The AIT concluded that operations management's oversight of fuel handling activities was weak and their failure to take more rigorous corrective actions from previous events allowed them to reoccur. Senior operations management has always delegated oversight of these activities to the refueling floor SRO. The Operations Manager stated that this decision was made under the belief that having a higher management presence on the refueling bridge would distract the operators from their duties. However, while the desire to reduce distractions was commendable, senior managers did not hold their people accountable, nor communicate with them, so senior managers remained unaware of concerns and practices known at the working level. For example, senior operations managers stated they had never heard of complaints from maintenance personnel that fuel handling equipment problems were caused by the manner in which operators were operating the equipment, yet many operations personnel at the level of shift supervisor and lower were aware of this complaint. Senior managers were unaware of the fact that double blade guide handles could be hit when moving double blade guides in the spent fuel pool, although this fact was learned from two operators during the AIT interview process. Lastly, human performance problems during fuel handling operations have repeatedly occurred over the years, yet operations management oversight of these activities remained unchanged.

Other examples of the lack of senior operations management oversight included: (1) a PCAF which was supposed to be issued within a day after Event 1 was not issued until 12 days later, a fact which the AIT identified to the operations senior managers; and (2) a Shift Supervisor assigned to observe and report back on refueling activities following Event 3 only observed 20 minutes of refueling activities before he left the refuel floor. The AIT concluded that this was an inadequate amount of time to verify the effectiveness of procedure changes implemented after Event 3.

ATTACHMENT 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

October 29, 1993

Docket Nos. 50-387

MEMORANDUM FOR: Richard W. Cooper, II, Director, Division of Reactor Projects

FROM: Thomas T. Martin, Region Administrator

SUBJECT: AUGMENTED INSPECTION TEAM CHARTER FOR REVIEW OF REFUELING ACTIVITIES AT SUSQUEHANNA

Over the last two weeks, multiple problems have been encountered during refueling operations at Susquehanna Unit 1 involving fuel handling equipment. Because the cause(s) of these events is uncertain, there were repetitive instances of problems, and there may be possible generic implications, I have determined that an Augmented Inspection Team (AIT) inspection should be conducted to review and evaluate the circumstances, safety significance, and generic implications that are associated with these problems. The NRC staff needs to fully understand the cause(s) of these events and determine whether further actions will be required. This is consistent with AIT selection criteria 05.02, b, c, e and f in NRC Inspection Manual 0325.

Accordingly, the Division of Reactor Projects (DRP) is assigned the responsibility for the overall conduct of this Augmented Inspection. Rob Temps, Project Engineer, DRP, is appointed as Augmented Inspection Team Leader (Other AIT members are identified in Enclosure 2). The Division of Reactor Projects (DRP) is assigned the responsibility for resident and clerical support, as necessary; and the coordination with other NRC offices, as appropriate. Further, the Division of Reactor Projects is responsible for the timely issuance of the inspection report, the identification and processing of potentially generic issues, and the identification and completion of any enforcement action warranted as a result of the team's review.

Enclosure 1 represents the charter for the Augmented Inspection Team and details the scope of the inspection. The inspection shall be conducted in accordance with NRC Management Directive (MD) 8.3, NRC Inspection Manual 0325, Inspection Procedure 93800, Regional Office Instruction 1010.1, and this memorandum.

Thomas T. Martin
Regional Administrator

Enclosures:
1. Augmented Inspection Team Charter
2. Team Membership

cc w/encls:
J. Taylor, EDO
J. Sniezek, OEDO
T. Murley, NRR
J. Partlow, NRR
J. Calvo, NRR
C. Rossi, NRR
L. Nicholson, Acting PD I-2, NRR
F. Miraglia, NRR
C. McCracken, NRR
F. Rosa, NRR
W. Russell, NRR
J. Richardson, NRR
A. Thadani, NRR
B. Grimes, NRR
J. Roe, NRR
E. Jordan, AEOD
D. Ross, AEOD
V. McCree, OEDO
W. Kane, DRA, RI
R. Cooper, DRP, RI
W. Lanning, DRP, RI
J. White, DRP, RI
W. Hehl, DRSS, RI
S. Shankman, DRSS, RI
S. Barber, SRI, Susqeuhanna
J. Stone, PD I-2, NRR
C. Sisco, DRS, RI
L. Bettenhausen, DRS, RI
W. Hodges, DRS, RI
E. Wenzinger, DRP, RI
K. Abraham, PAO, RI
M. Miller, SLO, RI

