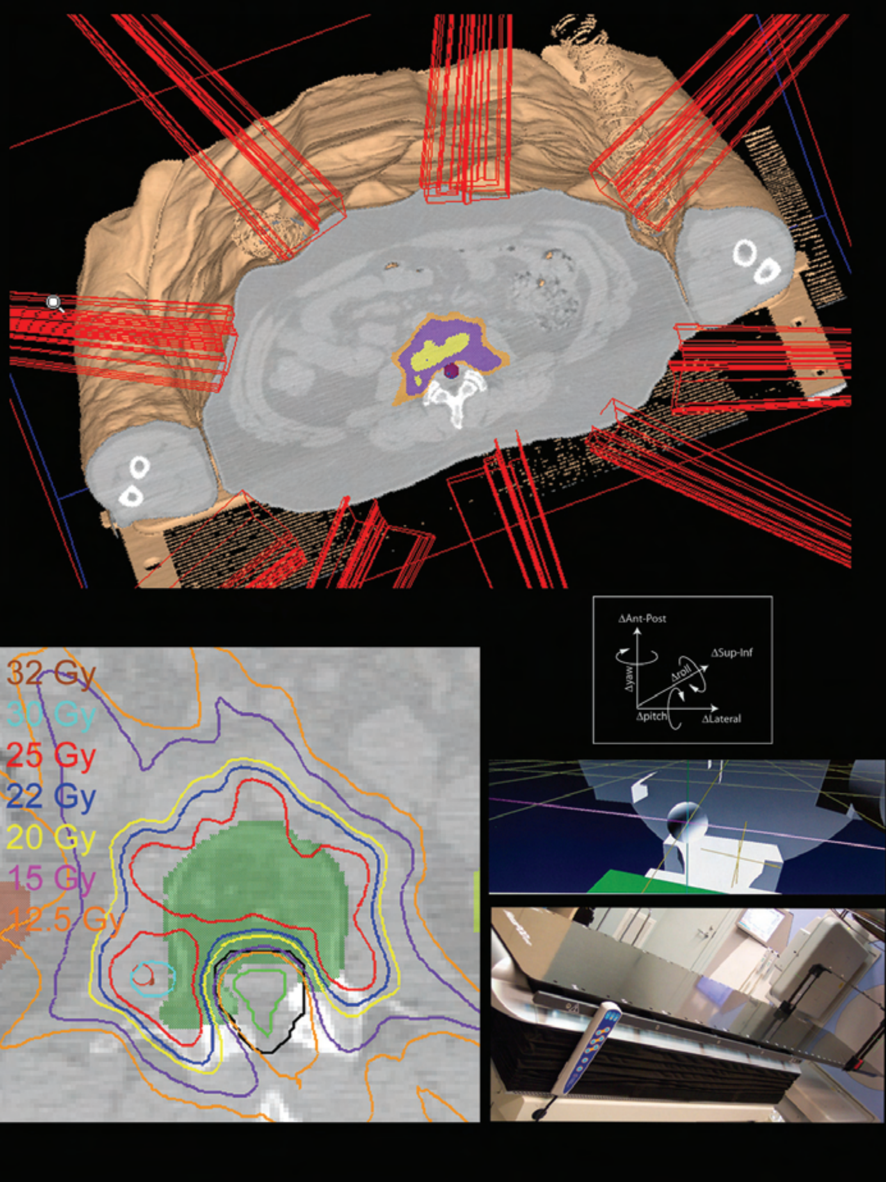
InterACTIONS

CANADIAN MEDICAL PHYSICS NEWSLETTER
Le BULLETIN CANADIEN de PHYSIQUE MÉDICALE

Adaptive Stereotactic Body Radiation Therapy with 6 Degrees of Freedom



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InterACTIONS

Volume 55, Number 1– janvier/January 2009

Cover Image

Stereotactic Body Radiation Therapy (SBRT) is the delivery of very high doses to extra-cranial tumours, typically 5 to 10 times larger than conventional radiation therapy doses. As a consequence, radiation damage is achieved through cell ablation as opposed to differences in cell-cycle repair between normal and tumour cells. The dose per fraction ranges from 14 to 25 Gy, delivered over 1 to 5 fractions, often using many beams and, in many cases, intensity modulation. The large image displays an intensity modulated radiation therapy plan delivering 25 Gy in 4 fractions. The tumour volume is shown in green colorwash in the transverse display. The IMRT plan is delivered using a 9 field co-planar step-and-shoot IMRT technique, using upwards of 75-80 segments. Patient immobilization is achieved using the Medical Intelligence Body-Fix immobilization system, consisting of a large full body vacloc bag coupled with a plastic external sheet and cushions that rests atop the patient. By creating a vacuum seal and using a calibrated vacuum, the external sheets and cushions provide pressure on the patient, securing them into the vacloc bag. Notice the wrinkles rendered on the patient surface are due to vacuum pressure from the pillows and external sheets (not visible). Highly conformal isodoses are achieved by using 4 millimeter micro-multileaf collimators, using 6 MV photons. Adequate conformality is not possible without the heavy use of on-line image guidance systems, such as the Cone Beam CT XVI platform on the Elekta Precise linear accelerators. Because of the tight margins, correcting in six-degrees (translation and rotations) becomes indispensible, particularly for spinal treatments as shown in the figure. Correcting for displacements and rotations is possible through the use of the Medical Intelligence EVO iGUIDE Hexapod robotic couch, which is mounted on top of the Elekta couch base. As of December 2008, Odette Cancer Centre in Toronto has been treating patients on a newly installed Hexapod robotic couch: a first in Canada. This issue's feature article discusses the rationale behind SBRT of spinal lesions, what is dosimetrically achievable, and ask the question: Is it safe?

Figure provided by Arjun Sahgal, Derek Hyde and Parminder S. Basran at the Odette Cancer Centre, Toronto ON

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The Canadian Medical Physics Newsletter, which is a publication of the Canadian Organization of Medical Physicists (COMP) and the Canadian College of Physicists in Medicine (CCPM) is published four times per year on 1 Jan., 1 April, 1 July, and 1 Oct. The deadline for submissions is one month before the publication date. Enquiries, story ideas, images, and article submissions can be made to:

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Please submit stories in Publisher 98, Word 6.0, Word 97, or ASCII text format. Hardcopy submissions will be scanned to generate an electronic document for inclusion in the Newsletter. Images in Tiff format at 300 dpi resolution are preferred.

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OPTION 3 ($400): Job posting is immediately e-mailed to COMP/CCPM members (no website or InterACTIONS! posting)

Message from the CCPM President:

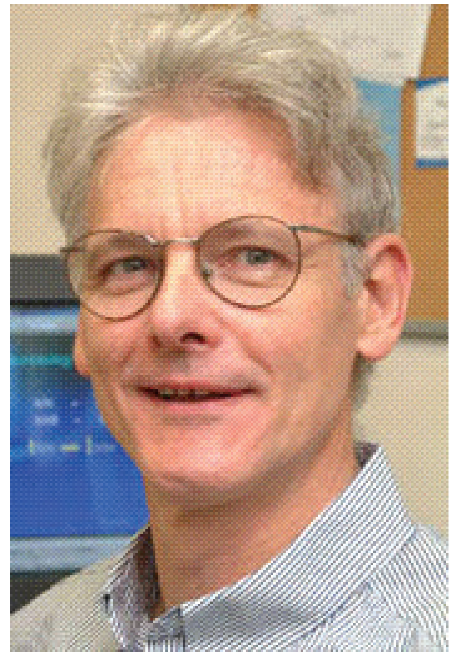
The CCPM board continues to discuss the issue of requiring a candidate applying for board certification to have trained in a CAMPEP accredited two year residency training program. This requirement will be implemented by the American Board of Radiology beginning in 2014.

A brief summary of the current USA situation is that the American Board of Radiology (ABR) will require an applicant to have graduated or be enrolled in a CAMPEP accredited **graduate** or **residency** training program for an application submitted in September, 2011 to write the computerized ABR part 1 exam in the beginning of 2012. For an application submitted in September, 2013 and later years the requirement becomes to have graduated or be enrolled in a CAMPEP accredited **residency** training program. Note that under the ABR certification exam process one can write their part 1 exam before having finished all the residency training requirements that have to be met in order to write their part 2 written exam. Also, the quickest one can complete board certification with the ABR is almost 2 years from the submission of an application to passing the final oral exam (ABR part 3), unlike the CCPM exam process that requires only half a year. In the USA the 2014 CAMPEP accredited residency requirement is largely driven by the AAPM, which has just announced that it is applying for state licensure for medical physicists in five states [http://www.aapm.org/pubs/enews/documents/eNewsAAPMACMPArticleRevised.pdf].

State licensure will require that medical physicists be board certified after a structured residency training program, the equivalent requirements as for licensure for other medical professions, one of the reasons that the AAPM is strongly promoting the CAMPEP residency training requirement for board certification. Regardless of whether provincial licensure for medical physicists will occur in Canada, there is across the board agreement that a structured residency training program produces better medical physicists than unstructured On the Job training. This last statement is supported by the higher pass rates in board exams by candidates from residency training programs.

In summary, the arguments for implementing a similar CAMPEP accredited residency training requirement by 2014 by the CCPM are improved competency and continued recognition by both state governments and the NRC in the USA of CCPM board certification. There is also the possibility of provincial licensure whether initiated by COMP or by the provinces if, for example, the public demands increased protection from radiation therapy incidents through provincial safety legislation. If the latter scenario occurs, our profession's image would be much better if the profession itself had already adopted a structured residency training program

Assuming one accepts that CAMPEP accredited residency training and board certification are good goals, a question that arises on both sides of the border is how many residency training slots are required and how many CAMPEP accredited residency training slots currently exist. I estimate that Canada will need 60 to 70 two year residency training slots to produce 30 to 35 board certifiable radiation therapy physicists per year. This number can be estimated from at least two approaches. In the past several years more than 30 applications (excluding repeat applications) for board certification in radiation therapy physics have been received per year. This means that with no future expansion in the required number of new certified radiation therapy physicists per year at least 60 residency training slots would be required in



Dr. Dick Drost,
CCPM President

Canada. A second way to reach a similar estimate is to look at the current numbers in Ontario. Ontario has 22 radiation therapy residency slots. Extrapolating this number to all of Canada, based on the population ratio of Canada to Ontario, one calculates 57 radiation residency training slots. Because of the aging patient population, baby boomer medical physicists nearing retirement, radiation therapy procedures becoming more complex, and the current shortage of medical physicists, both here and in the USA, 60 residency training slots is an underestimate.

