

ANNUAL REPORT  
ON  
THE EFFECTIVENESS OF TRAINING  
IN THE NUCLEAR INDUSTRY  
FOR  
CALENDAR YEAR 2000

September 2001

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BACKGROUND

The history of NRC regulation of training in the nuclear industry dates to the 1982 Nuclear Waste Policy Act (NWPA) which required the NRC to provide guidance on the instructional requirements for workers at nuclear power plants. To meet this directive, the Commission published a policy statement on training in March 1985 that endorsed the performance-based training accreditation process managed by the Institute of Nuclear Power Operations (INPO). When issuing the policy statement, the Commission deferred rulemaking to allow the industry to continue its efforts to upgrade their training programs. After an initial two-year period, evaluations of the accreditation process concluded that it was generally effective in improving the training programs, and 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 the existing 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 Guides 1.8 on personnel training and 1.149 on simulator certifications, requiring operating examinations to be conducted on a simulator, and establishing the licensed operator requalification training program.

In response to a 1990 court decision requiring a rule on training to satisfy the NWPA, 10 CFR 50.120, "Training and Qualification of Nuclear Power Plant Workers," was issued in April 1993 and became effective in November 1993. This rule recognizes that the safety of nuclear power plant operations and the assurance of general public health and safety depends on personnel performing at adequate levels. The rule requires that training programs be established, implemented and maintained using a systems approach to training (SAT) for nine categories of non-licensed workers at nuclear power plants. The systematic determination of job

performance qualification requirements and the provision for periodic retraining enhance public confidence in the ability of workers to perform successfully when required. The Code of Federal Regulations, 10 CFR 50.120, complements the requirements for SAT-based training for the requalification of licensed operators contained in 10 CFR Part 55, which were issued in 1987. 10 CFR Part 55 allows facility licensees to have an operator requalification program content that is derived using a SAT-based process or which meets the requirements outlined in 10 CFR 55.59 (c) (1) through (7).

### NRC MONITORING OF TRAINING

Public health and safety depend on proper operation, testing, and maintenance of plant systems and components by nuclear power plant personnel. Successful performance by nuclear power plant personnel is assured by having workers achieve and maintain job-task qualification through the SAT-based training and continuous retraining required by 10 CFR Part 55 and 10 CFR 50.120. The overall implementation of a systems approach to training is monitored by INPO as part of their accreditation reviews and is reflected in the status of accreditation throughout the industry as a whole. Therefore, 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 perspectives of the revised 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 for subsequent entry into the Human Factors Information System (HFIS). After entry into HFIS, that data is analyzed to identify the training-related performance issues. The NRC obtains additional data during the conduct of inspections of training programs when an appropriate cause is identified; and during the administration, inspection, and review of the results of licensed operator initial and requalification training activities. To obtain the Accreditation Process perspective, NRC assesses implementation of training by reviewing the effectiveness of the accreditation process administered by INPO by observing an Accreditation Team Visit and by observing meetings of the National Nuclear Accrediting Board. These activities were selected because

they provide an efficient and effective assessment of industry activities with minimal impact on licensees. Although each activity can provide 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 operators is contained in NUREG 1021, "Operator Licensing Examination Standards." Guidance for inspecting the aspects of the operator training programs unique to requalification is found in Inspection Procedure 71111.11, "Licensed Operator Requalification Program Evaluation." 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 Operator Licensing and Human Performance Section (IOHS) of the Equipment Quality and Performance Branch in the Office of Nuclear Reactor Regulation has the programmatic responsibility for ensuring that utilities implement training requirements addressed by 10 CFR 50.120 and 10 CFR Part 55 in an acceptable manner.

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 was formed in cooperation with the Nuclear Energy Institute (NEI) to provide 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. Based on the demonstrated success of this focus group in identifying and resolving issues, the potential exists to use the focus group approach as a forum for addressing generic training-related issues in all areas.

## Training-Related HFIS Data

### *Issues in LERs, Inspection Reports and Examination Reports*

Several aspects of worker performance are continually monitored and documented in the Human Factors Information System (HFIS) by the Operator Licensing and Human Performance Section (IOHS) during its ongoing reviews of LERs, inspection reports, and operator licensing examination reports. Twice each year IOHS compiles the available human performance data from HFIS for all plants, including training data, and identifies those plants where power plant worker performance may challenge a licensee's ability to operate safely.

