U. S. NUCLEAR REGULATORY COMMISSION
REGION I

SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE

INSPECTION REPORT 50-289/85-98

GENERAL PUBLIC UTILITIES NUCLEAR CORPORATION

THREE MILE ISLAND NUCLEAR GENERATING STATION UNIT ONE

ASSESSMENT PERIOD: SEPTEMBER 16, 1985 - JANUARY 10, 1986

BOARD MEETING DATE: JANUARY 24, 1986

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I. INTRODUCTION

A. Purpose and Overview

The Systematic Assessment of Licensee Performance (SALP) is an integrated NRC staff effort to collect available observations and data on a periodic basis to evaluate licensee performance. The SALP process is supplemental to the normal inspection processes used to ensure compliance with NRC rules and regulations. It is intended to be sufficiently diagnostic to provide a rational basis for allocating NRC resources and to provide meaningful guidance to the licensee's management in order to improve the quality and safety of plant operations and modifications.

This SALP is termed an interim SALP in that it covers the period from a few weeks prior to criticality to several days after the completion of the power escalation program. The purposes of this interim SALP are (1) to assist in the preparation for the first of two Commission-directed performance appraisal team (PAT) inspections, (2) to verify performance during the transition from a long-term shutdown condition to commercial power operation, and (3) to determine the allocation of NRC resources for future inspections.

An NRC SALP Board, comprised of the staff members listed in Section B, met on January 24, 1986, to review the collection of performance observations and data to assess the licensee's performance in accordance with the guidance in NRC Manual Chapter 0516, "Systematic Assessment of Licensee Performance." A summary of the guidance and evaluation criteria is provided in Section II of this report.

This report is the SALP Board's assessment of the licensee's performance at TMI-1 Nuclear Generating Station for the period September 16, 1985, through January 10, 1986. The summary findings and totals reflect a relatively short period compared to the normal assessment period which is at least 12 months.

B. SALP Board Members

Chairman

R. Starostecki, Director, Division of Reactor Projects

Members

R. Bellamy, Chief, Radiation Protection Branch, DRSS (Part Time)
L. Bettenhausen, Chief, Operations Branch, DRS
R. Blough, Chief, Reactor Projects Section No. 1A, DRP
R. Conte, TMI-1 Senior Resident Inspector
S. Ebneter, Director, DRS (Part Time)
W. Kane, Deputy Director, DRP
H. Kister, Chief, Projects Branch No. 1, DRP (Part Time)
P. McKee, Chief, Operating Reactor Programs Branch, Division of Inspection Programs, IE
J. Thoma, TMI-1 Operating Reactors Project Manager, Project Directorate No. 6

Other Attendees

N. Blumberg, Lead Reactor Engineer, DRS (Part Time)
R. Urban, Reactor Engineer, RPS 1A, DRP (Part Time)
R. Weller, Section Leader, Project Directorate No. 6
F. Young, TMI-1 Resident Inspector

C. Background

1. Licensee Activities

The major milestones of the licensee's power escalation program along with completion dates are listed in Figure 1. This schedule was proposed by the licensee and agreed to by the NRC staff. The licensee completed its program within a few days of the planned schedule. The program included six NRC Region I hold points.

The assessment period began with the plant in hot shutdown. The reactor was taken critical on October 3, 1985, for natural circulation testing and other low power tests. On October 9, 1985, the main generator was placed on-line.

Between October 13 and 18, 1985, the turbine was taken off-line several times with the reactor at low power to repair weld failures on drain lines from steam inlet piping to the main turbine.

On October 19, 1985, a test of the reactor trip on loss of main feedwater was initiated from 40 percent power and a subsequent natural circulation test was completed. The reactor was restarted and the main turbine generator placed on-line on October 23, 1985, then taken to 48 percent power.

The reactor was then operated at 48 percent power for operator training and steam generator leakage monitoring. Between November 24, 1985, and December 27, 1985, the licensee completed additional planned steady-state power operation at 75 percent power. On December 27, 1985, the NRC released the licensee to take the plant to full power. However, the maximum achievable power was limited due to secondary side fouling of the steam generator, which caused higher than expected steam generator water levels. Even after raising the steam generator water level limit, as has been done at other B&W plants which experienced the same problem, the licensee was able to achieve only 88 percent of full power.

On January 2, 1986, the licensee satisfactorily completed the final power ascension tests -- reactor trip on turbine trip and EFW initiation on loss of reactor coolant pumps. After the planned January 2 trip and an unplanned trip during start-up on January 4, the steam generator fouling was apparently alleviated and the plant reached full power.

During the above period, two unplanned reactor trips occurred: on December 1, 1985, from 75 percent power, as discussed above, and on January 4, 1986, from 22 percent power. The first occurred because of a main generator breaker trip due to a malfunction in a main electrical generator protection relay. The other occurred because of another secondary plant malfunction that caused a high level in a moisture separator which resulted in a turbine-to-reactor trip.

The annual emergency preparedness exercise was completed satisfactorily on November 20, 1985. Also, the licensee completed construction of a new annex to the training building which, among other support functions, will house the plant-specific simulator scheduled for delivery in June 1986.

2. Inspection Activities

In May 1985, Region I established the TMI-1 Restart Staff organization to provide an intensive review of licensee activities using an augmented shift coverage plan. This organization continued to function from that time through delays in restart authorization and through the licensee's power escalation testing (PET) program. There was a high level of Region I management involvement including the Deputy Director, Division of Reactor Projects, who served as TMI-1 Restart Director on site.