Based on informal enquiries with medical physicists in most provinces, the number of expected CAMPEP accredited residency slots in Canada by 2010 is estimated at 40 to 44. The distribution of these slots across Canadian provinces is not proportional to their population. This means that the increased number of CAMPEP accredited residency slots required to get to at least 60 in Canada will have to come from provinces that currently have few or no residency training

(Continued on page 11)

Message from the COMP Chair:

I wish to offer my deepest thanks to **Maryse Mondat** who is leaving the position of Treasurer effective January 1st, 2009. Maryse is finishing 3 years as COMP Treasurer and it has been a pleasure to work with her during this time. **Bill Zeigler** will be officially taking over as Treasurer on January 1st but is already getting into the swing of things. Bill has had lots of experience with accounting roles in other organizations over the years and I am sure that he will find this one to be the most satisfying.

The annual mid-year COMP Executive meetings were held on November 28th in Toronto. These meetings were very productive and I will provide you with an update in this message.

Many of the topics of discussion surrounded the action items that came out of our strategic plan. A summary of these items can be found in the July 2008 issue of Interactions in the Message from the Executive Director.

<u>Identify Potential Membership Categories</u>
We are looking at creating a category that would recognize excellence amongst the COMP membership. The results of this will be forwarded to membership prior to the 2009 ASM for voting.

<u>Research Membership Barriers and Opportunities (e.g. Academics)</u>
We are looking at ways to expand our membership and provide content for all aspects of Medical Physics.

<u>Implement Communications Strategy</u>
Some changes have already occurred with respect to the website and the electronic mail-outs for items of interest and speeding up the voting process for things such as by-law changes, etc…

<u>Explore the Creation of an Academic Affairs Committee</u>
This has been implemented through the creation of the **Science and Education Committee (SEC)** under the interim leadership of **Marco Carlone**. They are already working on ways to provide educational and scientific programs that we hope will meet the needs of the membership. Some of these items are discussed further on. Also, Students Council has been created and will report directly to the SEC. I would like to thank **Alejandra Rangel and Nadia Octave** who will be the first co-chairs. This will be an important voice for the student population.

<u>Conduct a Feasibility Study re: Running a Winter Program</u>
This was done, and it is feasible. The SEC is currently developing an annual "winter school" that will provide the highest quality of learning on various topics of current interest. The first session is targeted to occur in early 2010. This is one of the many ways we are looking at providing increased value for our members. More details will be published in the next issue.

<u>Consider Adding Refresher Course/ Workshops to the ASMs</u>
This topic is one of the top priorities for the SEC to develop after the "winter school" is underway. We appreciate any comments or suggestions you may have on this topic.

I wish to offer my deepest thanks to **Maryse Mondat** who is leaving the position of Treasurer effective January 1st, 2009. … **Bill Zeigler** will be officially taking over as Treasurer on January 1st but is already getting into the swing of things...

<u>Explore Running a Formal Track at Future CARO Meetings</u>
This also falls to the SEC to develop. The timeline we are looking at would be to begin at our next joint COMP-CARO meeting (not yet booked but likely 2012/2013).

<u>Revise Professional Materials for the Medical Physicist Profession</u>
This is well underway. We are creating a brochure about "Medical Physics in Canada". The last one was published in 1992 and is in need of a major update. This will cover everything from "What are Medical Physicists?" to Training/ Residency/ Academic Programs and Scope of Practice. This document should be available by mid-2009.

Mr. Jason Schella
COMP President

<u>Develop Guideline for the Development, Approval, and Use of Consensus Statements</u>
We now have a policy on this topic that will be used on future documents put forward by COMP. We are also in the process of reviewing past documents approved by COMP (such as the CAPCA "Standards") with the aim to correctly label these appropriately. The terms "Evidence-based Guidelines" and "Consensus Statements" were deemed appropriate and you may see some changes in previously published documents to reflect this nomenclature.

<u>Develop and Implement a Recruitment Strategy</u>
We are often asking for volunteers to help out and so we are looking at ways to entice members to give up some of their valuable time.

If you wish to help our organization grow, feel free to contact me at jason.schella@cdha.nshealth.ca or Nancy Barrett at nancy@medphys.ca.

I hope that this has provided you with a sense of what we have been up to over the last while.

All the Best in the New Year.

Message from the Executive Director of COMP/CCPM:

As I write this submission, we have just returned from the COMP and CCPM mid-year meetings in Toronto. These meetings provide an excellent opportunity for the very committed volunteers of both organizations to connect and work towards ensuring that the needs of the medical physics community are met today and into the future.

...we continue to focus on the strategic pillars of: *community; consensus; education; profile and organizational excellence*.

As we move into the third year of our strategic plan, we continue to focus on the strategic pillars of: *community; consensus; education; profile and organizational excellence*. It is encouraging to see that we are making progress in a variety of areas:

- The Science and Education Committee has begun planning the 2010 COMP Winter School which will be launched in January of 2010 in Western Canada. The COMP office will assist with venue selection and logistics.

The Science and Education Committee has begun planning the 2010 COMP Winter School which will be launched in January of 2010 in Western Canada. The COMP office will assist with venue selection and logistics.

- A Student Council has been formed and will report to the COMP Executive via the Science and Education Committee. The recognition that students have an important contribution to make is a key step in positioning COMP for the future.
- The Communications Committee is developing promotional material that will help COMP increase awareness of the profession of medical physics and attract new members to the organization.
- A taskforce has been developed to focus on membership expansion. This is a significant undertaking and the first step is to get a handle on what the potential membership is. We also need to determine what segments exist within the medical physics profession and what the needs of those segments are.
- In addition to its ongoing work, the Professional Affairs Committee is now working to support COMP's efforts to develop community by documenting the relationships we have with various adjacent organizations. Many of our members are connected to a number of other groups and keeping this list up to date is an ongoing effort.

Preparations are underway for the 2009 annual scientific meeting in Victoria so ***mark your calendars for July 21-24th.*** The conference will be taking place at the Fairmont Empress hotel and the Victoria Conference Centre. This premier downtown venue will enable delegates, family and friends to take advantage of all that the beautiful city of Victoria has to offer.

Professional Affairs Committee is now working to support COMP's efforts to develop community by documenting the relationships we have with various adjacent organizations.

By now, the 2009 online dues renewal process is available. This is our second year with this current system and we are hopeful that like last year, most members will choose to renew online. Please contact us if you have any difficulties and we will work to resolve them quickly.

I would like to take this opportunity to thank all of our sponsors who so generously support this newsletter, our annual directory and the scientific meeting.

By now, the 2009 online dues renewal process is available. This is our second year with this current system and we are hopeful that like last year, most members will choose to renew online.

Ms. Nancy Barrett,
COMP/CCPM Executive Director

Your support is most appreciated!

As always, please feel free to contact me at nancy@medphys.ca or Gisele Kite at admin@medphys.ca at any time with your feedback and suggestions.

CNSC Feedback Forum

What's in a Class II Facilities and Prescribed Equipment licence?

Submitted by: David Niven
CNSC, Ottawa ON

If you're reading this article, chances are that you have Class II prescribed equipment somewhere in your organization. Since the General Nuclear Safety and Control Regulations state that the licence must be posted outside the licensed facility, you probably walk past the licence on a regular basis. But have you ever stopped to really take a look at the licence? What information do those pages actually contain? If you've ever asked yourself that question (or if you're just now realizing that there are licences posted in your building), read on to find the answers!

LICENCE NUMBER

Every licence has a unique identification number which is divided into four parts. The first part is the core number, which is a unique number assigned to each licensee. The second part indicates the number

(Continued on page 9)

CLASS II NUCLEAR FACILITIES AND PRESCRIBED EQUIPMENT LICENCE	PERMIS PORTANT SUR LES INSTALLATIONS NUCLÉAIRES ET L'ÉQUIPEMENT RÉGLEMENTÉ DE CATÉGORIE II	**10000-1-13.0**

I) LICENCE NUMBER: 10000-1-13.0

II) LICENSEE

Pursuant to section 24 of the Nuclear Safety and Control Act, this licence is issued to:

Regional Health Sciences Centre
100 Hospital Road
Citywide, ON
I0I 0I0
Canada

This licence replaces licence 01461-14-13.1.

III) LICENCE PERIOD

This licence is valid from: November 28, 2008 to February 28, 2013 unless otherwise suspended, amended, revoked or replaced.

IV) LICENSED ACTIVITIES

This licence authorizes the licensee to:

(a) operate and service the medical accelerator and other radiotherapy facilities (524) listed in the Appendix: Nuclear Substances and Class II Prescribed Equipment of this licence, at the location(s) specified in the Appendix: Locations of Licensed Activities of this licence; and

(b) possess, transfer, import and store the nuclear substances that are associated with or arise from the activity described in (a).

V) CONDITIONS

The contents of the appendices attached to this licence form part of the licence.

1. Operation Limitations
Subject to any other condition of this licence and unless otherwise permitted by the prior written approval of the Commission or a person authorized by the Commission, the licensee shall carry out the licensed activities in accordance with the documents or parts thereof referred to in the Appendix: Licence Document(s).
(2917-7)

2. Inaccuracies Notification
The licensee shall report to the Commission or a person authorized by the Commission, as soon as is practicable, the discovery of any inaccuracy or incompleteness in the documents referred to in the Appendix: Licence Document(s).
(2920-6)

(Continued from page 8)

of licences (past or present) held by the licensee when this licence was granted. The third number is the year of expiry, and the fourth number is the version number. For example, this licence with number 10000-1-13.0 will expire in 2013 and has had no revisions to date. This was the 1st licence ever assigned to this licensee/ core number.

