.

Cette modification comprendra notamment les éléments suivants :

- obligation pour chaque titulaire de permis de nommer un RRP qui surveillera les activités autorisées ;
- accréditation du RRP par la CCSN ;
- accréditation sans entrevue de toute personne agissant présentement à titre de RRP ;
- contenu d'une demande d'accréditation ;
- obligation de passer une entrevue ;
- obligation de nommer un RRP remplaçant non accrédité, mais compétent ; et
- diverses dispositions requises à des fins d'équité et de bonne administration.

Maintenant que vous comprenez mes intentions à peine voilées à propos de la seule conséquence du 3e paragraphe, deux nouvelles exigences mineures s'ajoutent :

- nommer un RRP remplaçant – Sans devoir être accréditée, cette personne doit détenir des qualifications acceptables pour remplacer le RRP durant son absence. Cette personne doit être désignée par écrit, mais la CCSN n'a pas besoin d'en être informée. (Un tel document peut cependant être exigé lors d'une inspection.)
- le titulaire doit poser sa candidature pour accréditer le RRP actuel. Il s'agit d'une étape simple, afin que la CCSN ait un minimum d'information au sujet de tous les RRP. Il n'y aura aucune entrevue, puisque nous savons que vous êtes tous compétents.

Ceci résume la modification proposée qui, elle, ficelle le processus et ne devrait pas augmenter votre charge de travail. ■

Pour plus d'information, se référer au site internet de la CCSN

www.nuclearsafety.gc.ca/fr/index.cfm

ou communiquer avec moi. Michael F. James, aux coordonnées ci-dessous.

- Tel (613) 993-7867
- Couriel mike.james@cnsc-ccsn.gc.ca

Impressions of a New Member

. . . continued from page 26

order they are presented; that propositions be voted on (instead of just saying "aye"); that the agenda include an "Other Business" item (in case something needs to be added during the meeting); and that more time be allotted so each item can be gone through in more depth and there is time to discuss the item if needed. After all, the AGM only takes place once a year!

In general, I had a wonderful week at the conference. I met interesting people and my brain was overstimulated with information! I hope to meet you again at the Edmonton conference. ■

RSO Requirement

Changes to the Nuclear Safety and Control Act Regulations

by Michael F. James, Canadian Nuclear Safety Commission

Canadian Nuclear Safety Commission

Commission canadienne de sûreté nucléaire

The proposed amendment to the regulations governing Class II Nuclear Facilities includes medical linacs, brachytherapy remote afterloaders, and radioactive source teletherapy machines. The publication of this amendment and an accompanying Regulatory Impact Analysis Statement in the June 6, 2009, edition of the *Canada Gazette*, Part I, initiated a 30-day period of public consultation (from June 6 to July 6, 2009). Although by the time this article appears in the *Bulletin*, it will be too late to comment, the following explanation of the proposed changes should be helpful to Class II licensees.

Basically, the amendment formalizes the current practice of accepting only those who have passed an examination administered by the CNSC as an RSO. A brief description of the proposal, which has already been distributed to the affected population, can be viewed at the following websites:

- www.gazette.gc.ca/rp-pr/p1/2009/2009-06-06/html/reg2-eng.html
- www.gazette.gc.ca/rp-pr/p1/2009/2009-06-06/pdf/g1-14323.pdf

For those of you who are worried about the changes the CNSC intends to foist on the industry, I'll repeat that the main effect of the amendment will be to formalize current practice. That is, new RSOs must be accepted, through examination, by the CNSC. Under the proposed regulation, the process will be called "certification."

What's in it for you, the RSO or potential RSO? Formalization includes legal provisions to ensure that the process is fair. According to the proposed amendment, a person who disagrees with staff decisions must be given an opportunity to be heard. Also, the process is spelled out, which means CNSC staff cannot arbitrarily change it.

In short, the amendment

- requires each licensee to appoint an RSO to oversee the licensed activities,
- requires an RSO to be certified by the CNSC,
- proposes that any person now acting as an RSO be certified without examination,
- includes the content of an application for certification,
- requires an examination to be completed,
- requires the appointment of an uncertified but qualified "backup" RSO, and
- requires various provisions for fairness and good administration.

Although I stated earlier that the main effect of the amendment will be to formalize current practice, I must admit it has two new requirements—but both of them are minor.