ENCLOSURE 1

AUGMENTED INSPECTION TEAM (AIT) CHARTER

The general objectives of this AIT are to:

1. Review and evaluate the adequacy of the licensee's corrective measures, in concert with Region I management, prior to agreeing to resumption of refueling activites

2. Conduct a thorough and systematic review of the circumstances surrounding each of the refueling events which have occurred since October 1, 1993, and develop a detailed sequence of events for each occurrence.

3. Collect, analyze, and document relevant factual information to determine the causes, conditions, and circumstances pertaining to each event.

4. Review qualifications of the refueling operators and training they received on refueling operations.

5. Evaluate the licensee's review of and response to each event and implemented corrective actions, as well as their plans for resumption of refueling activities.

6. Review and assess the adequacy of licensee's refueling, surveillance, and test procedures as they existed before these events; and review and assess the changes recently made in these procedures.

7. Evaluate the licensee's procedures regarding SRO and RO responsibilities during refueling operations.

8. Determine if there are any generic implications that should be considered for further review or evaluation by the NRC staff.

9. Determine the adequacy of management oversight and control of refueling activities.

10. Assess the safety significance of each event and communicate to Regional and Headquarters management the facts and safety concerns related to problems identified.

11. Prepare a report documenting the results of this review for signature of the Regional Administrator within thirty days of the completion of the inspection.

ENCLOSURE 2

AIT MEMBERSHIP

Robert Temps, AIT Leader, Project Engineer, Division of Reactor Projects (DRP), Region I (RI)

Robert Summers, Assistant AIT Leader, Project Engineer, DRP, RI

Carl Sisco, Operations Engineer, Boiling Water Reactor Section, OB, Division of Reactor Safety, RI

David Desaulniers, Human Factors Assessment Specialist, HHFB, NRR

Scott Morris, Reactor Engineer, DRP, RI

Other NRC personnel, consultants, or contractors will be engaged in this AIT, as needed.

ATTACHMENT 2

PERSONS CONTACTED

Pennsylvania Power & Light Corporation

C. Boudman, Jr.	Asst. Foreman, Mechanical Repairs
R. Byram	Senior Vice President - Nuclear
K. Chambliss	Supervisor, Maintenance Production/Outage
T. Dalpiaz	Manager, Nuclear Maintenance
A. Dominguez	NSAG Site Supervisor
A. Fitch	Operator Training
T. Gorman	Senior Engineer, Systems Analysis
R. Heim	Senior Quality Control Specialist
G. Jones	Vice President - Engineering
D. Karchner	Power Production Engineer
J. Kenny	Supervisor, Nuclear Licensing
G. Kuczynski	Manager, Nuclear Plant Services
V. Kelly	Sr. Maintenance Project Eng., Maintenance Technology Group
R. Lengel	Project Engineer, Nuclear Steam Supply Systems
D. Marinos	Senior Nuclear Plant Specialist
T. Markowski	Supervisor, Dayshift Operations
K. Mattern	Supervisor, NSS Maintenance
D. McGann	Supervisor, Nuclear Compliance
J. Miltenberger	Manager, Nuclear Safety Assessment
L. O'Neil	Special Assistant, Sr. Vice President - Nuclear
H. Palmer	Manager, Nuclear Operations
D. Roland	Operations Shift Supervisor
D. Roth	NSSS Supervisor, NSE
A. Sabol	Manager, Nuclear Quality Assurance
R. Saccone	Manager, Nuclear Systems Engineering
H. Stanley	Vice President, Nuclear Operations
H. Woodeshick	Special Assistant to the President
P. Zabawa	Electrical Maintenance

General Electric Corporation

D. Rousal	Senior Engineer

ATTACHMENT 3

DETAILED TIMELINES FOR EVENTS 1 THROUGH 4

9/25/93

Unit 1 reactor shutdown. Refueling outage commenced.

