

**ANNUAL REPORT
ON
THE EFFECTIVENESS OF TRAINING
IN THE NUCLEAR INDUSTRY
FOR
CALENDAR YEAR 2007**

August 2008

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BACKGROUND

NRC regulation of training in the nuclear industry dates to the 1982 Nuclear Waste Policy Act (NWPA). The NWPA directed the NRC to provide guidance on the instructional requirements for workers at nuclear power plants. To meet this directive, in March 1985 the Commission published a policy statement on training that endorsed the performance-based training accreditation process of the National Academy for Nuclear Training. When issuing the policy statement, the Commission deferred rulemaking to allow the nuclear industry to continue its efforts to upgrade their training programs.

After a two-year trial period, evaluations of the accreditation process concluded that the accreditation process was generally effective in improving the training programs. Rulemaking related to the training of non-licensed personnel was not initiated. In November 1988 an amended policy statement on training was issued to reflect Commission views on training for non-licensed workers at nuclear power plants.

In May 1987, the NRC revised Title 10, Part 55, "Operators' Licenses," of the *Code of Federal Regulations* (10 CFR 55) to incorporate several new requirements and endorsements. The 1987 changes included removing instructor certifications, endorsing Regulatory Guides 1.8 (personnel training) and 1.149 (plant-referenced simulator), requiring operating licensing examinations to be conducted on a simulator, and establishing the current licensed operator requalification training program. 10 CFR 55 requires the content of a facility licensed operator requalification program to either meet the requirements outlined in 10 CFR 55.59 (c) (1) through (7) or be developed using a systems approach to training (SAT) based process, as defined in 10 CFR 55.4.

In response to a court decision requiring a rule on training rather than a policy statement to satisfy the NWPA, the NRC issued 10 CFR 50.120, "Training and Qualification of Nuclear Power Plant Workers," in April 1993. 10 CFR 50.120, which had an effective date of November 1993, acknowledges that the safety of nuclear power plant operations and the assurance of general public health and safety depend on personnel performing at adequate levels of competence. 10 CFR 50.120 requires that training programs be established, implemented, and maintained using a SAT-based process for nine categories of non-licensed workers at nuclear power plants.

SAT-based training provides for the systematic determination of job performance qualification requirements and for periodic retraining of personnel which enhance public confidence in the ability of workers to perform successfully. 10 CFR 50.120 complements the requirement for SAT-based training of licensed operators contained in 10 CFR 55.

The Operating Licensing and Human Performance Branch (IOLB) of the Division of Inspection and Regional Support under the Associate Director for Operating Reactor Oversight and Licensing in the Office of Nuclear Reactor Regulation has programmatic responsibility for ensuring that utilities implement training requirements addressed by 10 CFR 50.120 and 10 CFR 55 in an acceptable manner.

NRC MONITORING OF TRAINING

Public health and safety depend on proper operation, testing, and maintenance of power plant systems and components. Successful performance by nuclear power plant personnel is assured by having workers achieve and maintain job-task qualification through SAT-based training and retraining required by 10 CFR 55 and 10 CFR 50.120. The implementation of SAT-based training is monitored by the Institute of Nuclear Power Operations (INPO) during the training program accreditation reviews conducted for the National Nuclear Accrediting Board (NNAB) and is reflected in the status of accreditation throughout the industry as a whole. Accordingly, indications of favorable job performance and successful SAT implementation provide reasonable assurance that the training of nuclear power plant workers is adequate to maintain public health and safety.

This report assesses the effectiveness of the implementation of training from the perspective of the Reactor Oversight Process (ROP) and NRC monitoring of the Accreditation Process. To obtain the ROP perspective, the NRC reviews Licensee Event Reports (LERs), inspection reports, and operator licensing examination reports for personnel performance issues. The data obtained is analyzed by IOLB, using the Human Factors Information System (HFIS), to identify the training-related performance issues. The NRC obtains additional data during the conduct of “for cause” inspections of training programs and during the administration, inspection, and review of licensed operator initial and requalification training activities.

The NRC assesses the effectiveness of the accreditation process and industry's implementation of the systems approach to training by observing selected INPO-led Accreditation Team Visits and meetings of the NNAB. These activities provide an efficient and effective assessment of industry training activities and initiatives with minimal impact on licensees. Although each activity provides plant-specific information, the information is used in the composite for this report to assess the overall effectiveness of training in the nuclear industry.

