NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

Office of Public Affairs Telephone: 301/415-8200
Washington, DC 20555-001 E-mail: opa@nrc.gov
Web Site: http://www.nrc.gov/OPA

No. S-01-028

A NEW FUTURE FOR RADIATION PROTECTION

By

The Honorable Greta Joy Dicus
Commissioner
U.S. Nuclear Regulatory Commission

Presented to the Western New York
Health Physics Society Meeting

Syracuse, New York
November 2, 2001

Good afternoon! I am pleased to have been asked to address the Western New York Chapter of the Health Physics Society. As always, I look forward to meeting with Health Physics Society members, and have the opportunity to share with you the exciting news about the future of radiation safety and nuclear science initiatives in Congress, at the U.S. Nuclear Regulatory Commission, and the International Commission on Radiation Protection (ICRP). Now, more than ever before, it appears that we are on a new path of job opportunity and challenges in the radiation protection community. The fields of nuclear engineering, health physics, and radiation protection will play an integral part in this changing arena. It is truly exciting to be a part of this changing attitude toward nuclear energy and today I will take this occasion to share with you my thoughts on "A New Future for Radiation Protection, " which will discuss NRC's plans for ensuring it meets its human capital challenges and ensuring excellence in the Federal workforce in the 21st century, as well as some new insights into how the regulated field of radiation protection may change in the years to come.

In my presentation today, I will briefly look back at what has transpired over the past few years, but will focus primarily on the prospects for the future. I have intentionally kept my remarks brief so as to allow time for discussion.

THE CHANGING TIMES

During the past several years, the NRC has undergone a period of considerable change as part of our agency-wide efforts to increase the efficiency and efficacy of nuclear safety regulations. At the same time, increased demand for energy across the country and rolling blackouts in California have prompted Congress and the President to address the serious challenges that an energy crisis can bring. In doing so, we find ourselves right in the middle of an opportunity of a lifetime -- to help educate and provide an opportunity for the country to ask questions and learn about the advanced technology of nuclear energy to help meet society's demands and needs. As you are aware, the Commission's mission is to ensure the adequate protection of public health and safety, the common defense and security, and the protection of the environment in the application of nuclear technology for civilian use. The Commission does not have a promotional role for nuclear energy, but rather the NRC seeks to ensure the safe application of nuclear technology if society elects to pursue the nuclear energy option.

In my years as a State Regulator and an NRC Commissioner, I have come to know quite well the challenges associated with maintaining our human capital and in addressing the public's confidence and perception of our ability to regulate. Critical to our success is having technically competent staff available to effectively address new issues and challenges in the nuclear safety and materials arenas.

It may surprise some of you to know that as of this year, the supply of undergraduate-trained nuclear scientists and engineers is at a 35-year low. As highlighted by two recent bills introduced in Congress, S. 242 and H.R. 2126, called the "Department of Energy University Nuclear Science and Engineering Act," the number of undergraduate programs across our nation to train future scientists has declined to approximately 25, which is a 50 percent reduction since the 1970s. In addition, two-thirds of the nuclear engineering and radiation science faculty are over age 45 with little ability to attract and draw new and young talent to replace them in academia. With these statistics, the NRC has become increasingly mindful that the agency faces a significant challenge in maintaining the NRC staff's core scientific, engineering and technical competencies. Based on the demographics of the current workforce, I grow greatly concerned that over the course of the next decade, the net technical capability of the NRC will decline as a result of the loss of specific expertise through attrition.

Our ability to attract new talent does not equal the outflow of experienced workers. When we are able to attract talented young men and women, it is important. That we ensure ample opportunity for upward mobility and variety in career paths. We must endeavor to prevent in segments of the workforce moving outside the nuclear area. Maintaining and cultivating core competencies in nuclear-related areas is a key concern for both the industry and the NRC.

OUR MATURING WORKFORCE

With a tight labor market for nuclear engineers and a workforce with a large percent of personnel eligible to retire, the NRC, and I suspect, some of the facilities you work for, are faced with some significant workforce challenges. I believe that these challenges are not unique, and in fact, are shared by most if not all of us.

