ANNUAL REPORT
ON
THE EFFECTIVENESS OF TRAINING
IN THE NUCLEAR INDUSTRY
FOR
CALENDAR YEARS 2001 AND 2002

August 2003

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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 Equipment and Human Performance Branch 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 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 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 for cause inspections of training programs; and during the administration, inspection, and review of licensed operator initial and requalification training activities.

To obtain the accreditation process perspective, NRC assesses the effectiveness of the industry's use of the systems approach to training and the accreditation process by observing Accreditation Team Visits and meetings of the NNAB. These activities were selected as they provide an efficient and effective assessment of industry training activities and initiatives while having 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 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 “Reactor Safety Initiating Events, Mitigating Systems, Barrier Integrity,” 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. Based on the success of this 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

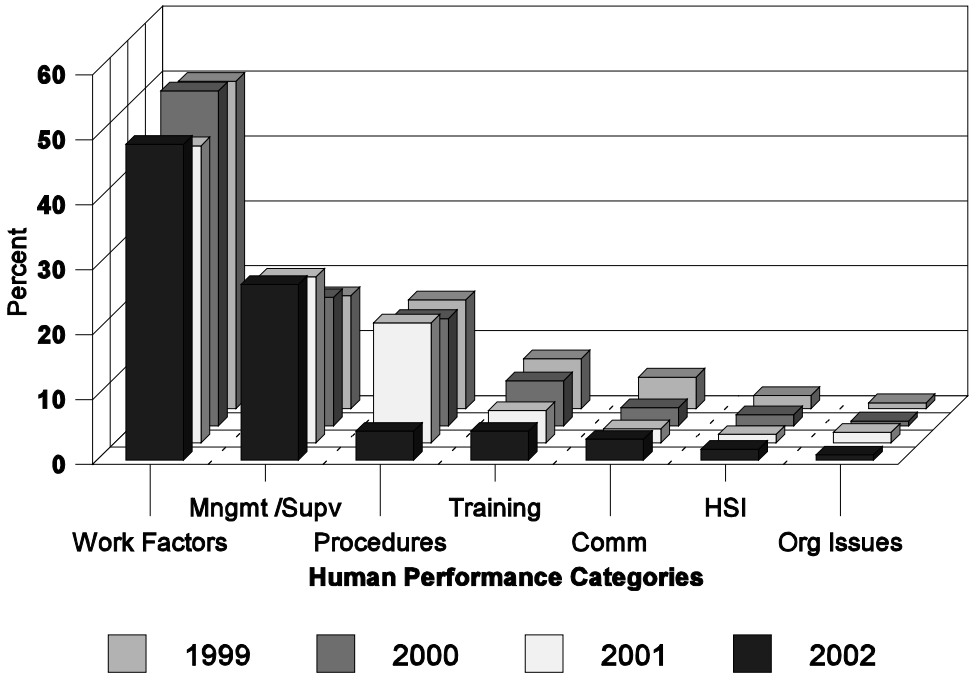

Figure 1, *HFIS 4-Year Trend*, shows the relative contribution of various categories of human performance issues to the overall industry total. A total of 3,041 human performance items were identified in LERs, inspection reports and examination reports during 2001. Of that total, 130 items were related to training. A total of 4,016 human performance items were identified in LERs, inspection reports and examination reports during 2002. Of that total, 193 items were related to training. Over the last four years, the contribution of training, for the industry as a

whole, has decreased from 7.7 percent in 1999 to 4.5 percent in 2002. A review of the 2001 and 2002, data shows that the number of training-related items for most licensees is clustered near the industry mean.

Within the context of this report, outlying performance is defined as exceeding two times the national average for the industry as a whole. For 2002, the number of training items at nine plants identified them as having outlying performance in the area of training. Five of the nine plants were among those plants identified as having outlying overall human performance.

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"[1]