**Figure 1 - HFIS 4-Year Trend**

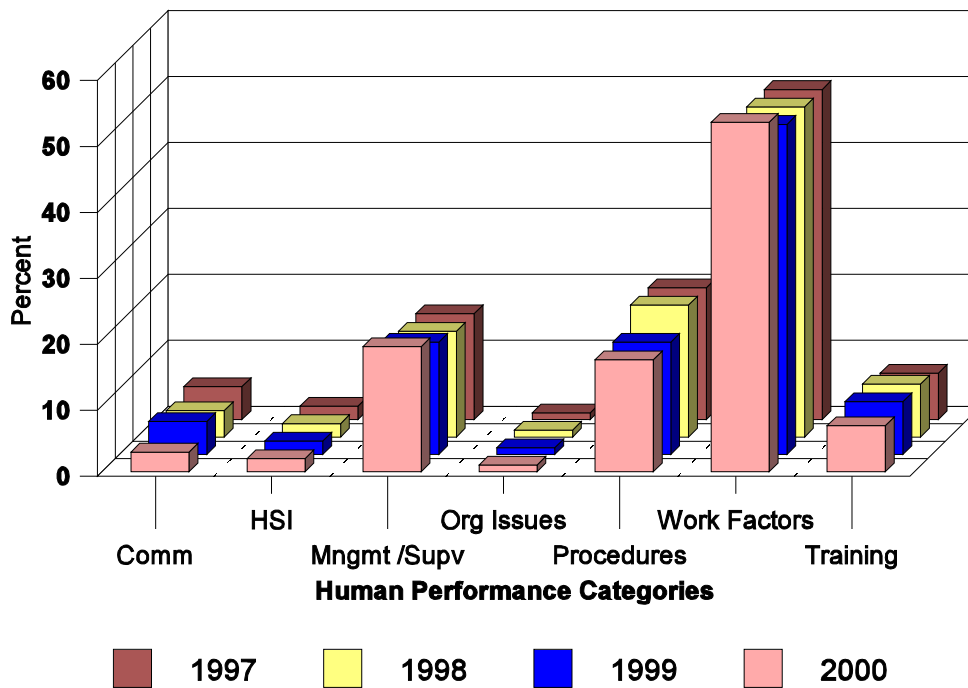


Figure 1, *HFIS 4-Year Trend*, shows the relative contribution of various categories of human performance issues to the overall industry total. A total of 5,207 human performance items was identified in LERs, inspection reports and examination reports during 2000. Of that total, 375 items were related to training. Over the last four years, the contribution of training has remained relatively constant at approximately 8 percent for the industry as a whole. A review of the 2000 data showed that the number of training-related items for most licensees is

clustered near the industry mean. The number of training items at seventeen plants identified them as having outlying performance in the area of training. Seven of the seventeen plants were identified as also having outlying overall human performance. Within the context of this report, outlying performance is defined as exceeding two times the national average for the industry as a whole.

As shown in Figure 1 on page 4, *Work Factors* continues to be the single largest contributor to overall human performance. *Work Factors* comprises 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. Many training-related issues are reflected in the area of *Work Practices*.

An analysis of training items by NRC Region showed that the distribution of training-related issues among the regions in 2000 varied from that of previous years. In 1997 and 1998, the training issues were evenly distributed among the Regions with a deviation from the regional-group average of approximately 6 percent. In 1999, the deviation from the group average within the regional group increased to 24 percent. No specific cause was identified for this change. In 2000, the training issues were again evenly distributed among the Regions with a deviation from the regional-group average of approximately 4 percent.