Because of his knowledge of the TMI-1 plant and experience with the TMI-1 restart process, the senior resident inspector was designated TMI-1 Restart Manager and assigned the responsibility to manage inspection activities. Shift inspectors, experienced in B&W plant operations, included resident/project engineers from Region I, other regions, the NRC training center, and NRC contractors. Shift inspector activities ranged from 24 hours per day to 12 hours per day, depending on the pace of licensee activities. The resident inspector and Region I inspectors conducted follow-up reviews of a programmatic nature in response to shift inspector concerns. As time permitted, they conducted reviews of equipment operability and of the technical adequacy of selected procedures. Region-based specialist reviews also occurred in the areas of radiation protection, training, engineering support, security, and emergency preparedness.

To provide additional technical expertise and experience with the TMI-1 restart, the former senior resident inspector for TMI-1 was assigned as a technical assistant to the TMI-1 Restart Director.

A total of 3936 inspection hours were expended during the period (shift inspector coverage was approximately 40% of that total) with a distribution in the appraisal functional areas as shown in Table 2. The inspection hours occurred during a 17-week period which converts to 232 hours/week or approximately 12,000 hours annually. Summaries of inspection activities and identified violations are tabulated in Tables 1 and 4 respectively.

This report also discusses "Training and Qualification Effectiveness" and "Assurance of Quality" as separate functional areas. Although these topics, in themselves, are assessed in the other functional areas through their use as criteria, the two areas provide a synopsis. For example, quality assurance effectiveness has been assessed on a day-to-day basis by resident inspectors and as an integral aspect of specialist inspections. Although quality work is the responsibility of every employee, one of the management tools to measure this effectiveness is reliance on quality assurance inspections and audits. Other major factors that influence quality, such as involvement of first-line supervision, safety committees, and worker attitudes, are discussed in each area.

II. CRITERIA

Licensee performance was assessed in selected functional areas significant to nuclear safety and the environment. Assessment areas were selected based on facility status (i.e., restart testing phase) and, for this interim SALP, NRC inspection program focus. Consequently, this interim SALP does not include certain typical SALP functional areas, such as emergency preparedness, security and safeguards, fire protection, technical support, and licensing. These will be addressed in the next SALP.

One or more of the following evaluation criteria were used to assess each functional area:

1. Management involvement and control in assuring quality
2. Approach to resolution of technical issues from a safety standpoint
3. Responsiveness to NRC initiatives
4. Enforcement history
5. Report and analysis of reportable events
6. Staffing (including management)
7. Training effectiveness and qualification

Based upon the SALP Board assessment, each functional area evaluated is classified into one of three performance categories. The definitions of these performance categories are:

Category 1. Reduced NRC attention may be appropriate. Licensee management attention and involvement are aggressive and oriented toward nuclear safety; licensee resources are ample and effectively used so that a high level of performance with respect to operational safety or construction is being achieved.

> The NRC attention recommendation may not be consistent with the above categories for a given SALP rating in a specific functional area. This is because of unique aspects of TMI-1 and because of public sensitivity to operational activities at the facility to which the NRC staff must be prepared to respond.

Category 2. NRC attention should be maintained at normal levels. Licensee management attention and involvement are evident and are concerned with nuclear safety; licensee resources are adequate and reasonably effective so that satisfactory performance with respect to operational safety or construction is being achieved.

Category 3. Both NRC and licensee attention should be increased. Licensee management attention or involvement is acceptable and considers nuclear safety, but weaknesses are evident; licensee resources appear to be strained or not effectively used so that minimally satisfactory performance with respect to operational safety or construction is being achieved.

Normally, the SALP Board assesses each functional area to compare the licensee's performance during the last quarter of the assessment period to that during the entire period in order to determine the recent trend for each functional area. Because of the short period covered by this SALP, the trend categories are not addressed, however, perceptible changes in performance in the last month of the period are addressed in the functional areas.

III. SUMMARY OF RESULTS

A. Facility Performance (September 16, 1985 - January 10, 1986)

	Functional Area	Category This Period
1.	Plant Operations	2
2.	Radiological Controls	1
3.	Maintenance	2
4.	Surveillance Testing	1
5.	Startup Testing	1
6.	Training and Qualification Effectiveness	1
7.	Assurance of Quality	1

B. Overview

Overall, licensee management prepared their operators and the plant well for restart in light of the long shutdown. Licensed operators conducted themselves competently and exhibited a detailed knowledge of the facility design and plant status. They demonstrated their skills especially well in operating the integrated control system in the manual mode. Despite signs of inexperience, non-licensed personnel also performed well. No plant trips occurred due to personnel error, but workers in safety-related spaces were not always careful in working around the equipment; this had the potential to cause safety system challenges. A strong training program contributed to the overall good results in operator performance.

Plant equipment was in good material condition and it reflected a strong preventive and corrective maintenance program applied during the long shutdown. The startup group assured that the numerous restart modifications were adequately tested to minimize operational problems during power ascension. Plant maintenance adequately maintained equipment subsequent to plant turnover. Very little safety-related equipment needed repairs during the startup test program.

In general, procedures were adequate but, in certain instances, problems with individual procedure steps challenged personnel in the proper implementation of the procedures. Even though a strong procedure control policy exists, apparently not all workers understand their responsibilities when procedures cannot be followed.

To varying degrees, the oversight review groups performed adequately. However, it appears that certain important findings by review groups were not effectively acted on by licensee management.

The radiological controls program continued to be implemented effectively during power operation. The unplanned radiological releases that occurred were due to poor work planning, not radiological planning.

The surveillance and startup test programs were strong, involved competent and dedicated personnel, and complemented each other in the restart. The power escalation program was slow and deliberate, and was effective in providing familiarization training for operators. It was also effective in identifying and correcting overall system integration problems.

The assessment covered a period of intense NRC staff review during transition from a long shutdown to commercial power operation. Licensee personnel attentiveness to the plant was probably heightened by these circumstances. Although many of the licensee's programs are strong, continued good nuclear safety performance will result only with effective program implementation and sustained personnel attentiveness and involvement.