Current projections are that <u>76 percent</u> of the nation's professional nuclear workforce can retire <u>within 5 years</u>. At the NRC, there are six times as many staff over the age of 60 as staff under 30; a ratio of 6:1. For comparison purposes, the same ratio at NASA is only 2:1. Moreover, 17 percent of NRC's engineers are already eligible for retirement and another 4 percent of the current workforce of engineers will become eligible for retirement each year for the next few years. At NRC's Office of

Nuclear Regulatory Research, one in four employees is eligible for retirement today; in the Office of Nuclear Reactor Regulation, whose office is responsible for the licensing and inspection of commercial nuclear power plants in this country, one in five employees is currently eligible for retirement.

Despite our efforts to hire new engineers and radiation science professionals, we have experienced a net loss of staff over the past five years. That loss is equivalent to roughly 8 percent of our engineering workforce. The bottom line is that we are losing expertise and, along with it, valuable institutional knowledge.

The combination of these long-term trends raises a red flag: how will NRC be able to maintain its core technical competence into the future? We need to plan for turnover and retirements, as any employer would, but we also need to judge carefully what expertise we must have among our employees. This has become so serious an issue that now Congress has also been asking us similar questions, and in a May 3, 2001, hearing on "The Future of the Nuclear Power Industry and How it Fits into a National Energy Strategy," our statement to the Senate Subcommittee on Energy and Water Development Committee said that NRC is systematically identifying future staffing needs and developing strategies which will address how to fill these gaps. Simply stated, we need to be able to respond to new technology, deal with emerging issues, and effectively participate in the international community. Our credibility as an effective competent regulator hinges on maintaining a strong technical base of expertise. So now, let's look ahead into the future....

RECENT NUCLEAR LABOR MARKET STUDIES

Annually, NRC and DOE contract with the Oak Ridge Institute for Science and Education to prepare labor market trends for nuclear engineers and health physicists.
First, for health physicists, by 1999, the profession experienced a decrease of over one-third in just two years on the number of enrollments and degrees earned. During the middle 1990s, the estimated number of job openings for new graduates decreased drastically to less than 100 annually. At this time, the available supply of new graduates seeking health physics positions was about 175. Both the Health Physics Society and 15 of the contractor-operated DOE facilities confirmed that job opportunities in this field had decreased dramatically, and that health physics-related positions were few and far between. The good news as we look ahead, is the number of job openings during the 2000-2005 time frame should increase in this field to about 100 to 135 per year. Thus, after several years of somewhat excess supply of new graduates, the demand for and supply of new graduates in health physics now appears to be fairly balanced.

Second, for nuclear engineers, the current labor market continues to improve substantially since the mid-1990s. Employers seeking to hire nuclear engineering graduates currently face a labor market where competition from other employers is quite strong. Starting salaries for nuclear engineers in the nuclear energy/nuclear weapons fields increased 6.0% for Bachelor's of Science level graduates, and 5.5% for both Master's of Science and Ph.D. degrees between 1999 and 2000. According to this report, this was the third consecutive year that annual salary increases for new nuclear engineering graduates were larger than any of the annual increases experienced between 1991 and 1997. That is certainly good news indeed!

The not-so-good news for employers, however, is that there continues to be a continual decrease in the supply of new nuclear engineering degrees (undergraduate and graduate) for a fifth consecutive year. In 1999, total enrollment in undergraduate and graduate nuclear engineering programs across the country had slightly more than 1250 students, with only 427 degrees earned and almost 50 percent of these degrees being Bachelor's degrees. Over the past five years, there has been almost a 50% decrease in the number of nuclear engineering degrees earned. The supply continues to decrease, and the country's university reactors and research programs are continuing to close, just as we begin to see light at the end of the tunnel.

There is good news, however. The decline in the employment of people employed in the nuclear energy fields during the 1990s appears to have stopped and there are improved career opportunities and emerging positions within our occupations which include work in radiation and radiological health, plasma studies, medical application, materials, and the food industries. For many employers, such as the NRC, other opportunities arise outside the traditional nuclear fields, and new nuclear engineering graduates are accepting positions in such as activities in electronics, mechanics, computing, and metallurgy.