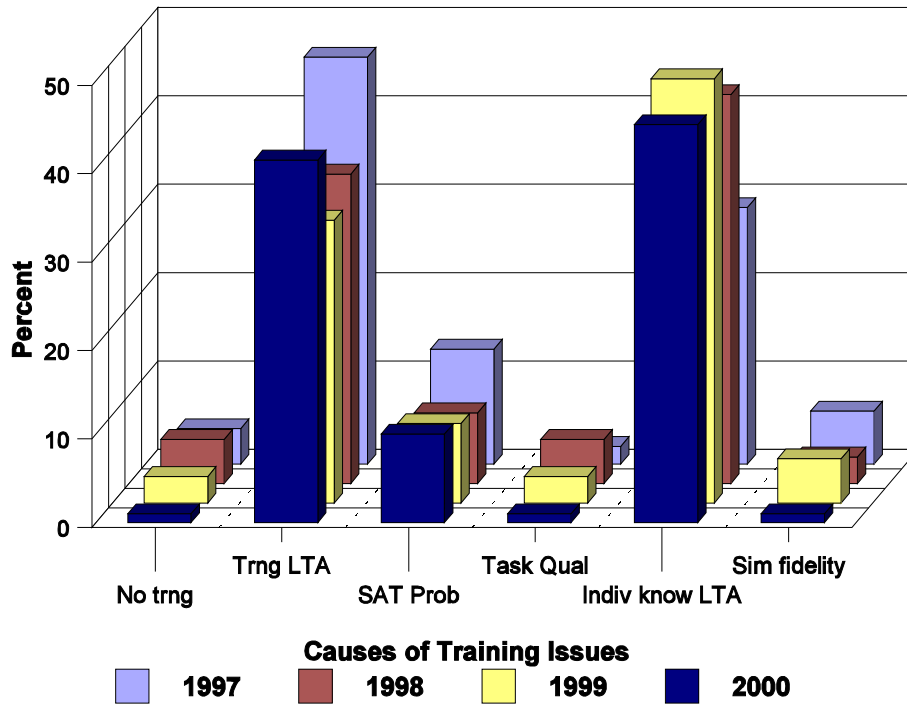
Figure 2, *HFIS 4-Year Training Data*, shows the breakdown of the training-related items into their specific causes. The graph in Figure 2 identified that the causes of the 375 training-related issues identified in 2000 continue to be concentrated in two distinct areas: "Training less than adequate (LTA)"<sup>1</sup> and "Individual knowledge less than adequate (LTA)"<sup>2</sup>. Approximately one-half of the individual knowledge deficiencies are linked to continuing training versus initial training.

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<sup>1</sup>Training was provided and was attended by the worker, but content was incorrect or incomplete.

<sup>2</sup>Complete and accurate training was received by the worker, but the worker was unable to perform successfully on the job.

**Figure 2 - HFIS 4-Year Training Data**

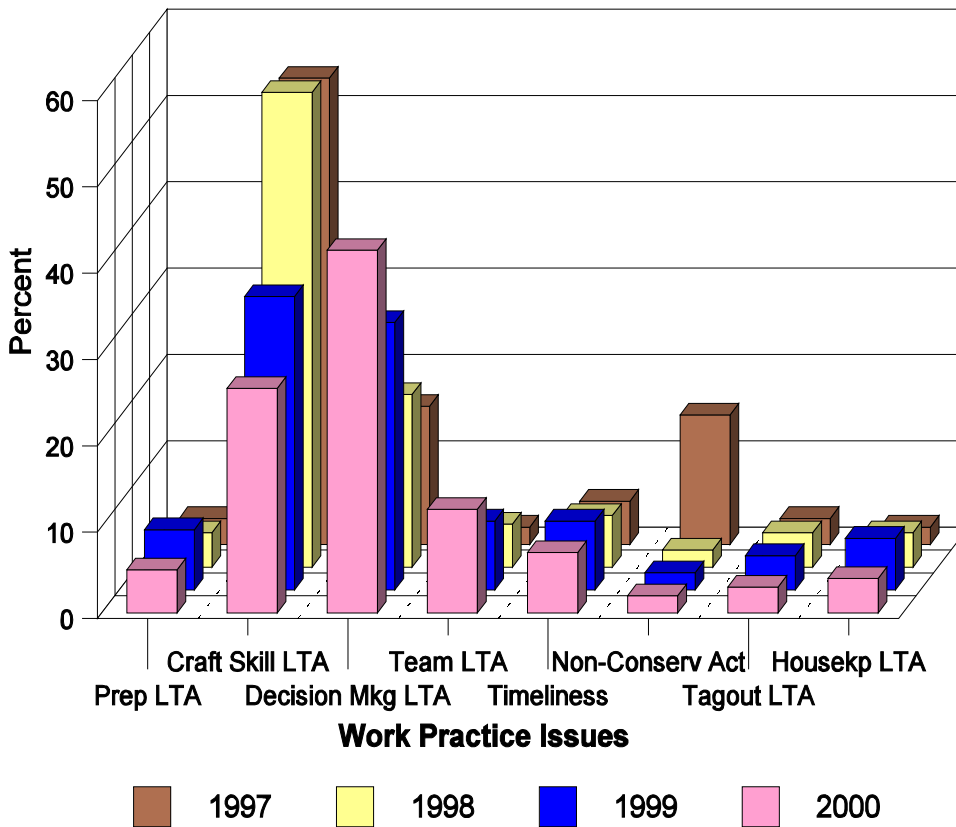


Inadequate training has historically been identified as a cause, and retraining recommended as the corrective action, for a wide variety of performance problems throughout the nuclear industry. When inadequate training has been determined to be a contributing cause to poor performance, often, all individuals who had the same training were retrained. However, corrective actions that focus on group retraining are not always successful because of differences in the level of skill throughout the worker population. Research has shown that wide-scale retraining is an appropriate solution for the resolution of performance issues only about 40 percent of the time.

