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Remarks by Ivan Selin  
Chairman, U.S. Nuclear Regulatory Commission  
at the  
NRC Aging Research Information Conference  
Tuesday, March 24, 1992, 8:20 - 9:00 a.m.

"Detection and Mitigation of Aging --  
The Key to Nuclear Power Plant Safety"

Good morning, ladies and gentlemen. I am pleased to welcome you to the NRC Aging Research Information Conference and to see the large turnout of representatives from utilities and the international community. As you know, numerous initiatives are underway within the NRC, the U.S. nuclear industry, and the international nuclear community to understand and manage the effects of nuclear power plant aging. The results of this research will be used principally to do three things: first, ensure that the safety margins of currently operating nuclear plants are maintained; second, provide the technical basis for renewal of nuclear plant operating licenses; and third, help to design advanced plants. While the Commission expects this conference to contribute significantly to the achievement of these objectives, that outcome is dependent on your active participation. I want to express our appreciation in advance for your willingness to join us today to address this vital issue.

The NRC's commitment to aging research has been substantial. Our ongoing research program to identify and address generic age degradation issues has accounted for a significant portion of our research budget for most of the past decade. For Fiscal Year 1992, it approximates 20% of our research budget. This work has been a centerpiece to our overall research program and we are very pleased with the way it has progressed. The aging of nuclear power plants is one of the most important issues facing the nuclear industry worldwide, and our strong interest in this area can be measured by our involvement in this conference. Principal addresses will be made by Commissioners Rogers and Curtiss, and the conference will conclude with a panel discussion chaired by Commissioner Remick.

It is our hope that we can all work together to see that the results of this research contribute to preserving the safety of currently operating plants worldwide and that the lessons learned in developing the data base are applied to future areas of

nuclear technology, including license renewal and advanced reactors.

I would like to make a brief comment at the outset on the prospect for license renewal. Lest there be any doubt of the Commission's commitment to the viability of renewal after Yankee Atomic Electric Company's recent decision to shut down the Yankee Rowe facility, I want to reaffirm our commitment to the renewal process. On the basis of my discussions with Dr. Kadak, President of Yankee Atomic, I believe that the decision to close Yankee Rowe was based on the circumstances unique to that plant, and not on obstacles to plant life extension itself. We stand ready to work with any licensees who want to proceed with license renewal. Our procedural rule is in place. We are considering a study of the Yankee Rowe experience to determine whether we need to change the processes we use to evaluate these types of technical issues in order to streamline the path for future applicants. Further, we support the initiatives for pursuing a technical examination of the Yankee Rowe reactor vessel and other systems.

Now, I want to highlight some of the NRC, industry and international community activities and focus on what I believe should be the future roles for each of us.

#### ROLE OF NRC

Let me turn first to the activities and role of the NRC. It is essential that as regulators we develop an independent capability to do two things: the first is to evaluate the effects of aging and the second is to provide guidance for managing aging in the operating nuclear power plants. Our capability grows out of our research on aging issues, which in turn permit the NRC to develop regulations and guidance to mitigate the effects of aging.

For over two decades the agency has been addressing age-related degradation of primary system pressure boundary components, including the reactor vessel, piping, and the steam generators. The effects of reactor vessel irradiation embrittlement and pressurized thermal shock are examples of issues that have had comprehensive treatment, and have benefitted from international participation.

Of particular importance is the ongoing cooperation between U.S. organizations (including NRC and the Electric Power Research Institute (EPRI)) and the Commonwealth of Independent States (CIS) on annealing of reactor pressure vessels. The work in this area should permit integration of this technology into the U.S. regulatory program.

The NRC has also established a working group on nuclear plant aging and license renewal as part of its cooperative program with the CIS. The first four areas of mutual interest that will be addressed by this U.S./CIS working group are:

- . equipment selection and data
- . degradation mechanisms and their effects on properties and performance
- . diagnostics, management, monitoring and trending
- . residual life prediction

Results of NRC research on aging of piping and steam generator tubes have been and will be used in addressing a number of issues. These include the validity of the leak-before-break concept, erosion-corrosion of piping, the effects of plugging steam generator tubes and steam generator tube inspection. Advances have also been made in our understanding of aging of other components and structures.

Another important aspect of our program is the maintenance of failure information about nuclear safety-related equipment. The NRC's Office for Analysis and Evaluation of Operational Data (AEOD) reviews plant operating data to compile information on equipment failure. They publish case studies on degradation phenomena and identify failure patterns or trends over an extended period. Such information is often vital to the formulation of regulatory guidance. For example, a comprehensive study of component degradation in service water systems facilitated development of Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." Through generic letters as well as NRC bulletins and notices, the NRC staff and industry share insights on age-related degradation in safety-related systems, structures, and components.

The importance of aging research to NRC's regulatory program became clear when we issued our final rule on license renewal on December 13, 1991. The license renewal rule contains two key concepts:

First, with the exception of age-related degradation and a few additional issues which are unique to the period of extended operation, the NRC regulatory process is adequate to ensure that the licensing basis of currently operating plants provides an acceptable level of safety for operation and to maintain that acceptable level of safety beyond the current 40 year term.

Second, each plant's licensing basis must be maintained during the renewal term, in part through a program of age-related degradation management for equipment that is of principal importance to the safety of the plant.

By requiring additional programs or corrective actions to manage age-related degradation effectively, the NRC will ensure that a plant's licensing basis is maintained during the period of extended operation. Thus, the aging research program will provide the technical basis for nuclear power plant license renewal.

