



Meeting Report: 48th Annual Meeting, National Council on Radiation Protection and Measurements (NCRP)

Prepared by: Glen Reeves

greeves@ara.com

1. SUBJECT

Meeting: Emerging Issues in Radiation Protection in Medicine, Emergency Response, and the Nuclear Fuel Cycle

Sponsor/chair: National Council on Radiation Protection and Measurements (NCRP)

Date: 12-13 Mar 2012

Location: Hyatt Regency, Bethesda, MD

Participating: Glen Reeves, ARA

2. MEETING AGENDA

Attached (5 pages).

3. ITEMS DISCUSSED:

The format consisted of a keynote address on childhood exposure to radiation from medical procedures and accidents followed by a session of four presentations on radiation protection of the patient. There were then three presentations on implication of the Fukushima Daiichi accident for radiation protection followed by a lecture on radiation biology. A second session on Fukushima was then held. Each of the scientific sessions had a Q&A at the end of the presentations. The summary below abstracts a few key points from each presentation.

4. SUMMARY:

Ninth Annual Warren K. Sinclair Keynote Address: *Childhood Exposure: An Issue from Computed Tomography Scans to Fukushima (Fred Mettler)*

Organ systems mature at different rates from birth to adulthood, thus affecting tissue damage and tissue conversion coefficients. The bone marrow retracts centrally with age; therefore radiation of the extremities is more damaging in children than adults. The number of non-growing ovarian follicles decreases with age; therefore prepubertal females are less sensitive to radiation than adults. The attributable risk of cancers for almost all sites is 3-5x greater in children (except thyroid, which is 38 times greater), particularly in females; this risk and the gender gap decreases with age. As for deterministic effects the skin of children may be more sensitive to radiation damage but it heals more quickly. There is no evidence from either the Life Span Studies or radiation therapy studies that the F1 generation is affected by radiation exposure in the parents, even though this happens in animal models. Neurologically radiation interferes with myelin production and can kill neurons. An interesting factoid is that adults lose on the average one neuron per second; Dr. Mettler informed the audience that they would lose about 3,000 neurons during his lecture!

Presentation: *Radiological Protection of the Patient: An Integral Part of Quality of Care (Clair Cousins)*

Hippocrates stated that the physician should prescribe a regimen if it is for the benefit of the patient and not "deleterious or mischievous". The government (UK) tends to think that quality of care is best measured by length of wait and duration of stay. The result is "quickly performed bad medicine"! Dr. Cousins introduced a new acronym,

VOMIT (Victims Of Modern Imaging Technology) to refer to excessive use of imaging studies to detect diseases of minimal consequence or for legal protection. Alternative imaging studies (e.g. MRI instead of CT) are often preferable; however, the former is not readily available after hours. Five to eight per cent of UK physicians thought ultrasound and MIR used ionizing radiation!

Presentation: *Enhancing Safety in Radiation Therapy: Structural and Cultural Underpinnings (Michael Steinberg; presentation given by ?? Low)*

Previous radiation therapy QA guidelines focused on devices, not the process; however, most catastrophic accidents are due to process errors rather than device failures. Risk equals the probability of occurrence times consequence severity times missed detection of error. The main problem is that complexity is increasing but QA techniques are not catching up.

Presentation: *Efforts to Optimize Radiation Protection in Interventional Fluoroscopy (Donald Miller)*

There are no simple methods to accurately estimate skin dose in interventional fluoroscopy. Double dosimetry (one badge worn outside, one underneath the apron or protective clothing) helps. Dr. Miller mentioned the difference between posterior lens opacities and cataracts; increased risk of the former has been demonstrated.

Presentation: *Standardization versus Individualization: How Each Contributes to Managing Radiation Dose in Computed Tomography (Cynthia McCollough)*

The goal is first to determine what exam best answers the clinical question, then determine the right dose for the specific patient and the specific task. A new technique, adaptive exposure control (AEC) adapts scanner output to the patient's thickness. Protocols require standardization for what are reasonable procedures and doses. Adjustment for patient size and specific task requires individualization. AEC is helpful here. The purpose of diagnostic reference levels is to detect situations where the dose is unusually high, not to specify the "right" levels. Notification values of 80 mGy for the head and 50 mGy for the torso are used; however there is greater variance among chest sizes than head sizes, making location of the reference point more critical in the former.