10/01/93

0600 Surveillances SO-181-001 (Weekly Refuel Platform Operability) and SO-181-002 (Unit 1 Main/Aux Hoist Operability) completed satisfactorily on the Unit 1 refueling bridge.

2117 Core offload commenced with the Unit 1 refuel bridge.

10/04/93

Unit 1 refuel mast grapple developed an air leak. A spare, "non-Q" grapple was installed on the mast as a replacement (NCR 93-112 had been initiated previously to make the component "Q"). The spare grapple had been pre-staged on the refuel floor prior to the start of the outage. (See Section 7.0.)

10/05/93

0320 Completed a partial SO-181-001 surveillance (i.e., did not perform the Control Rod Out & Bridge Travel Interlock test) on the repaired Unit 1 mast.

0340 The bridge operator was "uncomfortable" with the refuel bridge mast because SO-181-002 was not conducted as post maintenance testing, so he grappled and lifted the 1200 pound test weight to verify mast integrity before continuing fuel moves. Defueling operations were then resumed.

0826 Stopped defueling to accommodate a manual scram in support of CRD activities under the reactor vessel. Surveillance procedure SO-181-002 was performed because of questions raised about the operability of the Unit 1 mast after the new grapple was installed.

1500 Unit 1 mast failed SO-181-002 when the interlock which prevents bridge travel over the core with a load on the mast and with a control rod withdrawn one notch failed. Operators prevented actual movement over the core. Maintenance personnel were called in to troubleshoot. (See Section 7.0.)

10/06/93

0000 Electrical Maintenance personnel recalibrated the load cell on the Unit 1 bridge hoist. Surveillance SO-181-002 complete.

0115 Surveillance SO-181-001 complete.

0220 Resumed fuel offload.

0744 **EVENT #1**: A peripheral bundle was incorrectly removed from core location 31-56 (vice 29-55, adjacent to 31-56). Contrary to procedural requirements (Precaution 6.2.1 of OP-AD-107), the bundle was returned to its original location in the core after the SRO on the bridge received direction from the outage supervisor to place it there. The bridge SRO was under the assumption that the outage supervisor's decision had the concurrence of the reactor engineer. However, due to miscommunication by the outage supervisor, the reactor engineer thought the bundle had already been placed back in the core and he stated that he was going to check procedures to see if any requirements had been violated as a result of placing the bundle back in the core. The outage supervisor thought he had permission from the reactor engineer to place the bundle back in the core and relayed this to the bridge SRO. The Shift Supervisor was not aware of any of these activities until after the fact, although by procedure, he is responsible for directing fuel handling activities.

1033 Defueling resumed following corrective actions by operations management.

10/09/93

0113 Core offload completed.

10/25/93

1755 Completed surveillance procedures SO-181-001 and SO-181-002 on the Unit 1 refuel bridge.

10/26/93

0737 Commenced core reload.

≈0950 While moving the unloaded refuel bridge from the reactor cavity to the spent fuel pool, the mast grapple head contacted the reactor vessel flange protector, bending the mast (determined by PP&L 1 week after the event) causing a "Fault Lockout" on the bridge and leaving a distinct scrape marking on the reactor vessel flange protector. Operators were unaware of the cause of the lockout: the lockout was reset and refueling continued.