Guidance for administering examinations for licensed operator applicants and licensed operators is contained in NUREG 1021, "Operator Licensing Examination Standards for Power Reactors." Guidance for inspecting the aspects of the operator training programs unique to requalification is found in Inspection Procedure 71111, Attachment 11, "Licensed Operator Requalification Program" (IP 71111.11). In addition, the NRC verifies compliance with the requirements for SAT-based training through its inspection program and has done so when appropriate using Inspection Procedure 41500, "Training and Qualification Effectiveness," which references the guidance in NUREG-1220, "Training Review Criteria and Procedures."

The NRC also monitors the effects on the industry as new regulations and associated guidance documents are implemented by participating in meetings with regional training organizations and industry focus groups. NRC participates in meetings and workshops sponsored by the Mid-Atlantic Nuclear Training Group (Region I and Region III), the Southern States Nuclear Training Association (Region II), and Westrain (Region IV). The industry Operator Licensing Focus Group, formed in cooperation with the Nuclear Energy Institute (NEI), provides a forum for discussing and resolving issues related to the training, examination, and development of licensed operators. This forum has assisted the staff in identifying problematic areas and developing solutions.

The NRC also monitors industry human performance activities. The following sections of the report present data and discuss issues in three major areas of plant performance: (1) select areas of results arising from HFIS analysis, (2) key results from the monitoring of licensee requalification training program inspections, including a special discussion of an industry-adopted process to improve requalification examinations, and (3) observations of industry accreditation activities.

NRC MONITORING OF HUMAN PERFORMANCE

Issues in LERs, Inspection Reports and Examination Reports

Several aspects of worker performance are continually monitored and documented in HFIS by IOLB during its ongoing reviews of LERs, inspection reports, and operator licensing examination reports. Figure 1, *HFIS 3-Year Trend*, shows the relative contribution (in percent) of various categories of human performance issues to the overall industry total. A total of 4,295 human performance issues were identified in LERs, inspection reports and examination reports during calendar year (CY) 2007. (Note: This represents a notable reduction of 255 items from 2006). Of that total, 133 performance issues were attributed to training, indicating a gradual and clear reduction from 153 items reported in 2006 and 208 reported items in 2005. The fraction of overall human performance concerns attributable to training was only three percent for the industry as a whole, with a slight decline during the last three years. The 2007 data shows that the number of issues attributable to training for most licensees is clustered near the industry mean of only 1.30 issues per plant. Among the Human Factors reports for 2007, the greatest percentage of problems continues to lie in the following three categories:

Work Planning and Practices	47%
Problem Identification and Resolution	29%
Procedures and Reference Documentation	12%

As shown in Figure 1, *Work Planning and Practices* continues to be the single largest contributor to overall human performance errors. *Work Planning and Practices*, which is comprised of two components, *Work Practices and Awareness/Attention*, focuses on performance deficiencies resulting from power plant workers using practices that are inconsistent with the type or difficulty of the task being performed. Training-related issues are reflected in the area of *Work Planning* primarily in the subcategory of “work practices or skill of the craft less than adequate.”¹

¹Craft activities are not performed consistent with management expectations, the safety significance of the activity or industry standard, or if an individual was trained but the skill or knowledge was not sufficient to ensure successful on-the-job performance

Within the context of this report, outlying performance is defined as exceeding two times the National average for the industry as a whole. Given that the average number of hits per plant was 41, the criterion established for identifying the more problematic plants is twice the National average, or 82.

Most plants fell substantially below this criterion; in fact, both NRC Region 1 and Region 3 had no plants that exceeded twice the National average. Region 2 had only one outlier plant: Browns Ferry, Unit 1, having 153 hits with 56 percent of its performance problem area lying in *Work Planning and Practices*. Region 4 had three outlier plants: Palo Verde 1, Palo Verde 2, and Palo Verde 3 having 202, 201, and 193 hits, respectively, with the preponderance (80 percent) of their issues residing in two areas: *Problem Identification and Resolution* and *Work Planning and Practices*. It should be noted that the three Palo Verde Plants were also identified as outliers in CY 2006. Overall, however, for 2007, only four plants² have been identified as having outlying overall human performance. This is a noteworthy reduction from seven plants identified as outliers in CY 2006. Three of the four human performance outliers (Palo Verde 1, Palo Verde 2, and Palo Verde 3) are in column 3 or higher in the ROP Action Matrix.