Technical Support

Technical support staffing was ample with definite signs of both corporate and site engineering presence and involvement in plant activities. In general, management exhibited conservatism when faced with technical problems and, overall, technical support by licensee personnel was adequate but not aggressive. When technical problems could not be resolved immediately, appropriate interim measures were provided to assure nuclear safety, such as with the relief/safety valve problems associated with both the steam generators and the turbine-driven emergency feedwater pump steam inlet piping. In certain instances, however, appropriate measures or investigations were established only after prodding by NRC staff. Further, licensee review of certain problems or events could have been more thorough and complete. Apparently, engineering personnel and management were not always sufficiently inquisitive to assure a complete understanding of problems. In certain instances, especially during meetings on the sixth and final NRC hold point, there was an apparent attitude of shortsighted analysis of events. Upon final resolution, no unreviewed safety questions were identified, and ultimately, the licensee competently resolved the technical problems.

IV. PERFORMANCE ANALYSIS

A. Plant Operations (974 hours, 25%)

Analysis

The licensee displayed excellent overall control of the plant. Licensed shift personnel were professional and competent in handling routine evolutions and tests and were especially skillful in operating the integrated control system. Further, operators performed well and demonstrated a safety conscious attitude during unexpected events, such as the two unplanned reactor trips. The operators showed a high level of knowledge and the ability to use that knowledge in operating the plant safely. Shift turnovers were thorough and professional. The shift technical advisor was integrated into plant operations, especially in the evaluation of individual parameter trends and of plant transients. Licensee management instilled a team concept in the shift organization. Operations management insisted on a quiet, professional control room atmosphere. Resources were well managed to avoid excessive operator overtime while optimizing performance and training benefits of the test program. The licensee made effective use of pre-briefings for special evolutions and tests and was responsive to NRC comments for improving the briefings. Licensee management asserted their presence and involvement during the dayshift as well as backshifts. In summary, noteworthy performance by licensed operators, supervisors, and operations management resulted in excellent overall plant control.

Administrative controls, procedures, and procedural adherence are generally strong, but exceptions have been noted that require licensee management attention. Administrative controls for TMI-1 are well established and they reflect a strong commitment to meeting requirements to assure nuclear safety. These procedures also include licensee initiatives beyond regulatory requirements. However, certain equipment control administrative procedures are inconsistent with each other and with sub-tier documents with respect to independent verification of equipment control measures as described in NUREG-0737, TMI Task Action Plan Item I.C.6. Some of these procedures impose independent verification for less than the full safety-grade scope of equipment to which it is intended to apply.

Although most licensee personnel exhibited respect for administrative controls and attention to detail in implementing procedures, a significant number of exceptions were noted. These included three cases (two of which involved safety-related equipment) of conducting activities without a procedure, several minor examples of failure to adhere to procedures, and several other examples where personnel worked around obvious procedure errors rather than stopping implementation to obtain procedure change approval. There were also cases where a more conservative approach was needed in implementing equipment control (tagout) measures. In two cases, reliance on minimal isolation barriers for maintenance work resulted in small releases of radioactivity when single isolation points leaked. Management attention is needed to ensure that all personnel properly and conservatively implement administrative and procedural controls. Also, some upgrading of the quality of reviews of routine system operating and test procedures may be warranted to foster worker respect for procedures. This is highlighted by the fact that where procedures have received extra attention, they are generally of good quality and are strictly followed. Examples include safety system valve lineups and major tests.

There was a definite presence and attentiveness on the part of various oversight groups. The Nuclear Safety and Compliance Committee (NSCC) performed well. They scheduled their reviews and were able to implement their plans well. Their reviews were thorough. The NSCC staff has a high level of experience and good channels of communications to the board of directors. The Quality Assurance (QA) department's presence on site was strong. This was exemplified by their use of shift monitors, a unique and important licensee initiative. The presence of experienced (formerly licensed) operations personnel in the QA department enhances performance and credibility. Some problems were noted with the Independent On-Site Safety Review Group (IOSRG), including (1) failure to follow its own procedures and (2) lack of a systematic approach and sufficient depth in procedure review. Overall, the oversight groups provide potentially beneficial insights, but the degree to which the licensee uses the information is unclear. For example:

-- Board dispositions for some NSCC recommendations were not clear;

-- Management did not respond effectively to QA assessments regarding procedure implementation problems; and,

-- IOSRG discovery of a part of the independent verification problems did not lead to comprehensive resolution of inconsistencies.

In general, management exhibited conservatism when faced with technical problems and, overall, licensee technical support was adequate but not aggressive. When technical problems could not be resolved immediately, appropriate interim measures were provided to assure nuclear safety, such as with the relief/safety valves problem for steam generators and the emergency feedwater pump steam inlet piping. In certain instances, however, these measures were established only after prodding by NRC staff. Further, licensee review of certain problems or events could have been more thorough and complete. Examples included review of an RPS breaker malfunction, evaluation of letdown cooler leakage, and evaluation of decay heat system pressure indicator discrepancies. In general, corrective action was timely, but there were exceptions. For example, had a more aggressive approach been taken toward ventilation system balancing, noble gas contamination incidents might have been precluded or minimized. Other functional areas describe related instances of poor technical support, most notably reflected in "Furmanite" repair jobs. Apparently, engineering personnel and management were not sufficiently inquisitive to assure a complete understanding of certain problems, especially when a short-term, multi-disciplined review was needed. Upon final resolution, no unreviewed safety questions were identified and, ultimately, the licensee competently resolved the technical problems.

In summary, licensee management prepared the plant and their operators well for restart. For the most part, procedures were technically adequate but individual procedure step inadequacies challenged personnel in strictly adhering to those procedures. In general, there is respect for procedure adherence, but there were too many instances where personnel either did not follow or sidestepped a procedure step. It appears that in certain instances, personnel understanding of the licensee's strong procedural control policies are not well understood. To varying degrees, the oversight review groups are performing adequately; however, some important findings were not acted on effectively by licensee management. Overall licensee performance in this area was effective and well oriented toward nuclear safety.