1) There must be a backup RSO. This person must have reasonable qualifications to act in the RSO's absence but does not need to be certified. He or she must be designated in writing, but the CNSC does not need to be informed. (Keep your paperwork, though, because you may be asked for it during an inspection.)
2) Licensees must apply to have current RSOs certified. This is a simple application—a minimum of information on all RSOs will be kept on file and there is no exam (our current RSOs are all good people).

This amendment will tidy up the process and won't add significantly to your workload. ■

For more information on the proposed amendment, go to the CNSC website:

www.nuclearsafety.gc.ca/eng/lawsregs/proposedamendments/class2-RSO

Or, you can contact me, Michael F. James, as follows:

- (613) 993-7867
- mike.james@cnsc-ccsn.gc.ca

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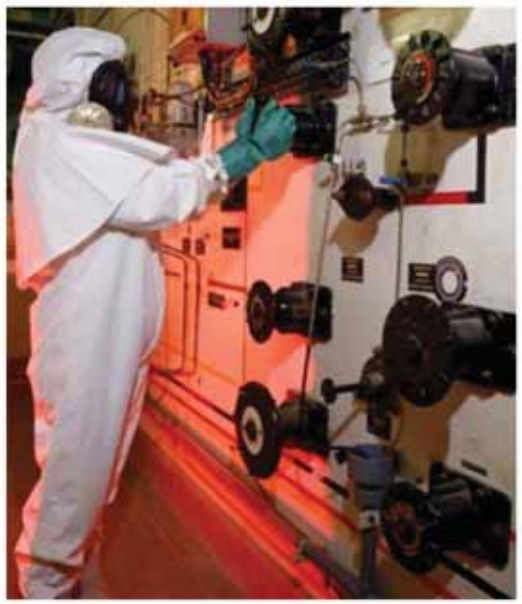

BNC

Berkeley Nucleonics Corporation

ICRP NEWS

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

INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

The second article in a series is always telling. Is the subject still interesting and useful after the inspiration to write the first article has passed? Let's hope so in this case!

A new four-year ICRP membership term began on July 1, 2009. The ICRP chair for the new term, the 12th new chair since 1928, is Dr. Claire Cousins, a consultant vascular radiologist at Addenbrooke's Hospital, in the United Kingdom. She has taken over from Dr. Lars-Erik Holm, who served for the last two terms and has now retired from ICRP. Dr. Cousins is the program director for Radiology Training in Cambridge and a member of the Royal College of Radiologists Training Accreditation Committee. Formerly, she was chair of ICRP Committee 4. Dr. Abel González now serves as vice-chair of the Main Commission. He succeeds Dr. Roger Cox, who continues to serve ICRP as a member of Committee 2.

In addition, we have four new Main Commission members: Professor Eliseo Vañó (Complutense University, Spain) as Committee 3 Chair; Dr. Jacques Lochard (CEPN, France) as Committee 4 Chair; Dr. John Cooper (UK HPA); and Dr. Ohtsura Niwa (NIRS, Japan). There are also several new committee and task group members. A complete membership list as of July 1, 2009, is available on the ICRP website.

A new, and hopefully useful, feature of the ICRP website is a comprehensive list of all ICRP publications dating back to 1928. Where relevant, each publication is linked to two other websites:

- www.sciencedirect.com where ICRP publications can be purchased
- www.icrp.info where portions of some ICRP publications can be downloaded free of charge

Several ICRP publications are currently in press. In the last issue, ICRP Publication 108, which should be available by the time you read this, was introduced; this time, we introduce ICRP Publication 109, which is due out very soon. The "recommendations" part of Publication 109 focuses on emergency exposure situations; an abstract for that part is found below. And, to commemorate the 80th anniversary of ICRP, an excellent invited paper entitled "The History of ICRP and the Evolution of its Policies," written by two former ICRP members, Dr. Roger Clarke (past ICRP Chair) and Dr. Jack Valentin (Scientific Secretary emeritus), is also in press.

Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations (ICRP Publication 109, in press)

This report was prepared to provide advice on the application of the Commission's 2007 recommendations. Advice on preparing for, and responding to, all radiation emergency exposure situations defined as "situations that may occur during the operation of a planned situation, or from a malicious act, or from any other unexpected situation and require urgent action in order to avoid or reduce undesirable consequences" is included. An emergency exposure situation may evolve, in time, into an existing exposure situation. The Commission's advice on these types of situation is published in two complementary documents: one for the emergency exposure situations outlined in this report; the other for existing exposure situations that follow emergency exposure situations, as outlined in the forthcoming report "Application of the Commission's Recommendations to the Protection of Individuals Living in Long-term Contaminated Territories after a Nuclear Accident or a Radiation Emergency."