A more in-depth regional analysis reveals the comparative number of human performance issues identified within each NRC Region.

REGION	HITS
1	568
2	1069
3	1186
4	1472

Clearly, Region 1 plants had the fewest and Region 4 had the most identified performance deficiencies; notwithstanding the relative Regional differences, 40-50 percent of all hits in each

Region fall into the *Work Planning and Practices* category. So as to better understand this

²Human performance outliers for 2007 are Browns Ferry, Unit 1 and Palo Verde 1, Palo Verde 2 and Palo Verde 3.

category, it is sectioned into two major sub-categories and described as follows:

1. **Work Practices**, which includes the following areas where the performance has been identified as Less than Adequate: work package quality; briefings, preparation, turnover; work practice or craft skill; non-conservative decision making/questioning attitude; team interactions; work untimely; non-conservative action; tag outs; and housekeeping.

2. **Awareness/Attention**, which includes the following areas where the performance has been identified as Less than Adequate: independent verification/plant tours; self-check; awareness or attention; and logkeeping or log review.

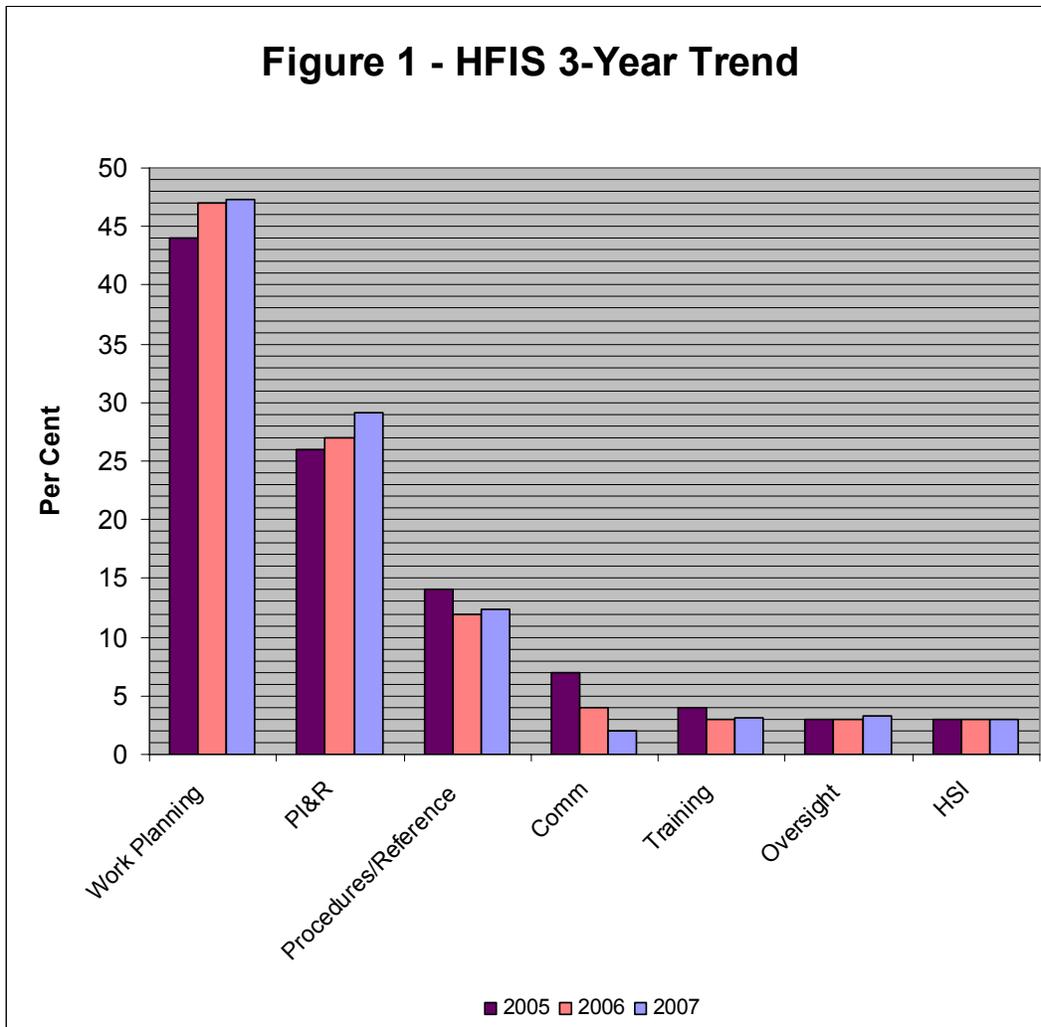
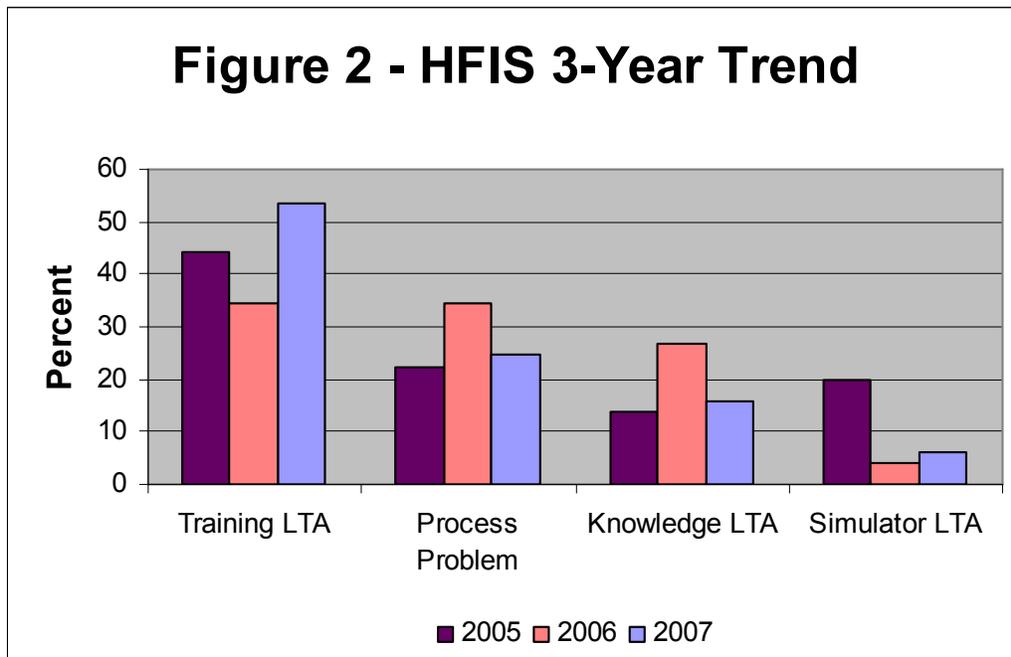


