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NCRP PROGRAM AREA COMMITTEE 6: RADIATION DOSIMETRY AND MEASUREMENTS

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Abstract

Program Area Committee (PAC) 6 of the National Council on Radiation Protection and Measurements provides guidance for radiation measurements and dosimetry – one of the most fundamental scientific areas of the Council's expertise. Seminal reports published by PAC 6 over many decades have documented the scientific and technical foundations of radiation measurements and dosimetry for generations of radiation scientists and radiation protection professionals. Ongoing work of PAC 6 is driven by advancing technology such as development of new types of instruments, biodosimetry and nanotechnology; by evolving understanding of radiation hazards such as effects on lens of the eye, and risks as from some high-dose medical imaging procedures; and by new situations faced in the modern socio-political environment including radiological and nuclear threats. The activities of PAC 6 are intended to formulate and document the dosimetric framework for radiological science to address these ever emerging challenges.

Keywords

National Council on Radiation Protection and Measurements; radiation dosimetry; biodosimetry; dose reconstruction

INTRODUCTION

The National Council on Radiation Protection and Measurements (NCRP) Program Area Committee (PAC) 6 focuses on quantitative issues related to radiation measurements and dosimetry. PAC 6 members (listed below) have been selected to bring to NCRP a broad range of expertise in internal and external radiation dosimetry and dose assessment and measurements of radiation, in academic, medical, industrial, operational, governmental, and research and development settings. The Committee has overseen the preparation of numerous reports over the past several decades and these have documented the scientific and technical foundations of radiation measurements and dosimetry for generations of radiation

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health scientists and protection specialists (Guilmette 2015). PAC 6 continues to address emerging issues facing modern day radiation protection professionals and researchers in health and other sciences that use or are associated with radiation.

RECENT ACTIVITIES

Recent reports and commentaries issued by NCRP regarding radiation measurements and dosimetry in the last 10 y are listed below. These activities were either overseen or supported in part by PAC 6. Several reports focus on radiation dose reconstruction which has become an increasingly important activity for the support it lends to health risk (epidemiological) studies (e.g., Simon et al. 2006) including those for nuclear weapons workers of the cold war era (Toohey 2008), as well as providing support to compensation programs for military veterans exposed to radiation from atomic weapons or tests (Blake and Komp 2014). Other topics address screening and protection from potential terrorist activities, and dose management in certain high dose medical procedures.

Reports

- Uncertainties in the Measurement and Dosimetry of External Radiation, NCRP Report No. 158 (NCRP 2007a).
- Ionizing Radiation Exposure of the Population of the United States, NCRP Report No 160 (NCRP 2009a).
- Radiation Dose Reconstruction: Principles and Practices, NCRP Report No. 163 (NCRP 2009b).
- Uncertainties in Internal Radiation Dose Assessment, NCRP Report No. 164 (NCRP 2009c).
- Population Monitoring and Radionuclide Decorporation Following a Radiological or Nuclear Incident, NCRP Report No. 166 (NCRP 2010a).
- Radiation Dose Management for Fluoroscopically-Guided Interventional Medical Procedures, NCRP Report No. 168 (NCRP 2010b).
- Uncertainties in the Estimation of Radiation Risks and Probability of Disease Causation, NCRP Report No. 171 (NCRP 2012).

Commentaries

- Radiation Protection and Measurement Issues Related to Cargo Scanning with Accelerator-Produced High-Energy X Rays, NCRP Commentary No. 20 (NCRP 2007b).
- Radiation Protection in the Application of Active Detection Technologies, NCRP Commentary No. 21 (NCRP 2011a).
- Radiological Health Protection Issues Associated With Use of Active Detection Technology Systems for Detection of Radioactive Threat Materials, NCRP Commentary No. 22 (NCRP 2011b).

ONGOING ACTIVITIES

Operation Tomodachi Radiation Dose Assessment Peer Review (SC 6-8)

Scientific Committee (SC) 6-8 was formed in 2012 to provide an external peer review report of documents submitted by the Defense Threat Reduction Agency (DTRA) related to the Operation Tomodachi radiation dose assessments produced by the Defense Assessment and Recording Working Group to address potential radiation exposures to U.S. Forces Japan subsequent to the Fukushima Daiichi nuclear reactor accidents in 2011. The Committee reviewed and provided comments and suggestions on multiple draft reports from DTRA through 2013 and 2014, and anticipates completing a summary document of the Operation Tomodachi Peer Review in 2015.

