

**ANNUAL REPORT
ON
THE EFFECTIVENESS OF TRAINING
IN THE NUCLEAR INDUSTRY
FOR
CALENDAR YEAR 2004**

September 2005

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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, 10 CFR Part 55 was revised to incorporate several new requirements and endorsements. The 1987 changes included removing instructor certifications, endorsing Regulatory Guide 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 Part 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.

In response to a court decision requiring a rule on training rather than a policy statement to satisfy the NWPA, 10 CFR 50.120, "Training and Qualification of Nuclear Power Plant Workers," was issued in April 1993. 10 CFR 50.120 had an effective date of November 1993. 10 CFR 50.120 acknowledges that the safety of nuclear power plant operations and the assurance of general public health and safety depends 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 Part 55.

The Operator Licensing and Human Performance Section (IOHS) of the Reactor Operations Branch in the Division of Inspection Program Management of 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 Part 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 Part 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) and inspection reports for personnel performance issues. That data is analyzed, 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 use of the systems approach to training by observing 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 candidates 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 71111.11, "Licensed

Operator Requalification Program Evaluation" (IP 71111.11). In addition, the NRC, for cause, 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."

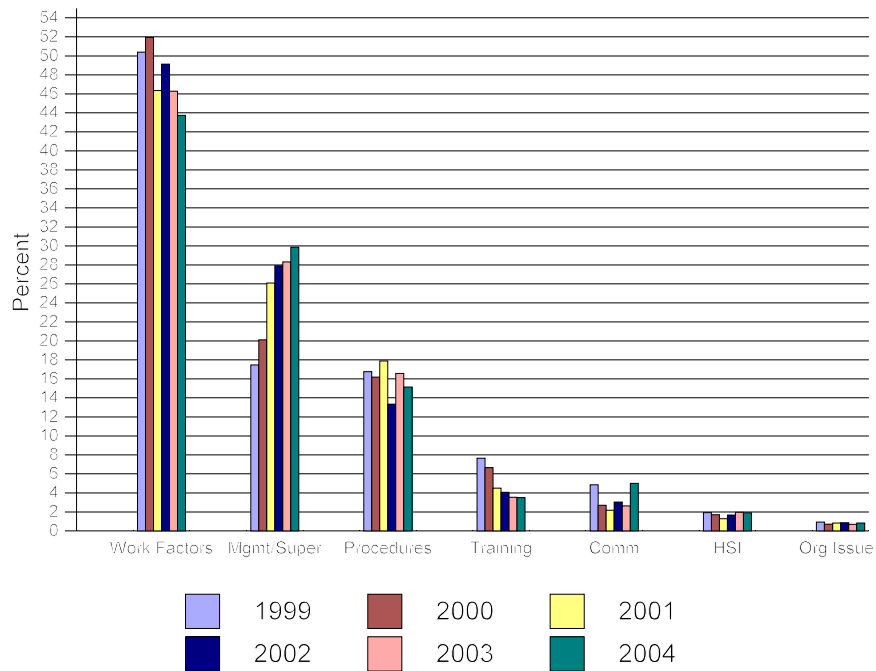
The NRC also monitors the effects on the industry as new regulations and associated guidance documents are implemented by participating in meetings with regional training organizations and industry focus groups. NRC participates in meetings and workshops sponsored by the Mid-Atlantic Nuclear Training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

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 IOHS during its ongoing reviews of LERs, inspection reports, and operator licensing examination reports. Figure 1, *HFIS 6-Year Trend*, shows the relative contribution (in percent) of various categories of human performance issues to the overall industry total. A total of 4,560 human performance items were identified in LERs, inspection reports and examination reports during 2004. Of that total, 160 items were attributed to training. The contribution to overall human performance attributable to training, for the industry as a whole decreased from 7.65 percent in 1999 to 3.51 percent in 2004. A review of the 2004 data shows that the number of items attributable to training for most licensees is clustered near the industry mean of 2.16 items.

Figure 1 - HFIS 6-Year Trend



As shown in Figure 1, *Work Factors* continues to be the single largest contributor to overall human performance. *Work Factors* is comprised of two components, *Work Practices* and *Awareness/Attention*. *Work Practices* 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 Practices* primarily in the subcategory of “work practices or skill of the craft less than adequate.”¹

Within the context of this report, outlying performance is defined as exceeding two times the national average for the industry as a whole. For 2004, 10 plants² have been identified as having outlying overall human performance. Nine of the ten human performance outliers are in column 2 or higher in the ROP Action Matrix.