Figure 2, *HFIS 3-Year Trend*, shows the breakdown of the items attributable to training into their specific causes. Figure 2 shows that the causes of the 133 training-related issues identified in CY 2007 are relatively concentrated in two distinct areas: “Training Less Than Adequate (LTA)”³ and “Training Process Problem.”⁴ The individual knowledge deficiencies are split approximately equally between continuing training and on-the-job training.



As noted in Figure 2, issues associated with “Training Process” and “Knowledge Less Than Adequate” declined approximately 10 percent in 2007 relative to the previous year. Similarly, simulator related performance errors only slightly increased from the previous year. Only one category, “Training Less Than Adequate,” showed a significant tick upward in percentage of problematic human performance errors.

³Training was provided and was attended by the worker, but the incident/condition is due to not providing any training on a specific topic, or training is incomplete/incorrect.

⁴Training problem is due to a break down in the SAT (examples: inadequate job or task analysis, inadequate program evaluation or feedback, failure to keep lesson materials current).

NRC MONITORING OF LICENSEE TRAINING PROGRAMS

The NRC can inspect facility training programs at any time to verify implementation of the training requirements contained in 10 CFR 50 and 10 CFR 55. Through inspections conducted prior to the implementation of 10 CFR 50.120, the NRC determined that training programs accredited and implemented consistent with National Academy for Nuclear Training (NANT) accreditation criteria and objectives would be in compliance with the requirements to have SAT-based training programs. As facility training programs continue to renew accreditation, training program performance indicators are monitored in lieu of conducting routine inspections of training programs. Using the guidance of the reactor oversight process, inspections of training programs are conducted whenever the causes of declining performance suggest training-related deficiencies outside the licensee response band. There were no training inspections conducted during CY 2007.

Evaluations of licensed operator continuing training are conducted on a biennial basis by region-based operator licensing examiners and on a quarterly basis by site resident inspectors. During CY 2007, 54 initial licensing examinations were administered and 46 licensed operator requalification program inspections were conducted using IP 71111.11. Issues identified during these inspections include:

- A green finding resulting from an identified performance deficiency based on licensed operators' failure to pass an NRC comprehensive biennial written examination. Of the 48 licensed operators evaluated, 10 did not pass their required biennial written examination. (Fermi)
- A white finding resulting from a failure to ensure the integrity of examinations and tests (a violation of 10 CFR 55.49, "Integrity of Examinations and Tests") during the 2005 and the 2006 annual operating exams at Unit 1. NRC inspectors identified practices that collectively had the impact of unintentionally compromising the examinations. These practices included: 1) a lack of simulator exam scenario diversity (i.e., The scenarios were substantially the same including: critical tasks; major transients; Emergency Operating Procedure flow paths; and emergency classifications); 2) an overuse of a single emergency operating procedure strategy

(i.e., full core Anticipated Transient Without Scram); and 3) a pattern of crews validating scenarios substantially similar to their exam scenario sets. (Nine Mile Point)

- A green finding was associated with crew performance on the simulator during the 2006 facility-administered requalification examinations. Of the six crews evaluated, two failed to pass their simulator examinations when the newly-developed, more comprehensive exams were re-administered in response to the above preliminary white finding. (Nine Mile Point)
- A green finding was issued for failing to meet the minimum licensed operator staffing requirements as stated in 10 CFR 50.54(m)(2)(i). Between March 2003 and February 2007, seven Senior Reactor Operators (SROs) who had not satisfied all the requalification requirements stood license-required positions that resulted in the staffing requirements of 10 CFR 50.54(m)(2)(i) not being met. (Oconee)
- A green finding was issued for failure to notify NRC of a licensee medical condition change in accordance with 10 CFR 50.74 when a licensed operator was taking prescribed medication for a potentially disqualifying medical condition. (Kewaunee)
- A Level IV non-cited violation (NCV) of 10 CFR 50.9 was issued for failing to provide complete and accurate information on NRC Form 396, "Certification of Medical Examination by Facility Licensee," for a licensed operator applying for renewal of his license. (Duane Arnold)
- A green finding was issued for failure to conduct simulator performance testing in a sufficient manner to demonstrate fidelity. (Davis Besse)

On a national basis, inspections of licensed operator requalification training programs have identified a limited number of site-specific weaknesses. However, the results of these inspections indicate that the power reactor facilities, overall, are satisfactorily maintaining their licensed operator requalification training programs. Licensees continue to demonstrate their ability to effectively develop and administer licensed operator requalification examinations. Licensee evaluations continue to satisfactorily identify licensed operator performance deficiencies. Licensees constructively use feedback from training for improving licensed operator training and involve management in the observation and evaluation of licensed operator performance. Resident inspector quarterly reviews of licensed operator requalification training and examinations have not revealed any areas of concern that were not being addressed by licensees in their corrective action programs.

Overall, the NRC's licensed operator requalification inspection program continues to confirm that those individuals who are licensed to operate or supervise the operation of reactor controls maintain the required level of competence to safely perform their licensed duties. In addition, the NRC's initial operator licensing examination program 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.

REQUALIFICATION EXAMINATION ISSUES

The 2006 Annual Training Report discussed INPO's and NEI's initiative toward implementing good testing practices in all licensee requalification programs. Toward this end, in 2007, INPO revised one of its accreditation documents (Academy Document 07-001, "Guidelines for Continuing Training of Licensed Personnel") to include a section on Licensed Operator Requalification Examinations. The section includes 10 specific standard practices intended to promote consistency in the content and rigor of required requalification examinations. During accreditation visits, INPO assesses the requalification examination quality against ACAD 07-001. During the most recent INPO/NRC Annual Training Meeting held April 10, 2008, INPO reported that it had found no significant issues with requalification examination practices during its accreditation visits.

