

POLICY ISSUE INFORMATION

November 2, 2012

SECY-12-0151

FOR: The Commissioners

FROM: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

SUBJECT: STATUS REPORT ON THE NUCLEAR REGULATORY
COMMISSION'S OPERATOR LICENSING AND
REQUALIFICATION TRAINING INSPECTION PROGRAMS
FOR LICENSED OPERATORS

PURPOSE:

The purpose of this paper is to inform the Commission on the status of the U.S. Nuclear Regulatory Commission's (NRC's) operator licensing and requalification inspection programs for licensed operators. This information paper was requested in a tasking memorandum to the Executive Director for Operations, dated February 8, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12039A155). This paper does not address any new commitments or resource implications.

SUMMARY:

This paper provides an overview of the NRC's current initial licensing examination program, its effectiveness, and the results of an independent program assessment chartered by the Nuclear Energy Institute (NEI). The NEI independent program assessment concluded that the current examination process is effective, but it made several recommendations for NRC and industry consideration to enhance the current NRC examination process. The staff has agreed to work with the NEI Licensed Operator Focus Group (LOFG) to revise the NRC's Knowledge and Abilities (K/A) Catalogs for Nuclear Power Plant Operators and the K/A statement selection process for the written examinations.

BACKGROUND:

The staff provided periodic reports to the Commission on the status of the NRC's licensed operator requalification and initial licensed operator programs from August 28, 1989

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(SECY-89-264, "Quarterly Status Report on the NRC Requalification Program"), through March 12, 2003 (SECY-03-0038, "Annual Status Report for FY 2002 on the Administration of the NRC's Requalification Program and the Results of Initial Operator Licensing Examinations"). The last report concluded that the NRC's licensed operator requalification inspection program continues to effectively ensure that licensed operators maintain the required level of competence to safely perform their licensed duties. The report also concluded that the NRC's initial operator licensing program continues to provide assurance that only those applicants who have mastered the knowledge, skills, and abilities to safely operate are being licensed. Based on the maturity and stability of the programs, the staff discontinued the periodic reports ("Staff Requirements - SECY-03-0038 - Annual Status Report for FY 2002 on the Administration of the NRC's Requalification Program and the Results of Initial Operator Licensing Examinations," dated March 25, 2003).

Over the past several years, the nuclear industry has noted instances of inconsistent performance with the training and licensing of licensed operator applicants. As a result, the NEI chartered a review of the NRC initial operator licensing examination process by an Independent Review Team (IRT) and provided the results to the staff in June 2011 (ADAMS Accession No. ML111940287).

DISCUSSION:

Operator Licensing Goals and Objectives

The NRC is responsible for licensing nuclear power plant operators to ensure that they are capable of understanding and controlling both the day-to-day operation of their power plants and potentially complex abnormal and emergency events that might occur. The licensed operators have a direct and immediate responsibility for preventing and mitigating operational events at their plants.

Section 107 of the Atomic Energy Act (AEA) of 1954, as amended, requires the NRC to determine the qualifications of individuals applying for an operator license, to prescribe uniform conditions for licensing such individuals, and to issue licenses as appropriate. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 55, "Operator's Licenses," requires operator license applicants to pass a written examination and an operating test satisfying the content requirements specified in the regulation. The intent of the written examination and operating test is to measure the applicants' knowledge, skills, and abilities such that those who pass would be expected to perform the duties required of a licensed reactor operator (RO) or senior reactor operator (SRO). The license examination is a confirmation that the NRC-approved, industry-accredited training programs produce operators with the knowledge, skills, and abilities to safely operate their plants. To ensure the uniformity that the AEA requires, the NRC and facility licensees comply with NUREG-1021, "Operator Licensing Examination Standards for Power Reactors," which contains specific instructions for developing, administering, and grading the licensing examinations.

Since the accident at Three Mile Island, the NRC has implemented numerous changes, clarifications, and enhancements to the operator licensing process in 10 CFR Part 55 and NUREG-1021 to improve the efficiency and effectiveness of the licensing process while ensuring it continues to reliably predict whether an individual will be a competent operator or senior operator. The most significant of these process improvements include:

