The Boice Report #26

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The Million Worker Study Comes to Oak Ridge

The first overview of the Million U.S. Radiation Worker and Veteran Study (MWS) appeared in the November 2012 issue of *Health Physics News*. Here's the second.

Overview. We know that radiation causes cancer, so what's to be learned? Well, the major unanswered question is the level of cancer risk when exposure is given not acutely, as was the case among the atomic-bomb survivors of Hiroshima and Nagasaki, but is given gradually over time.

What's the value? The direct study of low-dose-rate effects will be of immeasurable value in providing understanding and guidance in radiation protection. Current guidance incorporated into regulations is based largely on Japanese atomic-bomb survivors, which requires rather tenuous assumptions as to the dose and dose-rate effect factor as well as the representativeness of a 1945 Japanese population to today's workers and public. Studying healthy U.S. workers and veterans is directly relevant to setting standards for U.S. populations today, more so than a 1945 population living in a war-torn country and subjected to malnutrition, infections, and deprivation. Compensation schemes also would be better served.

How unique is the MWS? It is 12 times larger than the study of atomic-bomb survivors and, because of sheer numbers, has many more low-dose (<10 mSv) subjects and many more high-dose (>100 mSv) subjects. Such numbers and broad dose distributions provide substantial statistical ability to uncover and reveal precise estimates of radiation risk for individual organ sites. The population, however, lacks children so that risks among the very young cannot be determined. The ultimate goal is to link the epidemiology with radiation biology (Scientific Committee [SC] 1-21) to enhance the understanding and prediction of disease following exposures.

Who pays for this? As Alfred Hitchcock would say—"and now a word from our sponsors." The epidemiologic research is supported by the U.S. Department of Energy (DOE), the U.S. Nuclear Regulatory Commission (NRC), the National Aeronautics and Space Administration, the U.S. Environmental Protection Agency, the National Cancer Institute (NCI), the U.S. Department of Defense, and the Department of Veterans Affairs. Nonetheless, times are tight, continued funding is not guaranteed, and we struggle a bit on a year-to-year basis. So if you have friends in high places, please give them a call! And now a few highlights:

- ***Manhattan Project Workers and Beyond.*** Over 360,000 workers at DOE-affiliated facilities are under study. Workers at Rocketdyne (Atomics International) and Mound in Ohio have been studied, a new followup of Mallinckrodt workers is near completion, and Los Alamos is on the horizon. The Mound Study is the largest in the world, addressing the risk of ^{210}Po with over 200,000 urine samples evaluated for dose reconstruction. Cancer of the esophagus was increased, but the sample size was not sufficient to provide precise estimates for other organs. Polonium is of interest because of the poisoning of the Russian citizen in London where less than a microgram resulted in what appeared to be a 15 Gy whole-body dose. Polonium is unusual in that it seeks soft tissues and deposits alpha-particle energy in all tissues. Combined analyses are ongoing to address the risk to these workers of heart disease and dementia, including Alzheimer's disease.
- ***Atomic Veterans.*** Over 115,000 military participants at aboveground nuclear weapons tests at the Nevada Test Site and the Pacific Proving Grounds are under study. The January 2014 issue of *Health Physics News* provided an overview. Male breast cancer appears to be elevated, and the report of increased leukemia among participants at the Smoky shot in 1957 has been

confirmed. The approach to radiation dose estimation, including uncertainty considerations, has recently been published. Asbestos in boiler rooms was linked to increased mesothelioma among sailors.

- ***Nuclear Utility Workers.*** Over 150,000 early nuclear power plant workers are under investigation and preliminary results are anticipated by the end of the year. In the early years of development of nuclear energy, radiation protection guidelines allowed more exposure than today and some workers received cumulative doses over 1 Sv. The National Council on Radiation Protection and Measurements (NCRP) SC 6-9 on dosimetry (photo below) is addressing the complex issues associated with work in the nuclear industry, such as the nonuniform radiation fields that might occur during refueling or repair of steam generators. Special attention is given to identifying and tracking the transient workers who move from plant to plant because of their special skill sets.
- ***Industrial Radiographers.*** Nearly 130,000 workers in nondestructive testing are being evaluated. The dosimetry is largely straightforward because there are only a few radiation source terms to deal with (e.g., ^{190}Ir and ^{60}Co) and fields are relatively uniform. Unfortunately, accidents are not infrequent and severe radiation injuries occur. This is one of the occupational groups where there is the potential for approaching radiation guidelines of up to 20 mSv y^{-1}.
- ***Medical.*** If you like large data sets, you'll love our study of medical workers from the 1950s. We start with 29 million electronic records on 5.6 million workers and add 5.4 million microfilm records on 1 million workers and then hone them down to a manageable 250,000 early medical workers (we're still honing). Nearly 3,000 rolls of microfilm were scanned and images placed on 16 storage disks, each holding 4 TB (right, four terabytes!). We hope to initiate a pilot study with Memorial Sloan-Kettering Cancer Center (MSKCC) to validate our procedures for worker identification and dose determination.

Warren Sinclair. Ending on a sad, personal note, the world and the radiation community lost a friendly giant this spring. Warren, the second president of NCRP, died 14 May 2014 at the age of 90. He was liked, loved, appreciated, respected, and now missed.

Million Worker Study in Oak Ridge April 2014

Photo courtesy of Betsy Ellis

Left to right: Keith Eckerman (Oak Ridge National Laboratory [ORNL]), Craig Yoder (Landauer), Dick Toohey (Mel Chew, Inc.), Dan Stram (University of Southern California), Larry Dauer (MSKCC), Terry Brock (NRC), Marvin Rosenstein (NCRP Consultant), Kathy Pryor (Pacific Northwest National Laboratory [PNNL]), Bruce Napier (PNNL), John Boice (NCRP/Vanderbilt), Don Miller (Food and Drug Administration), Andre Bouville (NCI, retired), Harold Beck (DOE, retired), Rich Leggett (ORNL), John Till (Risk Assessment Corporation), and Mike Mumma (International Epidemiology Institute)

Not in photo: Dave Schauer (NCRP), Sami Sherbini (NRC), James Thompson (NRC), Cary Zeitlin (Southwest Research Institute), and Derek Hagemeyer (Oak Ridge Associated Universities [ORAU]).

Other attendees: Betsy Ellis (ORAU), Phil Wallace (ORAU), Donna Cragle (ORAU), David Girardi (ORAU), Richard Joiner (ORAU), and Ashley Golden (ORAU)