The Commission's 2007 recommendations restate its principles of justification and optimization, as well as its requirement to protect against severe deterministic injury, as it applies to emergency exposure situations. For the purpose of protection, reference levels for emergency exposure situations should be set in the band of 20–100 mSv effective dose (acute or per year). The reference level represents the level of residual dose or risk above which it is generally judged to be inappropriate for exposures to occur. The Commission considers that a dose approaching 100 mSv will almost always justify protective measures. Protection against all exposures, above or below the reference level, should be optimized.

More complete protection is offered by simultaneously considering all exposure pathways and all relevant protection options when deciding on the optimum course of action in the context of an overall protection strategy. Such a strategy must be justified as resulting in more good than harm. To optimize an overall strategy, the dominant exposure pathways, the time scales over which components of the dose will be received, and the potential effectiveness of individual protective options must be identified. If, in the application of the strategy, protection measures do not achieve their planned residual dose objectives or, worse, result in exposures exceeding reference levels defined at the planning stage, a reassessment of the situation is warranted. In planning, and in the event of an emergency, decisions to terminate protective measures should have due regard for the appropriate reference level.

The authority responsible for the overall strategy will decide when an emergency exposure situation changes to an existing exposure situation. This transition may happen at any time during an emergency exposure situation, and it may take place at different geographical locations at different times. The transfer should be undertaken in a co-ordinated and fully transparent manner, and it should be understood by all parties involved.

Question du numéro précédent

Le C-14 est l'un des deux radionucléides préoccupants des réacteurs CANDU, l'autre étant le H-3. Produits en quantités plus grandes dans les réacteurs CANDU que dans d'autres types de réacteurs, ces deux radionucléides (carbone et hydrogène) sont des éléments biologiquement importants partageant la propriété d'être de faibles émetteurs de particules bêta pures.

Dans les réacteurs CANDU, on retrouve surtout le C-14 sous deux formes : le CO_2 (de l'activation du modérateur O-17) et des particules insolubles (de l'activation du N-14 lorsque le nitrogène [l'air] pénètre le noyau). Historiquement, les matières particulaires devenaient un problème important à Pickering A ; aujourd'hui, elles demeurent des agents potentiellement dangereux de déchets de tubes, à cause de leur grande force, de leur contamination résiduelle et des détecteurs de flux. Ces particules s'ajoutent à une quantité impressionnante d'autres particules provenant de Pickering.

Le responsable de la radioprotection de votre bâtiment-réacteur a découvert que les travailleurs risquent d'avoir été exposés à des concentrations dans l'air d'une source insoluble de C-14. Quelles sont les possibilités pour (a) surveiller l'absorption à l'avenir et (b) évaluer les doses pour ceux et celles qui pourraient avoir été exposés il y a des semaines, voire des mois ?

Amusez-vous ! Souvenez-vous que cette rubrique s'adresse à vous ! Envoyez-moi vos réponses et vos suggestions pour les prochains numéros au secrétariat de l'ACRP.

Emélie Lamothe est spécialiste en radioprotection auprès de la société Ontario Power Generation (OPG). Elle est responsable des logiciels utilisés dans la gestion des risques d'irradiation et des données de dosage, de même que des dossiers de dosage au sein de l'OPG. Avant de travailler à l'OPG, elle était employée à l'EACL où elle occupait plusieurs postes en recherche, en radioprotection et en sécurité au travail.

Que faire au sujet de l'exposition à le C-14 ?

par Emélie Lamothe, spécialiste en radioprotection

Bonjour et bienvenue à nouveau. Lorsque vous lirez cet article, l'édition 2009 du congrès annuel de l'ACRP ne sera plus qu'un souvenir. Je l'ai trouvée très plaisante : j'y ai rencontré de bons amis et collègues, j'y ai goûté de la nourriture délicieuse et j'y ai entendu des présentations intéressantes. En écoutant parler Jag Mohindra sur les nouveaux attributs de conception des réacteurs, je n'ai pu m'empêcher de penser aux besoins futurs en dosimétrie, qui dépendront du design choisi. Cela m'a fait penser à la question du dernier numéro et à la réponse gracieusement fournie par Dr Dave Williams, scientifique principal de la Ontario Power Generation (OPG).