LICENSEE

This section states the name and address of the licensee. Don't worry if the address listed here doesn't match your actual location – you're not going crazy. This is the corporate address of the licensee. The phrase, "Pursuant to section 24 of the Nuclear Safety and Control Act…" is also always included here. In short, this is the part of the NSCA that empowers the CNSC to establish and manage licences.

LICENCE PERIOD

This simply states the date that the licence comes into effect and the date on which it expires. The qualifier, "…unless it is otherwise suspended, amended, revoked or replaced," allows your licence to be amended when there are changes in your facility – otherwise you would be stuck with things as they are until the expiry date. Remember that your licence cannot be extended past the expiry date by way of an amendment; it must go through a licence renewal process.

LICENSED ACTIVITIES

These are the activities the licensee is allowed to perform. Because the licensee may be an umbrella organization for multiple locations, this section refers to specific equipment at a specific location by referencing the appendices "Nuclear Substances and Class II Prescribed Equipment" and "Locations of Licensed Activities."

Each activity listed here is assigned a *usetype*, which is just a numerical code for that activity. Usetype 524, shown on this licence, is for a consolidated licence. Other examples of usetypes include 522 – operate a medical linear accelerator, 566 – service (by operator) Class II prescribed equipment, etc. The licence also states the allowed actions involving the nuclear substances that "…are associated with or arise from…" the activity described by the usetype. These actions include possession, transfer, import, export or storage. An example of such a nuclear substance would be an activated accelerator component.

CONDITIONS

The regulations already dictate how the allowed activities must be performed, so why are there even more conditions? Licence conditions are usually included for two reasons. The first is that regulations must be broad in order to apply to everyone under normal circumstances. Therefore, in cases where a facility- or licence-specific condition is applied, it will be listed here. For example, an Annual Compliance Report (ACR) must be submitted by all licensees; however the annual submission date may vary. Another common condition is the Inaccuracies Notification. This refers to inaccuracies in the appendix documents, and since each licence will reference different documents, this condition must be applied to each licence.

The second reason for including conditions is to address a requirement that is absent or unclear in the regulations. For example, the requirement to post emergency contact information was a common licence condition, however this was added to the revised Class II regulations (April 2008) and so no longer needs to be a separate condition. **It is important to remember that licence conditions carry just as much weight as any regulations.**

APPENDICES:

The final section of the licence contains several appendices, which in some cases form the bulk of the licence. The appendix "Nuclear Substances and Class II Prescribed Equipment" is divided into three sections: Accelerators, Prescribed Equipment Containing Sealed Sources and Other Nuclear Substances. Some licences, such as the consolidated licence used in this example, have something listed under each heading, but this may not always be the case – clearly a brachy-

(Continued on page 10)

Appendix: Nuclear Substances and Class II Prescribed Equipment

Regional Health Sciences Centre

a) Accelerators

Item	Equipment Make and Model	Beam Type	Maximum Operating Energy	In-House Servicing Permitted
1	Siemens ONCOR Impression Plus	Photons	15 MV	Yes
2	Siemens ONCOR Impression Plus	Photons	15 MV	Yes

b) Prescribed Equipment Containing Sealed Sources

Item	Equipment Make and Model	Nuclear Substance	Maximum Quantity	In-House Servicing Permitted
3	Varian GammaMed Plus	Iridium 192	555 GBq	Yes

c) Other Nuclear Substances

Item	Description	Nuclear Substance	Maximum Quantity
4	Replacement source for: Varian GammaMed Plus	Iridium 192	555 GBq

Appendix: Location(s) of Licensed Activities

Regional Health Sciences Centre

Regional Health Sciences Centre
100 Hospital Road
Citywide, ON

	Use/Operation	Storage
Room: C	Item 1	n/a
Room: D	Item 2	n/a
Room: A	Item 3	n/a
Room: B	Item 3	n/a
Room: F	n/a	Item 3 Item 4

All item numbers listed refer to the *Appendix: Nuclear Substances and Class II Prescribed Equipment* of this licence.

(CNSC...Continued from page 9)

therapy licence will have nothing listed under the accelerator section. Only prescribed equipment certified by the CNSC can be listed here. The appendix "Locations of Licensed Activities" lists the address and room numbers (if applicable) where the equipment or nuclear substance(s) listed in the first appendix can be used, operated or stored. As mentioned, the address here may be different from the licensee address in section II.

The third appendix consists of references to the Licence Documents. These are documents related to facility design, use, operation, etc. which were submitted by the organization in order to obtain the licence. Any correspondence that has taken place with the licensing specialist that the CNSC considers essential may also listed. Not every submission or correspondence makes it into the appendix; only those documents that form the licensing basis for the licence are included. Examples of such documents are facility drawings, safety reports, operational procedures, details of the radiation protection program, quality assurance procedures, emergency procedures, etc. Since these documents form a part of the licensing basis, licensees are expected to abide by them. During inspection, compliance against these documents is verified along with verification against the regulatory expectations. Therefore, if there are any changes made to the documents referenced in this section, the licensee is required to notify the CNSC and request an amendment to the licence.

A copy of the Annual Compliance Reporting Form is included as the last appendix (Note: Cyclotron licenses have an additional appendix which is not discussed in this article). This report, which summarizes important information pertaining to the operation of the facility over the past year, must be submitted on the date identified in section V of the licence. This information includes equipment and/ or source details, statistics on the number of Nuclear Energy Workers

(Continued on page 11)

Appendix: Licence Document(s)

Siemens ONCOR Impression Plus

[A1] The letter dated September 24, 2001 from Regional Hospital to the CNSC with the attached document entitled: "Radiation Therapy Licence Application Form C-120rev.1" including only the following attachments: Part F, Plans and Design of the Nuclear Facility and Mevatron KD Emergency procedures v 1.0. (CNSC Document No. 900000)

[A2] The letter dated September 19, 2003 from Regional Hospital to the CNSC with the attached document entitled "Re: Application for Licence to Operate for Commissioning" including only Part F - Box 37. (CNSC Document No. 1000000)

Developing Country - Resident Travel Award

In collaboration with BEST MEDICAL Canada the Canadian Organization of Medical Physicists (COMP) sponsors an annual travel award to enable senior Medical Physics Resident/Trainees to travel for educational purposes between Canada and a Developing Country.

The purpose of the Travel Award program is to help defray the costs to enable a) a senior medical physics Resident / Trainee from a developing country to travel to the COMP Annual Scientific Meeting and to spend up to 3 weeks visiting up to 2 other centres in Canada or b) a senior Canadian medical physics Resident to visit one or more Medical Physics Departments in developing countries for up to 3 weeks. Only one award (of a maximum of $5000) will be awarded each year, with awards going to a Canadian Resident and a Resident/Trainee from a developing country in alternating years.

See the COMP website for more details!

2009 Application - Deadline January 9, 2009

CNSC Feedback Forum*(Continued from page 10)*

(NEWs), non-NEWs and the doses they received, facility workload, etc. It is the licensee's responsibility to ensure that the ACR is submitted to the CNSC on time.

For security reasons, the appendices are not required to be posted with the licence itself. This is to prevent unauthorized persons from gaining access to the radioactive sources stored in the facility. In this case the radiation safety officer should keep the appendices in a safe place.

Finally, the licence is signed by the Designated Officer. The NSCA allows the Commission to transfer certain powers to specific individuals, such as issuing and amending licences. In this case, the Designated Officer is the Director of the Class II Nuclear Facilities Licensing Division.

And there you have it – the mysteries of the Class II licence revealed. Next time you walk by the entrance to your Class II prescribed equipment take a closer look at the licence. After all, it's not just there for decoration!

CCMP Presidents Message*(...Continued from page 5)*

slots. The main issue is funding. A cancer center can hire a "Junior physicist" and train them on the job while that person is producing therapy plans. Finding money for a two year residency slot where that person has to spend their time training, may have to go off site for some of their training, and may leave the province after finishing their residency is not easy.

All the discussion so far has been for radiation therapy residency slots, but the funding issues and lack of residency slots also applies in training imaging medical physicists. Currently, there are only two CAMPEP accredited residency programs in imaging physics in North America, one of them in Canada. Although there are only 2-3 CCPM board exams per year for imaging physicists, another two CAMPEP accredited imaging residency programs will be required to provide the 6 residency imaging slots for Canada's manpower needs.

2009 Sylvia Fedoruk Prize in Medical Physics

The Saskatchewan Cancer Agency is pleased to sponsor a competition for the 2009 Sylvia Fedoruk Prize in Medical Physics. This award is offered annually to honour the distinguished career of Sylvia Fedoruk, former Lieutenant-Governor of Saskatchewan and previously physicist at the Saskatoon Cancer Centre.

The prize will comprise a cash award of five hundred dollars ($500), an engraved plaque and travel expenses to enable the winner to attend the annual meeting of the Canadian Organization of Medical Physicists (COMP) and the Canadian College of Physicists in Medicine (CCPM), which will be held on July 21-24, 2009 in Victoria, BC.

The 2009 Prize will be awarded for the best paper on a subject falling within the field of medical physics, relating to work carried out wholly or mainly within a Canadian institution and published during the 2008 calendar year. The selection of the award-winning paper will be made by a panel of judges appointed by COMP.

Papers published in *Physics in Medicine and Biology* and *Medical Physics*, which conform to the conditions of the preceding paragraph, will automatically be entered in the competition and no further action by the author(s) is required. All other papers should be submitted electronically to:

Nancy Barrett
Executive Director
Canadian Organization of Medical Physics
E-mail: nancy@medphys.ca.

Each paper must be clearly marked: "Entry for 2009 Sylvia Fedoruk Prize" and must reach the above address no later than **Monday, February 2, 2009**.