The data shown in Figure 2 indicates that a balance has been struck between “Training LTA” and “Individual Knowledge LTA”, inferring a similar balance between the amount of group and individual retraining conducted. This balance appears to be borne out in figure 2 by an apparent decrease, in calendar year 2000, in individual knowledge LTA, i.e., a decrease in individual knowledge performance problems. A decrease in the number of individual knowledge performance problems can likely be credited to adequate evaluation of the group of training



**Figure 3 - HFIS 4-Year Work Practices Data**



program performance problems.

Figure 3, *2000 HFIS 4-Year Work Practices Data*, provides a breakdown of the 1380 work practice items identified in 2000. Increasing emphasis on individual performance can be seen in a decrease in the number of issues attributed to “Work practice or skill of the craft LTA” in 2000. The largest contributor, “Non-conservative decision making or questioning attitude less than adequate (LTA),”<sup>3</sup> may be linked to training. The increase may indicate a problem with the use of SAT with regard to program evaluation in this area. Inadequate training program evaluation has been noted as a weakness during recent NRC for-cause inspections of training. Sufficient data is not available to indicate whether this represents an increasing trend.

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<sup>3</sup> if personnel fail to stop work or establish appropriate controls when presented with unfavorable or uncertain conditions

## **NRC Inspection of Licensee Training Programs**

### *For-Cause Training Inspections and Operator Licensing Examination Report Findings*

The NRC can inspect facility training programs at any time to verify satisfactory implementation of the training requirements in 10 CFR Parts 50 and 55. Through inspections conducted prior to the implementation of 10 CFR 50.120, the NRC had found that training programs accredited and implemented consistent with the industry-wide objectives would be in compliance with the requirements contained in Parts 50 and 55 to have SAT-based training programs. As a result, training program performance indicators are monitored in lieu of routine inspection. Training program inspections are conducted whenever the number or type of training-related human performance issues suggests training-related deficiencies. An inspection of training programs was conducted at one site, Nine Mile Point, during calendar year 2000.

The Nine Mile Point (NMP) training inspection was conducted in June 2000 and focused on both the licensed and non-licensed operator training programs. The results of the inspection were documented in Inspection Report 50-220/2000-04 and 50-410/2000-04. The inspectors found that NMP failed to consistently implement the systems approach to training (SAT) process for the licensed operator training program as required by 10 CFR 55.59(c) and failed to consistently implement the systems approach to training (SAT) process for the non-licensed operator (shift technical advisors, auxiliary operators, licensed operator candidates) training programs as required by 10 CFR 50.120. Specifically, the licensed operator, initial licensed operator, non-licensed operator, and shift technical advisor training programs were not evaluated and revised based on observed performance deficiencies of licensee personnel in the job setting. Corrective actions to the self-revealing deficiencies addressed the apparent symptoms, but corrective actions to prevent recurrence were missing or erratic.

Inspections of licensed operator requalification programs continue to identify site-specific strengths and weaknesses. The performance level of licensed operator requalification training programs, as a whole, at the power reactor facilities inspected is being sustained. 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. From an industry-wide perspective, inspections of licensed operator requalification activities identified three recurring issues. The industry continues to be challenged in the areas of written exam quality, use of repetitive examination questions, and the validation of job performance measures. The follow-up review of the licensed operator requalification findings confirmed site specific weaknesses but did not indicate any programmatic weaknesses. The implementation of SAT-based training in the operator programs was adequate to assure operator competence in safely performing licensed duties.

## **Monitoring the Accreditation Process**

### *Observing Accreditation Activities and Coordinating Activities with INPO*

The NRC monitors 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 problems have been identified through routine monitoring.