Radiation Worker and Nuclear Weapons Test Participants Radiation Dose Assessment (SC 6-9)

SC 6-9 was formed in 2012 as part of the Million Worker Study (Bouville et al. 2015) to better understand and evaluate reported historical doses of U.S. radiation workers and nuclear weapons test participants to be able to best integrate personnel doses into epidemiology studies. The activities of this committee are continuing as the Million Person Study progresses.

Radioactive Nanoparticles

PAC 6 is currently supporting PAC 2 (Operational Radiation Protection) in overseeing the work of SC 2-6 in the preparation of a report on radiation safety aspects of nanotechnology and radioactive nanoparticles.

FUTURE ACTIVITIES

Future activities of PAC 6 will be determined by the needs of the professional community and government, as well as public, in need of advice, guidance, technical strategies, and methods related to radiation protection, dosimetry, and measurements. In addition, concepts for reports and commentaries originate within PAC 6. Following are some examples of topics that PAC 6 considers important and possibly worthy of future reports.

Scientifically Based Regulatory Framework for Radiation Biodosimetry

The primary goal for early-response biodosimetry is to provide dose and risk information to medical responders, primarily to facilitate their early medical management decisions, but also to support late phase and long-term health risk studies. Presently the U.S. Food and Drug Administration has yet to approve either a biodosimetry assay or device useful for dose or injury assessment for radiation-exposed persons. Thus, PAC 6 has recommended that NCRP develop a commentary report on issues related to radiation biodosimetry. This report could provide guidance to establish a framework for regulatory review of biodosimetry methods for a national radiation medical countermeasures program, and to review the many technical issues related to the use of biodosimetry methods in research and radiation protection activities.

Practical Methods for Data Collection for Dose Reconstruction Following Mass Exposure Events

After the 11 September and Fukushima events, programmatic emphasis for consequence management research and development has focused on certain medical countermeasures, dose mitigation strategies, management of contaminated food and land, and strategies to manage acute radiation effects. However, little has been done to develop suitable methods for collecting necessary data in the aftermath of a mass exposure event to evaluate of long-term health consequences. PAC 6 envisions the goal of a NCRP report to develop practical methods for obtaining individual and population information useful for realistic individual dose reconstruction in the aftermath of a mass exposure event which may include large scale injuries as well as exposures.

Update of NCRP Report No. 58 on Radioactivity Measurements

NCRP Report No. 58 entitled *A Handbook of Radioactivity Measurements Procedures* (NCRP 1978) was published as an update of NCRP Report No. 28, *A Manual of Radioactivity Procedures*, which was published as National Bureau of Standards Handbook 80 (NCRP 1961). This report focused on radioactivity standardization procedures, and measurement of radioactivity for clinical and biological purposes. By 1983, supplies of this report were exhausted, and NCRP took advantage of the situation to revise and expand the Handbook in its second edition, which was published in 1985 (NCRP 1985). All told, Report No. 58 was one of the NCRP's most successful reports, with over 13,000 copies sold. However, with time the report has become dated due to more recent developments in radioactivity detection instrumentation and techniques, and is no longer sought. Because of the historic success of this report, PAC 6 considers an updated version with expanded scope to be a desirable product for NCRP.

Eye Dosimetry

Following the 2011 statement by the ICRP (2011) regarding radiation effects on the lens of the eye, many countries including the United States (NRC 2011) have or are considering modifying their radiation protection dose limits for the eye. This could place new emphasis on methods, accuracy and uncertainties in measuring and evaluating radiation doses to the lens of the eye. PAC 6 is following these trends to evaluate whether to recommend formation of a committee to address new dose limits for the eye as well as how to measure the dose and how to reduce it. This work would be especially relevant for workers with significant risk of eye exposure such as interventional radiologists.

CONCLUSIONS

Seminal reports published by PAC 6 over many decades have documented the scientific and technical foundations of radiation measurements and dosimetry for generations of radiation protection professionals. Ongoing work of PAC 6 is driven by advancing technology such as new types of measurement devices and biodosimetry and nanomaterials; by evolving understanding of radiation hazards such as effects on lens of the eye, and risks as from some high-dose medical imaging procedures; and by new situations faced in the modern sociopolitical environment including radiological and nuclear threats. The activities of PAC

6 are intended to formulate and document the dosimetric framework for radiological science to address these ever emerging challenges.

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