Conclusion

Category 2

Recommendation

Licensee: Discuss at the SALP meeting (1) licensee actions to improve the technical support area, (2) measures to instill in all workers appropriate attention to operations phase administrative controls, and (3) licensee measures to ensure optimal benefits from oversight group findings.

NRC: PAT I should review extensively the licensee's independent technical and safety review process; by PAT II, an assessment should be made of the licensee's plant safety review processes; in particular, the reliance on individual reviews as contrasted with interdisciplinary committee reviews.

B. Radiological Controls (244 hours, 6%)

Analysis

The licensee's radiation protection program continued to be well defined by clear policies and directives. Startup inspections indicated that the licensee satisfactorily implemented the radiation protection program in accordance with regulatory requirements. An adequate staff was available to carry out the program, and the personnel involved were well qualified and capable of performing satisfactorily in their assigned areas of responsibility. A formalized training program for the radiation protection staff continued to be implemented and provided sufficient technical and practical instructions to assure competence in the organization.

Adequate management review and oversight are consistently evident as demonstrated by their awareness of daily activities, the establishment of effective inter-departmental communications and cooperation. The quality assurance department has a lead monitor in this area for oversight of radiological control activities. The radiation protection management staff takes the initiative in improving and enhancing radiological control practices and procedures. For example, (1) the licensee's radiological staff initiated the investigation of noble gas migration pathways in the auxiliary and fuel handling buildings, and consequently effected corrective measures to better control airborne activity in the facility; (2) both health physics-field operations and radiological engineering groups perform frequent planned inspections and audits of radiologically controlled areas, work activities, policies and procedures to assure quality performance; and (3) all anomalous occurrences that have the potential to affect exposures to workers or the general public are aggressively reviewed and evaluated to ascertain causal factors, corrective measures, and dose effects. Additionally, radiological controls awareness meetings are held monthly by the radiation protection, maintenance, and operation departments to exchange information and resolve concerns pertaining to radiological work, practices, and policies. These meetings are also attended by representatives from the bargaining unit, the Vice President and Director of TMI-1, and concerned workers.

The licensee generally exhibits good radiological control practices and they implement a very thorough radiation worker training program in an effort to ensure that radiation workers are aware of radiological safety procedures and are able to implement them competently.

The TMI-1 Restart Staff noted that the licensee consistently demonstrated a strong commitment to ALARA. During radiological work performed in this assessment period, the licensee used ALARA engineering practices, job planning, and worker training to reduce personnel exposure.

Effective programs relative to radioactive waste management, effluent monitoring, and control and transportation of radioactive materials were implemented and maintained. Effective quality control measures are embodied in laboratory procedures and practices. The licensee's performance in this area was consistent with regulatory requirements.

In general the licensee's performance during various operations and maintenance activities involving high levels of radioactivity demonstrated reasonable planning and preparation, good procedure development and/or use, and the establishment of appropriate radiological controls. However, there were examples where better planning could have prevented releases of radioactivity and the contamination of workers. For example, the work on the waste gas compressor resulted in a release because a check valve was relied upon to isolate the waste gas header (see Functional Area A, Plant Operations). Other similar instances were noted which related to poor work planning, although not specifically poor radiological planning. Licensee review of the above events was thorough with extensive use of the radiological awareness report and investigative reports.

In summary, the licensee was able to demonstrate that program elements continued to be effectively implemented during power operations, and the licensee adequately trained and qualified personnel responsible for implementation of the radiological control program. Implementation problems were not due to programmatic weaknesses but were related to poor individual worker performance or inadequate support from other departments such as operations or engineering. The licensee's program in this area is technically sound.

Conclusion

Category 1

Recommendations

None

C. Maintenance (288 hours, 7%)

Analysis

The maintenance organization was staffed with knowledgeable and skilled personnel to support the required maintenance activities to maintain safety-related equipment in a proper condition. When maintenance-related work was identified by operations, the maintenance department was aggressive in scheduling and completing the work based on the priority assigned by management. Managerial involvement on a daily basis in supervising, tracking, identifying and resolving problems resulted in a high level of plant operational readiness.

A continued positive management initiative was that of permanently assigning maintenance personnel to one of the six rotating shifts. This reduced the typical power plant peaks of high maintenance activity during the dayshift. It also allowed the maintenance department to schedule and perform corrective maintenance on vital equipment as problems developed. Placing a portion of maintenance personnel on shift work did, however, dilute the experience level in the I&C area. This dilution of experience in the I&C area caused minor operational problems which resulted in delays in retests until supervision arrived on site. The electrical and mechanical maintenance experience remained at a high level. The collective knowledge of the maintenance department was sufficient to resolve equipment problems. In addition, maintenance personnel appeared to be highly motivated and supportive of management.

Administrative controls in the area are adequate and properly implemented along with maintenance procedures. The staff identified a minor drawing control violation with respect to posted drawings inside control room cabinets. This was uncharacteristic of the licensee's drawing control program. Another instance was noted where individuals failed to follow a maintenance procedure and this resulted in the loss of a safety-related electrical bus. The individuals involved were disciplined for failing to cooperate in the licensee's review of this event. I&C personnel were involved to a limited extent in the procedure implementation problems addressed in other sections.

During this assessment period, several major safety-related systems were reviewed closely by inspectors to determine overall reliability and operability of the equipment. Emphasis was placed on preventive, as well as corrective maintenance by management in response to plant restart. Preventive maintenance procedures appropriately reflected vendor technical manual recommendations. Safety-related equipment was found to be in good material condition. Machinery history and maintenance records reflected proper documentation (consistent with restart hearing board requirements) and this resulted in development of a useful historical data base on plant equipment. Records and field observations reflected the involvement of the QA department in assuring operability of safety-related equipment.