Now I would like to identify several NRC initiatives involving aging research that we will continue to pursue:

- . First, is the incorporation of research findings on aging into our regulatory framework. The intent here is not to make the regulations more onerous, but rather to focus them more explicitly on detection and mitigation of age-related degradation. In some cases we can reduce the adverse impacts of regulations on component aging, as we have done in the area of fast-start testing of emergency diesel generators. In addition, more explicit recognition of the impact of aging is being incorporated into the revisions to the Standard Review Plan and in updates to codes and standards.
- . Second, is the use of insights gained from the aging research program to sharpen the inspection program. A well informed inspection staff is an important element in the management of nuclear plant aging.
- . Third, is the continuing AEOD program to document the occurrences of age-related degradation in safety-related structures, systems, and components.
- . Fourth, is the application of the lessons learned from aging studies in implementing the maintenance rule, in the evaluation of applications for license renewal, and in the evaluation of advanced reactor designs.
- . The final and most important effort is to continue our leadership in applying the principles of aging management to all of the world's operating reactors.

#### ROLE OF INDUSTRY

Next, I would like to turn to the role of industry in aging research. The nuclear industry bears the major responsibility for understanding the effects of aging in their plants and for implementing methods to detect and mitigate effects of age-related degradation.

For its part, the nuclear industry has recognized the importance of aging management to reliable and efficient operation, in addition to safety. Several initiatives have been jointly sponsored by the nuclear utilities, EPRI, and the U.S. Department of Energy. These initiatives are now coordinated by

the Nuclear Management and Resources Council (NUMARC) and are generally complementary to the NRC programs. In particular, the lead-plant and industry-report initiatives have proceeded in parallel with the rulemaking process for license renewal. The first application for license renewal will be developed under the lead-plant initiative and will be a demonstration of the license renewal process. Industry reports, now under review by the NRC staff, propose generic resolution of those technical and safety issues which the industry considers important to license renewal. If found acceptable by the NRC staff, these reports will expedite the license renewal process.

Other industry activities are also contributing important information. The Institute of Nuclear Power Operation (INPO) manages the Nuclear Plant Reliability Data System (NPRDS) and has made failure data on nuclear reactor equipment broadly available. To facilitate communication, EPRI sponsored the development of aging terminology, with input from the NRC, the NPAR laboratory staff, and utilities and NUMARC. The nuclear steam supply system vendors and numerous industrial laboratories are continuing to conduct aging research. Notable examples of their efforts include development of solutions to steam generator degradation problems for pressurized-water reactors and mitigation of reactor coolant system pipe cracking for boiling-water reactors.

While all of these efforts are important, I want to reiterate that the continued safety of nuclear plants will ultimately depend on the diligence of plant management and staff in implementing the technical and regulatory requirements that maintain the safety envelope. Continuing vigilance for phenomena that may give early signs of age-related degradation must be an element of current reactor operations.

The license renewal concept presents an additional challenge to the industry to demonstrate to the regulatory staff and to the public that age-related degradation is understood and is being effectively addressed for each plant, over the period of extended operation. Lastly, the industry should apply the results of aging research to advanced reactor designs.

## ROLE OF THE INTERNATIONAL COMMUNITY

Finally, there is an important third set of players in the aging research area that I want to acknowledge. The international community has recognized the importance of nuclear plant aging and has been active in addressing the issue. Several international efforts are underway to identify and shut down or upgrade plants that have safety deficiencies. The International Atomic Energy Agency (IAEA) has a dynamic program to address the safety aspects of nuclear power plant aging. The United Kingdom, Japan, France, Canada, Germany and Spain have programs well underway to address aging issues. As mentioned earlier, a joint U.S.-CIS working group on Nuclear Plant Aging and Life Extension has been established. The NRC staff is supporting these efforts by informing the various international organizations and fellow regulators of the results of NRC sponsored aging studies.

The IAEA program on nuclear plant aging and life extension has had a commendable start. It should move ahead aggressively, concentrating in the near term on issues, initiatives, regions, or even plants, where assistance to assess and mitigate aging impacts is most needed. In addition, just as the NRC is disseminating the results of our research efforts, I strongly encourage others performing nuclear plant aging studies to share the results broadly and on a timely basis.

Both on a bilateral basis and under the auspices of international organizations, it is essential to move forward aggressively to assist all plant operators to recognize and deal with aging to ensure that safety margins are maintained. We are concerned about the continued operation of some plants that may not have adequately addressed aging phenomena that may be reducing safety margins. This area deserves high priority in the international nuclear community.

## CONCLUSION

I hope my remarks have highlighted for you why we attach such importance to this conference and to your active participation in it. The importance of safe plant operation to the continuing viability of the nuclear option is clear. A considerable data base on nuclear plant aging has emerged; our understanding of these phenomena seems relatively mature. However, even three decades into power reactor operation, understanding of the aging phenomena continues to improve, so we cannot become complacent in our efforts to understand and deal with aging. Moreover, the lessons-learned must now be effectively applied, both in the regulations and in the plants. Plant-specific vulnerabilities need to be recognized and addressed.

The diligence of the regulatory staff and the nuclear utilities has been a significant contributor to three decades of

largely successful power generation. In areas where problems have been identified, a concerted effort has been made on both sides to resolve the issues and move forward to implement solutions. As average plant age increases, there will be a need for increased vigilance to detect and mitigate the effects of age-related degradation before they cause serious consequences. I believe that the regulators, the industry, and the international nuclear community are taking responsible steps, as I have described here today, to recognize and deal with nuclear plant aging.

I hope that this overview of age-related initiatives has demonstrated that a great deal of effort has been and continues to be invested in this area. We must continue to ensure that the results of our efforts are applied effectively, on a timely basis, where they are most needed, and that effective initiatives are not allowed to wane.