Réponse

Le C-14 a une longue vie (T½ = 5730 ans) et n'émet que des particules β (Emax = 156 keV), outre les rayonnements de freinage qui l'accompagnent. Les particules β elles-mêmes ne peuvent être détectées à l'intérieur du corps, seulement par l'analyse d'échantillons d'excréments. Le matériel insoluble (de type M ou S) absorbé par l'homme est surtout excrété (à moins d'être métabolisé) par les selles (plutôt que par l'urine ou l'haleine), c'est pourquoi celles-ci constituent la meilleure possibilité de surveillance d'absorption.

Le suivi régulier d'échantillons de selles sur une base périodique est dorénavant possible, quoique ces échantillons soient toujours difficiles à obtenir et à interpréter. Il existe une option préférable, à moins que le danger ne soit extrême. Il s'agit d'utiliser des prélèvements individuels d'échantillons d'air (PIÉA), qui tirent un échantillon de l'air aspiré. Bien que les estimés de tels échantillons d'air aspiré présentent une marge d'erreur importante (selon le rythme de respiration, ils peuvent être contaminés pendant le déshabillage et, le cas échéant, ils ne peuvent être mesurés à nouveau), les PIÉA sont considérés comme étant suffisamment exacts pour les doses situées bien en-deçà de la limite permise.

Pour les expositions passées, les fardeaux résiduels internes, dans les poumons par exemple, peuvent être évalués de deux façons : soit par l'analyse d'échantillons de selles, soit par la spectrométrie thoracique du rayonnement de freinage. Cependant, l'excrétion fécale de matériel dégagé des poumons est minime après la première semaine (l'excrétion quotidienne ~ 10(-4) du montant aspiré), les photos de rayonnement de freinage sont faibles (énergie maximale de 156 keV), et les techniques exigent une calibration précise et possiblement des corrections sur mesure, en fonction d'autres sources en arrière-plan et des dimensions physiques. Peu importe, le matériel aspiré bien au-dessus des limites permises peut être détecté plusieurs mois après l'exposition. En raison de la possibilité continue d'exposition future des travailleurs au C-14 insoluble, le laboratoire de surveillance humaine de Santé Canada (Gary Kramer, chef du laboratoire) détient un système de détection de germanium calibré pour ces évaluations. ■

Question du présent numéro

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

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 par courriel à **secretariat2007@crpa-acrp.ca**.

What to do about exposure to C-14?

by Emélie Lamothe, Health Physics Specialist

Hi and welcome back. By the time you read this article, the 2009 CRPA conference will be but a memory. I really enjoyed it—good friends and colleagues, great food, and interesting presentations. As I listened to Jag Mohindra's talk on new reactor design features, I kept thinking about future dosimetry needs, which will depend on the chosen design. This thought brings up last issue's question and the answer kindly provided by Dr. Dave Whillans, a senior scientist at Ontario Power Generation (OPG).

Last Issue's Question

C-14 is one of the two "Maple Leaf radionuclides" of special concern in CANDU reactors. The other is H-3. Produced in higher yield in CANDU reactors than in other types of reactors, both are biologically important elements (carbon and hydrogen) and both share the property of being weak "pure beta emitters."

C-14 is found in CANDU reactors mainly in two forms: CO_2 (from activation of moderator O-17) and insoluble particulates (from activation of N-14 when nitrogen [air] enters the core). Historically, C-14 particulates were a major problem at Pickering A; today, they are still potential hazards from Pickering pressure-tube waste and residual contamination and from flux detectors, among other things.

The RSO for your reactor building has discovered that workers may have been exposed to airborne concentrations of an insoluble C-14 source. What possibilities are available for (a) monitoring for intakes in the future and (b) assessing doses for those who may have been exposed weeks or months ago?

Answer

C-14 is long-lived (T½ = 5730 years) and emits only β- particles (Emax = 156 keV), plus the accompanying internal bremsstrahlung radiation. The β- particles themselves cannot be detected inside the body—only through the analysis of excretion samples. Human intakes of insoluble materials (Types M or S) are mainly excreted (unless metabolized) in feces (not in urine or breath), which is the best possibility for excretion monitoring.

In the future, routine monitoring of periodic fecal samples is possible, although these samples are always difficult to obtain and to interpret. A better possibility, unless the hazard is extreme, is the use of breathing-zone Personal Air Samples (PAS), which sample the inspired air. PAS estimates of intake carry significant uncertainty (depending on breathing rates, they can become contaminated during undressing and measurement can't be repeated), but they are considered sufficiently accurate for doses well below limits.