[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

Figure 2 - HFIS 4-Year Training Data

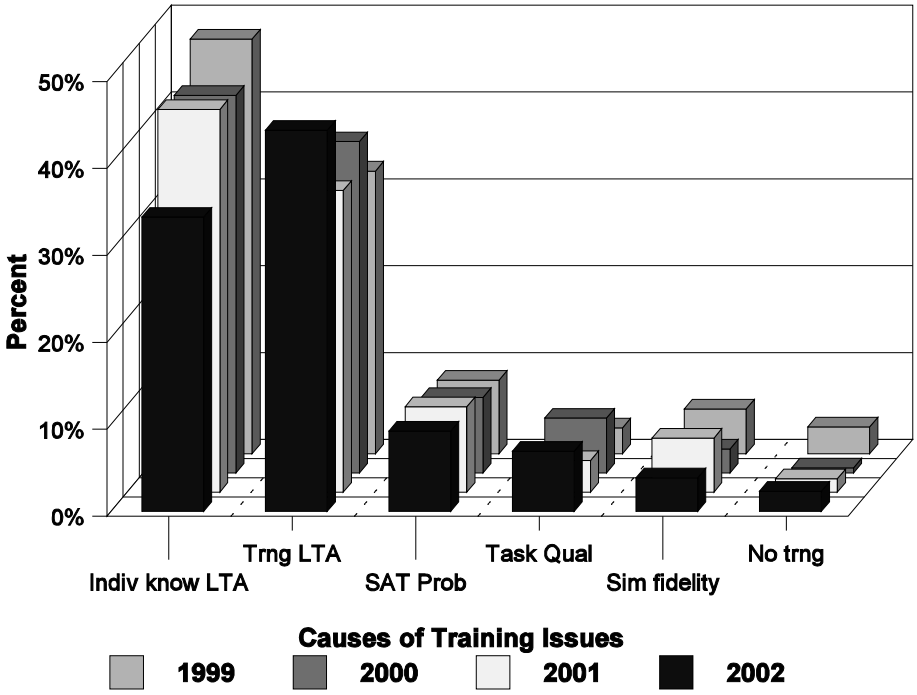

Figure 2, *HFIS 4-Year Training Data*, shows the breakdown of the training-related items into their specific causes. The graph in Figure 2 identified that the causes of the 325 training-related issues identified in 2001/2002, continue to be concentrated in two distinct areas: "Training less than adequate (LTA)"[2] and "Individual knowledge less than adequate (LTA)[3]." The individual knowledge deficiencies are split approximately equally between continuing training and initial training.

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.

[2]Training was provided and was attended by the worker, but content was incorrect or incomplete.

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

Figure 3 - HFIS 4-Year Work Practices Data

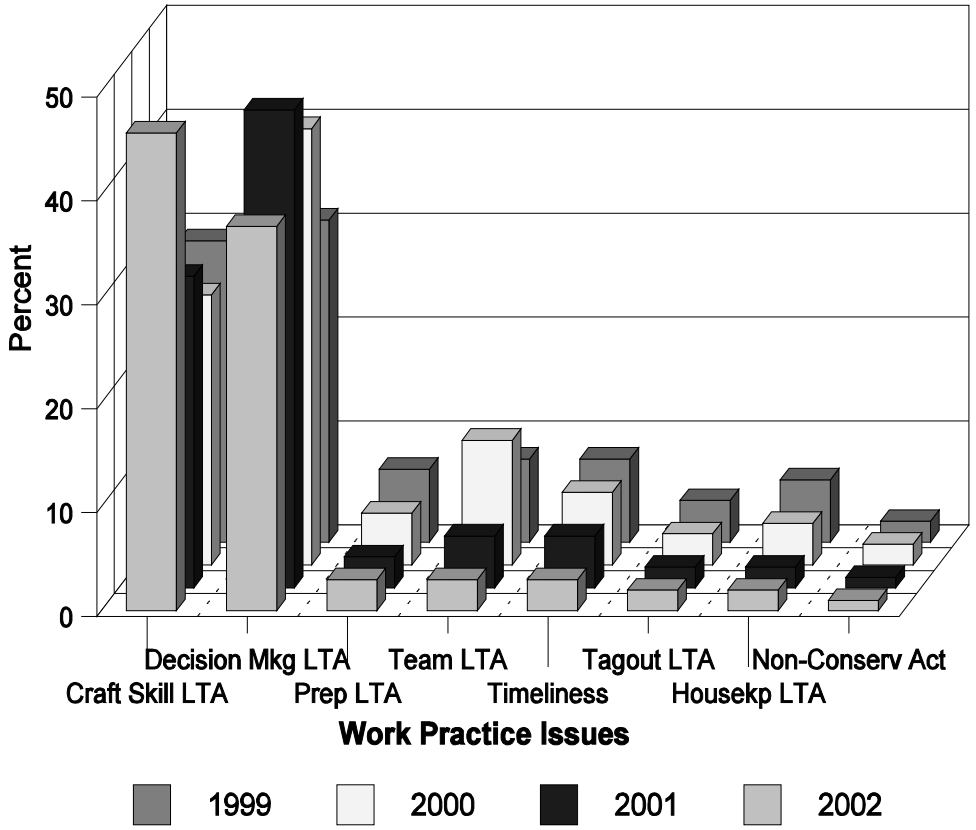

Figure 3, *2002, HFIS 4-Year Work Practices Data*, shows the breakdown of the 1023 *Work Practices* items identified in 2002. "Work practices or skill of the craft less than adequate" increased during 2002, and accounted for more than 45% of the *Work Practices* deficiencies. It is not possible to determine that portion of this area attributable solely to training or if this increase in identified deficiencies is due to the aging of the nuclear workforce. 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, total training deficiencies account for 20% of the total human performance deficiencies for 2002.

