REPORT TO THE AAPM THERAPY PHYSICS COMMITTEE

July 1, 2007 – October 31, 2007

a) Specific Aims
The specific aims of this project have not changed during this reporting period. The primary aim is to assure NCI and the cooperative groups that the participating institutions have adequate staff, equipment, and quality assurance procedures, so that all participants can be expected to deliver radiation treatments that are clinically comparable to other institutions in the cooperative groups. To accomplish this, the RPC monitors external beam and brachytherapy calibrations, evaluates the accuracy of dose calculation algorithms, and determines the adequacy of quality assurance procedures at the participating institutions. Methods include on-site dosimetry reviews, remote monitoring by mailed TLD and anthropomorphic phantoms, and evaluation of benchmark and human patient treatment plans.

b) Studies and Results
The RPC presently monitors 1,532 megavoltage therapy sites in North America, Europe, and elsewhere in the world, that participate in cooperative group clinical trials funded by the NCI. This is an increase of about 60 institutions in the last year. The cooperative groups monitored include ACOSOG, ACRIN, CALGB, COG, ECOG, GOG, NABTT, NCCTG, NSABP, RTOG and SWOG. We also communicate regularly with the Cancer Trials Support Unit (CTSU) to assure that institutions participating through their programs are properly monitored.

• On-Site Dosimetry Reviews: In the year since October 1, 2006, RPC physicists have performed on-site dosimetry evaluations at 31 institutions, evaluating 180 beams (a “beam” is a single photon beam or a cadre of electron beams). Twenty-eight (90%) of the institutions received at least one recommendation for actions that should improve their quality assurance programs. During the last year, development was begun of procedures for dosimetry review visits to proton facilities.

• TLD: Between October 1, 2006 and September 30 2007, 10,539 (distinct energies) beams were measured with TLD at the monitored institutions. Overall, 1.5% of the irradiated TLD received doses that disagreed with the institution’s stated dose by more than 5%. Institutions continuing to use the obsolete calibration protocol (TG-21) exhibited a higher discrepancy rate than the institutions that had converted to the new calibration protocol (TG-51). The number of institutions still using TG-21 has decreased slightly to 11% as of October 1, 2007. In 2003, the RPC began sending TLD to institutions on an annual schedule, rather than waiting six months from receipt of the previous shipment. This has been a successful change in that it allows us to manage our TLD mailings better throughout the year. In addition, this change, along with more aggressive pursuit of delinquent institutions, has reduced the TLD return time from about 40-50 days at the beginning of 2003-2004, to about 20 days today. Increased efficiencies resulting from electronic data collection and review have reduced the time from TLD irradiation to delivery of reports to about 21 days (from 35 days in 2001). TLDs were irradiated in >30 proton beams of different energies SOBPs, and field sizes, to evaluate the response and suitability of the RPC TLD system, and preparations were made to begin routine monitoring of proton facilities. An optically-stimulated luminescence (OSL) system was evaluated for its ability to replace TLD with equivalent accuracy and lower cost.

• Patient Treatment Review: In the year since October 1, 2005, individual protocol patient treatment records were evaluated for 396 patients treated on GOG, NSABP, NCCTG, and RTOG protocols. Of these, 47 patients received brachytherapy treatments.