For historical exposures, residual internal burdens, for example, in the lungs, can be assessed in two ways: by analyzing fecal samples and by lung counting of the internal bremsstrahlung. However, fecal excretion of materials cleared from the lung is very low after the first week or so (daily excretion ~ 10(-4) of intake), the bremsstrahlung photons are weak (maximum energy 156 keV), and the techniques require careful calibration and perhaps individual corrections for other background sources and physical dimensions. Nevertheless, intakes well below the dose limits can be detected many months after the intake. Because of the continuing possibility for future worker exposures to insoluble C-14, the Health Canada Human Monitoring Laboratory (Gary Kramer, head) has a germanium detector system that is calibrated for these assessments. ■

This issue's question

These days, there is a great deal of speculation about which type of reactor will be built at OPG's Darlington site. Arguments abound as to the pros and cons of the three potential designs. The one element these designs have in common, however, is the use of slightly enriched fuel. What then is the specific activity of 1 kg of 5% enriched uranium fuel (commonly referred to as slightly enriched fuel)?

Have fun! Remember, this column's for you. Send your answers and suggestions for future issues to secretariat2007@crpa-acrp.ca.

CRPA(R) Special Meeting

. . . continued from page 27

committee is to be selected by the committee members. The committee would continue to report to the CRPA Board of Directors.

The motion was carried.

Value to be added to the CRPA(R) title

It was resolved that, as soon as these four representatives are elected to the new committee, their first mission should be to develop ways to improve the recognition and visibility of CRPA(R) professionals. The CNSC is a critical organization to consider.

Adjournment

As there was no other business, the meeting was adjourned at 5:40 p.m. All adopted resolutions must be approved by the CRPA Board of Directors before they can be implemented. ■

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Election Nominations

CRPA Board of Directors

The Nominations Committee is seeking individuals for consideration to stand for election for the following positions:

President Elect • Treasurer • Director (2)

All full members are encouraged to submit the name of a person(s)who they would like to be considered as a candidate(s) by the Nominations Committee for the upcoming election. Members nominated must be CRPA members in good standing.

If you are interested or know a member who should be considered, please contact any member of the Nominations Committee (see listing in this *Bulletin* under CRPA Committees) or email the Secretariat at secretariat2007@crpa-acrp.ca.

Deadline for recommendations is November 30th.

Nomination pour élection

Conseil d'administration de l' ACRP

Le comité des nominations recherche des individus qui désirent soumettre leur nom afin d'être considérés pour les élections aux postes suivants :

Président(e)-élu(e) • Trésorier • Directeur (2)

Tous les membres à part entière sont encouragés à proposer des personnes qui aimeraient être considérés comme candidats par le comité de nomination pour les prochaines élections. Les candidats potentiels doivent être des membres en règle de l'Association.

Si vous êtes intéressé(e) ou connaissez une autre membre pouvant l'être, veuillez contacter une membre du comité de nominations (voir la liste dans ce *Bulletin* sous les comités) ou envoyez un courriel à l'attention du Secrétariat à l'adresse suivante : secretariat2007@crpa-acrp.ca.

La date limite est le 30 novembre.

Coming Events / Réunions à venir

- **Conference on Modern Radiotherapy: Advances and Challenges in Radiation Protection of Patients**
  Dec. 2–4, 2009, Versailles, France
  Additional Conference information is available on the IRPA website: (www.irpa.net)

- **Health Physics Society (HPS) Midyear Topical Meeting: Radiation Risk Communication to the Public**
  Jan. 24–27, 2010, Albuquerque, NM
  For more information, visit the HPS website at www.hps.org/meetings.

- **2010 Health Physics Society (HPS) Professional Development School/ Radiation Risk Communication: Issues and Solutions**
  Jan. 27–29, 2010, Albuquerque, NM
  This school will explore all aspects of radiation risk communication. We also plan to offer live webcasting for the first time. For more information, visit the HPS website at http://hps.org/meetings/meeting26.html

- **CRPA Annual Conference 2010: Aiding the Radiation Protection Professional**
  May 23–26, 2010, Edmonton, Alberta
  Join us as we discuss the technical, professional, and regulatory challenges faced by radiation protection professionals across the country. For more information, visit the CRPA website at www.crpa-acrp.com.