No instances were noted of inoperability or poor testing because of maintenance procedures. However, certain maintenance procedures lacked specificity and clarity associated with the recording and/or evaluation of as-found conditions. This lack of clarity has forced maintenance personnel, independent of plant engineering, to evaluate and determine the operability of equipment in the field with limited guidance. This has pointed out a need for enhanced procedure review and approval and better technical support on the evaluation of as-found conditions.

Maintenance personnel, in particular, and other groups of personnel doing work in safety-related spaces, were somewhat insensitive to the change to an operating mode. In certain instances, personnel continued their working habits as though the plant was in a shutdown condition. As a result, a violation occurred on unsecured scaffolding that in a seismic event may have jeopardized the ability of the diesel generator to function. Other potentially adverse conditions occurred, the most significant of which was the inadvertent tripping of the emergency feed pump during scaffold construction, causing the pump to be inoperable for several hours. The day-to-day approach and attitudes of non-operations personnel was changing but not completely corrected by the end of the period.

Housekeeping and fire protection measures remained consistent with the previous high standards implemented during the long shutdown. Extensive use of absorbent material to collect oil drippings was used and contaminated drainage was directed to floor drains using tygon tubing. However, certain areas of the turbine building were not reflective of those cleanliness standards that were applied to safety-related areas. No fire hazards were created in the turbine building; by the end of the period, conditions improved substantially in that building.

Sufficient technical support was provided to maintenance and good communication existed between this department and plant engineering. There was consistent evidence of engineering evaluations in maintenance packages. There was, however, incomplete support for "Furmanite" repair to leaking flanges and valves. The licensee started work during the 40% trip outage without considering the stress induced by this process on the flange bolts. Another example was the poor control of the amount of Furmanite for repeat injections evidenced during the full power trip outage. As a result, an OTSG level instrument root valve clogged during the injection process and the material was later blown into the OTSG. Further, no consideration was given to the effects of the material in the OTSG until questioning by the NRC staff occurred. Upon complete review of these problems, no unreviewed safety questions were identified by the licensee. These examples reflect a need for licensee management to assure a more inquisitive evaluation of plant problems.

Overall, the maintenance program is properly established, implemented, and adequately staffed. Management involvement at all levels is evident. Equipment and plant material condition are well maintained and in a condition that supported unit startup. The QA department is very active in this area. Personnel attitude toward work in the spaces still reflects attitudes associated with a plant in cold shutdown; however, it has not as yet had an adverse effect on plant safety.

Conclusion

Category 2

Recommendations

None

D. Surveillance Testing (252 hours, 7%)

Analysis

During this inspection there was a high level of NRC inspection coverage in this area as evidenced by inspection report documentation of all or portions of over sixty surveillance tests. This included all types of surveillances, including maintenance, operations, radiological controls, and instrument and control surveillance. In addition, the data and calculations of numerous other surveillance tests were reviewed.

The licensee has a strong administrative program which assures that tests are conducted at the specified frequency. The overall administrative program was properly implemented except for minor problems. A computerized scheduling system was used for the surveillance test program. Accordingly, surveillance tests were effectively integrated with routine plant operations and well coordinated with operations department activities. Surveillance procedures, with a few minor exceptions, were properly implemented. Surveillance tests required by the technical specifications were conducted at the specified frequency with one exception. A fire surveillance was missed for several days due to the improper issuance of a procedure change. This violation of requirements was considered minor.

During this inspection period, NRC staff performed an extensive review of safety-related equipment operability regarding the following components: the makeup pumps, decay heat pumps, and the diesel generators. The review included operating procedures, technical specification compliance, inservice testing, preventive maintenance, maintenance history, and surveillance testing. Applicable surveillance tests were found to be technically adequate in that they met all applicable NRC requirements. Surveillance test procedures, along with maintenance procedures and post-maintenance testing, provided adequate assurance that the selected safety-related components were operable when called upon.

Surveillance procedures were properly followed. Tests were performed in a deliberate manner ensuring that each step was completed prior to proceeding to the next step.

Records were well kept. For a surveillance test of frequency of ninety days or longer, a hard copy record of the last completed test was maintained in the control room. Once a test was completed, the newer test was placed in the file and the older test was sent to plant records for microfilming. This system enabled technicians or operators good access to the most recently completed tests, if necessary. In addition, extensive test records were reviewed by NRC and found to be complete with one exception, discussed below.

Of particular concern during this period were the circumstances that developed during and after a routine surveillance test of the pressurizer power operated relief valve (PORV). The issues of concern included: (1) a routine test that could not be completed because a portion of the test was not conducted correctly, (2) the unnecessary creation of both a deficiency sheet and an exception sheet as a result of that test and, subsequently, throwing these sheets away and (3) the confusing documentation used to substantiate the shift supervisor's determination of operability of the PORV. There was prompt involvement by senior management in the retest when operability questions arose. However, the NRC staff's early involvement in this process led to discovery of the exception and deficiency sheets that had been thrown away and the identification of the poor instructions for handling exceptions and deficiencies. This records handling problem was considered uncharacteristic of the licensee's records management program. It did point out a need for additional attention to detail on the part of licensee personnel in handling these particular records. Further, the licensee's review and approval process could have developed better instructions for the handling of test problems.

Although other mistakes were made by personnel, in general, licensee supervision caught them before any adverse condition resulted. A number of examples were noted in which supervision or senior personnel corrected errors made by junior personnel. This was especially evident in the I&C area. Because of supervisory presence, corrective actions were appropriate to satisfactorily complete tests and avoid challenges to safety systems.