- An increase in the scope of the written examinations with the addition of new examination questions testing the principles of heat transfer and fluid mechanics, and the theory of fluids and thermodynamics. The written examination passing score increased from 70 percent to 80 percent.
- Development of NUREG-1122, "Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Pressurized Water Reactors," and NUREG-1123, "Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Boiling Water Reactors," which provide the basis for the development of content-valid, performance-based operator licensing examinations.
- In 1987, consistent with the Commission Policy Statement on Training and Qualification of Nuclear Power Plant Personnel, the NRC amended 10 CFR Part 55 and endorsed industry-accredited, systems approach to training (SAT)-based programs to provide an improved basis for administering the operator licensing process. The amended rule also required the operating test to include an evaluation of the applicant's team skills and to be partially administered on a plant-referenced simulator or an NRC-approved simulation facility.
- Implementation of a generic fundamentals examination (GFE) that is administered early in the facility licensees' operator training programs. The examination tests the fundamental knowledge topics required by 10 CFR 55.41, "Written Examination: Operators," and 10 CFR 55.43, "Written Examination: Senior operators," and is a prerequisite for applicants to take the site-specific written licensing examination.
- In 1999, the NRC amended 10 CFR Part 55 to allow facility licensees to voluntarily prepare the site-specific written examinations and operating tests for NRC review and approval. The NRC retains final grading responsibility and administers the operating test.
- In 2001, the NRC amended 10 CFR Part 55 to allow license applicants to fulfill a portion of the application experience requirements by manipulating the controls of a plant-referenced simulator, in place of the facility, for the minimum required five significant control manipulations.

License Applicant Selection and Training Processes

In accordance with 10 CFR 55.31(a)(4), a license applicant must provide evidence that he or she has successfully completed the facility licensee's requirements to be licensed as an RO or SRO. Regulatory Guide (RG) 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," Revisions 2 and 3, provide guidance on an acceptable method of implementing this regulation. Generic Letter (GL) 87-07, "Information Transmittal of Final Rulemaking for Revisions to Operator Licensing: 10 CFR Part 55 and Conforming Amendments," informed facility licensees that they have the option to substitute an accredited, SAT-based program in place of the operator training program that the NRC staff previously approved for the given facility. Licensed operator training programs are accredited through the independent National Nuclear Accrediting Board (NNAB). Every facility licensee has obtained and periodically renewed the accreditation of its licensed operator training program, indicating that every facility

licensee is implementing the education and experience guidelines that the NNAB endorses. The NRC administers licensing examinations to applicants who meet the license eligibility education and experience guidelines outlined in the National Academy for Nuclear Training (NANT)¹ “Guidelines for Initial Training and Qualification of Licensed Operators,” and who have successfully completed the facility’s NNAB-accredited SAT-based training program.

The Institute of Nuclear Power Operations (INPO) monitors the overall implementation of the industry’s SAT-based programs as part of its accreditation reviews conducted periodically at all nuclear power plants. The NRC monitors INPO accreditation activities instead of conducting inspections to assess facility compliance with the SAT requirements contained in 10 CFR Part 55. However, other than endorsing the NANT license eligibility guidelines, the NRC is not involved in the facility licensees’ licensed operator applicant selection process.

Since 2007, one of the industry’s concerns, also raised by the Professional Reactor Operator Society (PROS), is that the NRC’s written examination process has resulted in an increasing level of difficulty that is adversely affecting the success rate or “throughput²” for applicants entering the licensed operator training programs. For example, while the NRC RO and SRO examination pass rates in 2011 were 91 percent and 92 percent, respectively, the industry-reported RO and SRO throughputs were 62 percent and 72 percent. The staff’s view is that the average written examination scores are a better indicator of examination difficulty. Over the last 10 years, the RO and SRO average written examination scores have been relatively constant, hovering in the 85 percent to 89 percent range, indicative of a consistently moderate difficulty level. With respect to throughput, the staff’s view is that other factors, not related to the NRC’s current written examination process, are the main causal factors affecting the success rate of licensed operator applicants. Several industry root cause assessments, conducted after NRC examinations that resulted in high failure rates, identified contributing factors such as facility licensee audit written examination level of difficulty not commensurate with NRC licensing examinations, inadequate audit and NRC written examination validation processes, and weak management oversight of applicant performance.

As a result of the industry’s concern with low applicant throughput, INPO coordinated an industry-wide self-assessment and “Call to Action” to identify the key attributes necessary for initial license training class success. These attributes have since been added to the NANT “Guidelines for Initial Training and Qualification of Licensed Operators.”

In summary, the staff acknowledges industry stakeholders’ concerns that the written examination process may be adversely affecting candidate selection and success rate (i.e., throughput). Notwithstanding the staff’s view that the written examination process is not a significant causal factor for low applicant throughput, the staff has agreed to work with the NEI LOFG as discussed below to revamp the NRC’s Knowledge and Abilities (K/A) Catalogs (NUREG-1122 and NUREG-1123) and the K/A statement selection process for the written examinations.