- **Health Physics Society, 55th Annual Meeting**
  June 27–July 2, 2010, Salt Lake City, UT
  For more information, visit the HPS website at www.hps.org/meetings.

- **21st World Energy Congress: Responding Now to Global Challenges**
  Sept 12–16, 2010, Montreal, Quebec
  For more information, visit www.wecmontreal2010.ca.

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Readers' Corner

Readers' Corner is where you get to share your ideas and opinions or to comment on something we have published in the Bulletin. We ask that you try to keep your letters to no more than 500 words. Please include your name and affiliation with your letter. Anonymous letters will not be published. Letters commenting on another author's work will be sent to the author with a request for a reply. If possible, the comment and the reply will be published together.

Please send your letters to the CRPA Secretariat at secretariat2007@crpa-acrp.ca. We look forward to hearing from you.

Coin des lecteurs

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*. Nous vous demandons de limiter votre correspondance à moins de 500 mots et d'y inclure votre nom et affiliation, puisque nous ne publierons pas les lettres anonymes. Les commentaires s'adressant à un auteur en particulier seront envoyés à celui-ci, accompagnés d'une demande de réponse. Si cela est possible, nous publierons le commentaire et sa réponse ensemble.

Prière d'envoyer vos lettres au Secrétariat de l'ACRP à secretariat2007@crpa-acrp.ca. Nous sommes impatients de vous lire.

President's Message / Message du Président

. . . suite de la page 7

nation. D'un côté positif, le comité d'experts du gouvernement sur l'approvisionnement d'isotopes médicaux a reçu des propositions de plusieurs régions du pays et il pourrait y avoir place à l'optimisme : le sérieux besoin d'investissement dans l'infrastructure pourrais avoir lieu dans un avenir rapproché.

Du côté de l'énergie nucléaire, Bruce Power a retiré ses demandes de permis pour les nouveaux réacteurs de Tiverton et Nanticoke et les plans de l'Ontario pour de nouvelles unités à Darlington semblent avoir été mis de côté indéfiniment. Néanmoins, il reste encore un intérêt marqué pour de nouvelles centrales nucléaires en Alberta et en Saskatchewan.

Plus près de chez moi, nous avons rangé les décorations et chapeaux de fête (et malheureusement mangé le gâteau au complet), après avoir eu du bon temps à célébrer le 50e anniversaire du réacteur nucléaire de McMaster. J'étais fier d'entendre, et de raconter à mon tour, les histoires entourant l'impact majeur qu'a eu le réacteur sur l'enseignement de la radioprotection au cours des années. Souhaitons maintenant un automne excitant et l'annonce de bonnes nouvelles pour l'industrie que nous supportons, des annonces que nous pourrons célébrer dans 50 ans d'ici.

David Tucker
Président, ACRP

. . . continued from page 7

in patient care in the nation's hospitals. On the positive side, the government's expert panel on the medical isotope supply has now received proposals from many areas of the country, and there may be some cause for optimism that the sorely needed investment in infrastructure may occur in the near future.

On the nuclear power side, Bruce Power has withdrawn its licence applications for new reactors in Tiverton and Nanticoke, and Ontario's plans for new units at Darlington seem to have been indefinitely sidetracked. Nonetheless, there is still strong interest in new nuclear power plants in Alberta and Saskatchewan.

Closer to home for me, we have put away the decorations and the party hats (and, unfortunately, eaten all the cake), after having a very enjoyable time celebrating the 50th anniversary of the McMaster Nuclear Reactor. I took particular pride in hearing, and then retelling, stories about the significant impact the reactor has had on health physics education over the years. Here's hoping for an exciting fall with some announcements of good news for the industries we support, announcements that we will still be celebrating 50 years from now.