Staffing was ample in this area along with good interdepartment interfacing. A specially assigned staff representing the maintenance and operations department assured overall good coordination of surveillance test implementation and records. Personnel, in general, were qualified to perform surveillances but as noted above, some inexperience was evidenced by a few individuals. None of the unplanned reactor trips during this period were caused by surveillance tests.

Overall, the licensee has a strong surveillance program. Management and QA department involvement in this area is evident. The problems observed were few in number and did not adversely affect plant safety. The licensee safely conducts surveillance tests during plant operations.

Conclusion

Category 1

Recommendations

None

E. Startup Testing (561 hours, 14%)

During this SALP period, the licensee performed an extensive power escalation test program over a three-month period. This program was successfully completed with only minor performance problems noted. Testing was performed at predetermined power levels from 0 to 100 percent power for both transient and steady-state conditions and included tests of reactor physics performance, natural circulation, integrated control system, feedwater system, emergency feedwater system, plant performance during reactor trips, and measurements of reactor coolant system and steam generator leakage. NRC inspectors witnessed all scheduled plant transients and portions of selected steady-state tests, and reviewed all licensee test data and resolutions to all test exceptions and deficiencies.

Overall test performance by licensee personnel, including plant operators, reactor engineers, test engineers, and supporting personnel from the headquarters safety analysis group, was very good. Operators always remained in control of the plant during special and intensive test periods. The reactor engineering group, which performed the physic testing, was well prepared in this aspect of the startup test program. The licensee assured that ample supporting specialists from the fuel vendor and corporate fuel groups were present. In addition, innovative software programs were employed to monitor and predict core status on a real time basis. With proper interfacing with the licensed operators, this resulted in tests being completed in an effective and well-controlled manner. Although reactor engineers initially were aggressive in their requests to operators to establish plant test conditions, plant operators were always in control of plant operations.

The startup test engineers had the largest portion of the program; directing test evolutions from natural circulation testing through the final reactor trip at 88 percent power, to subsequent steady-state testing at 100 percent power. Except for the first part of the natural circulation test, plant testing was well-coordinated with good interface with the plant operators. Data were properly taken, data stations were adequately manned, and data reduction was performed properly. Test exceptions and deficiencies (E&Ds) were properly resolved and all data along with test problems were reviewed by the Test Acceptance Group in formal meetings conducted periodically during each test phase. In spite of some minor delays during the program, all testing was completed within the scheduled time frame of the test program.

The extensive pre-test training of reactor engineering and test engineering personnel was evident in the overall lack of personnel problems during test performance. Test briefings for major evolutions were thorough and extensive. Problems noted during earlier tests, where applicable, were factored into briefings for later tests. Quality assurance involvement in startup testing was extensive in that QA monitors were on shift for all testing. In addition, QA had prepared a detailed test monitoring plan and documentation of QA monitoring activities was comprehensive. Licensee management attention and involvement were very evident in that top management was present and witnessed major test evolutions and power escalations.

Generally, in handling technical problems, licensee management did exhibit conservatism. During the initial startup, licensee management ordered the reactor to be stabilized high in the source range until one of the two instrument channels for the intermediate range neutron power was fixed. While performing an all-rods-out boron measurement test during zero power physics testing, too much boron was added to the reactor causing subcriticality. This "boron overshoot" condition was promptly noted and the reactor engineers and operators displayed a cautious approach in the boron dilution needed to correct the problem. The licensee was responsive to staff concerns on the emergency feedwater system turbine relief valve inadvertent actuation problem and to the interaction problem between the steam generator safety valves and the turbine bypass valves. Adequate interim corrective action in terms of procedural guidance was provided to the operators for both of these technical problems. Overall, licensee management competently resolved their technical problems.

Based on staff review, the startup test procedures were comprehensive and accomplished the desired test objectives with some minor problems as discussed below. Procedures were followed completely during the test. All test data reviewed by the NRC staff were correct, and E&Ds were properly resolved.

Notwithstanding the positive aspects of the test program, some problems with procedures and personnel were observed. During the first part of natural circulation testing, test engineers did not appear to be fully organized. This problem was recognized by management and was quickly corrected. The test could have been better planned to instruct the operators how to recover from the unique plant conditions. As a result, at initial restoration of forced circulation flow, a steam generator safety valve lifted. Other procedure deficiencies were noted with respect to clarity of instructions. Test management took corrective actions to improve these situations. At the conclusion of the test program following the reactor trip at 88 percent power, one further test deficiency was noted in that the reactor trip test failed to document the reset function of the letdown isolation valve MU-V3 following the reactor trip. The adequacy of MU-V3 to open after a trip was subsequently demonstrated through a separate retest after NRC staff prodding on the issue.

In summary, the licensee performed very well during the TMI-1 restart startup testing program. Aggressive management attention and involvement at the upper and middle management levels contributed to the effective program. The startup program was effective in identifying equipment problems, especially from the viewpoint of integrated system operations. The test program was thoroughly planned, accomplished on a realistic schedule, and provided ample time for operator training and familiarization. Licensee initiatives having generic B&W applicability in this area were noteworthy. Although they constituted unique tests, more comprehensive reviews should have been considered by the licensee before implementation.

Conclusion

Category 1

Recommendations

None

F. Training and Qualification Effectiveness (NA)

Analysis

The various aspects of this functional area have been considered and discussed as an integral part of the other functional areas and the respective inspection hours have been incorporated into the respective functional areas. Consequently, this discussion is a synopsis of the assessments conducted in other areas. Training effectiveness is measured primarily by the observed performance of licensee personnel and, to a lesser degree, as a review of program adequacy. This discussion addresses three principal areas: licensed operator training, non-licensed staff training, and the status of INPO training accreditation.