The award winners from the last five years were:

Magdalena Bazalova, Luc Beaulieu, Steven Palefsky, Frank Verhaegen, "Correction of CT artifacts and its influence on Monte Carlo dose calculations", *Medical Physics 34, 2119-2132 (2007)*

Brian Nieman, Ann Flenniken, S. Lee Admanson, R. Mark Henkelman, John G. Sled, "Anatomical Phenotyping in the Brain and Skull of a Mutant Mouse by Magnetic Resonance Imaging and Computed Tomography", *Physiol Genomics **24**:154-162* (2006)

Guy-Ann Turgeon, Glenn Lehmann, Gerard Guiraudon, Maria Drangova, David Holdsworth, Terry Peters, "2D-3D registration of coronary angiograms for cardiac procedure planning and guidance. *Medical Physics, **32**(12): 3737-49* (2005)

P. Johns, M. Wismayer, " Measurement of coherent x-ray scatter form factors for amorphous materials using diffractometers", *Physics in Medicine and Biology"*, **49**, 5233-5250 (2004)

A. Samani, J.Bishop, C. Luginbuhl, D. Plewes, " Measuring the elastic modulus of ex-vivo small tissue samples", *Physics in Medicine and Biology*, **48**, 2183-2198 (2003)

Harold Johns Travel Award Announcement
Deadline for Application: 10th April 2009

The Board of the Canadian College of Physicists in Medicine is pleased to honour the Founding President of the College by means of the Harold Johns Travel Award for Young Investigators. This award, which is in the amount of $2000, is made to a College member under the age of 35 who became a member within the previous three years. The award is intended to assist the individual to extend his or her knowledge by travelling to another centre or institution with the intent of gaining further experience in his or her chosen field, or, alternately, to embark on a new field of endeavour in medical physics.

The H. E. Johns Travel Award is awarded annually by the Canadian College of Physicists in Medicine to outstanding CCPM Members or Fellows proposing to visit one or more medical physics centres or to attend specialized training courses such as the AAPM summer school. The applicant should not have previously taken a similar course or have spent a significant amount of time at proposed institutions. The award is for $2,000 and will be paid upon receipt of a satisfactory expense claim. The deadline for application is four months prior to each CCPM annual general meeting. All applicants must have written and passed the exam for membership in the CCPM within the previous three years. They should supply a one page proposal indicating the course they wish to attend or the name(s) of the institutions they would visit and the reasons for their choice. They should also supply an estimate of the costs involved and letters from their present employer indicating that they are in agreement with the proposal. For a visit to an institution the candidate must have the institution write to the Registrar in support of the visit. The candidate should also provide their curriculum vitae and the names and phone numbers of two references whom the Awards Committee can contact. No reference letters are required. The Awards Committee reserves the right to contact additional individuals or institutions.

Applicants may travel either inside Canada or elsewhere. If their proposed expenses exceed the value of the award, then they should also indicate the source for the additional funds required.

The award is intended both to assist the individual in their medical physics career and to enhance medical physics practice in Canada. Recipients are therefore expected to remain in Canada for at least one year following their travel. Applicants should be working in Canada but need not be Canadian citizens.

Successful candidates will have two years after their application deadline to complete their travel. They will be required to submit a short report to the Canadian Medical Physics Newsletter.

The award recipient will be chosen by a committee consisting of the Chairman of the Examining Board, The Registrar and the President of the College. Their choice will be based upon 1) the written proposal submitted by the candidate, 2) references obtained by the committee and 3) membership exam results. The award will be announced at the Annual General Meeting of the College.

Unsuccessful candidates in any one year who are still eligible in subsequent years may have their applications considered again by writing to the Registrar and providing any necessary updated information.

Applications should be sent to:
Dr. Wayne Beckham
The Registrar
Canadian College of Physicists in Medicine
c/o BC Cancer Agency, Vancouver Island Centre
2410 Lee Avenue, Victoria, BC, Canada V8R 6V5

2008 AMP Meeting

Submitted by: John Andrew
PEI Cancer Treatment Centre, Charlottetown

The 10th annual Atlantic Medical Physicists (AMP) meeting was held in Halifax on September 12th and 13th. The AMP meeting is attended by medical physicists and medical physics graduate students, dosimetrists, and accelerator service personnel from the Atlantic Province's cancer clinics and hospitals. Medical physicists from Atlantic universities as well as interested individuals from outside our region are also encouraged to attend. The location normally rotates between the six Atlantic cancer centres. The 2008 meeting began at noon Friday over lunch at a restaurant close to the QEII Hospital. We then moved to a meeting room at the QEII where the service engineers and dosimetrists split off for their own meetings while the physicists discussed administrative issues and held a short scientific session.

On the administrative front, we decided to formalize our AMP meeting process by creating an executive group that would organize our yearly meetings. We also discussed a plan for a voluntary audit process that would involve one or two physicists visiting each other's clinics on a regular basis to help ensure accuracy of the physics aspects of radiotherapy. The equipment procurement process and a proposed joint medical physics residency program for the Atlantic region were also discussed.

On the scientific side, short presentations were made by Mike Hale, Grant MacNevin (via a web-based connection from Charlottetown), George Mawko, Edward Kendall, Wei-Hong Huang, David Goodyear, Tanner Conner, Edwin Sham and James Robar. Cupid Daniels was the MC.

The timing of the AMP meeting was arranged to coincide on Friday evening and Saturday with GE Healthcare's Multi-Modality Educational Symposium at the Halifax Marriott Harbourfront Hotel. The symposium included three simultaneous sessions on Nuclear Medicine, CT and Oncology. Oncology topics included PET/CT, RapidArc and 4D Gating with excellent speakers coming from across North America.

Thank you to Cupid Daniels, the recently appointed Head of Medical Physics at the QEII, for organizing the meeting and to GE Healthcare for inviting our AMP contingent to their educational symposium.

Report on CNSC ACT Information Session

Submitted by: Michael Evans
McGill University Hospital, Montreal QC

On Dec. 1, 2008 I attended a one day information session given to licensees on the Nuclear Safety and Control Act in Ottawa. The session ran from 8:30 am to 4:30 pm and was attended by about 25 participants. The majority of the attendees were from Class I facilities including technical and regulatory people from Ontario Power Generation, AECL, and other representatives from industry. There seemed to be 2 attendees from the medical and Class II side including myself and Ms. A. Lauzon from the radioprotection service of Centre hospitalier de l'Université de Montréal.

The session was given by lawyer Bernie Shaffer, Q.C., Senior Council to the CNSC. Mr. Shaffer has 35 years experience in this field and was able to deliver a most interesting and informative program to a group on scientists and technical people having a limited amount of legal expertise.

The stated goals of the session were to obtain an understanding of the legal framework in which the CNSC operates; to be able to navigate through the *Nuclear Safety and Control Act* ; and to be familiar with the terminology used in the *Nuclear Safety and Control Act* and the Regulations.

In particular, the course aimed to deliver a review of the following topics:

- i) The legal and constitutional underpinnings of the *Nuclear Safety and Control Act* and the CNSC,
- ii) Federal jurisdiction over nuclear undertakings and activities, and how that jurisdiction can be shared with the provinces,
- iii) How the Rule of Law and the concept of fairness apply to CNSC licensing, operations and process,
- iv) The independence of the CNSC as an expert nuclear regulator, contrasted with its financial, legal, regulatory and public accountability as a federal administrative agency,
- v) The structure, terminology, and main features of the *Nuclear Safety and Control Act*,
- vi) The key 'players' under the Act, including the Commission, the President, Inspectors, Designated Officers, CNSC staff and the licensees,
- vii) The main powers and responsibilities of the key players and the legal controls over their powers,
- vii) The regulatory process of the CNSC, including licensing, compliance monitoring and enforcement,
- ix) Enforceable and non-enforceable regulatory documents of the CNSC and how they affect regulated persons,
- x) CNSC regulation-making and the federal regulatory process.
- xi) CNSC Compliance Policy – from education and voluntary compliance to orders and enforcement.
- xii) Inspections and investigations – the role of the Charter
- xiii) Offences and penalty provisions of the NSC Act and prosecutions.
- xiv) Penalty and sentencing options under the NSC Act.

All (127!) Sections of the Act were reviewed, and some of their implications with respect to the regulations in general terms were also reviewed. Mr. Shaffer gave a very animated and informative description of the Act, and as an RSO myself, I certainly found the legal description useful in understanding how the CNSC works and applies regulations to our particular Class II installation. I would encourage anyone who deals with the CNSC on a regulatory level to attend this information session given by the CNSC.

Mark your calendar!

Canadian Organization of Medical Physics

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The Uncertainties for Spine Stereotactic Body Radiotherapy: Is it safe?

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Introduction

Stereotactic body radiotherapy (SBRT) for spine metastases is an active area of development in the field of radiation oncology. It emerged with the advent of sophisticated technologies for body immobilization, image-guided radiotherapy (IGRT), micro-multifleaf collimators (miMLC), and intensity modulated radiotherapy (IMRT). SBRT implies 1 to 5 fractions of high biologic effective dose delivered conformally to the target while sparing the organs at risk. In the case of spine metastases as illustrated in Figure 1, we target the transverse process while sparing the spinal cord from myelopathic doses. One can appreciate the steep dose gradient between the edge of the target volume treated with 16 Gy (blue color wash) and the thecal sac (green color wash).

This technique was developed for patients where prior radiation failed in controlling spine metastases. For these patients, treatment options have been limited to further radiation (at a lower total dose to avoid radiation cord injury) or surgery. Often patients are too ill for surgery given the invasiveness of the procedure and prolonged rehabilitation required post-surgery, and the efficacy of low palliative total doses in the case where radiation failed the first time is questionable. In order to provide these patients with a new option of a second course of high dose radiation to the tumor, while sparing the spinal cord, Hamilton et al. described the first successful treatments[1, 2]. He designed an invasive stereotactic body frame to achieve the required immobilization where the frame was attached to the vertebral body spinous processes with the patient in the prone position, and an incorporated stereotactic fiducial system for CT localization. However, the frame was simply not practical given the invasiveness, complexity, and inability for fractionated therapy.

Sahgal, Larson and Chang recently wrote an extensive review on spine SBRT where clinical outcomes, technologies required, and controversies in the treatment planning are outlined.[3] The aim of this paper is to focus on the data with respect to inter and intra-fractional variation in patient positioning by highlighting data reported, and focus on the dosimetric outcome of small errors in translation and rotation specific for spine SBRT.