NRC MONITORING OF THE ACCREDITATION PROCESS

Observing Accreditation Activities and Coordinating Activities with INPO

The NRC monitors NNAB, NANT, and INPO accreditation activities as indicators of the overall effectiveness of the industry's use of the SAT. The NRC monitors accreditation in lieu of conducting inspections to assess the level of compliance with the SAT requirements contained in 10 CFR 50.120 and 10 CFR 55. Monitoring training program effectiveness through a review of the accreditation process increases the NRC's efficiency by focusing Agency resources on the inspection of licensee training programs only when performance problems have been identified through routine monitoring.

Observing Accreditation Activities

The NRC uses observations of NNAB meetings to provide assurance that training programs accredited and implemented in accordance with the NANT objectives will be in compliance with the SAT requirements contained in 10 CFR 50.120 and 10 CFR 55. NRC staff, drawn from various levels that included representatives from headquarters and all regional offices, attended eight meetings of the NNAB during CY 2007. The staff observed the presentation of training programs from sixteen sites to the NNAB for accreditation renewal. During the sessions observed by the NRC, the NNAB reviewed technical programs from six sites and operator training programs from 10 sites.

NRC observers who attended the accreditation reviews were favorably impressed with the Board and the level of professionalism exhibited by its members. Illustrative of that quality, several NRC observer comments follow:

“I was impressed by the depth, relevance and usefulness of the dialogue that occurred between the Board Members and the licensee representatives.”

“Board Members demonstrated that they were prepared and had an appropriate level of knowledge of licensee performance to support their review.”

“Solid board performance.”

“Good follow-up questions, particularly related to previous findings and root cause determinations.”

Several NRC observers favorably noted NNAB questions related to the sustainability of SAT-based training programs. SAT issues were discussed in the areas of Analysis, Design, Trainee Evaluation (including evaluation of instructors), and Program Evaluation. NRC observation of accreditation activities indicated that training programs accredited by the NNAB continue to be effective.

As described in the Memorandum of Agreement between INPO and NRC (updated December 10, 2007), NRC staff continued to review INPO plant evaluation and accreditation reports in accordance with the NRC's Field Policy No. 9, "NRC Review of INPO Documents," to ensure that significant safety issues receive appropriate follow-up. No safety-significant issues were identified in CY 2007 as a result of the reviews of either plant evaluation or accreditation reports.

Coordinating Activities with INPO

The NRC/IOLB staff meets with INPO's Training and Education organization at least once each year to exchange information related to training in the nuclear industry and to discuss observations made by NRC observers to INPO-led Accreditation Team Visits and to the NNAB.

The most recent meeting was held at NRC Headquarters, in Rockville, MD on April 10, 2008. Discussion topics included a summary of accreditation visits and results in CY 2007, changes and challenges to the accreditation and plant evaluation processes, new reactor accreditation, future technological advances in training delivery systems, knowledge management initiatives, and slight declines in applicant performance on initial license examinations. The minutes for the 2008 INPO/NRC meeting and its enclosures (accession number ML081130273) are available electronically from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

CONCLUSIONS

During CY 2007, the number of HFIS issues related to training has declined and lies at a three percent level relative to the seven categories of assessment. The notable problematic area continues to be *Work Planning and Practices*. The NRC identified four plants as outliers in the area of human performance of which all four were also identified as having a substantial percentage of human performance concerns in *Work Planning and Practices*. In addition, five green findings, one white finding, and one non-cited violation were issued in the area of licensed operator training.

While the monitoring of industry performance in the area of training during CY 2007 provided some indications of minor training program weaknesses, overall, the industry is successfully implementing training programs in accordance with the regulations.

Monitoring the INPO-managed accreditation process continued to provide confidence that accreditation is an acceptable means of ensuring the training requirements contained in 10 CFR 50 and 10 CFR 55 are being met. In addition, the NRC's assessment of the accreditation process indicates that continued accreditation remains a reliable indicator of successful SAT implementation and contributes to the assurance of public health and safety by ensuring that nuclear power plant workers are being appropriately trained.