Presentation: *What Happened at Fukushima and Lessons Learned (Michael Corradini)*

One interesting factoid: the east coast of Japan actually sank a little after the earthquake, thus leaving pipes and hydrants exposed and also lowering the protective barriers. The number of known dead is 15,584 with another 3,155 missing and over 6,000 injured. The reactor shutdown mechanisms worked and all emergency generators started; however the tsunami wiped these out. In retrospect the spent fuel pools were fine; no significant radiation release occurred from these. The U.S. plant manager on duty has complete authority; this is not quite the case in Japan, which may have contributed to the magnitude of the disaster. The amount of radiation released was around 10% of that released during the Chernobyl catastrophe, and approximately ten times greater than released at TMI. The meltdown of the reactor at TMI was not discovered for about five years.

Presentation: *Fukushima Daiichi Accident: Community Impacts and Responses (Steven Becker)*

There was an "Emergency Evacuation Preparedness Zone" that did not have to be evacuated right then, but people living there were supposed to be ready. However hospitals in that zone couldn't accept in-patients, and supplies couldn't or wouldn't come in. There was an atmosphere of helping and general civility in the shelters; there was however looting and increased crime outside, particularly in the "No Go" zone. Two myths that policymakers should disabuse themselves of: 1) If there isn't enough information, wait for more before talking to the public; 2) Withhold information to prevent the public from panicking. The best guideline is, according to Dr. Becker, "Information should be disclosed correctly and quickly so people can make judgments". One problem in communication at Fukushima was that many of the phones were down, and many of the authorities couldn't make it to where their phones were anyway.

Presentation: *Rad Resilient City: A Preparedness Checklist to Save Lives Following a Nuclear Detonation (Monica Schoch-Spana)*

The University of Pittsburgh Medical Center has prepared a community resilience preparedness checklist. A "rad resilient city" is one that has adopted this checklist and planned accordingly. This will save tens of thousands of lives. The checklist is focused on fallout avoidance. Contrary to popular belief, most fallout casualties can be avoided, and persons should quickly shelter rather than flee the area. People need to be prepared themselves, and not simply wait for the responders to help. Reaction to the checklist since its publication September 2011 has been favorable. The speaker commented that it's better for an NGO to "take the political hit"; elected officials may be reluctant to do that. The goal is to have informed residents who seek shelter swiftly and independently.

Thirty-Sixth Lauriston S. Taylor Lecture on Radiation Protection and Measurement: *From the Field to the Laboratory and Back: the “What Ifs”, “Wows”, and “Who Cares” of Radiation Biology (Anton Brooks)*

Dr. Brooks grew up in St. George County, Utah, one of the areas most affected by fallout during the days of atmospheric testing. He recalled being a teenager working at a gas station when the AEC told his gas station to wash of cars that had driven through the fallout field. He wondered what would happen to him! This became a desire to find out what the risks of cancer and other diseases from fallout were. Low LET radiation studies have shown a huge plateau where there is no cancer or life span decrement until you get out a very long time and have higher dose rates. Plutonium, “the most toxic material known to man” according to some, is no more hazardous than other alpha emitters. The “hot particle hypothesis”, where a very high dose occurs around a large radioactive particle, has been disproven; there is no effect due to particle size, only to total dose. Tissue responds as a unit, not as a single cell. Also, radon alone is not the second or even third cause of lung cancer; however, in combination with smoking, it is very hazardous. Compared to many carcinogenic chemicals, radiation is a good cell killer but a poor mutagen and carcinogen. Dr. Brooks also presented evidence that the linear no threshold hypothesis (LNTH) may very well overestimate the risk of cancer at low doses. The reason is that low-dose responses are nonlinear; different sets of genes react to high doses than react to low doses, and there are different mechanisms of actions responding to high vs. low doses. The LNTH may be good for regulations but NOT for low-dose risk assessment! Another point was that it was once thought that internal emitters were more dangerous than external radiation; again, dose for dose they are not. His final point was that nuclear power does not have increased mortality than other forms of power.

