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OPENING REMARKS BY DR. SHIRLEY ANN JACKSON, CHAIRMAN U.S. NUCLEAR REGULATORY COMMISSION AT THE OECD/CSNI WORKSHOP ON TRANSIENT THERMAL-HYDRAULIC AND NEUTRONIC CODES REQUIREMENTS IN ANNAPOLIS, MARYLAND NOVEMBER 5, 1996

Good morning. I would like to welcome you to the OECD/NEA Committee on the Safety of Nuclear Installations Workshop on Transient Thermal-Hydraulic and Neutronic Computer Codes Requirements -- and to the beautiful city of Annapolis, Maryland. The purpose of this workshop is to reach some conclusions regarding computer code capabilities, and the need to ensure that thermal-hydraulic and neutronic codes are reliable, easy to learn, use, and modify. I am particularly interested in this subject because thermal-hydraulics and neutronics are fundamental to nuclear power technology, and understanding these disciplines is absolutely essential to ensuring reactor safety.

Of course, a detailed understanding of thermal-hydraulics and neutronics has been seen as important to reactor safety for a long time. One of the first safety studies in the United States involving these disciplines was published in 1956 as WASH-740, which helped to establish the concept of an engineered containment building. During the 1960s, when thermal-hydraulic code development was initiated, the U.S. Atomic Energy Commission emphasized the prevention of core melting, and the requirement for an emergency core cooling system (ECCS) to supply water to a reactor in the event of a large loss-of-coolant accident -- a LOCA.

The 1971 SEMISCALE experiment, which resulted in the large bypass of the emergency core cooling system, put a spotlight on thermal-hydraulics, and led to the protracted ECCS hearings conducted by the U.S. Atomic Energy Commission in 1972 and 1973. The result of the hearings was a set of very conservative regulations and assumptions for large-break LOCAs that were intended to cover the large uncertainties reflecting our rather poor state of knowledge at that time.

During the 1970s and 1980s, the NRC -- sometimes in cooperation with organizations like OECD and EPRI -- conducted many thermal-hydraulic tests in SEMISCALE, the loss-of-fluid test facility (LOFT), the multiloop integral system test facility (MIST), the full integral simulation test facility (FIST), and other facilities to confirm our understanding of large-break LOCAs. The NRC also engaged in aggressive computer code development to try to model the coupled neutronic and thermal-hydraulic phenomena mathematically. By 1988, we concluded that our knowledge and analytic capability had improved sufficiently to support modification of NRC regulations for large-break LOCAs to remove some of the earlier conservatisms.

Having concluded that our analytical capability was developed enough to support the then-current licensing reviews, including the new best-estimate analysis option, the NRC essentially went into a maintenance mode with these codes. However, several things occurred to change this posture. First, the new passive plant designs, that were submitted for certification in the U.S., pushed our computer codes into hydraulic regimes that required additional development and testing. Second, risk-informed regulation required a better understanding of event sequences beyond the design basis, resulting in a need for more robust and faster-running codes. Third, a computer revolution occurred, making our main-frame codes obsolete. Finally, budget constraints provided greater incentives to accelerate progress to a more efficient program.

Recently, we completed new experimental work on the low-flow regimes of the new passive plant designs, and we have developed improved models for the codes. We also have new state-of-the-art computing facilities. The challenge ahead of us is to develop a new set of coupled neutronic and thermal-hydraulic codes that will take us into the 21st century.

As we embark on this task, however, we need to address more specific questions. How can we be more efficient in the development and maintenance of our codes? How do we retain the value of our investment in existing codes and plant models? How do we best utilize modern computer technology? How do we take advantage of new developments in numerical methods and two-phase fluid dynamics? How do we identify features that can increase speed, accuracy, and reliability? How do we make the codes easier to use? Of course, we have our own preliminary answers to these questions, and these answers will be reflected in the presentations here. What we hope to accomplish in this workshop is to gain the perspective of the international community on these questions, and to factor <u>your</u> views into the decisions that we must yet make with respect to code development.

This workshop comes at a time of great change that is affecting the way we approach our research cooperation. One change is the

uneven pattern of growth in the use of nuclear power worldwide. In the Pacific Rim, ambitious nuclear programs are being implemented; while in other regions, the nuclear option has leveled-off or is in decline.

Also, as a result of economic constraints in many countries, all now must be more selective about our research programs. Each country must decide where to focus its own research efforts, and where to seek to join in efforts with others to save scarce resources, and to avoid duplication of effort. I believe that we can achieve more focussed and prioritized safety research on a global scale. This approach will require extra planning internationally, and will, of course, take a higher level of coordination than in the past.

International cooperation has a long history of success in the nuclear industry. The nuclear power industry has recognized the benefit of sharing information in the design, development, construction, and operation of nuclear power plants. Major vendors have exchanged manufacturing licenses. Recently, we have seen international mergers. Likewise, domestic and international operators' groups have banded together to share information and experience.

I believe that the world's nuclear regulators should follow suit and establish a better mechanism to exchange information, to identify common trends and approaches, and to provide better support for safety worldwide a mechanism which better reflects the needs and priorities of regulators. Therefore, I have initiated an effort to establish an international nuclear regulators forum, with a policy-oriented focus. At a meeting of senior regulators convened by the NEA near Paris in September, I discussed this proposal with some of my colleagues from other national nuclear regulatory organizations, and I found strong support for the forum idea. I will be pursuing this initiative more specifically early next year.

In closing, let me express the hope that this workshop will produce a useful exchange of views on thermal-hydraulics and neutronics code development.

Thank you.