David Tucker
President, CRPA

Co-op Studies

A stepping stone to an exciting future

. . . continued from page 12

training—and had the opportunity to learn about the department's affiliates by going on inspections, decommissionings, and commissionings of different departments. Her co-op experience has made her aware of the crucial role that the medical and health physics field plays in our health-care system and how significantly it impacts, protects, and aids patients. For her, the best part about her time in the RSHP was the interaction with her co-workers and the knowledge she gained not only about the field but also about the co-op program—having four McMaster graduates working in the department (three from the undergraduate medical and health physics co-op program and one, her supervisor, from the medical physics masters program) was the opportunity of a lifetime. Everyone in the department was an extraordinary resource and made her feel part of the team, an experience she would never have had without the co-op work term. ■

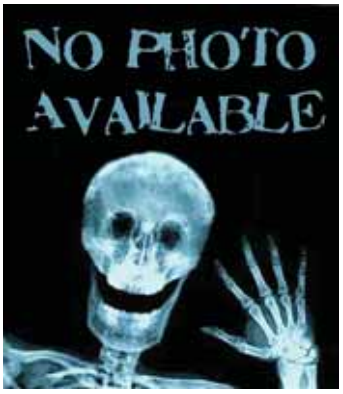
For more information on co-op programs, check out the following links:

- McMaster Science Career and Cooperative Education at www.science.mcmaster.ca/scce
- Canadian Association For Cooperative Education at www.cafce.ca

Contributors

Maliha Altaf is a Medical and Health Physics student (class of 2011) from McMaster University. She has just completed an eight-month co-op work term with The Ottawa Hospital and has now (temporarily) made the leap back into student life.

Maliha Altaf est étudiante en physique médicale et en radioprotection (promotion 2011) à l'Université McMaster. Elle revient temporairement à la vie étudiante après avoir participé à un programme d'une durée de huit mois à l'hôpital d'Ottawa



Dr. Chauhan, a research scientist at Health Canada, is involved in novel research developments in areas of ionizing radiation. The outcomes of her efforts have led to considerable contributions to departmental research and development. Her areas of expertise include molecular biology, in vitro radiobiology and genomics.

Docteure Chauhan, chercheuse scientifique à Santé Canada, s'implique dans de nouvelles découvertes en matière de rayonnement ionisant. L'apport scientifique des résultats de ses travaux a considérablement contribué à la recherche et au développement ministériels. Ses domaines de compétence comprennent la biologie moléculaire, la radiobiologie in vitro et la génomique.

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).

Jean-Pierre Gauvin, CRPA(R), has 31 years of experience in radiation protection and environmental hygiene and has been certified by the American Board of Industrial Hygiene, the Canadian Registry Board of Occupational Hygiene (CRBOH), and the Canadian Environmental Certification Approvals Board. In addition to being president of the Local Organizing Committee for the 2009 CRPA convention in Montreal, he has served as vice-president for Congress Affairs of the International Radiation Protection Association (1988–92), president of CRPA, president of the Montreal Foundation for Radiation Protection (1988–96), and president of the CRBOH. In 1997, he received the CRPA Founders' Award. Currently, he is director general of Contex Environment Inc.

Jean-Pierre Gauvin, CRPA(R) compte 31 années d'expérience en radioprotection/hygiène environnementale. Récemment, il a agi à titre de président du comité d'organisation local du congrès 2009 de l'ACRP. Par ailleurs, M. Gauvin a occupé la vice-présidence des affaires du congrès (1988-1992) de l'Association Internationale de radioprotection (IRPA), ainsi que la présidence de l'ACRP (1992-1993) et de la Fondation Montréal pour la radioprotection (1988-1996). En 1997, on lui a remis le prix des fondateurs de l'ACRP. Il est membre certifié de l'American Board of Industrial Hygiene, du Conseil canadien d'agrément des hygiénistes du travail, ainsi que du Bureau canadien de reconnaissance des spécialistes en environnement. Actuellement, il dirige la société Contex Environnement inc.

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.

Matthew Howland is currently completing his Hon. B.Sc. in biochemistry at the University of Ottawa. He is also employed by Health Canada's co-op program, where he actively participates in research focused on the biological ramifications

of alpha-particle exposure. The goals of this research are to better understand the role of radon as a carcinogen.

Matthew Howland termine présentement son baccalauréat en sciences (avec mention) avec spécialisation en biochimie à l'Université d'Ottawa. Il travaille également au programme d'enseignement coopératif en participant activement à des recherches sur les ramifications biologiques de l'exposition aux particules alpha. Ses recherches visent à mieux comprendre le rôle du radon en tant qu'élément carcinogène.

Michael James has worked for the CNSC (formerly the AECB) since 1977. Prior to that he had experience in design, operation, and installation of particle accelerators.

Michael James travaille pour la Commission canadienne de sûreté nucléaire (CCSN), anciennement intitulée Énergie atomique du Canada limitée (EACL), depuis 1977. Auparavant, il a œuvré dans la conception, l'exploitation et l'installation d'accélérateurs de particules.