The training department was staffed with knowledgeable and experienced personnel. The lesson plans, specialized manuals and courses, hands-on experience, and/or extensive use of simulator and basic principles simulator training provided meaningful and practical training not only to licensed operators but also to other operator technical personnel. This was evident in the performance of new candidates for operator licenses. All candidates for licenses or instructor certifications passed. They included four SRO candidates, one RO candidate (on retake), and one instruction certification candidate.

As noted in the plant operations section, observations of licensed operator personnel by shift inspectors produced a good deal of information relative to their level of knowledge and performance skills. The results of that review were favorable. The special interviews and discussions on shift confirmed a high level of knowledge of facility design with only minor weaknesses observed. Operators were well prepared for restart and demonstrated especially strong skills in manipulating the integrated control system in the manual mode. The training for the non-licensed staff consisted of both formal and on-the-job training. Based on NRC observations, this program was also effective in producing performance-oriented personnel similar to the licensed operator program. During the implementation of work activities, in general, non-licensed personnel were appropriately knowledgeable in the requirements of the procedures and plant design. Experienced personnel provided adequate guidance to less experienced personnel.

No plant trips occurred due to personnel error. However, inspectors saw a persistent problem with workers in various plant areas having the potential to cause a trip or a challenge to a safety-related system. Personnel (licensed operators included) were also involved in the problem with the proper implementation of administrative controls for procedure implementation. There seemed to be a disconnect between the well-stated management policies in these areas and the understanding of those policies by certain individuals.

Even with the corrective action initiated before the end of the power escalation program, licensee management had not completely reached all plant workers and corrective action is not yet complete.

The licensee received training program accreditation from INPO in the following five areas: control room operators; senior reactor operators; shift technical advisors; auxiliary operators; and radiological control technicians.

In summary, the licensee's training program is effective and is oriented toward improving on-the-job performance. The program has the support and commitment of management. The QA department is actively involved in training. In general, personnel are knowledgeable of work and procedural requirements, and conduct activities with care. When faced with problems, personnel take conservative measures and seek help.

Conclusion

Category 1 (based on functional areas addressed)

Recommendations

None

G. Assurance of Quality (NA)

The various aspects of quality assurance program requirements have been considered and discussed as an integral part of each functional area and the respective inspection hours are included in each one. Consequently, this discussion is a synopsis of the assessments conducted in those areas.

The quality assurance department continued their aggressive involvement in oversight activities. This was reflected in their unique three levels of review along with a substantial resource initiative --24-hour QA shift monitors. Licensee management continued their orientation in staffing the department with experienced personnel along with providing career enhancement positions for licensed (or formerly licensed) TMI-1 operators. This had the added benefit for licensee management of enhancing the operational expertise of the QA department to fulfill its responsibilities in the oversight of operations.

There was a definite QA presence and involvement in the various facets of field activities. The monitoring level of review was effective in identifying the procedure implementation problems later noted by the NRC staff. As a result of successful monitoring, the audit group more effectively used their time in reviewing programs and program implementation. However, licensee management apparently did not effectively respond to the QA department for the procedure implementation problem, which was highlighted in the QA department's annual effectiveness review.

In summary, there was management and quality assurance (QA) department presence and involvement in all facets of activities at the site. Licensee management may need to provide additional attention to the QA department's effectiveness reviews.

Conclusion

Category 1 (based on the functional areas addressed)

Recommendation

Licensee: None

NRC: PAT look at the effectiveness of the QA review process.

V. Supporting Data and Summaries

A. Investigations and Allegations Review

There are no open investigations for TMI-1. The investigation on the environmental equipment qualification apparent material false statements was completed during this period and it is being reviewed by Region I staff.

There were no allegations received during this assessment period.

B. Escalated Enforcement Actions

None

C. Management Conferences

None

D. Licensee Event Reports

Only three licensee event reports were submitted during this period. They are listed below instead of being tabulated in a separate table.

-- LER 85-002, dated October 3, 1985, for the manual reactor trip (from hot shutdown condition) that occurred on September 7, 1985, due to operator action in response to a fire in the rod control system. The root cause was an equipment/component malfunction (re: PLANT OPERATIONS AREA).

-- LER 85-003, dated December 31, 1985, for the reactor trip from 75 percent power that occurred on December 1, 1985, due to a proximate cause of high pressure in the RCS. The root cause was an equipment/component malfunction with a main generator relay that caused a main turbine rejection which caused the transient in the RCS (re: PLANT OPERATIONS AREA).

-- LER 85-004, dated December 26, 1985, for inoperable fire barriers found on November 26, 1985, to a makeup pump cubicle without a fire watch during modification work. This was due to personnel error (re: PLANT OPERATIONS AREA).

In summary, all LERs were listed in the plant operations area; two with component failure causes and one with a personnel error cause.

No casual link can be inferred among the three LERs. However, LER 85-003 and an LER to be submitted outside this assessment period reflects a possible need for improvement in the design of secondary trip function logic in which a one-out-of-one malfunction caused a transient on the RCS.

LER 85-004 was indicative of the worker in the spaces problem identified in the maintenance area.

E. Reactor Trips/Forced Outages

Table 5 reflects the unplanned reactor trips and reactor shutdowns along with root causes. Also, the main turbine was taken off-line with the reactor critical at low power during October 13-18, 1985, for turbine steam inlet drain line repairs, as discussed in paragraph I.C.1.

The following reactor trips that occurred during this period were planned per the licensee' test program:

--	October 15, 1985, Manual	PLANNED in accordance with startup test procedures
--	October 21, 1985, Loss of Feedwater	PLANNED in accordance with power escalation procedures
--	January 2, 1986, Turbine Trip	PLANNED in accordance with power escalation procedures

F. Planned/Unplanned Releases

Table 6 is a summary of the more significant unplanned releases for the period, along with a summary of the routine releases from the plant on a monthly basis. No regulatory limits were violated.