¹ The NANT operates under the auspices of the Institute of Nuclear Power Operations (INPO). It integrates the training efforts of all U.S. nuclear utilities, the activities of the National Nuclear Accrediting Board (NNAB), and the training-related activities of INPO.

² “Throughput” is the ratio of individual applicants who are licensed by the NRC to the applicants who enter the training program.

Overview of the Current Initial Operator Licensing Examination Process

The NRC's initial operator licensing examination consists of the following parts: (1) a written GFE (covering reactor theory, thermodynamics, and components) administered nationwide on a quarterly basis that license applicants have to pass as a prerequisite for taking the site-specific examination; (2) a site-specific written examination covering plant systems, emergency and abnormal plant evolutions, and plant-wide generic K/As; and (3) a site-specific operating test consisting of a crew-based, dynamic simulator performance demonstration, an individual, task-based walk-through operating test covering control room and in-plant systems, and various plant administrative requirements.

The site-specific written examination consists of 75 multiple choice RO questions and 25 SRO questions that sample the topics listed in 10 CFR 55.41 and 10 CFR 55.43. The examination authors (either the facility licensee or the NRC) develop or select written examination questions based on a "systematic and random" sample plan of K/A statements selected from the applicable K/A Catalog. Because the K/A Catalogs are based on generic job and task analyses, and not all facilities of even the same vendor type are the same, examination authors can eliminate inapplicable or inappropriate K/A statements.

The site-specific simulator and walk-through operating tests sample the topics listed in 10 CFR 55.45, "Operating tests." Although the operating tests use the K/A Catalogs as a reference, given the logistics and guidelines for development and administration of the operating test, development of the operating test based on a random sample of K/A statements is not considered practical. Instead, a systematic approach is used to develop the operating test.

The K/A Catalogs provide the basis for the development of content-valid written examinations and operating tests and ensure compliance with the "uniform conditions" for licensing individuals as operators required in Section 107 of the AEA of 1954. The pressurized-water reactor (PWR) and boiling-water reactor (BWR) K/A Catalogs were developed in 1986 based on an INPO Job Task Analysis and contain approximately 5,100 and 7,000 K/A statements, respectively. A team of industry licensed operators and senior operators, as well as NRC operator licensing examiners, rated each K/A statement for its importance to the safe operation of the plant in a manner ensuring personnel and public health and safety. Importance ratings are given for each K/A statement based on a rating scale that starts at a "1" rating that represents "Insignificant Importance" up to a "5" rating for "Essential Importance." Absent a plant specific priority, only those K/A statements having an importance rating of 2.5 or higher will be selected for testing.

Thus, the licensing examinations are developed based on validated job performance criteria, the K/A Catalogs, which provide an objective basis to judge an applicant with sufficient confidence to grant or deny a license.

Initial Operator Licensing Program Assessment and Feedback

As a result of the industry's concerns with some aspects of the initial operator licensing examination process and, in particular, its concern with low throughput for applicants entering the licensed operator training programs, NEI chartered a review of the initial operator licensing examination process by an IRT. The IRT's charter was to assess the effectiveness and efficiency of the operator licensing examination and training processes. The IRT was comprised of three individuals with expertise in educational processes and testing theory, nuclear power

plant management, and licensed operator training and testing processes. NRC management and staff representatives, comprised of individuals from headquarters and all four regions, met with the IRT on several occasions to exchange information and gain perspective. The IRT also interacted with nuclear power plant personnel; representatives of other testing organizations, such as the Educational Testing Service and the U.S. Navy; and INPO. The IRT discussed its preliminary findings with the NRC staff and industry executives before issuing its final report in June 2011. The NEI Nuclear Strategic Issues Advisory Committee (NSIAC) was supportive of the IRT recommendations but requested a more detailed assessment of the level of effort needed to implement some of the recommendations. The NEI LOFG is leading the effort to coordinate resolution of the IRT recommendations with the NRC's involvement in the process.

The IRT concluded that the current examination structure, consisting of written, simulator, and job task performance tests, "has been a viable and effective means of verifying operator competence" and "should be retained." The IRT's proposed recommendations also included updating the job task analyses for licensed operators to reflect changes in job duties that may have evolved since the current NRC K/A Catalogs were first developed in 1986. The IRT proposed that an integrated examination strategy be developed to indicate the preferred method (written examination or operating performance test) of examining each selected K/A statement. The IRT also highlighted enhanced guidance for use of previously developed ("exam bank") written questions and more stringent NRC operating performance test "pass/fail" criteria as potential areas for industry and staff consideration. In addition to these measures, which would involve the NRC, the IRT recommended that facilities fully implement the existing INPO guidelines to address weaknesses in the examination validation process as well as applicant training and evaluation at some facilities that have contributed to inadequate applicant selection and performance in the initial license examination process. INPO recommended that the industry focus on areas such as applicant selection, preparation, training, and mentoring as a way of improving license applicant success rates (i.e., throughput). The IRT also recommended that accredited training program learning objectives be better linked to the updated K/A statements.