NRC INSPECTION 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. Training program inspections are conducted whenever the number or type of training-related human performance issues suggests training-related deficiencies. For cause inspections of training programs were not conducted during calender years 2001 and 2002. However, during this period, IP 41500 and NUREG 1220 were used as investigatory tools while performing the following inspections:

Indian Point 2 - Inspection Procedure 95003, “Supplemental Inspection for Repetitive Degraded Cornerstones, Multiple Degraded Cornerstones, Multiple Yellow Inputs, or One Red Input” (IP 95003)

> The January 2001, Indian Point 2 (IP2) IP 95003 inspection was performed in response to the facility’s having multiple degraded cornerstones. The team verified the training and qualifications of station personnel with respect to the level of work assigned. The team conducted observations of training using the guidance and checklists found in NUREG-1220. The team observed that operator performance issues have contributed to previous events and that some performance problems continued to occur. Operator performance errors were observed in the August 1999, reactor trip, the February 2000, steam generator tube failure, and the January 2001, turbine trip. The team noted an increased emphasis on overall improvement and a recognition of the need for an improved training program. However, a number of program and process issues were identified. The results of the inspection are documented in Inspection Report 50-247/2001-002 (ML011000373).

Indian Point 2 - Inspection Procedure 95002, “Inspection For One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area” (IP 95002)

The April 2002, inspection activities at Indian Point 2 focused on the evaluation of the crew high failure rate during facility-administered annual licensed operator requalification examinations. Initial inspection activities associated with the high crew failure rate consisted of independent assessment of licensed operators performance, evaluation of scenario quality, evaluation of remediation, and interviews of members of the training and operations staff. The findings from the initial inspection activities were preliminarily characterized as having substantial safety significance (Yellow) in NRC Inspection Report 50-247/2001-13 (ML013410076).

In April 2002, the NRC completed an IP 95002 supplemental inspection at IP2. The team conducted observations of training using the guidance and checklists found in NUREG-1220, evaluation of remediation, and interviews of members of the training and operations staff. The team determined that the performance issues associated with the crew high failure rate had existed in other areas of operator training for at least three years. However, continued ineffective, and in many cases incomplete, response to the corrective actions associated with prior assessments and evaluations prevented any significant improvement in operations training. Audits and self-assessments of operations training were conducted by station personnel, contractors, and industry peers at least annually since 1998. The audits and assessments were critical of all aspects and areas of operations training, including plant specific knowledge of the instructors, the lack of instructors with IP2 experience, the quality of lesson materials, and the fundamental knowledge weaknesses of the licensed operators. However, the inspectors noted that none of the audits or self-assessments identified long-term operator performance, either in the simulator or control room, as an area of concern. The results of the inspection are documented in Inspection Report 50-247/2002-09 (ML021510228).

Inspections of licensed operator requalification programs continue to identify site-specific strengths and weaknesses. The staff continues to believe 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.

During this reporting period, the staff made one yellow, one white, and three green findings on operator requalification. In addition, four operator licensing issues were identified.

The yellow finding involved the crew high failure rate during facility-administered annual licensed operator requalification examinations at IP2 (discussed on page 9)

The white finding involved an examination compromise at Cooper resulting from an improper validation process for the July 2000 biennial written requalification examinations. The staff identified the issue in the fall of calendar year 2001. After the examinations were regraded, two operators were found to have failed the examination. In May 2002, the staff conducted a supplemental inspection per IP 95001 and concluded that the licensee had satisfactorily addressed all of the requalification issues associated with the finding and implemented all required corrective actions.

The three green findings were at Calvert Cliffs (methods and standards used to reactivate operator licenses to support refueling outages), LaSalle (two of nine crews failed the requalification operating test), and Millstone, Unit 3 (two of ten crews failed the dynamic simulator portion of the licensed operator requalification examination).

Four additional issues have been identified. At Kewaunee, three simulator issues have been identified concerning the failure to comply with 10 CFR 55.46, "Simulation Facilities." The first issue involves the failure to maintain simulator fidelity by correcting modeling and hardware discrepancies, discrepancies identified from scenario validation and discrepancies identified during performance testing per 10 CFR 55.46(d)(2). The second issue involves the failure to conduct performance testing throughout the live of

the simulation facility per 10 CFR 55.46 (d)(1). The third involves the failure to ensure all required testing of the simulator is up to date with the most recent core load prior to taking credit for reactivity manipulations to meet NRC licensing examination eligibility requirements per 10 CFR 55.31 (a)(5) and 55.46 (c)(2). These issues are considered unresolved and are being considered for enforcement.