1008 **EVENT #2**: On the next fuel move, while lowering a fuel bundle into core location 13-48, a 10-inch section of the telescoping mast "hung up" and subsequently dropped 10-15 inches. Operators stopped lowering the mast at 375 inches and verified that there was no slack cable alarm present (i.e., the bundle itself did not move during the event). Operators on the bridge checked the bundle and core top guide for interference, then lowered the fuel bundle into its intended location. The operators then moved the mast to a defueled region of the core and attempted to recreate the event by extending and retracting the mast. On the third cycle of the mast, the condition was reproduced. The operators reported the incident to the Shift Supervisor and fuel handling activities were suspended.

≈1100 Mechanical maintenance personnel identified a bend in the mast following inspection of it. Maintenance recommended the use of the Unit 2 bridge for the completion of refueling.

10/27/93

0630 Surveillances SO-181-001 and SO-181-002 completed on Unit 2 bridge.

0850 Commenced refueling with the Unit 2 bridge.

1538 **EVENT #3**: A double blade guide (removed from core locations 37-22 & 39-24) impacted the pressure vessel wall during its movement from the core to the fuel pool. Just prior to impact, the SRO on the bridge realized that the mast was not raised high enough for the blade guide to pass through the transfer canal (grapple height was 150 inches which is satisfactory for mast movement *without* a load attached). The bridge was stopped (and its direction actually reversed) prior to the mast impacting the wall, but the momentum of the blade guide allowed it to swing forward and strike the vessel wall. The mast was then raised to the proper height and the blade guide moved to its intended location in the fuel pool.

1945 Mechanical Maintenance personnel conducted a visual inspection of the mast using a video camera and identified a distinct "bow" in the 10-inch section; however, they did not identify any contact/friction points or other observable damage. The mast was cycled up and down several times without any abnormal indications. The 1200 pound test weight was lifted to ensure mast structural

integrity. After concurrence by operations and maintenance personnel, the mast was cleared for use. The vessel wall was also inspected using the video camera and no non-conforming conditions were noted.

2349 Resumed fuel reload after plant management modified the refueling procedures (e.g. requiring the mast to be fully raised prior to moving the bridge between the reactor cavity and the fuel pool, raising the mast in "slow" speed only) and implemented other short term corrective actions.

10/28/93

0231 Refueling operations were suspended when operators were unable to seat a fuel bundle in core location 13-24 due to interference from a bent blade guide handle in the adjacent cell. The fuel bundle was returned to the fuel pool at position DD-29 per reactor engineer direction.

0646 The interfering double blade guide (in positions 13-22 and 15-24) was moved to the fuel pool. Refueling operations resumed.

0707 2 more bundles moved into the core (within 9 minutes).

0710 **EVENT #4**: While lowering the mast in preparation for grappling a new fuel bundle in the fuel pool, one of the telescoping mast sections "hung up" and then suddenly dropped. A large amount of bubbles were observed in the pool for 5-10 seconds following the event. Final mast conditions indicated a normal air system, mast position of 206 inches, load cell reading of 193 pounds, and no slack cable alarm. No radiation alarms were received. Refueling operations were stopped. Inspection of the mast revealed that the 10-inch section was bent. (PP&L subsequently determined that the cause of this event was due to weakening of the mast from EVENT 3 and subsequent mast weakening and eventual bending from hydrodynamic forces on the mast as a result of rapid bridge movements.)

0900 Preparations were made to replace the mast on the Unit 1 bridge in order to ready it for refueling.

1130 The SSES Vice President - Operations directed a halt to fuel loading pending the completion of an Event Review Team investigation and implementation of comprehensive corrective actions.

1700 The previously damaged Unit 1 mast was removed from its bridge. By agreement with Region I management, PP&L agreed to curtail further refueling activities.

10/29/93

1200 NRC Augmented Inspection Team arrived on site.

ATTACHMENT 4

PREVIOUS IMPACT EVENTS AT SSES SINCE 1984

(1) 3/29/84; Unit 2: A fuel bundle hit the transfer canal ("cattle chute"). PP&L attributed the root cause to one of two possibilities; slippage of the fuel hoist or a stuck downbutton on the hoist. The bundle was inspected, no problems were noted, and no other corrective actions were taken beside maintenance activities.