If we are to adapt our workforce to this changing environment, then we as nuclear regulators and employers must reassess and make available new ideas to seek, find, employ, and continue to train technically competent employees. Legislative proposals, such as those introduced by the Senate and the House of Representatives, if approved, will help to reverse a serious decline in our nation's capability to produce nuclear scientists and engineers. NRC, in its planning, budgeting and performance management process, is actively addressing and planning for ways to ensure that adequate attention is devoted to addressing and resolving our core competency issues.

In addition to these strategies to recruit and retain staff with critical skills, we will continue to provide training opportunities, flexible work schedules, up-to-date technology tools, on-site day-care, and health and fitness programs. Through the use of these strategies and an expanded recruitment program, we believe that NRC is striving to meet it needs and is positioned well to address the human capital challenges of today and the future.

THE FUTURE OF RADIATION PROTECTION

Now that we have made plans for securing the future of our nuclear workforce, let me change gears for a moment, and share with you the second half of my topic today which concerns the future of radiation protection and a proposed new outlook as outlined by the ICRP.

As you all are aware, technology evolves with the advancement of science, and science advances through research and study. Advances in the effects of ionizing radiation on human health can be described as perhaps one of the most studied and better understood health effects relationships from a scientific point of view. Nevertheless, there is still much more to be learned and there continues to be disputes about what we know in the scientific community. It has also proven to be very challenging to translate our knowledge into a regulatory framework to protect public and worker health and the environment. Regulatory agencies are faced with a challenge of how to translate our current knowledge of radiation health effects into a regulatory framework, that is protective of not only workers, but the public health, safety, and the environment.

Many factors influence decisions in the business of setting regulatory standards for radiation protection. Historically, NRC's regulatory approach for radiation protection has considered new scientific information on radiation health effects as but one important input into this complex business. The NRC is dependent upon the process by which independent bodies of experts evaluate technical data

on radiation health effects and then other bodies of experts, drawing upon published, peer-reviewed studies, develop international recommendations for systems of radiation protection.
The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the Radiation Effects Research Foundation (RERF), and the U.S. National Research Council's committees on the Biological Effects of Ionizing Radiation (BEIR), have all provided a series of reports to advise governments around the world on the health consequences of radiation exposures. In turn, the ICRP, internationally, and the National Council on Radiation Protection and Measurements (NCRP), in the U.S., then review this vast quantity of technical data, take account of any new biological information, and develop recommendations consistent with the new information. Federal agencies, such as the NRC, then review these recommendations, and if we agree that revisions to the current radiation protection framework are needed, then the changes are proposed through an open and inclusive process that provides for full and complete stakeholder input.

ICRP UPDATES AND CHANGES

In 1990, the ICRP made major revisions to its basic radiation protection recommendations. Because of timing and other considerations, NRC adopted only a few of the ICRP 60 recommendations into 10 CFR Part 20. As an example, NRC adopted the ICRP recommendation to lower the annual dose limit for members of the public to 1 mSv (100 mrem) down from 5 mSv (500 mrem). However, with respect to the occupational exposures, NRC believed that a reduction to the ICRP-60 recommendation of 100 mSv (10 rem) in 5 years [with a 50 mSv (5 rem) maximum in any one year] was not necessary because in 1987 over 98.7% of individuals requiring radiation monitoring received doses less than 20 mSv (2 rem) per year (in 1999, this number had increased to 99.6%). In addition to these statistics, the NRC had also included the concept of maintaining radiation exposures As Low As Reasonably Achievable (ALARA) into its revised Part 20.

The ICRP system of radiological protection that has evolved over the years now covers many diverse topics. Subsequent to issuance of Part 20 in 1991, ICRP has issued publications 66 and 68-72 which contain updated models to reflect new biokinetic information and related parameters for calculation of exposure from radioactive materials. In general, emerging issues presented to the ICRP have been dealt with on an individual basis that results in an overall system, while very comprehensive, is also very complex. With such a complex system, it is not surprising that some perceived inconsistencies in the recommendations themselves may lead to concerns that radiation protection issues are not being adequately addressed. Different stakeholders in decisions involving radiation protection tend to focus on different elements of this incoherence.

