The Boice Report #51

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Golden Eyes

Jennifer Boice (left) and Helen Maroulis at Cashell Elementary School
Photo courtesy of Eleni Stamoulis

The Golden Girl. Helen Maroulis had a goal to win an Olympic gold medal when she was seven years old and in elementary school. She had to wrestle boys who didn't want to wrestle her. Her first year was abysmal, 1–30. She continued, losses turned to wins, and in high school she was the Maryland champion, besting the best boys in the state. She went to Canada to wrestle since the United States does not support female wrestling. Her hero was the great Japanese champion, Saori Yoshida, who had won 13 world championships and 3 Olympic golds. After being beaten by Yoshida twice before, Helen studied all Yoshida's videos and learned Japanese to understand Yoshida's coaches. In Rio de Janeiro, Helen became the first U.S. woman to win an Olympic gold medal in women's wrestling, beating the reigning champion, who had not lost since 2012. My wife was Helen's elementary school music teacher (see picture). Helen came back to her elementary school (with her mother) and spoke to the kids, mesmerizing them with tales of their elementary school when she was their age and of the fabulous experiences in the Olympics. When she was about to leave, she asked whether anyone would like to see her medal. You can imagine the spontaneous outburst from 380 kids. She stayed to have photos taken with each child—and even the teachers. She said, "Love what you do" and "Go after your dream!" You may not win a gold medal, but always be motivated, work hard, and don't give up (even if those around you are discouraging). Go for your dream, whether in sports, music, science, medicine, teaching, or even *health physics* (well the latter might be a bit of literary license). But shouldn't we be so motivated to continue our quest to improve radiation protection and radiation understanding, strive to meet the needs of the nation (which are legion), and provide the foundation for future generations? Go for the gold!

Cataract Workshop. *The eyes and me*. The National Council on Radiation Protection and Measurements (NCRP), the Greater New York Chapter of the Health Physics Society, and Memorial Sloan Kettering, with indirect support from the New York City Department of Health and Mental Hygiene, sponsored a cataract workshop on 29 August 2016 titled Lens of the Eyes—Next Steps: A Stakeholder Workshop on Implementation and Research. There were 12 presentations, ample discussion, and many question-and-answer sessions to be synthesized and published. Nearly 90 attended. The purpose was to present the conclusions of NCRP Scientific Committee 1-23 on Guidance on Radiation Dose Limits for Lens of the Eye (to be published shortly as NCRP Commentary No. 26) and then look to the next steps with a focus on stakeholders, implementation, and research. It was "*eye*" opening!

The eyes have it. The detailed presentations are available. I will summarize what caught my *eye*:

Introduction (John Boice) – the International Commission on Radiological Protection published guidance to lower the lens of the eye dose limit to 20 mSv y^{-1}. Although accepted by most of Europe, it continues to cause challenges in implementation.

NCRP Guidance (Eleanor Blakely) – Based on new epidemiologic data, evaluation of the quality of studies, differences in scoring systems for lens opacities, coupled with clinical evaluations, NCRP recommends lowering the lens of the eye limit from 150 mSv y^{-1} (equivalent dose) to 50 mGy y^{-1} (absorbed dose). NCRP recognizes that any change in limits will entail an additional cost burden, and the level of protection gained should be commensurate with the cost of implementing the change. NCRP recommends that a threshold model continue to be used for radiation protection purposes.

Dosimetry Is Challenging (Chris Passmore) – It is difficult to measure lens dose, especially when there is no clear regulatory guidance on what to measure! Should it be $H_p(0.07)$, $H_p(3)$, or $H_p(10)$ [$H_p(3)$ seems the winner] and based on what geometrical considerations? How exquisite should the dosimetry be?

Nuclear Power Plants (Dennis Quinn) – Lowering the lens dose by a factor of three would not be a problem, except when it is! Possible challenges to lowering the dose limit occur with spent and damaged fuel rods, high-energy beta particles, and doses from various orientations in the workplace such as steam generator entries. Safety glasses and training are important, as are the new commercial dosimetry and actions from the National Voluntary Laboratory Accreditation Program (NVLAP).

Medical Facilities (Lawrence Dauer) – The greatest population exposure is from medical procedures. Children receive 10% of procedures. Patient and physician lens of the eye doses should be kept below 0.5 Gy. Shielding strategies are recommended for interventional radiologists. NCRP has initiated an update of the medical component in Report No. 160.

International Radiation Protection Association (IRPA) Guidelines (Stephen Balter) – IRPA has developed a guideline protocol for eye dose monitoring and eye protection of workers. Some interventional radiologists and cardiologists who perform fluoroscopically guided interventions approach and exceed 20 mSv. Protective glasses are needed. The Electric Power Research Institute hosted an informative cataract workshop, in coordination with the International Atomic Energy Agency, in June 2015.

European Status and Radiobiology Mechanisms (Elizabeth Ainsbury) – There is a lot of biology we don't know. How does ionizing radiation contribute to lens opacities? Cataracts are the most frequent cause of blindness in the world. Is there a genetic predisposition? What is the relative biological effectiveness for high linear-energy-transfer exposures? Does protraction matter? How strong is the evidence for a threshold? Are there age and sex effects? Although not lethal, cataracts affect the ability to work.

Lens of Eye Research and Study Needs (Gayle Woloschak) – Radiation doesn't cause cancer of the lens of the eye in humans, but it causes cataracts. How do lens cells die following radiation exposure if they do not have DNA to be damaged? Cataract induction decreases as the exposure is protracted. Radiation-induced cataract studies are almost nonexistent. New biology, not available 20 years ago, could be applied to understand radiation-induced cataracts. Posterior subcapsular cataracts are one of the few markers of radiation exposure and should represent a good model system.

Keep your eyes on the prize. Cataracts occur at doses lower than thought years ago. Protection is needed, and guidance is to lower the dose limit to the eye, improve training, and wear your badge! Is the cost to implement changes commensurate with the level of protection afforded? NCRP recommends that an occupational limit of 50 mGy y^{-1} to the lens of the eye is appropriate based on the latest scientific understanding. We all will get cataracts if we live long enough. There's a need to integrate the best biology with the best epidemiology. Improved studies of human cataract development could be conducted linking the Million Person Study of 150,000 nuclear power plant workers with Medicare files. There's more here than meets the eye. Don't be blindsided; instead, target resources to help us understand radiation-induced cataracts and ways to protect against them.

Lens of the Eye Workshop, New York City, 29 August 2016

Submitted photo

Front row, left to right: Eleanor Blakely (Lawrence Berkeley National Laboratory), Gayle Woloschak (Northwestern University), John Boice (NCRP), Elizabeth Ainsbury (Public Health England), and Bae Chu (Memorial Sloan Kettering Cancer Center); back row, left to right: Kathryn Held (NCRP), Michael Grissom (MPG-HP, Inc.), Chris Passmore (Landauer, Inc.), Stephen Balter (Columbia University), Lawrence Dauer (Memorial Sloan Kettering Cancer Center), Dennis Quinn (DAQ, Inc.), and Geoffrey Korir (New York City Department of Health and Mental Hygiene-Office of Radiological Health)