POLICY ISSUE
INFORMATION

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FOR: The Commissioners

FROM: R. W. Borchardt
Executive Director for Operations

SUBJECT: TRAINING AND INFRASTRUCTURE NEEDS TO ACCOMPLISH NEW REACTOR INSPECTIONS AND OPERATOR LICENSING

PURPOSE:

The purpose of this paper is to provide the staff's plan for assessing and meeting training and infrastructure (e.g., simulator) needs to accomplish inspections and operator licensing related to new reactors, including pre-construction, construction, and operations phases. The Commission requested this information paper in staff requirements memorandum (M071024B) entitled "Periodic Briefing on New Reactor Issues," dated November 13, 2007.

BACKGROUND:

The U. S. Nuclear Regulatory Commission (NRC) has developed and implemented an effective and efficient program to train NRC inspectors and operator licensing examiners (examiners) for the current fleet of operating reactors. The NRC requires construction inspectors to complete the training and qualification program outlined in Inspection Manual Chapter 1252, "Construction Inspector Training and Qualification Program." Reactor inspectors and examiners must complete the training and qualifications program outlined in Inspection Manual Chapter 1245, "Qualification Program for the Office of Nuclear Reactor Regulation Programs." These programs include a seven-week training regimen in either Westinghouse pressurized-water reactor or General Electric boiling-water reactor technology and use existing NRC simulators.

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The seven-week technology series includes three weeks of vendor-specific systems training, two weeks of training on transients and technical specifications, and two weeks of simulator training on normal and emergency operations. The Westinghouse full course series provides a sound basis for efficient three-week cross-training courses in Combustion Engineering and Babcock and Wilcox technologies. The cross-training courses include a mix of classroom and simulator training, and focus on the differences in systems, transient response, and technical specifications from the Westinghouse technology.

The NRC owns four full-scope nuclear power plant control room simulators, one for each of the current United States (US) nuclear reactor vendor types. The agency acquired the simulators as "used" equipment; that is, they were originally manufactured for use by the reactor vendor for vendor-sponsored training or by utilities for licensed operator training. A staff of three simulator engineers (NRC employees) with expertise in the four hardware/software combinations maintains the NRC simulators. Three contract workers provide hardware maintenance support.

DISCUSSION:

Technical Knowledge

To develop the technical knowledge of plant design and operation specific to each new reactor design, the staff plans to apply the current inspector and examiner training model. It is essential that a complete plant design, including control room design and plant procedures, be available to develop a training program that will provide NRC inspectors and examiners with the technical knowledge of plant design and operation required to effectively carry out their regulatory responsibilities. At this time, control room designs have not been completed or approved for any new reactor design to be licensed in the US.

Human factors engineering will be part of the final control room design process. A task analysis, performed as part of an applicant's Human Factors Engineering Program, serves as a basis for highly integrated control room (HICR) design, emergency procedure development, and staffing decisions. The task analysis is used to identify specific knowledge and abilities (K&A) of licensed operators. K&As are cataloged and provided to the staff and then used in inspector/examiner training and in operator licensing examinations. The industry plans to provide the new K&As to the NRC to permit publication in April 2011. NRC examiners will use these catalogs in developing operator examinations.

In the interim, the staff has developed four two-day training courses to provide an overview of the differences between the new reactor designs (Westinghouse's AP1000, General Electric Nuclear Energy's Advanced Boiling Water Reactor and Economic Simplified Boiling Water Reactor, AREVA Nuclear Power's U.S. Evolutionary Power Reactor, and Mitsubishi Heavy Industries, Ltd's. U. S. Advanced Pressurized Water Reactor) and the operating reactor designs. In addition, a more detailed two-week course, similar to the classroom portions of the Combustion Engineering and Babcock and Wilcox cross-training courses, has been tested in a pilot program for the Westinghouse AP1000 design. The staff plans to develop similar courses for the remaining new reactor designs. These two-day and two-week courses are also conducted at the Professional Development Center for Office of New Reactor licensing project managers and technical reviewers. Completion of the new reactor cross-training courses for

inspectors and examiners must await the completion of control room designs, as simulator acquisition cannot proceed without more detailed information on design-specific HICRs.