• Credentialing Processes: The RPC participates in the credentialing of institutions for protocols involving advanced technologies including brachytherapy, IMRT, stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT). This activity is partially supported by a subcontract from the Advanced Technologies for Clinical Trials grant. For IMRT and SRS, credentialing includes irradiation of an anthropomorphic phantom provided by the RPC that contains anatomic structures and dosimeters. To date, the RPC has issued 405 reports to institutions that irradiated the RPC head and neck IMRT phantom. Of these, 310 indicated that the irradiation complied with the institution’s treatment
plan within criteria agreed to by the RPC and the RTOG. The first-time pass rate continues to be 69%. The RPC’s lung phantom has been used to credential institutions to participate in stereotactic lung trials. Twenty-five reports have been issued. Of them, 18 indicated that the irradiation complied with the institution's treatment plan within criteria agreed to by the RPC and RTOG. Valuable data regarding heterogeneity corrections has been obtained and is being prepared for publication. Through a subcontract issued to Washington University, software was developed to enable phantom measurements to be compared with treatment plans using a 2D gamma-index calculation. The RPC plays the lead role in credentialing institutions for a partial breast irradiation (PBI) trial run jointly by NSABP and RTOG. Credentialing requires completion of facility and knowledge-assessment questionnaires (using web-based forms) and electronic submission of a benchmark treatment plan. To date, 2015 applications for credentialing have been received (all or part) and 1648 credentials have been issued (3D CRT arm-917; Mammosite arm-604; multicatheter arm-127). The remainder are awaiting submission of required information or replies to questions. Complete applications are processed within 2 business days. The RPC participated in the development of NCI guidelines for the use of protons in clinical trials, and in an RTOG guideline for the use of IGRT.

- **Low-Energy Brachytherapy Sources:** Dr. Ibbott represents the RPC on a subcommittee appointed by the AAPM to address the use of new sources. The RPC acts as a clearinghouse of information and makes available on a web site a list of sources meeting the AAPM dosimetric prerequisites. Discussions have been held with the ESTRO physics committee regarding linking brachytherapy information compiled by the two groups.
- **Planning Workstation:** An educational grant from Varian Corporation enabled the RPC to acquire an Eclipse treatment planning workstation. The TPS is now being used to re-calculate institutions' brachytherapy treatment plans for verification. Progress is being made to implement external beam calculation reviews.
- **Database:** The RPC database continues to greatly facilitate our work. Results of remote measurements, on-site dosimetry reviews, and treatment record reviews are available to RPC staff immediately. Through an agreement with the Health Services Research group at Memorial Sloan-Kettering, the RPC acquired demographic information about the remaining radiotherapy centers in the US and these data are being entered into our database.
- **Webpage:** The RPC webpage continues to be maintained and updated regularly. We have implemented online web forms for a number of credentialing activities, including RTOG 0413/NSABP B-39.
- **Community Relations:** The RPC participated in the development and conduct of a workshop on radiation therapy QA held in February 2007. The RPC played a lead role in organizing and conducting this workshop. The proceedings have been accepted for publication in IJROBP.
- **AAPM Oversight:** The AAPM Therapy Physics Committee continues to be our scientific advisory committee. We report to this committee three times per year, and participate in subcommittees, task group, and working groups. A task group of the TPC performs a one-day in depth evaluation annually.
- **Clinical Advisory Committee:** A group of 5 radiation oncologists was formed as a clinical advisory committee. The Committee is contacted when questions arise regarding RPC clinical operations.

c) **Significance**
Radiation therapy continues to move towards highly conformal therapies using high technology modalities. As clinical trials incorporate these technologies, the RPC is developing tools to monitor the quality of these therapies. At the same time, we continue our traditional role, monitoring conventional therapies, which still represent the bulk of treatments in clinical trial studies. The TLD monitoring program and on-site dosimetry reviews have played a key role in achieving consistent dosimetry over the years. Evidence of our contributions to improved dosimetry at participating institutions is demonstrated by the recommendations made by the RPC following a visit.

d) **Plans**
Plans for this budget period are not significantly changed from those outlined in the application for the current grant cycle.
- **On-Site Dosimetry Reviews:** FTE physicists will review 50 beams. Visits will be made to proton facilities.
- **Mailed TLD Program:** Our criteria for acceptability have not changed. An alternative to TLD (OSL) will undergo extensive evaluation during the next year. Routine monitoring of proton facilities will begin.
• **Credentialing:** We will continue to work with the groups to focus our efforts appropriately.