Technology for spine SBRT

The Cyberknife® (Accuray, Inc., Sunnyvale, CA, USA) was initially developed as a frameless radiosurgery system for the brain and spine, and the largest series of clinical experience for spine SBRT has been reported with this technology.[4] The Cyberknife consists of an X-Band 6 MV linear accelerator, a high precision six-axis manipulator (robotic arm), and a near real-time intra-fractional image correlating system based on stereoscopic kilovoltage X-ray imaging. This is a non-isocentric radiation delivery system and so the robotic arm moves the beam generated by the linac to the position of the tumor rather than the patient being shifted to the isocenter of the machine. Even though the mechanical accuracy has been reported to be within 1 mm,[5-7] the residual target motion (target movement between successive image-guided corrections) is patient specific and variation up to 2 mm and 2 degrees has been observed.[8] The Cyberknife system is unique in that automatic linac positional adjustments in all six degrees-of-freedom (6-DOF) in near real-time compensate for detected changes in target positioning. Couch adjustments are still required for translations beyond 10 mm, rotational offsets of 1 degree for pitch and roll and 3 degrees for yaw. This technology has evolved to provide faster treatments with 800 MU/min output, a motorized collimator system (the Iris®), and a six-degree of freedom robotic couch.

Several linac SBRT systems are equipped with CT image guidance, stereoscopic X-ray image guidance, or both IGRT solutions. All systems can perform spine SBRT as they are based on IMRT using a miMLC and IGRT and as a result several centres are performing spine SBRT.

At the University of Toronto, spine SBRT is performed on the Elekta Synergy equipped with a 4 mm miMLC (Figure 2) and a kv cone-beam IGRT system. Immobilization is achieved using the BodyFIX system (Medical Intelligence, Schwabmuenchen, Germany) which comprises a double vacuum assisted whole body immobilization system. This

(Continued on page 22)

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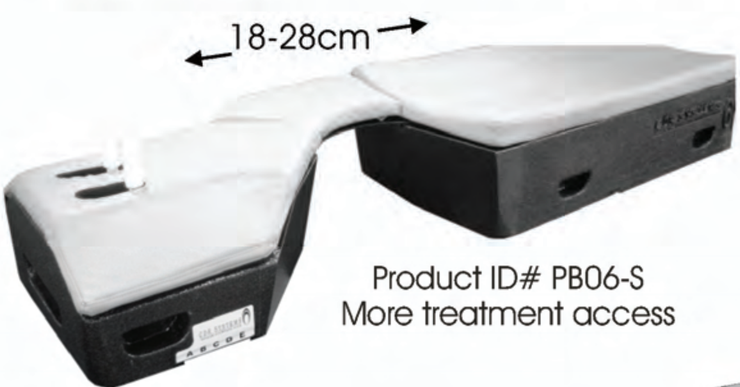

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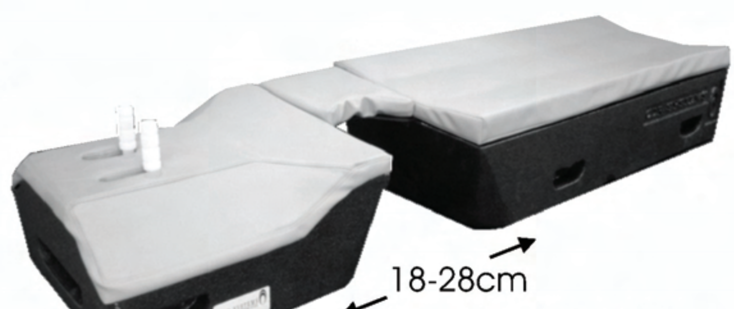

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(Continued from page 16)

system has been well described.[9] For fine patient positioning in all 6-DOF, to correct for identified displacements to match precisely the location of the isocenter, the Sunnybrook Odette Cancer Centre recently acquired the latest generation of the HexaPOD robotic couch (Medical Intelligence, Schwabmuenchen, Germany). We will evaluate the potential for sub-millimeter (as small as 0.1 mm) and sub-degree (as small as 0.1°) couch motion, and this technology is highlighted on the cover of this issue. These extensive technologic requirements for spine SBRT is necessitated by the need to be as precise as possible, as inaccuracies in dose delivery can lead to overdosing of the spinal cord, and myelopathy has already been reported with this technique.[10]

Inter-fractional Positioning Set-Up Variation

Table 1 summarizes the current literature of inter-fractional positional set-up variation with image-guidance where the data is provided for each translational and/or rotational individual axis. The systems of immobilization are also provided. These positional variations are detectable with image-guidance and correctable with remote couch motions. Corrections are dependent on the threshold of the couch for translational corrections and capacity for rotational corrections. For large translational or rotational errors the patient is typically re-set up.

These data have been reported sufficiently that translational and rotational set-up errors can be reported separately as illustrated in Table 1. Overall, with rigid body immobilization most positional set-up errors are on average 1-2 mm. However, Mahan et al. reported significant set-up variations in each axis of translation and the standard deviation reported is greater than that observed in the other highlighted studies.[11] They acknowledge one reason for this variation, as compared to other data, is the lack of a rigid body fixation device.

Intra-fractional Positioning Variation

Intra-fractional error refers to uncertainties that exist despite initial set-up correction with image-guidance. These residual errors include patient positional rotational and translational errors caused by patient motion during radiation delivery, and involuntary organ/target motion. For the spine, organ motion does not seem to be an issue with proper immobilization. Shiu et al. reports negligible spine motion with their rigid stereotactic body frame system (Integra/Radionics, Burlington, MA).[12] However, they report with free breathing, and no rigid immobilization, the potential for vertebral bodies to move substantially (i.e. >1 cm) in the sup-inf direction as detected by fluoroscopy.[12] Nelson et al. reported on spine SBRT patients immobilized in a custom cradle.[13] Initially 4D CT was performed in 10 patients, however, 4D CT was abandoned as the axial skeleton showed stability in position and a free breathing approach was adopted.[13]

The data in Table 2 represent those reports where the intra-fractional positional errors are provided for each individual translational and/or rotational axis. These data indicate relative stability in the target with use of a rigid immobilization system and image guidance. The translational deviations are on average sub-millimeter and rotation deviations are sub-degree.

Interestingly, data from Jin et al. show that intra-fraction motion increases over time.[14] A systematic drift over time is also observed with spine patients treated with the Cyberknife (vaccum bag immobilization) in the supine and prone position as detected by stereoscopic X-ray imaging in a period of 15 minutes.[15] Hoogeman et al report the intra-fractional displacements to increase linearly with time, however, this effect was more pronounced those patients in the prone position.[15] Therefore, new technologies in volumetric IMRT delivery may be an important advance in reducing the impact of dosimetric uncertainties due to intra-fraction motion by significantly reducing treatment time associated with step and shoot IMRT.

(Continued on page 23 and 24)

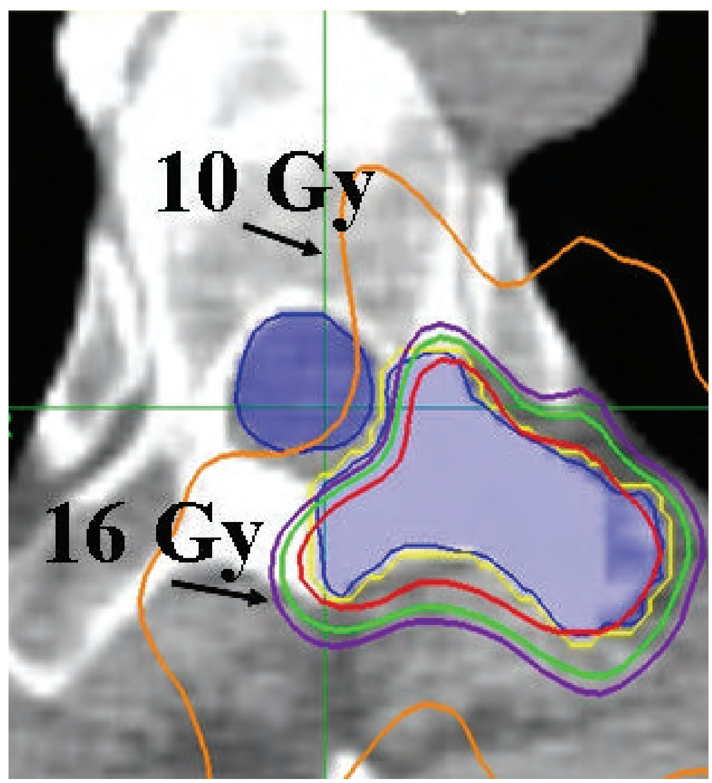

Figure 1: A SBRT plan where the transverse process was targeted with 16 Gy in two fractions. The 16 Gy purple isodose line is conforming around the target (blue color wash) while the thecal sac is spared from high dose.