The staff plans to use HICR simulators in inspector and examiner training for new reactor technologies. The lack of finality in HICR design for the next generation of plants poses a challenge to the staff in determining the optimal approach. The staff's current plan is to identify the options associated with the use of HICR simulators, assess the pros and cons of each option, and develop a recommendation on which simulator option to pursue. For example, one option is the use of limited-scope simulators. Advances in computer technology allow for a high degree of modeling fidelity in a physical environment significantly smaller than a HICR. This portability may allow examiners and inspectors to run simulation models on personal computers to evaluate events and licensing scenarios. Regarding full-scope simulators, several options exist, including HICR plant-specific simulators, generic simulators that may accommodate multiple simulation models, and contract training services at facilities external to the NRC.

As more data become available on simulator costs, new reactor construction schedules, the number of units of any particular design to be built, and the designs themselves (relative to HICR), the staff plans to assess the use of new reactor simulators to support inspector and examiner training. By late November 2008, the staff will have prepared an information paper on its assessment of options and recommendations for new reactor simulation. Although complete specific design information may not to be available, the time needed for simulator construction and acceptance testing requires that the simulator option decision be made in calendar year 2009. To allow sufficient time to train and qualify inspectors and examiners, execution of the proposed or alternative options is expected in fiscal year (FY) 2010 with an HICR simulator expected for training in FY 2012. Qualifying examiners by FY 2012 will permit the NRC to conduct operator licensing examinations and to license operators in time for the projected fuel load of the first reactor in 2014. These dates are best estimates developed through discussions with industry stakeholders.

Regulatory Oversight in the Highly Integrated Control Room Environment

The advent of the HICR will necessitate changes to the regulatory oversight practices currently used to monitor plant operations. With the current operating plants, NRC inspectors and examiners can easily observe plant status and operator actions. In the HICR environment, inspector and examiner observation of operator performance will be different because the operators work at individual computer consoles rather than at large control room panels where their actions are readily observable. The staff plans to address this challenge through a variety of approaches including the use of HICR mockups and walk-through exercises and the conduct of focus meetings. For instance, the Technical Training Center (TTC) staff plans to meet with currently qualified licensing examiners and resident inspectors to investigate the impact of HICR on the new reactor training and qualification program. The purpose of the meetings will be to observe an HICR simulator to assist the staff in defining reactor inspector and examiner training and qualification program changes necessitated by HICRs, the digital human-system interface, and distributed control systems. Proposed topics of discussion include physical fidelity requirements for NRC HICR simulators, challenges to HICR crew interactions and communications, and inspector oversight in the HICR environment. The staff also expects to benefit from the experiences in Europe and Asia with the HICR environment and relevant regulatory oversight and monitoring in the HICR environment. The staff will continue to

communicate with its international regulatory counterparts in developing its inspection and examination processes for new reactors.

Whereas a complete design is needed to support technical knowledge training of NRC inspectors and examiners, a generic HICR simulation is likely to be sufficient for training them on how to maintain regulatory oversight in an HICR environment. A generic HICR simulation is also likely to be useful in training the trainers on teaching techniques unique to digital controls. An example of an existing generic HICR simulation is the Halden Man-Machine Laboratory at the Halden Reactor Project in Norway. The staff plans to consider this simulator option and its use both for instructor training and for developing effective strategies that examiners can use to monitor operator actions and interject examination questions at appropriate times. The staff also plans to assess how such a simulator may help the staff develop effective strategies that inspectors can use to monitor plant status in the HICR environment during normal and off-normal operations.

COMMITMENTS:

The staff has committed to provide a Commission Paper that discusses the staff's assessment of options and recommendations for new reactor simulation by November 30, 2008.

RESOURCES:

To support licensed operator examination activities, the staff estimates resource needs of 6 full-time equivalents (FTE) in FY 2010 and 4 FTE in FY 2011. These resources are addressed in the FY 2010 PBPM and will be addressed in the FY 2011 Planning, Budgeting, and Performance Management (PBPM) processes respectively. In addition, the staff is addressing a requirement of $15 million in FY 2010 PBPM process to support the range of options currently under investigation.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and concurs.

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