

## The Boice Report #8



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### Study of U.S. Nuclear Power Plant Workers

Prior to 1984, over 310,000 workers were employed in the nuclear utility industry. The long-term follow-up of such a large group with good measures of exposure presents an opportunity to provide new information on the possible risk of radiation received at a low dose rate over long periods of time (Hall et al. 2009). The U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) have partnered with the National Council on Radiation Protection and Measurements (NCRP) to conduct a mortality study of these workers as part of the Million U.S. Worker and Veteran Study (Boice 2012). A workshop was convened 8 November 2012 in Bethesda, Maryland, with participants from the NCRP, NRC, DOE, U.S. Environmental Protection Agency, National Cancer Institute, Radiation Effects Research Foundation (Hiroshima), Landauer, Inc., Nuclear Energy Institute, International Epidemiology Institute, and Oak Ridge Associated Universities (see photo on [page 12](#)).

- In 1957 the town of Moorpark, California, became the first in the country to be powered by electricity produced from a nuclear reactor. The Sodium Reactor Experiment designed by Atomics International produced the electricity, and the event was featured on Edward R. Morrow's television show *See It Now*.
- Currently 104 nuclear reactors produce just over 20 percent of the electricity in the United States and five new plants are under construction. Over 600,000 workers have been employed in nuclear power generation.
- Early regulations allowed workers to receive up to 30 mSv per quarter ( $120 \text{ mSv y}^{-1}$ ), and although rare, some workers did receive high cumulative exposures. A broad distribution of radiation doses (currently 6 percent of the workers have been found to have cumulative doses  $>50 \text{ mSv}$ ) will enhance the statistical power of the study to detect any associated increases in cancer or other causes of mortality should they have occurred.
- Worker exposures in the nuclear industry have decreased over the years and are now on the order of  $2 \text{ mSv y}^{-1}$  on average. The worker population selected for study was extended to 1984 because after the Three Mile Island accident in 1979, new regulations for safety required refitting and reactor modifications that increased exposures slightly for the workforce until about 1984.
- Most exposures are to penetrating gamma radiation with few neutron exposures or intakes of radionuclides. Populations with similar exposures to penetrating photon radiation include U.S. Navy submariners and shipyard workers, industrial radiographers, certain medical workers in radiation therapy and nuclear medicine, and certain DOE workers.
- The current population of over 310,000 was identified from NRC files (the Radiation Exposure Information and Reporting System [REIRS]) and from dosimetry records from Landauer, Inc. Feasibility studies have indicated that combining these sources with records from early nuclear power plants will enhance both the validity and quality of the study (Jablon and Boice 1993, Muirhead et al. 1996). Efforts are currently being made to increase the population base with early microfilm records and by contacting other dosimetry firms and nuclear utility companies.

- A previous study of workers at 15 U.S. utility companies was large (~54,000) but of low statistical power to reveal any radiation effects (Howe et al. 2004). This was because the workers selected for study had to be employed in 1979 or after and thus were relatively young, with few deaths (1,190) and low average cumulative dose (26 mSv). The ongoing study has more deaths (>54,000) than the total number of workers in the previous study and a broader dose distribution.
- Workers in the United States are mobile and can work in several industries. To obtain career doses, population rosters are planned to be cross-linked with the REIRS and Landauer, Inc., databases and then with DOE Radiation Exposure Monitoring Systems, other DOE population cohort records, and U.S. military dosimetry systems (Boice et al. 2006).
- Special efforts will be made to evaluate exposures received by nonplant workers (so-called transient workers with special skills) and from employment in other countries.
- Validation of film-badge readings from years past will be possible because of the availability of stored worker and control film badges in salt mines in the state of Kansas.
- The study is on a fast track and is anticipated to be completed within two years.

#### References

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### Nuclear Power Plant Worker Workshop—November 2012



Standing, left to right, Noelle Metting, Vince Holahan, Terry Brock, Steve Simon, Mark Salasky, Doris Lewis, Dave Schauer, Ellen Anderson, Betsy Ellis, Derek Hagemeyer, Laura Atwell, Ralph Andersen, Roy Shore, Mike Mumma, David Pawel, Jim Cassata, Binni Chadda, Jerry Puskin, Andre Bouville, and Marvin Rosenstein. Kneeling, left to right: Gladys Figueroa, John Boice, and Marilyn Diaz