(continued from page 22)

	Translational Inter-fractional Patient Set-Up error: Isocenter Deviations
TomoTherapy Hi-ART (Cervical tumors custom aquaplast mask otherwise a conformable vacuum cushion, Vac-Loc, Med-TEC, Orange city, IA)	***n=7 patients, MV CT*** • Shifts based on external laser marks to MV CT position Standard deviation= ± 4.0 mm, ± 4.1, ± 4.3 mm (L-R, A-P, S-I)
Elekta Synergy S®[16] (BodyFIX®, Medical Intelligence, Schwabmuenchen, Germany)	***n=9 patients, Cone-Beam CT, 199 CT images*** Mean: 0.6 mm, 0.5 mm, 0.3 mm (L-R, A-P, S-I)
M.D. Anderson[18] (Stereotactic Body Frame System, Integra/ Radionics, Burlington MA)	***n=20 patients, CT on rails, 53 CT images*** Mean: 0.6 ± 3.0 mm, 0.8 ± 2.8 mm, 0.1 ± 3.8 mm (L-R, A-P, S-I)
Memorial Sloan Kettering[17] (in-house stereotactic body frame)	***n=7 patients, In-room CT, final position verified with DRR to portal image, 33 CT images*** • Mean: 2.3 ± 2.3 mm, 0.1± 2.1 mm, 0.2 ± 2.3 mm (L-R, A-P, S-I)
University of Heidelberg[19] (in house body cast/head mask stereotactic body frame)	***n=5 patients, Cone-Beam CT, 26 CT images*** • Thoracic spine (3 patients): 1.6 ± 1.2 mm, 1.4 ± 1.0 mm, 2.3 ± 1.3 mm (vertical error in transverse plane), < 3mm CC (L-R, A-P, S-I) • Lumbar spine (2 patients): 1.4 ± 1.0 mm, 1.2 ± 0.7 mm, 1.8 ± 1.2 mm (vertical error in transverse plane), < 3mm CC (L-R, A-P, S-I)
	Rotational Inter-fractional Patient Set-Up error: Isocenter Deviations
Memorial Sloan Kettering[20] (in-house stereotactic body frame and body cradle)	***n=16, CBCT*** Mean: 0.1 ±0.5°, -0.5 ±1.1°, 1.1 ±1.0° (pitch, yaw, roll)
Novalis® System: infared ExacTrac subsystem and kv steresoscopic IGRT system (BodyFix®)[21]	***n=52 patients, Stereoscopic X-ray*** Mean: 0.7 ± 1.7°, 0.7 ±1.8°, 0.7 ±1.6° (yaw, roll, and pitch)
M.D. Anderson[18] (BodyFIX®)	***n=20 patients, CT on rails, 53 CT images*** • Mean: 0.06 ± 0.71, 0.16 ± 0.75, 0.01 ± 0.87 (pitch, yaw, roll)
Elekta Synergy S®[16] (BodyFIX®)	***n=9 patients, Cone-Beam CT, 199 CT images*** • Mean : 0.0 °, 0.6°, -0.3° (pitch, yaw, roll)

Table 1. Inter-fractional set-up errors along translational and rotational axis as detected with image-guidance for spine SBRT.

(continued on page 24)

(Continued from page 23

Dosimetric Impact of Positional Variations

Guckenberger et al. reported on 9 patients treated with spine SBRT, and performed simulation of translational and rotational errors ranging from 0.5-10 mm in the left-right direction towards the PTV, 1-10 mm in the sup-inf direction, and 0.5°-7.5° for each pitch, roll, and yaw.[16] They concluded maximum tolerable errors to maintain the dose to the spinal cord within ± 5% of 1 mm in the transversal plane, 4 mm in the sup-inf direction, and maximum rotations of 3.5°.[16]

Yenice et al. modeled the impact of one patient with a L4 tumor. Daily set-up positioning deviations for each of three fractions was 0.8, 1.1, and 2.9 mm in the x-y direction, 2.8, 2.2, and 1.5 mm in AP, and 0.8, 3.6, and 3.1 mm in the sup-inf direction, respectively.[17] They report that without correcting the patient's position, the spinal cord would have received a 90% increase over the intended dose while only 14% if corrected.

Wang et al. report an extensive analysis of 20 patients treated with spine SBRT, where they modeled the dosimetric impact of potential residual set-up uncertainties in each translational and rotational axis.[18] They looked at 1, 2, and 3 mm shifts in left-right, ant-post, and sup-inf axis, and 1, 2, and 3 degree rotations in pitch, roll, and yaw axis. They created in each case a new plan with the isocenter offset was created to accurately simulate the error, and therefore 756 plan were created. This is a more robust methodology as opposed to the data by Guckenberger where the spinal cord structure was shifted and rotated and the dosimetry compared to the initial plan. Wang et al. report for the organ at risk (OAR), being the spinal cord or cauda equina, a right to left shift of 2 mm resulting in 9/20 patients experiencing a 25% increase in the dose to 0.01 cc (D 0.01 cc). When the isocenter was shifted posteriorly into the OAR, at 2 mm shift an increase by 25% to the D 0.01 cc was observed for 13/20 patients. Sup-inf shifts of up to, and including, 3 mm had negligible effects. In terms of rotational deviations, up to 3 degrees did not cause a 25% increase in the D 0.01 cc. However, a 3 degree rotation resulted in a significant increases in the OAR for roll (1/20 patients) and pitch (4/20 patients). Of note, these patients had longer target volumes involving three vertebral bodies.

At the University of California, San Francisco a study was performed with the Cyberknife based on 6 treated spine SBRT patients immobilized in a vac-loc.[8] The residual tar-

(Continued on page 25)

Commercial System (Immobilization technique)	**Intra-Fractional Position Variation**
Varian 21EX with 120-leaf multileaf collimator[15] (customized cradle)	***n=33 patients, cone beam CT(pre and post treatment CT)*** Translational error: 0.4 mm, 0.6 mm, 0.9 (L-R, A-P, S-I)
Memorial Sloan Kettering (in-house stereotactic body frame and body cradle)	***n=16 patients (pre and post treatment CT)*** Translational error: 0.6 ±0.5 mm, 0.6 ±0.5 mm, 1 ±0.8 mm (L-R, A-P, S-I) • Rotation Error: 0.2 ±0.4°, -0.2 ±0.3°, 0.1 ±0.6° (pitch, yaw, roll)
Memorial Sloan Kettering[17] (in-house stereotactic body frame and body cradle)	***n=2 patients, in-room CT (pre and post treatment CT for 6 set-ups)*** Mean: -0.1 ± 0.5, -0.4± 1.4, 1.3 ± 0.9 mm (L-R, A-P, S-I)
Novalis® System: infared ExacTrac subsystem and kv steresoscopic IGRT system (BodyFix immobilization)[21]	***n=25 patients, Stereoscopic X-ray fusion to DRR taken at time of CT simulation @ 1, 7, 15 min post-initial set-up(during radiation delivery)*** Translational error: 0.1 ± 0.9 mm, 0.2 ± 1.2 mm, 0.2 ± 1.0 mm (L-R, A-P, S-I) • Rotation Error: 0.0 ± 0.6°, 0.1 ± 0.6°, 0.2 ± 0.6° (yaw, roll, pitch)
Cyberknife[8] (vac loc)	***n=6 patients, Stereoscopic intra-fractional x-ray system, 30 images per patient(during radiation delivery)*** Translational error: ± 1 mm • Rotation Error: ± 1° • S-I: sporadic errors of 2 mm observed • Roll and pitch: sporadic errors of 2°

Table 2. Intra-fractional set-up errors along translational and/or rotational axis as detected with image-guidance for spine SBRT.

(Continued from page 24)
get position was sampled 30 times per patient (based on actual intra-fractional x-ray images), and the dosimetric impact on the target and spinal cord determined. The residual target error was defined, and calculated, as the average target motion between two successive intra-fractional X-ray images, and the correction to the target position included all 6-DOF. In general, the dosimetry to the target was affected less than that of the spinal cord due to the intimate location of the spinal cord with the target volume. The target-cord interface is where the steep dose gradient is created in order to spare the spinal cord while still achieving acceptable coverage at the target-cord interface. Variations in spinal cord dose ranged from 1-4.5% (0.4-1.7 Gy) for the D 0.1 cc, and 1.1-4.4% (0.4-1.6 Gy) for the D 0.3 cc. As we are already pushing the limits of the spinal cord dose in terms of what we allow in order to achieve adequate coverage of the target, these data highlight the potential for intra-fractional motion to impact the dose to small volumes of spinal cord and should be incorporated into the decision of the dose threshold when accepting a plan. Furthermore, preliminary data presented at CARO and ASTRO 2008 by Sahgal et al., on known cases of myelopathy post-spine SBRT, highlight the importance of point doses to the spinal cord and risk of myelopathy.[10]

Conclusion

This report highlights the main potential sources of position uncertainties that can affect dose delivery. First are those inter-fractional rotational and translational deviations that can be corrected with image-guidance, and second are those translational and rotational deviations that occur while the patient is being treated. Intra-fractional deviations are correctable ideally with a system of IGRT that allows for near real-time intra-fractional monitoring while the beam is on, otherwise the treatment has to be stopped and an image taken with subsequent corrections made and treatment restarted. Several other potential sources of error exist tend to be sub-millimeter and include, for example, image fusion uncertainties due to body deformation between planning and treatment, the residual error of the IGRT system, grey scale vs. bone matching, organ motion of the spinal cord, etc.

The data illustrate that intra-fraction deviations tend to be minimal with the use of a rigid immobilization system, and the initial set-up optimized using image-guidance. Furthermore, based on the dosimetric impact of small translational and rotational errors on the spinal cord, one could conclude that fine translation corrections may be more important to correct using new generation robotic couches as opposed to small rotational errors. Overall, spine SBRT is safe given these conditions of ideal patient set-up and image-guidance.

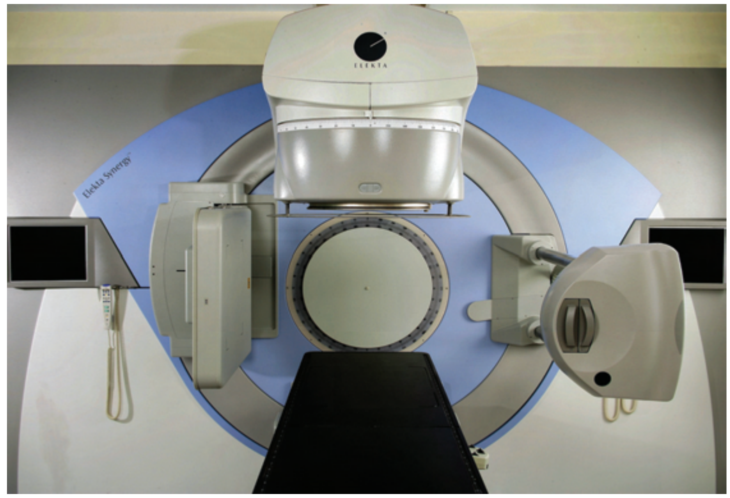

Figure 2: The Elekta Synergy linac with on board kv cone-beam system.

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2008 Professional Survey

Submitted by: Joseph E. Hayward on behalf of the Professional Affairs Committee
Juravinski Cancer Centre, Hamilton, ON

The following is the report on the data received from the professional survey administered in 2008. The survey was sent to all 445 COMP full members in the spring of 2008 and 218 responded. Although a slight increase in absolute numbers from the previous survey (174 members responded in 2006), this is still only a 49.0% response rate. To put this number in perspective, recall that voter turnout in the recent Canadian Federal Election was the lowest in recorded history at 59.1%. Clearly, the validity of the conclusions from the data is based upon the completeness of the original data set. In the interest of achieving the most complete data set possible, **please take the time to complete the next survey when it is administered in 2010**.