• **Patient Treatment Review:** Except for some studies evaluated by the RTOG QA office, the RPC is the only QA office that focuses on technical evaluation of radiation dose (dosimetry review). The RPC will continue to review some fraction of patients to assess the quality of the data currently being submitted. The Eclipse workstation will be incorporated into our recalculation of external beam dose distributions.

• **Anthropomorphic Phantoms:** Again this year, additional phantoms were constructed to meet the demand for credentialing on all existing protocols and new developing protocols. Special attention continues to be given to the evaluation of heterogeneity corrections in lung protocols.

• **Liaison with Cooperative Groups, AAPM, etc.:** The AAPM Therapy Physics Committee continues as our scientific advisory body.

• **Data Transfer:** The RPC, through the ATC subcontract, continues to develop and implement electronic data exchange capabilities. We now use electronic data routinely in the evaluation of phantom irradiations.

• **Webpage:** We continue to add capabilities to the RPC webpage.

**PARTICIPANT FEE:**

- Institutions invoiced FY07 1496
- No XRT/Canceled/Inactive 10
- Invoiced by RDS 0
- Institutions paid 973

**PUBLICATIONS AND ABSTRACTS**

**Publications Accepted/Published (2005-present):**


Abstracts


Invited Articles


Letters to the Editor/Newsletters


Book Chapters


Presentations

International Activities

Geoffrey Ibbott presented at the ABR/CAMPEP Summit, Dallas, TX, August 17-19, 2007.


Francisco Aguirre attended the IV Latin American Congress, Cartagena, Columbia, October 7-10, 2007.

Visits to Institutions

1. Scott Davidson performed a research visit at the Washington University, St. Louis, MO, July 5-11, 2007.

2. Francisco Aguirre performed radiological physics measurements and reviewed patient dosimetry at the Montefiore Medical Center, New York, NY, July 8-14, 2007.


5. Scott Davidson performed a research visit at Regions Hospital, St. Paul, MN, September 14-20, 2007.


Meetings Attended

(July 1, 2007 - October 31, 2007)


17. David Followill attended the ATC-QARC Meeting, Providence, RI, July 31-August 1, 2007.
24. Francisco Aguirre attended the SWOG Meeting, Huntington Beach, CA, October 4-6, 2007.
27. Andrea Molineu attended the SWAAPM Meeting, Irving, TX, October 18-19, 2007.

Respectfully submitted,

Geoffrey S. Ibbott, Ph.D.
EXPENDITURES OF THE RADIOLOGICAL PHYSICS CENTER
(RPC Grant and the Advanced Technology Subcontract)
July 1, 2007 - October 31, 2007

PERSONNEL (salaries, fringe benefits): $757,019
7 Physicists, 1 Supervisor of Quality Assurance Dosimetry Services, 1 Sr. QA Dosimetrist, 3 QA Dosimetrists, 1 Informatics Manager, 1 Database Administrator, 1 Programmer Analyst I, 1 Radiological Physics Supervisor, 6 Radiological Physics Technicians, 1 Coordinator of Research Data, 1 Department Administrator, 1 Office Manager, 1 Sr. Administrative Assistant, 1 Administrative Assistant, 1 Sr. Secretary, and 3 Graduate Research Assistants.

TRAVEL
Visits:

Davidson, Scott Research visit – Washington University, St. Louis, MO $ 576.37
Aguirre, Francisco Montefiore Medical Center, New York, NY $ 2,443.98
Alvarez, Paola AOS Scottsdale, Phoenix, AZ $ 733.95
Alvarez, Paola Cobb Center for Radiation Therapy, Atlanta, GA $ 697.99
Davidson, Scott Research – Regions Hospital St. Paul, Minneapolis, MN $ 1,701.89
Followill, David Tacoma Valley ROC, Tacoma, WA $ 1,525.12
Lowenstein, Jessica Tacoma ROC – St. Joseph, Tacoma, WA $ 1,362.45
Molineu, Andrea Halston Cancer Center, Springfield, MO $ 1,000.89
Sub-Total $ 10,042.64