Presentation: *U.S. Public Health Response to the Fukushima Radiological Emergency: One Agency’s Perspective (Charles Miller)*

The CDC activated its Emergency Operations Center (EOC) for the first time ever for a real world radiation incident. EOC activities were even more intense than for the swine flu pandemic in 2009. Cargo and passengers from Japan headed to the U.S. were screened, and there were contaminated passengers (and cargo). However CDC (nor anyone else) has authority to quarantine passengers contaminated with radiation. They can if the passenger has a transmissible disease (though of course contamination by radioactive materials can also be spread)! Because of conflicting duties the “A-Team” (advisory team for environment, food, and health comprised of personnel from EPA, CDC, USDA, and FDA) was never in full force in Tokyo. Communication was a problem. At first they had to speak “off the record”. Also noted was that means of communication are changing; young people don’t even have radios. Early PAGs were guidelines, not rules. Potassium iodide is a supplement to primary protective actions, not a substitute for evacuation, shelter in place, and food interdiction. The final point was that Fukushima was a great tragedy for Japan; it also became a public health emergency for the U.S.

Presentation: *U.S. Department of Energy/National Nuclear Security Administration’s Response to the Fukushima Daiichi Nuclear Power Plant Emergency (Joseph Krol)*

The NNSA was the only agency (at first) to detect the ground truth with respect to contamination. Per agreement DOE/NNSA did not share data except with the host. This led to a lot of controversy. Main contaminants were iodine and cesium, with a very few traces of strontium. They conducted several flyovers for detection and monitoring beginning day 6, then daily thereafter for some time. One pilot accumulated 6 mrem after several flights. However, when they measured the dose he received on a roundtrip flight from the U.S. to Japan, it was 13 mrem! Main lesson learned: always shelter-in-place, with few exceptions. More dose would be received in evacuation.

Presentation: *Reference Levels in the Context of Fukushima: Lessons Learned and Challenge to Radiation Protection System (Kazuo Sakai)*

There was a level of dose above which it was considered “inappropriate to plan to allow exposures to occur”. The Japanese government also had optimization levels, down to 1 mSv/year. One major lesson learned is that signs limiting children to one hour of play in a school playground is not a good idea; parents will almost invariably not only keep their children away but assume the government is not caring enough about their health. The public considered any dose above 1 mSv/year as dangerous. It is highly inappropriate, scientifically as well as politically, to predict how many people will die from radiation released by the accident. (Note: this is a major disadvantage of the LNTH, as it lends itself quite readily to such predictions even though initially it was explicitly stated that this hypothesis was to be used solely as a regulatory guide, not an epidemiological fact.) One problem is that incorrect perception about radiation effects causes people to focus too much concern on themselves and too much stigma on others. The maximum dose to the Japanese public that was evacuated was 23 mSv; NCRP recommends evacuation be considered to avert effective doses to the public of 50-500 mSv.

Presentation: *Findings of the Blue Ribbon Commission on America's Nuclear Future (Richard Meserve)*

This Commission was founded 29 Jan 2010 and was to have its recommendations in two years. They were to focus especially on the back end of the cycle (storage, spent-fuel processing, final disposition). Recommendations were:

1. Use a consent-based approach. The flap over using Yucca Mountain is well known. However, New Mexico has accepted the Waste Isolation Pilot Plant(WIPP) with no public outrage. Sweden, Spain, and Finland actually had competition for their final national storage site; Dr. Meserve had photos of a barroom crowd in Spain celebrating the selection of their city. In Sweden the runner-up city was given a rather large financial consolation prize for not being selected! Key is to have a national referendum first, involve the communities in the selection and regulatory process, ask for volunteers, and similar steps.
2. Have a dedicated agency to implement waste management, with authority and adequate funding.
3. Collect taxes on power usage and dedicate it to waste management, not disappear into the general fund.
4. Develop at least one geologic disposal facility.
5. Develop at least one consolidated storage facility. Currently there are nine sites, all closed.
6. Develop a large-scale transport system.
7. Support R&D for new technology.
8. Active U.S. leadership at the international level. (Note: we have to get our own act together first!)

5. ACTION ITEMS:

No specific action items aside from distribution of this report. Next NCRP Annual Meeting will be held 11-12 March 2013 on "Radiation Dose and Impacts on Exposed Populations". Location will be Bethesda, MD.