The report was prepared under contract by a private firm, Association Management, Consulting & Evaluation Services (AMCES). Particular thanks to Jarett Kingsbury of AMCES, who was the principal author of the report, and to Sherry Connors, whose survey published in InterACTIONS in July 2007 led to the addition of the questions regarding vacation time and professional allowance.

The professional survey will be administered again in 2010. Any feedback regarding the survey process or report would be appreciated.

2008 COMP PROFESSIONAL SURVEY: FINAL REPORT

The 2008 edition of the COMP professional survey provides documentation of compensation and benefits currently provided to members. The survey was sent out to all 445 full members in June of 2008.

There were 218 Respondents to the survey (or 49% of full members contacted), representing a 25.3% increase in response rate over the 2006 Survey, which had 174 Respondents.

1. Age (n=218).

Age	21 - 30	31 – 40	41 – 50	51 – 60	61+	Average
Men (n=165)	10	49	52	46	8	45.0
	6.1%	29.7%	31.5%	27.9%	4.8%	
Women (n=53)	14	24	14	1	0	36.6
	26.4%	45.3%	26.4%	2.3%	0.0%	

2. Gender (n=218).
In total, 165 men (75.7%) and 53 women (24.3%) responded to the survey.

3. Location (n=218).

BC	AB	SK	MB	ON	QC	NB	NS	NL	PEI	INTL
24	24	5	19	79	22	4	8	4	3	26
11.0%	11.0%	2.3%	8.7%	36.2%	10.1%	1.8%	3.7%	1.8%	1.4%	11.9%

The distribution of the respondents has not changed significantly from the 2006 survey. The only province that had a significant change in the number of respondents was Manitoba, which nearly tripled the response rate of 7 in 2006.

4. Please indicate the highest level of education that you have attained (n=218).
Of those who responded to the question, 63.8% had earned their Doctorate as their highest level of education, 34.4% had earned a Masters Degree, and 1.8% had earned a Bachelors Degree. Although the number of respondents has increased by 25.3%, the distribution between each of the levels of education has remained essentially the same as reported in the 2006 survey.

5. Please indicate your certification (n=218).
58% of the respondents in the 2003 Survey had CCPM certification, which increased to 64% in 2006. The result for the current

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survey is 68% representing an increase of 10% over the 2003 results. A professional certification of some form is held by 77% of all respondents. Of those who had a certification other than MCCPM or FCCPM, the majority held a DABR (11 of the 19 or 58%). Also of note is that 13 Respondents had two certifications.

6. Who is your primary employer (n=218)?

The primary employer for 99 of the 218 Respondents was a Hospital (45.4%) and 85 were employed by a Cancer Institute (39.0%), 23 were employed by a University, Government or Research Institute (10.5%), while 11 were employed by another organization (5%). Of the remaining respondents, the majority (7 out of 11) were employed in Industry.

7. What is your primary function within your workplace (n=218)?

160 of the 218 Respondents (73.4%) worked in a Clinical Service capacity at their organization. This represents an increase from the 2006 figure of 67.2%. 19 (8.7%) worked in Teaching and Research & Development (a decrease from 14% in 2006). 20 (9.2%) worked in Administration, 6 (2.8%) worked in Radiation Safety, with the remaining 13 (6.0%) working in another capacity.

8. How many years of experience do you have within your field (n=218)?

- 53 of the 218 Respondents (24.3%) had worked in the field for less than 5 years – the same number as the 2006 Respondents,
- 64 Respondents (29.4%) had worked in the field for a period between 5 to 10 years – up from 24% in 2006,
- 25 Respondents (11.5%, down significantly from the figure of 21% two years ago) had worked in the field for 11 to 15 years,
- 27 Respondents (12.4%, nearly static from the figure of 12% in 2006) had worked in the field for 16 to 20 years, and
- 49 Respondents (22.5%, up from 20% two years ago) had worked in the field for more than 20 years.

9. What is your specialty (n=218)?

186 of the 218 Respondents (85.3%) identified Radiation Oncology Physics as their declared subspecialty, an increase from 82% two years ago. 19 (8.7%), identified the Diagnostic Radiological Physics subspecialty, 5 (2.3%) identified Nuclear Medicine Physics (down from 7% two years ago), 5 (2.3%) Medical Resonance Imaging, and the remaining 3 (1.4%) identified an alternate subspecialty.

10, 11. Income by category.

Note that incomes have been normalized to 1.0 FTE. In 2006, 93.8% of Respondents indicated an FTE=1.0 and in 2007, 96.0% of Respondents indicated an FTE=1.0.

2006 Income by Gender (n=176).

Income ($CDN)	<50,000	50,000 – 75,000	75,001 – 100,000	100,001 – 125,000	125,001 – 150,000	150,001 – 175,000	>175,000	Average
Men (n=133)	2	18	23	23	39	14	14	123,271
	1.5%	13.5%	17.3%	17.3%	29.3%	10.5%	10.5%	
Women (n=43)	2	9	9	12	10	1	0	99,714
	4.6%	20.9%	20.9%	27.9%	23.3%	2.3%	0.0%	

For data submitted by respondents, the increase in income from 2005 for men was $7,523 or 6.5% and $21,282 or 27.2% for women.

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2007 Income by Gender (n=178).

Income ($CDN)	<50,000	50,000 – 75,000	75,001 – 100,000	100,001 – 125,000	125,001 – 150,000	150,001 – 175,000	>175,000	Average
Men (n=135)	1	7	23	29	40	13	22	133,144
	0.7%	5.2%	17.0%	21.5%	29.6%	9.6%	16.3%	
Women (n=43)	0	8	8	15	11	1	0	107,350
	0.0%	18.6%	18.6%	34.9%	25.6%	2.3%	0.0%	

The increase in income from 2006 for men was $9,873 or 8.0% and $7,636 or 7.7% for women.

2006 Income by Location (n=176).

	BC (n=22)	AB (n=21)	SK (n=4)	MB (n=13)	ON (n=64)	QC (n=17)	NS (n=4)	NB (n=3)	PEI (n=3)	NFLD (n=4)	INTL (n=21)
Income (Median)	100,000	110,817	120,000	128,800	120,000	72,000	132,000	135,000	105,000	85,000	139,300
Income (Mean)	99,574	112,502	100,500	129,574	128,514	74,804	130,449	110,973	115,440	103,571	139,586
Change from 2005 (Mean)	+6.5%	+7.0%	+11.3%	+2.9%	+14.8%	+0.5%	n/a	n/a	n/a	n/a	-6.6%

2007 Income by Location (n=178).

	BC (n=22)	AB (n=21)	SK (n=4)	MB (n=13)	ON (n=64)	QC (n=18)	NS (n=4)	NB (n=3)	PEI (n=3)	NFLD (n=4)	INTL (n=22)
Income (Median)	102,000	118,635	129,000	134,300	130,000	78,000	136,000	143,120	105,000	113,000	151,900
Income (Mean)	102,236	120,849	115,500	134,701	138,706	81,811	142,919	132,557	116,963	117,000	156,927
Change from 2006 (Mean)	+2.7%	+7.4%	+14.9%	+4.0%	+7.9%	+9.4%	+9.6%	+19.5%	+1.3%	+13.0%	+12.4%

Income by Specialty (n=176 in 2006, n=178 in 2007).

Specialty	2006 Income (Median)	2006 Income (Mean)	2007 Income (Median)	2007 Income (Mean)
Radiation Oncology Physics (n=149 in 2006, n=151 in 2007)	111,000	117,294	120,000	126,761
Diagnostic Radiological Physics (n=15)	110,000	115,194	120,000	124,832
Nuclear Medicine Physics (n=5)	119,000	126,400	127,000	139,800
Magnetic Resonance Imaging (n=4)	135,000	134,000	144,200	142,550
Other (n=3)	95,000	103,333	98,000	102,667

(Continued on page 29)

Professional Survey… continued

(Continued from page 28)

Income by Level of Education (n=176 in 2006, n=178 in 2007).

Level of Education	2006 Income (Median)	2006 Income (Mean)	2007 Income (Median)	2007 Income (Mean)
Bachelors Degree (n=3)	66,800	68,914	78,300	74,600
Masters Degree (n=62 in 2006, n=64 in 2007)	100,000	104,713	115,000	114,422
Doctorate (n=111)	126,000	125,980	128,000	135,517

12. What was your Annual Professional Allowance (including all travel allowances)?

Year	Annual Professional Allowance
2006 (n=134)	$3,361
2007 (n=143)	$3,461

13(a). Did you perform any consulting work in 2007 (n=176)?

The number of respondents who performed consulting work has remained static from 2005 (15% in 2005 and 14% in 2007).

13(b). Please indicate your total income from consulting fees.

Income ($CDN)	1 – 5,000	5,001 – 10,000	10,001 – 15,000	15,001 – 20,000	20,001 – 25,000	>25,000	Average
2007	12	2	1	1	3	13	43,617
2005	9	5	1	0	1	3	10,968

Of note there were 4 members whose income was solely derived from consulting.

13(c). Please indicate your nominal consulting hourly rate.

Hourly Rate ($CDN)	0 - 50	51 – 100	101 – 150	151 – 200	>200	Average
2007	1	5	19	4	2	146.67
2005	0	7	17	1	2	129.26

14. Do you foresee your income increasing, decreasing, or remaining the same for the next year (n=178)?

128 of the 178 Respondents (72%) indicated that they expected their income to increase over the next year. Only 4 (2%) indicated that their income would go down, with the remainder (46 or 26%) not expecting any change.

15. How many hours do you work in a normal work week (n=178)?

87 of the 178 Respondents (49%) worked on average between 35 to 40 hours per week. 62 (35%) worked between 40 to 50 hours and 23 (13%) worked more than 50 hours in a week. Only 6 (3%) of the Respondents worked less than 35 hours in a

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Professional Survey… continued

(Continued from page 29)

week. (Note that hours have been normalized to 1.0 FTE.)