Figure 2, *2004 HFIS 6-Year Work Practices Data*, shows the breakdown of the 1437 *Work Practices* items identified in 2004. “Work practices or skill of the craft less than adequate” increased from almost 40 percent in 2003 to more than 45 percent in 2004 of the *Work Practices* deficiencies. It is not possible to determine that portion of skill of the craft attributable solely to training. When the deficiencies attributed to “work practices or skill of the craft less than adequate” are combined with the deficiencies attributed to training, the resultant total accounts for 18 percent of the total human performance deficiencies for 2004. The number of combined skill of the craft and training deficiencies at 10 plants³ identified them as having outlying performance. Of the 10 human performance outliers, 6 were among those plants identified as having outlying combined skill of the craft and training performance.

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

² Human performance outliers for 2004 are Davis Besse, Palo Verde 2, Point Beach 2, Point Beach 1, Hope Creek, Palo Verde 1, Palo Verde 3, Indian Point 2, Perry, Cooper

³ Plants with the highest combined skill of the craft and training deficiencies for 2004 are Davis Besse, Cooper, Indian Point 2, Browns Ferry 1, Hope Creek, Palo Verde 2, Perry, Palo Verde 1, Turkey Point 3, Turkey Point 4

Figure 2 - HFIS 6-Year Work Practices Data

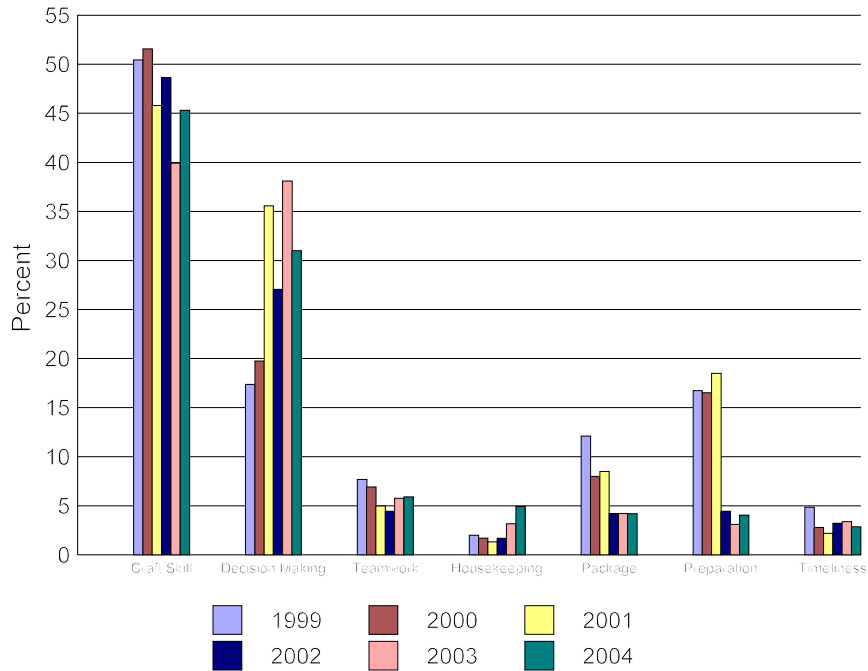


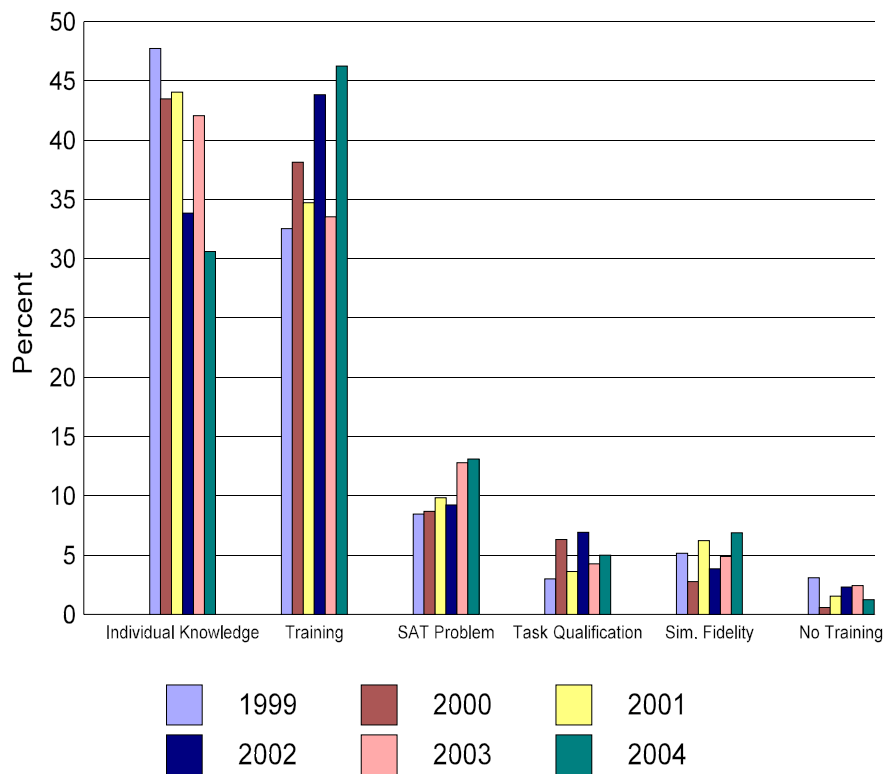
Figure 3, *HFIS 6-Year Training Data*, shows the breakdown of the items attributable to training into their specific causes. Figure 2 shows that the causes of the 160 training-related issues identified in 2004 continue to be concentrated in two distinct areas: “Training less than adequate (LTA)”⁴ and “Individual knowledge less than adequate (LTA)”⁵. The individual knowledge deficiencies are split approximately equally between continuing training and initial training.

⁴ Training was provided and was attended by the worker, but content was incorrect or incomplete.

⁵ Complete and accurate training was received by the worker, but the worker was unable to perform successfully on the job.

The number of training items at 11 plants⁶ identified them as having outlying performance in the area of training. Of the 10 human performance outliers, 6 were among those plants identified as having outlying overall training performance.

