

## Where Are the Radiation Professionals? (WARP)

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April 11, 2016

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## Not a new issue

- In 1976, Dade Moeller and Rolf Eliassen predicted a 50% shortfall in the number of HP graduates needed in the next 5 years [HP 31(1), 1-11].
- In 1988 Ken Mossman and John Poston published "Education and Training in Health Physics—a Look to the Future" [HP 55(2), 223-227] and noted that the US DOE "reports current shortages of professional health physicists in the civilian nuclear industry and predicts a high potential for shortages during the next 15 y."
- In 2001 the HPS issued Position Statement 15, "Human Capital Crisis in Radiation Safety," which noted: "It is clear to the radiation safety community that the current imbalance between supply and demand will significantly worsen in the near term, after which it will soon become untenable."

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## Not much progress

- In 2004, Kevin Nelson, chair of the HPS Human Capital Task Force reported that a crisis can occur when any of the four R's are neglected: Recruiting, Resources, Retention and Retirement (HPS News, 32 (9), 18-20).
- As of today, it seems that all four R's have not only been neglected, but have fallen on very hard times.
- Meanwhile, usage of ionizing radiation has increased tremendously in medicine, and the increase in the number of procedures has followed the increase in the consumption of medical care by an aging population.

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## What new data are available?

- Professional society membership
- Student enrollment and graduation rates
- Education and training grants
- Research funds
- Fukushima Dai-Ichi accident
  - U.S. support to Japan
  - Impact on new and existing NPPs

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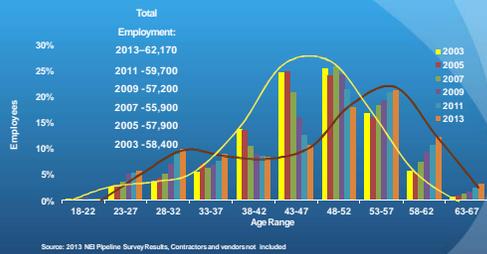
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## Nuclear Industry Employment Distribution by Age



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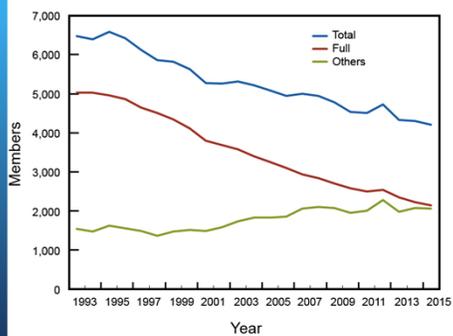
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## Health Physics Society



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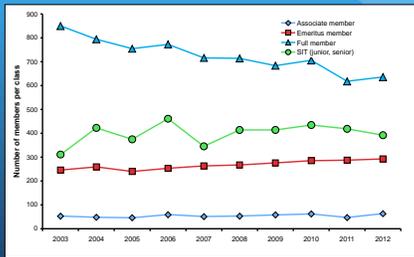
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## Radiation Research Society




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## Academic funding

- Nuclear fellowship program not in President's budget, but restored by Congress
- DOE low-dose radiation research program funding diverted to clean energy (may be restored by Congress)
- State funding for university programs dwindling
- University support for small enrollment programs dwindling (12 programs graduate <6 students/year)
- Only 12 academic programs in HP appear to be viable in the long term.

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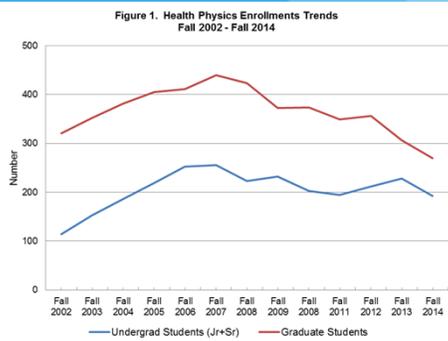
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## Student enrollment




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## Fukushima Dai-Ichi

- “The response to an accident 8,000 miles away stretched the capabilities of the U.S. government to, and in some cases beyond the breaking point.” C. W. Miller, CDC, 2012 NCRP annual meeting
- Derailed the “nuclear renaissance” but D&D operations of closed NPPs may require more HP coverage than routine operations
- However, NPPs remain the only proven, large-scale, continuous method of centralized electricity production that is largely free of carbon dioxide emissions

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## And it's not just us

- The GAO (2014) estimates that 31% of the federal workforce will be eligible to retire by September 2017, and the percentage of engineering and technical professionals eligible to retire by September 2017 is even higher at 41%.
- Similarly, a survey of the Conference of Radiation Control Program Directors (directors of state agencies that regulate the use of radioactive materials and radiation-producing devices within their states) predicted that over 50% of the technical staff in the states' Radiation Control Programs will need to be replaced in the next 10 years.
- The National Academy of Sciences has expressed concern about the future supply of radiochemists (NAS, 2012).