The IRT first shared these recommendations with the NRC staff in a public meeting on November 15, 2010 (ADAMS Accession No. ML103260196). Subsequently, the NRC held a public meeting with the NEI LOFG on December 8, 2011 (ADAMS Accession Nos. ML120040069 and ML113500224), which included an LOFG presentation describing proposed actions related to addressing several, but not all, of the IRT recommendations. After its review of the IRT report and discussions during public meetings, the staff concludes that changes to the K/A Catalogs or changes to the initial license examination process are not required to ensure that the NRC continues to make appropriate decisions on whether the applicants have demonstrated that they have the knowledge, skills, and abilities to safely operate their plants. However, the staff agrees that enhancements could be made to the examination process, and possibly the K/A Catalogs, to improve the consistency and validity of the NRC's initial operator licensing process.

As discussed previously, PROS has communicated to the Commission and staff that there has been an increase in the written examination level of difficulty. PROS attributes the increase in examination difficulty to the two following attributes:

- "written test questions have become an exercise in memorization of trivial items"
- "written tests are closed-book, but in the plant procedure use is required"

Consistent with the “Written Examination Guidelines” detailed in NUREG-1021, the staff agrees that “the knowledge tested should not be trivial in nature.” Given the number of site-specific written examination questions prepared per year and the number of different facility licensee examination developers, it is inevitable that a small number of flawed test items will be approved for use on the written examinations. However, there has been no factual evidence provided to substantiate the concern that a significant number of NRC examination questions are testing trivial knowledge. Facility licensees develop, review, and validate more than 90 percent of the NRC examinations. The staff’s view is that NUREG-1021’s pre- and post-examination quality assurance (QA) review processes are sufficient for facility examination developers to identify and address any questions determined to be unacceptable because of testing concepts with no direct, important relationship to the licensed operators’ or senior operators’ ability to perform their job. As stated previously, absent a plant specific priority, only those K/A statements having an importance rating of 2.5 or higher will be selected for testing. These QA reviews also allow facility licensees to eliminate any K/A statements pre-examination for which a psychometrically sound question cannot be developed and a post-examination requirement for facility licensees to evaluate the validity of questions missed by half, or more than half, of the applicants. The post-examination review process also solicits test item feedback from the applicants with the facility position(s) to better ensure that the NRC grading process properly resolves any problematic questions.

As to open-reference written examination questions, the staff notes that there is no prohibition on their use on NRC examinations. The staff has provided quantitative ranges for the typical numbers of open-reference questions on the written examination, but it cautioned that these ranges are not absolute limits or goals. The staff’s position has been that open-reference questions should be judiciously and sparingly used because the initial license examinations should rely more heavily on closed-reference questions that evaluate more effectively the applicants’ level of knowledge and how well the applicants are able to recall, comprehend, and answer or resolve issues and problems. The initial examination should not simply be a test of the applicant’s ability to answer a question by looking up information in reference materials (i.e., open-reference “direct lookup questions”). Psychometrically sound closed-reference multiple-choice questions, and not rote memorization, evaluate the applicant’s recognition of the correct answer, thereby maintaining test item operational validity.

Ongoing NRC/Industry Initiatives for Improving the Examination Process

The staff monitors the effects on the industry as new regulations and associated guidance documents on operator licensing process are implemented. In 1999, the LOFG was formed in cooperation with the NEI to provide a forum for discussing and resolving issues related to the initial operator licensing examination program. The staff has conducted public meetings at least annually with the NEI LOFG to solicit industry feedback and promote the efficient, effective, and consistent preparation and administration of initial operator licensing examinations. As noted above, in a December 2011 public meeting, the staff and the NEI LOFG discussed the LOFG’s preliminary recommendations for revising the K/A Catalogs and the NUREG-1021 K/A sample plan process. The LOFG proposed that an industry working group, with NRC examiner participation, revise the K/A Catalogs (NUREG-1122 and NUREG-1123) to better reflect licensed operator knowledge requirements, skills, and abilities required in the current operating environment. The revision process would be modeled after the processes, including lessons learned, used to develop Draft NUREG-2103, “Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Westinghouse AP1000 Pressurized-Water Reactors,” and Draft

NUREG-2104, "Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Advanced Boiling-Water Reactors." The revision effort will also consider development of an integrated examination sample plan that defines the K/A statements to be tested in each of the three examination settings - the written examination, the dynamic simulator operating test, and the control room/in-plant operating test. The staff has agreed to participate in the revision efforts and will schedule a public meeting with the LOFG for December 2012 to provide a status update.