### *Observing Accreditation Activities*

The NRC uses observations of the National Nuclear Accrediting Board (NNAB) meetings as a means of assuring that training programs accredited and implemented in accordance with the INPO objectives would be in compliance with the SAT requirements contained in 10 CFR 50.120 and 10 CFR Part 55. NRC staff attended eight meetings of the NNAB during calendar year 2000. The staff observed the presentation of training programs from 21 sites to the Board for accreditation renewal. During the 22 sessions that the NRC attended (one facility appeared before the Board twice), the NNAB reviewed technical programs from 15 of the sites and operator training programs at seven sites. The staff observers were drawn from various levels of the NRC staff and included representatives from headquarters and three of the four regions.

The NRC observers noted several positive aspects of the Board's review activities. Among those aspects were the NNAB member's efforts to establish the relationship between past problems and current ones. Several of the observers noted that the scope and quality of the accreditation self-evaluations conducted by the utilities varied. However, the observers noted that the Board adequately probed areas which should have been identified by the utility in their self-evaluation but were only found by the accreditation team. In addition, the observers noted the depth of questioning by the Board in the areas of follow-through, corrective actions, and

sustainability of corrective actions. Observers from several different meetings noted issues related to the implementation of the systems approach to training which were probed by the Board. SAT issues were related to the areas of Analysis, Design, Trainee Evaluation (including evaluation of instructors), and Program Evaluation. The range of SAT-related issues probed by the Board reflected similar types of weaknesses identified by the NRC during for-cause training inspections conducted since 1996. A summary of NRC Accrediting Board observations, particularly those comments related to implementation of SAT, were discussed at the April 11, 2001, INPO/NRC coordination meeting on training. Based on the range of questions and the depth to which weaknesses were probed, the training programs accredited by the National Nuclear Accrediting Board continue to be effective and the NRC continues to have a favorable assessment of the accreditation process.

INPO described the outcomes of their pilot effort to incorporate the accreditation review process into the plant evaluation process at the INPO/NRC coordination meeting. The two evaluations were combined to reduce the burden on facilities and to allow a broader look at the issues. The accreditation objectives and criteria used to evaluate the training programs were unaffected by the team consolidations. NRC is monitoring the implementation of this approach to ensure that results continue to provide a favorable view of accreditation. In July 2000, NRC observed a combined plant evaluation/accreditation team visit. The observer noted that the accreditation objectives and criteria used to evaluate the training programs were unaffected by the combined team.

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 2000 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. During these meetings, NRC representatives also discuss the observations made by NRC observers to the NNAB. The 2000 meeting was held at NRC Headquarters, in Rockville, MD on February 28, 2000. Discussion topics included a description of changes being made to the accreditation review process, changes in the operator licensing application process, implementation of Revision 8 to NUREG 1021, Examination Standards, INPO accreditation and training initiatives, and a review of the SAT issues identified by the NRC during inspections as well as the SAT implementation issues raised by observers to the NNAB. The minutes for the 2000 INPO/NRC training-related meeting can be found in ADAMS, the NRC's document management system, at ML003701239.

The 2001 INPO/NRC Training Coordination Meeting was held on April 11, 2001 at INPO Headquarters in Atlanta, GA. Agenda topics included the exam question bank, proposed changes to 10 CFR Part 55, simulator manipulations, and trends related to the results of NRC license exams in 2000.

In addition, INPO presented an overview of the outcomes of their training accreditation visits. Technical programs at six (6) nuclear power plants were placed on accreditation probation in calendar year 2000 by the NNAB for training program deficiencies. The number of probations was sufficiently high that INPO organized a Training Improvement Task Force to determine the underlying causes. The following common themes were identified at those facilities placed on probation:

1. Training was not a part of core business.
2. Training was conducted for training's sake and was not seen as a tool to improve performance.
3. Weaknesses applied to technical and operator training programs.
4. Senior management was not engaged.

Moreover, the following findings were contributors to these common themes:

1. Independent self-assessments were not rigorous.
2. Corrective action programs were weak.
3. Training performance indicators, in their present format, were not useful.
4. Accreditation preparation visits were viewed as a cyclical effort vice an ongoing effort.

The NNAB is to be commended for placing facilities on accreditation probation and INPO is to be commended for attempting to determine the causes of the increasing number of accreditation probations. However, the NRC is concerned about the apparent negative trend in training performance indicated by the number of probations. The NRC will continue to monitor INPO activities and industry training to ensure weaknesses are addressed and the effectiveness of training continues.

## CONCLUSIONS

The monitoring of industry performance by IOHS during 2000, in the area of training, provided some indications of specific weaknesses in training programs. The calendar year 2000 activities monitoring the effectiveness of training in the industry continued to provide confidence that the training requirements contained in 10 CFR Parts 50 and 55 are being met.