Figure 3 - HFIS 6-Year Training Data



⁶ Plants with outlying performance in the area of training for 2004 are Perry, Cooper, Indian Point 2, Davis Besse, Three Mile Island, Dresden 2, Duane Arnold, Palo Verde 1, Palo Verde 2, Point Beach 2, South Texas 1

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 Parts 50 and 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. An inspection of training programs was conducted at one site, Cooper Nuclear Station, during calendar year 2004.

The Cooper Nuclear Station (Cooper) training inspection was conducted during April and May, 2004 and focused on the licensed operator training programs after the failure rate on the biennial requalification written examination, administered in November and December 2003, exceeded 25 percent. The results of the inspection were documented in Inspection Report 50-298/2004-011. A violation of 10 CFR 55.59(c) was identified. The inspectors found that Cooper failed to adequately implement a systems approach to training for licensed operator requalification training. Reduction of training on plant systems and technical specifications, lack of periodic examinations to test training effectiveness, examination administration issues, and other failures to follow program guidance resulted in the high failure rate on requalification examinations. Immediate corrective actions implemented included remedial training and retesting of those operators who failed the examination prior to returning the operators to licensed duties. The licensee also conducted a root-cause analysis, identified several programmatic failures, and initiated corrective actions to address those programmatic issues.

In addition, a noncited violation (NCV) of 10 CFR 55.59(b) was identified at Cooper. Due to errors in regrading the 2003 biennial written examination, three licensed operators were returned to licensed duties, but were later determined to have failed their requalification examinations. As a result, remedial training and re-examination were not completed before

returning the affected operators to licensed duties. The failure to accurately grade the requalification written examinations was a performance deficiency that was more than minor because Cooper had the opportunity to identify and correct the grading errors prior to returning operators to licensed duties.