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.

Aimée Lauzon has a BSc in physics and, in 2008, received her MSc in medical physics in the field of magnetic resonance imaging from the Université de Montréal. Since January 2009, she has been employed as a medical health physicist at Centre hospitalier de l'Université de Montréal (CHUM).

Aimée Lauzon a fait ses études à l'Université de Montréal où elle a obtenu un baccalauréat en physique puis, en 2008, une maîtrise en physique médicale dans le domaine de l'imagerie par résonance magnétique. Depuis janvier 2009, elle est physicienne médicale en radioprotection au Centre hospitalier de l'Université de Montréal (CHUM).

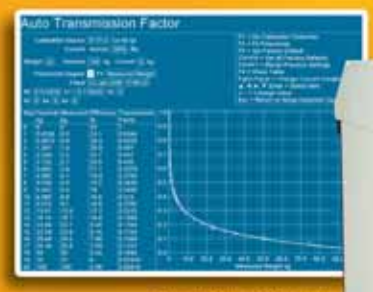
Lysanne Normandeau is a health phycisist, head of radiation safety services for the Université of Montreal Health Center, and a health physics teacher for master students in medical physics at the Université of Montreal. She has been an active member of CRPA since its foundation and was a director on the executive committee for several years.

Lysanne Normandeau est physicienne en radioprotection, chef du Service de radioprotection du Centre hospitalier de l'Université de Montréal. Elle enseigne la radioprotection au programme de maitrise en physique médicale de l'Université de Montréal. Elle a joint l'ACRP dès l'année de sa fondation et a été active comme membre de plusieurs comités ainsi du comité exécutif de notre association plusieurs années.

Joseph Vincelli œuvre dans les domaines de la radioprotection et de l'hygiène et sécurité au travail depuis plus de vingt ans. Il détient un baccalauréat ès sciences avec spécialisation en biologie, une maîtrise ès sciences en hygiène au travail et un diplôme en écosalubrité. Au fil du temps, il a travaillé comme technicien en radioprotection, responsable de la radioprotection et hygiéniste industriel. En janvier 2009, il était promu au poste de directeur des opérations du Service de sécurité et d'hygiène du milieu (SSHM) de l'Université McGill. De plus, il est membre agréé du Conseil canadien des professionnels en sécurité et détient le titre de CRPA(R).

Joseph Vincelli has been working in the field of radiation safety and occupational health and safety for over 20 years. He has a BSc in biology, an MSc(A) in occupational health sciences, and a diploma in environmental health sciences. Over the years he has worked as a radiation safety technician and as a radiation safety officer and occupational hygienist. In January 2009 he was promoted to operations manager for the Environmental Health and Safety Office at McGill University. He is certified as CRSP (Certified Registered Safety Professional) and CRPA(R). ■

Meet the newest members of the CANBERRA Contamination Monitor Family



Auto Transmission Factor Calibration Screen

The Cronos-11

The Cronos-4

The Cronos Gamma Object/Tool Monitors

CANBERRA is pleased to announce the addition of the Cronos-4 and Cronos-11 Gamma Object/Tool Monitors to our suite of advanced personnel contamination monitors. The Cronos monitors join our industry standard Argos™ and GEM™ Whole Body Monitors and Sirius™ Hand and Foot Monitors. Built on our established GEM Gamma Exit Monitor technology and with input from a wide variety of our customers, Cronos is the monitor you need in your facility for high through-put, durability and ease of operation.

Both Cronos models have high sample capacity to accommodate larger items (or a larger number of items) than typical units in use today. The Cronos-4 has a 129-liter internal volume (twice that of other units), and the Cronos-11 has a volume two and a half times larger than the Cronos-4 at 325 liters.

With six large plastic detectors surrounding the sample on all sides, both Cronos models offer minimum detectable activities (MDAs) comparable to much smaller units as well as a uniform efficiency response.

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- Lead shielding - 25 mm (1 in.) – on all sides and an option for another 25 mm of lead shielding
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- USB®, Ethernet and parallel interfaces
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- Built-in weighing scale, up to 100 kg, with removable scale tray for cleaning
- Use of same software for operation and reports as in Argos, GEM and Sirius monitors to simplify training
- Software includes capability for calibration versus weight and user-definable transmission correction factors for specific activity determination
- Compatible with optional CRemote Centralized Remote Control Software for system management from anywhere on the network

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The CANBERRA personnel contamination monitor family.

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