The staff also monitors the administration of the operator licensing functions in the regional offices. The headquarters staff annually performs an assessment in one regional office to evaluate the overall effectiveness of that office's operator licensing program and its adherence to 10 CFR Part 55, NUREG-1021, and other policy documents. The assessment includes a detailed review of the preparation, administration, and grading of initial operator licensing examinations with an emphasis on examination consistency and the quality of the regional review and comment resolution processes for facility licensee-developed examinations. Each regional office conducts a similar self-assessment during the years when they are not evaluated by the headquarters staff.

Overview of the Licensed Operator Requalification Process and Other New Initiatives

The overall process for licensed operator requalification is dictated by 10 CFR 55.59, "Requalification," which requires each licensed operator and senior operator to complete a requalification program that the facility licensee has developed and the Commission has approved. Requalification programs are considered approved by the Commission when they are based on a SAT and accredited by the NNAB after evaluation by INPO. INPO reviews the details of each facility's licensed operator requalification program every 4 years. As 10 CFR 55.59 further requires, each requalification program is to be conducted for a continuous period not to exceed 2 years promptly followed by successive requalification programs, and that each 2-year requalification program include a comprehensive written examination and an annual operating test. Since 1994, the examinations have been developed and administered solely by facility licensees, although the NRC could develop and administer these exams if the NRC loses confidence in the ability of the facility licensee to do so.

Beyond what has been discussed above, there are no additional specific regulatory requirements for licensed operator requalification training and examination. For example, there are no specific regulatory requirements for the number of training hours that must occur in every 2-year requalification program, nor are there any specific requirements for the topics to be trained on or the content of the examinations. These details are contained in the industry standard for requalification as outlined in the NANT "Guidelines for the Continuing Training of Licensed Personnel," and in additional communication between INPO and facility licensees (e.g., significant operating experience reports).

The primary role of the NRC in licensed operator requalification is to provide oversight of facility programs through inspection. (INPO also provides oversight as discussed above). These inspections are conducted in accordance with Inspection Procedure (IP) 71111.11, "Licensed Operator Requalification Program and Licensed Operator Performance." The inspections performed at each facility include an annual collection of examination results, a biennial inspection by NRC examiners, and a quarterly inspection by the resident staff. The biennial inspection reviews requalification written examination and operating test quality, remedial

training and re-examinations, conformance with operator license conditions, simulator performance, problem identification and resolution (PI&R) as it relates to licensed operator performance, and observation and assessment of the facility licensee's ability to administer requalification examinations and assess their licensed operators, including the ability of the facility to maintain appropriate examination security. The review effort includes direct observation of operating crew performance during the simulator operating test scenarios as well as observation of individual operator performance during the control room or in-plant portion of the operating test.

The resident inspector staff's quarterly inspection includes observing licensed operator requalification training and testing activities (4 hours per quarter), and observing licensed operator performance in the actual plant's main control room during periods of heightened activity or risk (4 hours per quarter, which may be combined with other resident inspector activities in the main control room). Major changes incorporated into IP 71111.11 as a result of a January 2012 revision included: (1) revised tools for assessing the biennial inspection areas to make the IP more effective and easier to use; (2) the addition of the PI&R section; and (3) the addition of the resident staff's observation of licensed operator performance in the actual plant's main control room with guidance provided for performing this inspection activity. The addition of the PI&R review and the observation of licensed operator performance in the actual plant control room were added to address recent licensed operator performance issues, which include operating fundamentals such as command and control, procedure adherence, and conduct of operations.

The staff is also considering changes to the initial operator licensing and requalification processes as part of the NRC's response to the Fukushima accident. These initiatives may include additional NRC oversight of severe accident management and extensive damage mitigation guidelines, and the training and examination of licensed operators on these subjects.

CONCLUSIONS:

The NRC's initial operator licensing examination program, as confirmed by the NEI IRT assessment, continues to provide reasonable assurance that only those applicants who have mastered the knowledge, skills, and abilities required to safely operate and supervise the reactor controls are being licensed to do so. However, the staff agrees that licensing process enhancements may be appropriate and is working with the NEI LOFG to revamp the NRC's K/A Catalogs and the K/A statement selection process for the written examinations.

COORDINATION:

The Office of the General Counsel has reviewed this Commission paper and has no legal objection.

/RA/

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