Meetings:

Aguirre, Francisco AAPM Annual Meeting, Minneapolis, MN $ 1,154.00
Aguirre, Francisco SWOG meeting, Huntington Beach, CA $ 601.83
Aguirre, Francisco ASTRO meeting, Los Angeles, CA $ 1,360.85
Alvarez, Paola AAPM Annual meeting, Minneapolis, MN $ 1,111.54
Bencomo, Jose AAPM Annual meeting, Minneapolis, MN $ 3,105.15
Bivens, Whitney AAPM Annual meeting, Minneapolis, MN $ 1,080.59
Davidson, Scott AAPM Annual meeting, Minneapolis, MN $ 1,227.58
Davis, Cindy ASTRO meeting, Los Angeles, CA $ 1,777.55
Followill, David AAPM Annual meeting, Minneapolis, MN $ 2,701.03
Followill, David ATC – QARC meeting, Providence, RI $ 978.92
Followill, David COG meeting, Denver, CO $ 1,001.80
Followill, David ASTRO meeting, Los Angeles, CA $ 2,406.18
Hall, Franklin ASTRO meeting, Los Angeles, CA $ 2,047.48
Harris, Irene AAPM Annual meeting, Minneapolis, MN $ 1,552.54
Harris, Irene NCCTG meeting, Minneapolis, MN $ 1,198.01
Heard, Malcolm AAPM Annual meeting, Minneapolis, MN $ 1,252.96
Hernandez, Nadia AAPM Annual meeting, Minneapolis, MN $ 1,579.67
Homnick, Jacklyn SW-AAPM conference, Irving, TX $ 1,059.00
Homnick, Jacklyn CIRMS meeting, Gaithersburg, MD $ 1,657.87
Ibbott, Geoffrey AAPM Annual meeting, Minneapolis, MN $ 2,384.30
Ibbott, Geoffrey ATC – QARC meeting, Providence, RI $ 945.04
Ibbott, Geoffrey NCI Group Chairs meeting, Washington, DC $ 850.59
Ibbott, Geoffrey NCCTG meeting, Minneapolis, MN $ 1,232.53
Ibbott, Geoffrey Imaging Network ACRIN Fall meeting, Arlington, VA $ 1,426.77
Ibbott, Geoffrey SW-AAPM conference, Irving, TX $ 1,010.88
Ibbott, Geoffrey CIRMS meeting, Washington, DC $ 1,420.89
Ibbott, Geoffrey ASTRO meeting, Los Angeles, CA $ 1,626.56
Lazar, Sussanah AAPM Annual meeting, Minneapolis, MN $ 903.46
Lowenstein, Jessica GOG meeting, Philadelphia, PA $ 1,344.12
Lowenstein, Jessica AAPM Annual meeting, Minneapolis, MN $ 916.42
<table>
<thead>
<tr>
<th>Consultant</th>
<th>Event Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molineu, Andrea</td>
<td>AAPM Annual meeting, Minneapolis, MN</td>
<td>$1,549.37</td>
</tr>
<tr>
<td></td>
<td>SW-AAPM conference, Irving, TX</td>
<td>$467.26</td>
</tr>
<tr>
<td>Molineu, Andrea</td>
<td>ASTRO meeting, Los Angeles, CA</td>
<td>$2,094.22</td>
</tr>
<tr>
<td>Nitsch, Paige</td>
<td>AAPM Annual meeting, Minneapolis, MN</td>
<td>$1,063.54</td>
</tr>
<tr>
<td>Roll, Joye</td>
<td>GOG meeting, Philadelphia, PA</td>
<td>$1,030.12</td>
</tr>
<tr>
<td>Roll, Joye</td>
<td>ASTRO meeting, Los Angeles, CA</td>
<td>$2,275.47</td>
</tr>
<tr>
<td>Wells, Nathan</td>
<td>AAPM Annual meeting, Minneapolis, MN</td>
<td>$1,471.45</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td></td>
<td><strong>$52,867.54</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL AMOUNTS</strong></td>
<td><strong>$62,910.18</strong></td>
</tr>
<tr>
<td>CONSULTANTS</td>
<td>$-0-</td>
</tr>
<tr>
<td>SUPPLIES:</td>
<td>$34,397.00</td>
</tr>
<tr>
<td>Office supplies, laboratory and record keeping, TLD, TLD supplies, software, equipment, etc.</td>
<td></td>
</tr>
<tr>
<td>OTHER EXPENSE:</td>
<td>$32,771.00</td>
</tr>
<tr>
<td>Postage, telephone, reprints, copying, computer fees, equipment repair, registration fees, tuition, freight/delivery, etc.</td>
<td></td>
</tr>
<tr>
<td>SPACE RENTAL:</td>
<td>$80,428.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Expenditures July 1, 2007 - October 31, 2007</td>
<td>$967,525.18</td>
</tr>
<tr>
<td>Indirect costs @ 26%</td>
<td>$251,556.55</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$1,219,081.73</td>
</tr>
</tbody>
</table>
RPC Report to TPC October 2007