In July 2001, I joined the Main Commission of the ICRP and in September attended my first meeting to discuss these and other additional changes. One area of particular interest to the NRC is the value selected for Doses for Protective Action, or Protective Action Levels to a member of the public. Current NRC regulations state an annual limit of 1 mSv (100 mrem) to any member of the public, which, as I mentioned before, was derived from ICRP 60. Internationally, there may be an interest to drop the public limit to a few tens of mSv, or about one-tenth of the limit from natural background. This equates to a source-related constraint of about 0.3 mSv (30 mrem) per year as the point of specifying whether or not a source (licensee) is appropriately controlling their material. This would be a factor of three reduction from an individual facility, if the ICRP were to adopt this recommendation. Of greatest concern, is the fact that the 1 to 0.3 mSv (100 to 30 mrem) reduction would have significant political ramifications not only for the regulated community, but especially for the public's perception of the reasons behind why this proposed change is being introduced, especially since any proposed decrease in regulatory limits would likely have no change in the actual doses received from licensed facilities by the public.

Another major shift considered by ICRP is going from a utilitarian ethical policy ("How much does it cost and how many lives are to be saved?" or "The greatest good for the greatest number"), to an egalitarian policy in which the doctrine of recognition of individual rights (dose constraints) and equal treatment of individuals should be the guiding principle. Classical cost-benefit analysis when discussing collective dose is unable to consider the individual, and the ICRP attempted to correct this by the concept of the constraint. The constraint is an individual-related criterion, applied to a single source in order to ensure that the most exposed individuals are not subjected to excessive risk and to limit the inequity introduced by cost-benefit analysis.

In addition to the changes that the ICRP has under consideration, there are two other major efforts underway, both in the U.S. and internationally, to update dosimetric methods and reassess the health risk form low-levels of ionizing radiation. First, there are reviews underway by both the RERF and the U.S. Department of Energy (DOE) to revise the DS86 dosimetry system that was used in the health assessments of the A-Bomb survivors. More specifically, preliminary investigation indicates that there are discrepancies between the DS86 calculation of neutron flux at certain distances from the bomb hypocenter and the measured values from materials activated by thermal neutrons. Secondly, in 1998, the National Research Council was awarded a 3-year grant by several Federal Agencies to conduct a re-assessment of the health risks associated with exposures to low-levels of ionizing radiation (BEIR VII). This reassessment will include a review of the data that might affect the shape of the dose-response curve at low doses, and in particular, will investigate if a threshold in the dose-response relationship exists to provide a better understanding of the influence of adaptive response and radiation hormesis on radiation dose response.

CONCLUSION

As you can see, the NRC, nuclear industry, and you as health physics, nuclear engineers and scientists, are at an exciting time in history. Not only is the labor market beginning to place a demand that is outpacing supply - - particularly for radiation sciences and nuclear engineering expertise, but there appears to be opportunities for great change in the more clearly defining the underlying theory of our basic radiation protection philosophy in the next few years.

Because of all these ongoing efforts, and the fact that any proposed change to the current regulations would provide little to no added benefit to the general public, it is my view that the NRC should not forge ahead with a strategy to begin a proposed rulemaking process now to revise Part 20, but wait until the recommendations of these international bodies converge in the next three to five years. Knowledge and uncertainty about radiation health effects are not exclusively the domain of any individual country. Radiation health effects is an international science. Once these final recommendations from these scientific bodies have been made available for review, and if, the NRC decides to revise its regulations, we can then consider all the new and updated information provided, not only from the ICRP, but from the RERF and BEIR VII studies as well. With the plethora of new scientific information available to all of us in the near term, I believe it is advisable to obtain all the facts and information that we can before a decision is made to proceed with any proposed rulemaking for 10 CFR Part 20.

As always, NRC will continue to remain open to new concepts and be prepared to make whatever modifications to our regulations are deemed necessary in order to plan for the future of radiation protection in the 21st century. Continuing coordination and international support for a path forward in radiation protection will, in my opinion, go a long way towards resolving some of the current controversies in the U.S. about radiation protection standards with the desirable end result of increasing public confidence in our regulatory programs.

Again, I want to thank you for this opportunity to be an invited speaker at your meeting today. I would be pleased to answer any questions that you may have at this time.