

**ANNUAL REPORT
ON
THE EFFECTIVENESS OF TRAINING
IN THE NUCLEAR INDUSTRY
FOR
CALENDAR YEAR 2003**

September 2004

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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 (simulator certifications), requiring operating licensing examinations to be conducted on a simulator, and establishing the licensed operator requalification training program. 10 CFR Part 55 allows the content of a facility licensed operator requalification program to be either derived using a systems approach to training (SAT) based process or meet the requirements outlined in 10 CFR 55.59 (c) (1) through (7).

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 using the Human Factors Information System (HFIS), the NRC reviews Licensee Event Reports (LERs) and inspection reports for personnel performance issues. That data is analyzed 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" (IP 41500), which references the guidance in NUREG-1220, "Training Review Criteria and Procedures" (NUREG 1220).

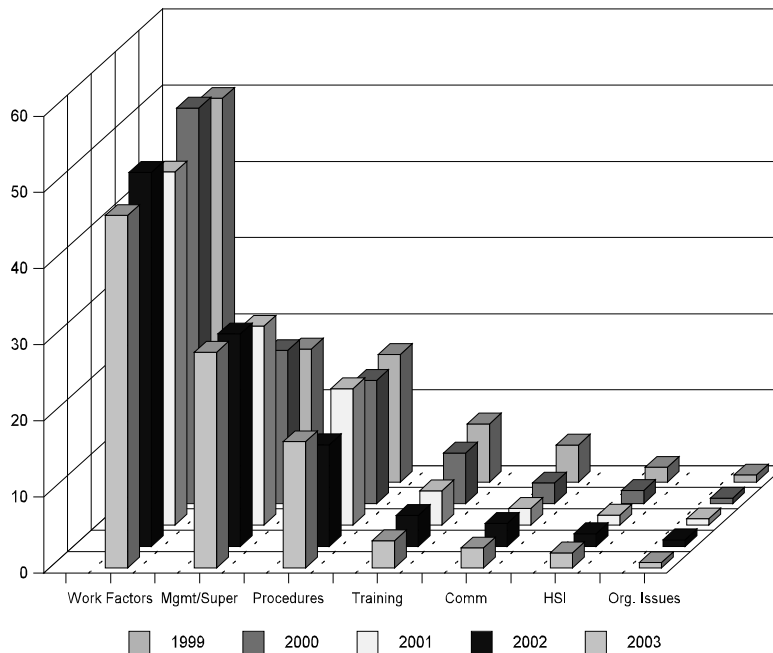
The NRC also monitors the effects on the industry as new regulations and associated guidance documents are implemented by participating in meetings with regional training organizations and industry focus groups. NRC regularly participates in meetings and workshops sponsored by the Mid-Atlantic Nuclear 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 5-Year Trend*, shows the relative contribution of various categories of human performance issues to the overall industry total. A total of 4,378 human performance items were identified in LERs, inspection reports and examination reports during 2003. Of that total, 166 items were related to training. Over the last five years, the contribution attributable to training, for the industry as a whole, has decreased from 7.65 percent in 1999 to 3.54 percent in 2003. A review of the 2003 data shows that the number of training-related items for most licensees is clustered near the industry mean.

Figure 1 - HFIS 5-Year Trend



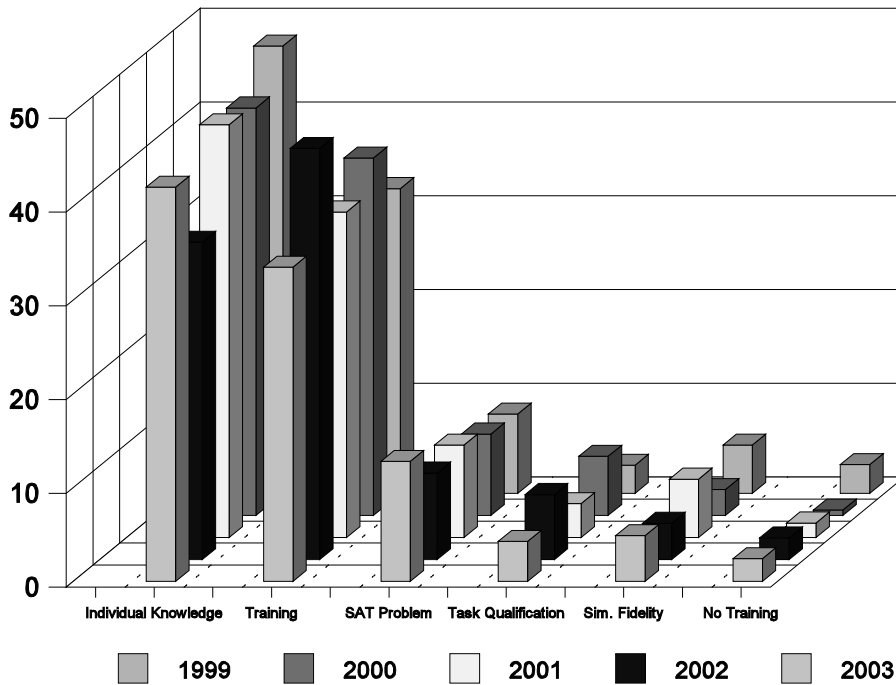
Within the context of this report, outlying performance is defined as exceeding two times the national average for the industry as a whole. For 2003, the number of training items at 10¹ plants identified them as having outlying performance in the area of training. Of the 10 plants, 9 of the plants were among those plants identified as having outlying overall human performance.²

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 area of “work practices or skill of the craft less than adequate”³

Figure 2, *HFIS 5-Year Training Data*, shows the breakdown of the training-related items into their specific causes. Figure 2 shows that the causes of the 166 training-related issues identified in 2003 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.