In addition to the training inspection conducted at Cooper, licensed operator continuing training was evaluated more than 30 times by region-based and site resident inspectors using Inspection Procedure 71111.11. Issues identified during these inspections include:

- Four examples of NCV's of a failure of the simulator to demonstrate expected plant response to transient conditions. (Hope Creek, IP2, Nine Mile, TMI)
- Four green findings of a failure to conduct simulator testing in accordance with ANSI/ANS standard. (Beaver Valley, Hope Creek, IP2, Salem)
- Two examples of NCVs involving potential examination compromise. (Fort Calhoun, Fitzpatrick)
- Three green findings resulting from crew performance on the dynamic scenario portion of the facility-administered annual operating test. (Dresden, Nine Mile, TMI)
- Two NCVs and one severity level (SL) IV violation resulting from the failure to notify the NRC of a change in operator status in accordance with 10 CFR 50.74(c). (Kewaunee, Prairie Island, Vermont Yankee)
- Two NCVs resulting from a failure to properly reactivate senior reactor operator licenses. (Farley, Palisades)
- One NCV and one SL-III violation resulting from a failure to provide complete and accurate information to the NRC which impacted a licensing decision. (Cook, Watts Bar)

- One green finding resulting from a failure to demonstrate satisfactory individual requalification performance. (Dresden)
- One green finding resulting from a lack of assurance that the operating exam is at least 50 percent unique compared to other exams administered during the cycle. (TMI)
- One green finding resulting from a lack of documentation of remediation training plans for senior reactor operators and reactor operators. (TMI)

On a national basis, inspections of licensed operator requalification programs continued to identify site-specific strengths and weaknesses. The results of these inspections indicate that the power reactor facilities inspected 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 requalification training and involve management in the observation and evaluation of examinations. 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 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 to do so.

NRC MONITORING OF THE ACCREDITATION PROCESS

Observing Accreditation Activities and Coordinating Activities with INPO

The NRC monitors NNAB, NANT, and INPO accreditation activities as an indicator of the overall effectiveness of the industry's use of the systems approach to training. 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 Part 55. Monitoring training program effectiveness through a review of the accreditation process increases NRC 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 Part 55. NRC staff attended seven meetings of the NNAB during calendar year 2004. The staff observed the presentation of training programs from 15 sites to the NNAB for accreditation renewal. During the sessions observed by the NRC, the NNAB reviewed technical programs from 8 sites and operator training programs from 7 sites. The NRC observers were drawn from various levels of the NRC staff and included representatives from headquarters and all regional offices.

NRC observers made the following observations:

- The process remains strong.
- The process is more streamlined and focused. There is less detail and more focus on the management of training.
- An exceptional level of preparation by members of the NNAB
- Members of the NNAB asking probing questions in the area of self-assessment.
- Excellent followup related to previous accreditation.

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 National Nuclear Accrediting Board continue to be effective.

During 2004, the NRC observed an Accreditation Team Visit to the McGuire Plant. The NRC observer participated in all aspects of the accreditation process up to and including the meeting with the NNAB. The observer reported that the INPO-led team worked well together, identified strengths and areas for improvement, corroborated findings, and team interactions with the licensee were conducted in a professional manner. The observer also noted that the team was particularly effective in supporting their conclusions with facts.

As described in the Memorandum of Agreement between INPO and NRC, 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 calendar year 2004 as a result of the reviews of either plant evaluation or accreditation reports.

Coordinating Activities with INPO

The IOHS 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 2004 meeting was held at NRC Headquarters, in Rockville, MD, on May 18, 2004. Discussion topics included changes to the accreditation and plant evaluation processes, the Knowledge and Ability Catalog enhancement project, licensed operator requalification, licensed operator requalification program changes, requalification inspection results, licensed operator eligibility, proficiency, and activation, and implementation of the simulator rule. The minutes for the 2004 INPO/NRC meeting and its enclosures (accession number ML042440770) 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 calendar year 2004, the NRC identified ten facilities as outliers in the area of human performance. Of the 10 human performance outliers, 6 were also identified as having outlying overall training performance and 6 were identified as having outlying combined skill of the craft and training performance. In addition, 10 green findings, 11 non-cited violations, one severity level IV, and one severity level III violation were issued in the area of licensed operator requalification.

While the monitoring of industry performance in the area of training during 2004 provided some indications of training program weaknesses, overall, the industry is successfully implementing training programs in accordance with the regulations.

Monitoring the INPO accreditation process continued to provide confidence that accreditation is an acceptable means of ensuring the training requirements contained in 10 CFR Parts 50 and 55 are being met. In addition, the NRC 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.