TABLE 1

INSPECTION REPORT ACTIVITIES

TMI-1 NUCLEAR GENERATING STATION

REPORT NO./PERIOD AREA INSPECTED	INSPECTOR TYPE	HOURS	AREAS INSPECTED
85-22 9/16/85-10/11/85	SHIFT RESIDENT/PROJECT STARTUP TESTING ENGINEERING SPECIALIST	683	Power Operations Startup Testing
85-24 10/11-18/85	SHIFT RESIDENT/PROJECT STARTUP TEST RADIATION SPECIALIST	369	Power Operations Startup Testing Licensed Operator Training Radiological Effluent Control
85-25 10/18-25/85	SHIFT RESIDENT/PROJECT STARTUP TEST	352	Plant Operations Startup Testing
85-26 10/25-11/12/85	SHIFT RESIDENT/PROJECT RADIATION SPECIALIST	501	Plant Operations Startup Testing Radiological Effluent Control
85-27 11/12-27/85	SHIFT RESIDENT/PROJECT STARTUP TESTING	603	Plant Operations Startup Testing Radwaste Management
85-28 11/27-12/13/85	SHIFT RESIDENT/PROJECT STARTUP TEST RADIATION SPECIALIST	540	Plant Operations Startup Testing Radiological Effluent Control
85-30 12/13/85-1/10/86	SHIFT RESIDENT/PROJECT STARTUP TEST RADIATION SPECIALIST ENGINEERING SPECIALIST	888	Plant Operations Startup Testing Radiation Protection

TABLE 2

INSPECTION HOURS SUMMARY (9/16/85 - 1/10/86)

TMI-1 NUCLEAR GENERATOR STATION

	HOURS	% OF TIME
Plant Operations	974	25
(Shift Inspection Hours)	1617	41
Radiological Controls	244	6
Maintenance	288	7
Surveillance Testing	252	7
Startup Testing	561	14
Training and Qualification Effectiveness	(included in above)	
Assurance of Quality	(included in above)	
Total	3936	100

TABLE 3

ENFORCEMENT SUMMARY (9/16/85 - 1/10/86)

TMI-1 NUCLEAR GENERATING STATION

A. Number and Severity Level of Violations

Severity Level I	-
Severity Level II	-
Severity Level III	-
Severity Level IV	6
Severity Level V	1
Deviations	-
Total	7

B. Violations vs. Functional Area

Functional Area	Severity Levels						
	I	II	III	IV	V	Dev	Total
Plant Operations				4			4
Radiological Controls							
Maintenance				1	1		2
Surveillance Testing				1			1
Startup Testing							
Training and Qualification Effectiveness							
Assurance of Quality							
Totals				6	1		7

TABLE 4

ENFORCEMENT DATA

TMI-1 NUCLEAR GENERATING STATION

Inspection Report No.	Inspection Date	Severity Level	Functional Area	Violation
85-22	9/16-10/11/85	IV	Maintenance	Failure to properly control scaffolding in safety-related areas
85-25	10/18-25/85	V	Maintenance	Failure to properly control drawings inside control room electrical cabinets
85-27	11/12-27/85	IV	Plant Operations	Failure to establish or properly change procedures for safety-related activities
85-27	11/12-27/85	IV	Plant Operations	Failure to completely review for adequacy procedures for independent verification of safety-related activities
85-27	11/12-27/85	IV	Plant Operations	Failure to properly implement technical specifications and related administrative control for independent onsite safety review group (IOSRG) activities

TABLE 4 (Continued)

Inspection Report No.	Inspection Date	Severity Level	Functional Area	Violation
85-27	11/12-27/85	IV	Security (Plant Operations)	Failure to properly implement security personnel badge identification control measures
85-30	12/13/85	IV	Fire Protection (Surveillance)	Failure to properly inspect a fire door on the specified frequency

TABLE 5

UNPLANNED REACTOR TRIPS AND SHUTDOWNS

Unplanned Reactor Trips

Date	Description	Root Cause
December 1, 1985, High RCS Pressure	The high RCS pressure resulted due to a load rejection with the tripping of the main generator breaker. An over-excitation protective relay malfunctioned when a regional grid voltage transient coupled with a relay setpoint drift occurred	Secondary plant transient due to electrical grid transient
January 4, 1986, Turbine Trip	The turbine trip resulted because of an abnormal high level in one of six moisture separators due to a level controller malfunction in the feedwater heater drain collection tank	Random equipment malfunction in the secondary plant

Unplanned Shutdowns

None

TABLE 6

RADIOLOGICAL EFFLUENT RELEASES

Anomalous Occurrences Resulting in Off-Site Releases of Noble Gases

Date	Component Involved	Release Point	Activity Released (Ci)	Duration	% of Technical Specifications Quarterly Limit, Gamma
10/21/85	Reactor Trip at 40%	Main Steam Relief Valves (MSRV)	1.07E-6	10 sec	3.8 E-8
10/28/85	Makeup Pump	Station Vent (SV)	0.7	42 min	0.0015
11/2/86	Reactor Coolant Evaporator	SV	1.05	75 min	0.02[illegible]
11/19-20/85	Main Steam Valve Testing	MSRV	1.6 E-7	5 sec	3.48 E-[illegible]
12/1/85	Reactor Trip at 75%	MSRV	7.32 E-6	7 min	1.5 E-7
12/17/85	Waste Gas Compressor	SV	1.4	54 min	0.001
12/30/85	Makeup Pump	SV	46.3	274 min	0.07

Normal Operating Releases - Predominantly Noble Gases

October	0.15 (0.02% particulates)	0.00132
November	18.8 (0.0003% tritium)	0.02
December	5.29	0.0076

Normal Operating Releases - Liquid - Predominantly Tritium

October	1.0 (0.03% non-tritium)
November	1.19 (0.01% non-tritium)
December	5.99 (4.4 E-3% non-tritium)