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## Other considerations

- Although the supply of medical physicists seems adequate for the near term, limited slots are available in accredited clinical training programs
- State radiation control programs face increasing needs for regulation of external beam radiotherapy and radiopharmaceuticals (agreement states)
- Waste disposal is still an issue
- Spent fuel still needs to go somewhere

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## Issues needing immediate attention

- Federal workforce: essential government functions cannot be performed by contractors
- Research support needed to ensure junior faculty become senior faculty to teach the next generations of health physicists
- Professional societies are an 18<sup>th</sup> century model trying to recruit millennials
- Radiological sciences need to take their proper position in STEM initiatives
- There is no public understanding of radiation

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## Issues still a little ways down the road but will need HP expertise

- TENORM in fossil fuel production
- Radiation risks to astronauts beyond low earth orbit
- Radiological emergency response
  - Rapid exposure screening
  - Radiation countermeasures
  - Community resilience
  - Managing competing risks
- Stakeholder empowerment, not just engagement

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## What to do?

- Grow your own
  - Industry supported training programs at local community colleges for technician-level training
  - Seamless integration of all education levels from 2-year programs to four-year and graduate programs (Texas A&M, South Carolina State)
  - Use the military-to-civilian transition pipeline

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## What else to do?

- Create a joint program support office in OPM
  - Coordinate recruiting and career management of radiation professionals in the federal civil service
  - Centralize and provide better visibility for the function of radiation professionals
  - Monitor federal staffing levels and needs;
  - Enhance mechanisms for interagency collaboration;
  - Broaden expertise through rotation among agencies
    - e.g., PHS commissioned officers already detailed to EPA, FDA, etc.

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## More education

- Establish basic and advanced competency profiles to serve as guidance upon which to base the education, training, qualification and appropriate use of radiation professionals
  - e.g., require graduation from an ABET-accredited program, require CHP for a licensee RSO
  - Use the NEI Nuclear Uniform Curriculum Program (NUCP)
- Internships, practicum and co-op appointments, pre- and post-doctoral fellowships at national labs, medical centers, federal agencies should be funded and guaranteed for the long-term, so that prospective employees can expect career stability

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## More to do

- Provide research support in the radiological disciplines, including HP, radiation biology, radiochemistry, radioecology, nuclear engineering, etc.
- Focus research support on low-dose and dose-rate effects, validity of LNT, biomarkers for dose, etc., etc.
- Establish a robust surge capacity for radiation emergency response; the Medical Reserve Corps is a good start, but may not be adequate for a major event

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## And still more

- Continue to monitor the situation and adjust management emphasis as needed (NCRP CC-2)
- Keep Congress advised of the situation—likely to get worse before it gets better

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## Not just USA, either

- Similar efforts underway in Europe
- NEA report on Nuclear Education and Training: from Concern to Capability (2015)
- 12 recommendations, along the same lines as WARP:

**Recommendation 10**

*Governments should strongly encourage and support international initiatives and programmes, which foster consistent quality of the education and training being delivered in different countries and overall contribute to enhancing human resource development capacities.*

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**Where are the Radiation Professionals (WARP)?**  
NCRP Statement No. 12, December 17, 2015

Since the discovery of x rays and radioactivity in the 1890s, sources of ionizing radiation have been employed in medicine, academia, industry, power generation, and national defense. To provide for the safe and beneficial use of these sources of radiation, the United States developed a cadre of professionals with the requisite education and experience. Unfortunately, their numbers have diminished alarmingly (AAAS, 2014; GAO, 2014; HPS, 2013; N/ANRC, 2012).

**Methods**

To study the decline in radiation professionals and potential national crisis, the National Council on Radiation Protection and Measurements (NCRP) sponsored a workshop in June 2013 in Arlington, Virginia to evaluate whether a sufficient number of radiation professionals exist now and into the future to support the various radiation disciplines essential to meet national needs. Attendance at this workshop included professionals from government, industry, academia, medicine, and professional societies. Presentations from over 30 groups (NCRP, 2013) resulted in the recommendations found in this Statement.

**Findings**

Evidence presented at the workshop revealed that the country is on the verge of a severe shortfall of radiation professionals such that urgent national needs will not be met. Factors contributing to the downturn include the economy, attention, redrafted national priorities, and decreased public funding.

## Thanks for your attention!



**A Clarion Call**

**A National Effort is Needed**

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