<table>
<thead>
<tr>
<th>Clinical Study Groups</th>
<th>Office Reviewing</th>
<th>Special Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gynecologic Oncology Group GOG</td>
<td>RPC</td>
<td>Radiotherapy manual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electronic Transfer of Patient Records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Image Based Treatment Planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IMRT Guidelines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Defining Treatment violations</td>
</tr>
<tr>
<td>National Surgical Adjuvant Breast and Bowel Project NSABP</td>
<td>RPC</td>
<td>IMRT Guidelines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partial Breast RT Credentialing</td>
</tr>
<tr>
<td>North Central Cancer Treatment Group NCCTG</td>
<td>RPC</td>
<td>Rapid Review of Lung Study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3D CRT credentialing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stereotactic Phantom</td>
</tr>
<tr>
<td>Radiation Therapy Oncology Group RTOG</td>
<td>RTOG/RPC</td>
<td>IMRT H&amp;N Phantom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prostate Phantom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prostate Implant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Credentialing LDR/HDR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stereotactic Head Phantom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lung Phantom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4D Liver Phantom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cervix HDR/LDR protocol compliance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient Calculation Program</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partial Breast RT Credentialing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IMRT Benchmark Case</td>
</tr>
<tr>
<td>Southwest Oncology Group SWOG</td>
<td>QARC</td>
<td>3D Benchmark Case</td>
</tr>
<tr>
<td>Clinical Trial Support Unit CTSU</td>
<td>QARC, RPC, RTOG</td>
<td>RPC Institution List</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RTF Numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TLD Monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Review RT Facility Questionnaire</td>
</tr>
<tr>
<td>American College of Radiology Imaging Network ACRIN</td>
<td>N/A</td>
<td>Participate in the development of guidelines for quality assurance of institution participating in ACRIN CT Dose Measurements</td>
</tr>
<tr>
<td>American College of Surgeons Oncology Group ACOSOG</td>
<td>QARC</td>
<td>RPC Institution List</td>
</tr>
<tr>
<td>Cancer and Acute Leukemia Group B CALGB</td>
<td>QARC</td>
<td>TRUS Prostate Approval Collaboration</td>
</tr>
<tr>
<td>Children’s Oncology Group COG</td>
<td>QARC</td>
<td>3D Benchmark Case</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IMRT Benchmark Case/Phantom</td>
</tr>
<tr>
<td>Eastern Cooperative Oncology Group ECOG</td>
<td>QARC</td>
<td>CT/MRI Fusion Benchmark</td>
</tr>
</tbody>
</table>