16. Please indicate which benefits are covered (in part or in whole) by your employer (n=172).

Benefit	Yes	No	Unknown
Medical Coverage	91.9%	2.3%	5.8%
Dental Coverage	87.8%	7.6%	4.7%
Term Life Insurance	82.6%	9.9%	7.6%
Disability Insurance	87.8%	7.6%	4.7%
Liability Insurance	46.5%	20.9%	32.6%
Retirement Pension Plan*	91.9%	4.7%	3.5%
Sabbatical Leave	27.3%	51.2%	21.5%
Tuition Benefits (self)	18.6%	55.8%	25.6%
Tuition Benefits (dependents)	8.7%	66.3%	25.0%

*Exclusive of CPP or QPP

17. How many vacation days do you get during a year exclusive of statutory holidays (n=169)?

Vacation time	Percentage Response
15 or less Vacation Days	3.6%
16-20 Vacation Days	45.5%
21-25 Vacation Days	32.5%
26-30 Vacation Days	15.4%
>31 Vacation Days	2.9%

18. Do you expect to retire from full-time practice of medical physics within the next 10 years (n=177)?

A significant number of the Respondents, 43 (25%), will retire in the next ten years. This is an increase from the 32 (18.4%) reported in the 2006 Survey.

The Radiation Safety and Techincal Standars Advisory Committee (RSTSAC) is currently looking for committee volunteers.

The mandate of the RSTSAC is:

- To review and comment on existing and proposed regulations in the areas of radiation safety and technical standards on behalf of the COMP/CCPM membership.
- To be proactive in the development and review of radiation safety and quality assurance protocols for use by the COMP/CCPM membership.
- To provide advice to COMP/CCPM on matters relating to radiation safety, technical standards, quality assurance and associated training and continuing education issues.
- To act as a resource to the COMP/CCPM membership in radiation safety training.
- To act as a repository of federal and provincial regulations relating to radiation safety and technical standards.

If you are interested in offering your services or would like more information, please contact Nancy Barrett at nancy@medphys.ca or 613-599-1948.

2008 Annual Scientific Meeting Proceedings and DVD available for purchase

If you are interested in purchasing the 2008 Annual Scientific Meeting Proceedings in hard copy format ($35) or DVD format ($10) please contact the COMP office at admin@medphys.ca.

Deadline Alert!

CCPM Membership and Fellowship Exam Applications

January 5, 2009

Did you know…

InterACTIONS is published four times a year:
January , April, July, October

Submission deadlines for each issue are:
December 1, March 1, June 1, September 1

Next deadline is September 1st! Get your material in early!

Dates to Remember

Jan 24-29, 2009
BiOS 2009
San Jose, CA, United States

Feb 16-18, 2009
International conference on Medical Physics, Radiation Protection and Radiobiology
Jaipur India

Feb 29-Mar 1
CaRS
Mont Tremblant QC

March 1
Deadline for April submission to InterACTIONS

Apr 28– May 1, 2009
Radiobiology & Radiobiological Modelling in Radiotherapy
Chester, Cheshire, UK

May 31-June 2
American Brachytherapy Society AGM
Toronto, ON

May 28-31, 2009
TCP Workshop
Edmonton AB

June 14, 2009
Extracranial Radiosurgery Symposium
Winnipeg MB

June 14-18
SNM
New Orleans USA

June 25-26, 2009
AAPM Summer School: Clinical dosimetry measurements in radiotherapy,
Colorado College, USA

July 21- 24, 2009
2009 COMP Annual Scientific Meeting and CCPM Symposium
Victoria, B.C.

July 26-30 2009
2009 AAPM Annual Scientific Meeting
Anaheim, CA

Sept 7-18
World Congress– Medical Physics and Biomedical Engineering
Munich, Germany

Sept 14-18
ESTRO
Goteborg, Sweden

Sept 30-Oct 3
CARO
Quebec City , QC

Call for Abstracts and Invitation to:

WesCan 2009

March 18 – 20, 2009
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A favorite meeting for physicists, therapists, students and support personnel (and hockey fans) since 1979. WesCan is educational, engaging, informal and always fun!

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Early Registration Deadline: **February 13, 2009**

Deadline for discounted hotel rates: **February 13, 2009**

Deadline for abstract submission: **February 13, 2009**

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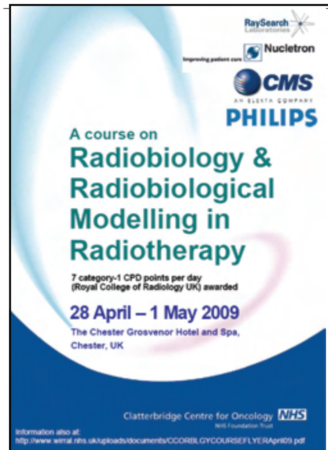

The course provides the background to understand both the basis of radiation treatment for cancer and the use of radiobiological models in the evaluation and optimisation of radiotherapy treatment plans. It is suitable for anyone involved in Radiotherapy: Radiation Oncologists (especially those in training for (UK) FRCR part I), Physicists, Therapy Radiographers, Researchers and University Teachers. Days 1 and 2 will cover fundamentals – clonogenic assays, cellular response to radiation, the effect of doserate, radiation quality (LET), cell-cycle effects, the influence of oxygen, the linear-quadratic (LQ) formula and its limitations, the 5 Rs of Radiotherapy, the principles of fractionation and specific considerations in LDR and HDR brachytherapy. Days 3 and 4 are dedicated to the basis and use of radiobiological models (TCP, NTCP, EUD) in both the evaluation and optimisation of radiotherapy treatment plans. This is the first-ever course giving extensive coverage, including hands-on practice, to these modeling tools, which are beginning to be available in commercial treatment planning systems.

The teaching faculty is composed of Radiobiologists, Radiation Physicists and Radiation Oncologists who are internationally known for their research and are experienced teachers of various aspects of Radiobiology and its application to Radiotherapy.

Students are encouraged to bring with them, in poster format, presentations of Radiobiological Modelling work from their own departments; these will be displayed during the course.

VENUE

All the lectures and practical sessions will take place at **The Chester Grosvenor and Spa**, Eastgate, Chester CH1 1LT, Cheshire, UK (www.**chestergrosvenor**.com). The Chester Grosvenor is in the heart of the old Roman city of Chester, some 25 miles from Liverpool, and within reach of both Manchester and Liverpool airports.

By arrangement, it will be possible to view the spacious and modern Radiotherapy facilities at the Centre, which include the UK's only proton-therapy facility as well as *cone-beam* and 4D CT.

Course Organisers: *Prof. Alan E. Nahum, Physics Dept. and Consultant Dr. Pooja Jain, Radiotherapy Dept., Clatterbridge Centre for Oncology*
alan.nahum@ccotrust.nhs.uk; tel: +44 (0)151 334 1155 extn. 4169
pooja.jain@ccotrust.nhs.uk; tel: +44 (0)151 334 1155 extn. 5915.

2009 AAPM Summer School

Topic: Clinical Dosimetry for Radiotherapy

Course Directors: D.W.O. Rogers and
Joanna E Cygler

Clinical dosimetry for radiotherapy covers the most important task in clinical medical physics: getting the dose measured correctly in brachytherapy, external beam therapy and IMRT.

Topics include fundamentals, protocols, all forms of instrumentation, and standards.

June 21-June 25,2009
The Colorado College, Colorado Springs, Co.

Check the COMP website for course details and the AAPM website for further details.

Editors Note: The "New Normal" for Medical Physicists?

Warm greetings and best wishes for the New Year! While I feel optimistic about the coming year, I remain a bit sore from the last one.

The year of 2008 was an interesting and eventful one, not just for Medical Physicists, but for all of us here in Canada and abroad. From isotope woes at Chalk River to shoe-tossings in Iraq, 2008 is certainly a year worthy of review.

Medical Physicists in Canada and across the world, are well aware of the role they play in the safety of civilians, particularly through the enforcement and development of radiation safety policies of radioisotopes and other radiation delivery devices,

Many of us have come to accept the realities of the so-called 'new normal' where more emphasis is placed on securing access to our facilities and isotopes – these new responsibilities can be accepted as a natural consequence of our government's increasing awareness of threats to our population. We, as Medical Physicists, are not immune to global concerns.

However, the recent terrorist attacks in Mumbai come as a shock to many of us, not only as Medical Physicists, but at a much more visceral level as unwilling spectators of violence.

The International Conference on Medical Physics, held by the Association of Medical Physicists of India, took place in Mumbai at the same time of the attacks. While the conference location was not targeted, the Oberoi and Taj Palace Hotels, being 5 star hotels, naturally hosted many of the attendees. **Sandeep (Sam) Jeswani**, Director of Customer Relations for Tomotherapy Inc, was killed in the attacks while dining at the Oberoi Hotel, victim to open gunfire. There are reports of near misses for other attendees.

It is one thing to read about these brutal activities in the paper or watch them on TV. We are constantly bombarded with these tragedies every day and it is natural to become immune to them during the 8 or so hours away from the workplace. But it is another thing to have this news thrust upon you during your working life as well. I have to confess some selfish investment in this issue, having spent most memorable experiences at the Taj Palace Hotel, which was irreparably defaced in these attacks.

All this gets me thinking about those other places in the world where these actions *are* the 'new-normal' and how our Medical Physics colleagues are handling life and work. I'm sure a helping hand would be appreciated.

To see out what you can do, check out the IOMP website. There remains a lot of work to do.

On an Editorial note, I want to thank all of this issues contributors, particularly the feature article which was a last minute scramble. This newsletter is as good as YOU want it to be: your contributions are welcome. For those who are our regular contributors, your timely contributions help keep the newsletter arrive in our members mailboxes in a timely manner.

As always, I'm looking for new material in the newsletter so if you see or hear anything pertaining to Medical Physics, or perhaps you have a really, really bad physics joke, pass it along! I'm always available at Parminder.basran@sunnybrook.ca

Finally, my three year term as Editor is coming to an end in October 2009. If you or someone you know be interested in helping out with this valuable task, please let me know. Wishing you a happy and safe New Year.

Parminder S. Basran
COMP Newsletter Editor

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