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- 1 Plants with outlying performance in the area of training are Indian Point 2, Columbia Generating Station, Dresden 2, Dresden 3, D. C. Cook 2, Davis Besse, D. C. Cook 1, Cooper, Duane Arnold, Kewaunee.
 - 2 Human performance outliers for 2003 are Indian Point 2, D. C. Cook 1, D. C. Cook 2, Davis Besse, Dresden 2, Dresden 3, Duane Arnold, Perry, Point Beach 2, Cooper, Diablo Canyon 2, Columbia Generating Station.
 - 3 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
 - 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.

Figure 2 - HFIS 5-Year Taining Data



Examples of events occurring as a result of training-related issues include:

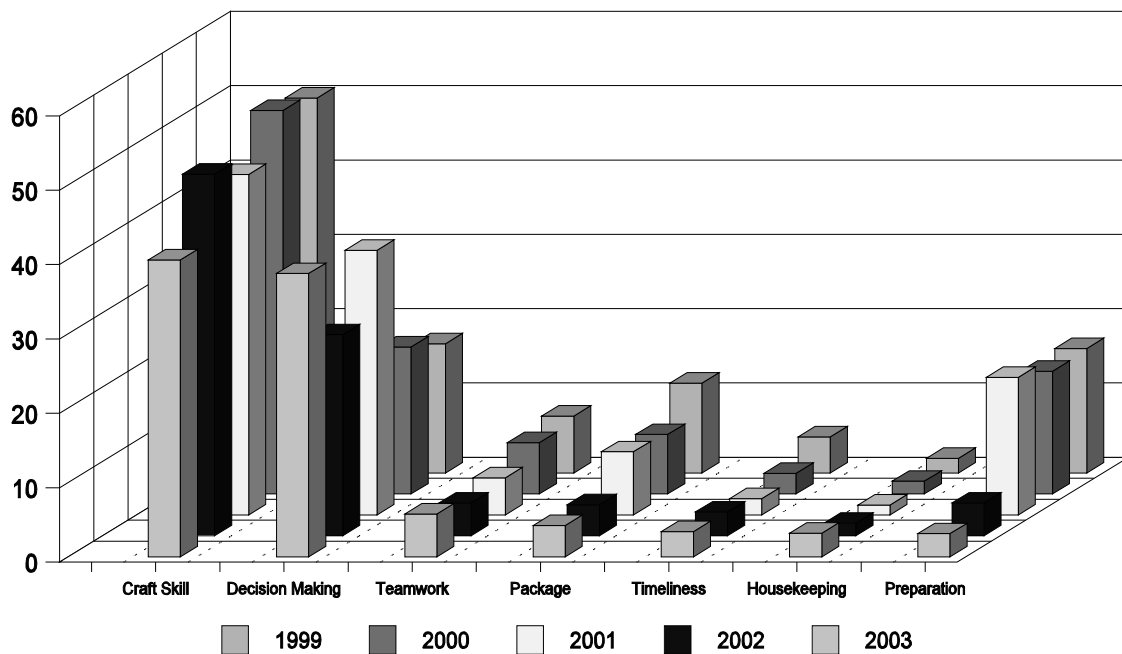
Less than adequate chemistry technician training resulted in an out-of-specification chemistry condition that existed for a time period in excess of Technical Specification allowed outage time.

Less than adequate training permitted control room operators to place the solid state protection system in operation without recognizing that the steam generator low-low level actuation signal would also generate an AFW pump start signal.

A lack of training permitted personnel to inadvertently cut the wrong cable resulting in both trains of the hydrogen mitigation system being declared inoperable.

Figure 3, 2003 HFIS 5-Year Work Practices Data, shows the breakdown of the 1416 Work Practices items identified in 2003. “Work practices or skill of the craft less than adequate” decreased during 2003 but still accounted for almost 40% of the Work Practices deficiencies. “Decision making Less than adequate”⁶ increased from 27% to 38%. It is not possible to determine that portion of either skill of the craft or decision making attributable solely to training. It is interesting to note that 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 36% of the total human performance deficiencies for 2003. This compares with 20% of the total human performance deficiencies for 2002. Of the 10⁷ plants with the highest combined skill of the craft and training deficiencies, 8 were among those plants identified as having outlying overall human performance.