In the fourth issue, Dresden had not conducted a comprehensive biennial requalification written examination during the last requalification program cycle (10 CFR 55.59(c)). Dresden administered the exam approximately 6 months late. The NRC issued an exemption to allow the requalification program to resume a proper examination schedule and issued 47 notices of enforcement discretion to individual operators. This issue is being considered for enforcement.

Overall, the NRC's licensed operator requalification inspection program continues to effectively ensure 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.

MONITORING 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 2001, and eight meetings during calendar year 2002. The staff observed the presentation of training programs from 37 sites to the NNAB for accreditation renewal. During the 42 sessions that the NRC attended (five facilities appeared before the Board twice), the NNAB reviewed technical programs from 17 of the sites and operator training programs from 25 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 problems and current ones, questions that are comprehensive and thorough, and a deep questioning attitude that reflects a exceptional level of preparation.

One observer noted that the Board asked critical and probing questions on a repeat area for improvement that had also been identified in the last annual Recurring Weaknesses letter. Observers also commented favorably on the depth of questioning in the areas of self-assessment, corrective actions, and sustainability of corrective actions. Several observers

noted 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 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. 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.

An observer noted that during a 2002, Board meeting prior to the licensee's entry into the meeting, board members asked the INPO staff what, if any, adverse impact placing the plant on probation would have on the plant.

The "Annual Report on the Effectiveness of Training in the Nuclear Industry For Calendar Year 2000" described efforts by INPO to consolidate the accreditation review process and the plant evaluation process. Problems encountered with management of the two processes in a combined manner has resulted in the consolidated team effort to be canceled.

During calendar year 2002, INPO and the NANT changed the objectives and criteria associated with the process of accrediting training programs. The new objectives and criteria were used on Accreditation Team Visit reviews conducted after September 2002. The previous objectives were: 1) Training Program Content, 2) Organization and Management of Training, 3) Development and Qualification of Staff, 4) Analysis, Design, and Development, 5) Conduct of Classroom Training and Individualized Instruction and Trainee Evaluation, 6) Conduct of Laboratory and In-Plant Training and Trainee Evaluation, 7) Conduct of Simulator Training and Trainee Evaluation, and 8) Systematic Evaluation of Training Effectiveness.

The new objectives are: 1) Training for Performance Improvement, 2) Management of Training Processes and Resources, 3) Initial Training and Qualification, 4) Continuing Training, 5) Conduct of Training and Trainee Evaluation, and 6) Training Effectiveness Evaluation. Objectives 2 through 5 are a compilation of the objectives and criteria from the previous system. Objective 1 requires facilities to look at the impact, either positive or negative, training

has on plant performance. In addition to a change in the objectives, the format and information required to be in the Accreditation Self Evaluation Report was also changed.

During the period of this report, NRC observers from Headquarters observed the on-site accreditation team activities leading up to the meeting with the Board. NRC participated in Accreditation Team Visits at Oyster Creek (August 2001), Millstone (June 2002), and McGuire (November 2002). The Oyster Creek and Millstone visits were conducted using the prior accreditation objectives and criteria. The McGuire visit was conducted using the new objectives and criteria. In all cases, the NRC observer found that the INPO team was professional in all its interactions with the licensee, worked well together, identified strengths and areas for improvement and corroborated findings. The observer also noted that the teams were particularly effective in supporting their conclusions with facts.

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 years 2001, and 2002, 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 INPO-lead Accreditation Team Visits and to the NNAB.

The 2001, meeting was held at INPO Headquarters, Marietta, Georgia on April 11, 2001. Discussion topics included results of the training improvement task force, on-line training and professional development seminars, the effectiveness of the Memorandum of Agreement between NRC and INPO, operator licensing, and activities of the accreditation working group. The minutes for the 2001, INPO/NRC meeting can be found in ADAMS at ML011090268.

The 2002, meeting was held at NRC Headquarters, in Rockville, MD on April 10, 2002. Discussion topics included guidance documents referenced in Licensing Basis documents, an update on the Accreditation Improvement Initiative, training warning flags and recurring accreditation weaknesses, recent problems noted in licensed operator requalification, experience with the operator requalification significance determination process, and implementation of the simulator rule. The minutes for the 2002, INPO/NRC meeting can be found in ADAMS at ML021160697.

NRC activities monitoring the effectiveness of the accreditation process continue to provide confidence that accreditation is an acceptable means of ensuring that 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.

CONCLUSIONS

The monitoring of industry performance by IOHS during 2001 and 2002, in the area of training, provided some indications of limited specific weaknesses in training programs. However, all indicators suggest that, overall, the industry is successfully implementing training programs in accordance with the regulations.

The calendar year 2001, and 2002, 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.