Figure 3 - HFIS 5-Year Work Practices Data



⁶ If personnel fail to stop work or establish appropriate controls when presented with unfavorable or uncertain conditions

⁷ Plants with the highest combined skill of the craft and training deficiencies are Davis Besse, Columbia Generating Station, Cooper, Indian Point 2, Perry, South Texas 1, D. C. Cook 2, Dresden 3, Catawba, Duane Arnold.

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. Such “for cause” inspections of training programs were not conducted during calendar year 2003. However, licensed operator continuing training was evaluated more than 35 times by region-based and site resident inspectors using Inspection Procedure 71111.11. Issues identified during these inspections include:

Six examples of non-cited violations (NCV) of 10 CFR 55.46 or unresolved issues involving either simulator fidelity discrepancies resulting in actual incorrect operator actions in the plant or inadequate simulator performance testing that could potentially result in failure to identify deficiencies in fidelity.

One minor violation involving examination integrity.

One NCV of 10 CFR 50.54(i) in which a grading error on a written exam allowed operators who did not pass the exam to return to shift and manipulate the controls of the reactor.

One green finding resulting from three of nine evaluated crews failing the facility administered requalification examination.

One green finding resulting from a grading error during the annual operating test. The grading error involved a pass-fail decision for one operating crew and two licensed operators during the dynamic simulator scenario portion of the operating test.

Licensed operator initial and requalification training programs and examination development processes were also reviewed. During one inspection, NCVs of 10 CFR 55.40 and 55.49 were identified as a result of written examination outlines not being systematically or randomly prepared. Both content and discrimination validity were adversely affected by the licensee's improper development of examinations and, as a result, the equitable and consistent administration of the examination were also adversely affected.

As part of a Problem Identification and Resolution inspection at one facility, inspectors identified several instances where the licensee did not fully engage the training organization to respond to operator performance errors. These instances were viewed by the inspectors as missed opportunities. Issues identified included late identification of entry into Technical Specification Limiting Condition for Operations (LCO) action statements, LCO times being entered improperly in operator logs, missed 10 CFR 50.72 notifications, failure to maintain required differential pressure across the steam generator tubes, and valve mis-positioning events. Also during this inspection, deficiencies were identified in the Initial Licensed Operator (ILO) program in the area of course design and implementation. In particular, lesson plans, instructor plant-specific technical knowledge, instructor plant-specific operational experience, and instructional quality were deficient. Lesson plans for some systems and administrative portions of the program were technically incorrect. Following submission of a condition report, the licensee suspended ILO training while the training staff corrected course material.

Nationwide, inspections of licensed operator requalification programs continued to identify site-specific strengths and weaknesses. The results of these inspection 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 six meetings of the NNAB during calendar year 2003. The staff observed the presentation of training programs from 20 sites to the NNAB for accreditation renewal. During the 21 sessions observed by the NRC (one facility appeared before the Board twice), the NNAB reviewed technical programs from 9 of the sites and operator training programs from 12 sites. The staff observers were drawn from various levels of the NRC staff and included representatives from headquarters and all regional offices.

The NRC observers noted several positive aspects of the NNAB's review activities. Among those aspects were the NNAB member's efforts to establish the relationship between past and current problems and corrective actions, probing questions on how training is used to improve performance, skepticism toward glowing accreditation team reports, and a questioning attitude reflecting an exceptional level of preparation. Observers also commented favorably on the depth of questioning in the areas of self-assessment, corrective actions, and sustainability of corrective actions.

An observer noted that during a NNAB discussion immediately prior to the licensee's entry into the meeting, board members asked the INPO staff what, if any, adverse impact would result from placing the plant on probation. This was discussed with INPO as a means of assuring that Board probation decisions would not be influenced by concerns of adverse impact.

Several observers noted Board 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. The SAT-related issues probed by the Board were similar to the types of weaknesses identified by the NRC during for-cause training inspections conducted since 1996. NRC observation of accreditation activities indicated that training programs accredited by the National Nuclear Accrediting Board continue to be effective.

As described in the Memorandum of Agreement between INPO and NRC, NRC resident inspectors 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 training issues were identified in calendar year 2003 as a result of resident inspectors' 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-lead Accreditation Team Visits and to the NNAB.

The 2003 meeting was held at INPO Headquarters, in Atlanta, GA, on August 8, 2003. Discussion topics included changes to the accreditation process, an update on the Plant Evaluation Improvement Initiative, licensed operator requalification, experience with the operator requalification significance determination process, influence of the training process on safety culture, and implementation of the simulator rule. The minutes for the 2003 INPO/NRC meeting can be found in ADAMS at ML032690117.

CONCLUSIONS

During calendar year 2003, the NRC identified eight facilities that were outliers in the areas of human error, training, and skill of the craft. In addition, six non-cited violations were issued involving simulator fidelity discrepancies.

While the monitoring of industry performance in the area of training during 2003 provided some indications of training program weaknesses, overall, the industry is successfully implementing training programs in accordance with the regulations.

Calendar year 2003 activities 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.