(2) 3/31/84; Unit 2: An operator forgot to retract the hoist after releasing a blade guide. The bridge was moved and the mast was bent when the grapple caught on a blade guide bail handle. Cause of the event was attributed to the operator's overzealousness and inexperience. Corrective actions comprised improving training and ensuring that any operator moving fuel for the first time would be supervised by someone who had actual fuel handling experience.

(3) 3/22/86; Unit 1: The mast experienced binding while lowering a fuel bundle. Maintenance determined the binding was due to an "external force" which bent the sections. The mast was replaced with Unit 2's mast. No explanation of the "external force" was given, nor did the SOOR issued for this event address or explain what the force was. (See Section 7.)

(4) 4/13/89; Unit 1: Operators were unable to release a double blade guide from the hoist. The blade guide had to be physically pried from the grapple. The cause was attributed to a bent bail handle. Before this event, the bridge operator had banged the blade guide into the transfer canal. The SOOR for this event stated that how or when the handle was bent could not be determined. The SOOR discounted the impact as the cause for the bent handle.

(5) 10/16/89; Unit 2: An operator was heading for the transfer canal when he realized his Y coordinate was wrong. He stopped bridge movement and moved the mast in the Y direction. However, he ran the mast into the side railing of the chute and damaged the mast. Root cause was attributed to the operator being tired and anxious for turnover and inattention to detail. Corrective actions were administrative in nature.

(6) 10/16/92; Unit 2: The mast was damaged when it contacted the transfer canal. The bridge was being moved to the spent fuel pool. The root cause was attributed to inattention to detail. The SOOR for the event stated that it was an isolated instance.

ATTACHMENT 5

BUNDLE/BLADE GUIDE MOVEMENT ERRORS

The following history of bundle/blade guide mis-manipulations was compiled from various SOOR's. SOOR numbers appear in parentheses.

September 20, 1986 (2-86-157)

EVENT: Fuel bundle found in incorrect position in the core.
CAUSE: Operator error.
ACTION: Incorporate lessons learned into training before the next outage.

September 27, 1987 (1-87-270 and 271)

EVENT: 3 double blade guides removed from wrong location.
CAUSE: Failure to follow procedure; operator error.
ACTION: Issued management letter to all licensed operators.

EVENT: Fuel bundle removed from wrong location in the core.
CAUSE: Failure to follow procedure; operator error.
ACTION: Issued management letter to all licensed operators.

April 15, 1988 (2-88-91)

EVENT: Wrong fuel bundle placed in the core.
CAUSE: Operator error.
ACTION: Incorporated lessons learned into operator training; purchased a new "sight box" to aid in peripheral vision; Reactor Engineering revised RE-TI-004 (to provide copies of all changes to the core component movement sheets to Operations so that it can trend the number of mispositioning occurrences).

April 13, 1989 (1-89-127)

EVENT: Fuel bundle placed in wrong location in the fuel pool.
CAUSE: Operator error.
ACTION: Essentially none. In the SOOR analysis, Reactor Engineering stated that all steps known to prevent errors were taken and no further actions were needed to prevent recurrence.

September 19, 1989 (2-89-125)

EVENT: Wrong fuel bundle moved during core reload.
CAUSE: Operator error.
ACTION: Counseled operators.

April 17, 1991 (2-91-102)

EVENT: Moved fuel bundle without verifying all initial conditions.
CAUSE: Operator error.
ACTION: Address in operator training; Enhanced procedures regarding suspending/reinitiating fuel movements.

March 20, 1992 (1-92-105)

EVENT: 3 fuel bundles found in wrong position in the fuel pool.
CAUSE: Lack of attention to detail; operator error.
ACTION: Verified accuracy of position counters; permanently label trolley beams.

ATTACHMENT 6

HUMAN FACTORS CONCERNS

1. COMMUNICATIONS

During Event 1, the operators' response to an incorrect fuel bundle being pulled from the core was compromised by a communication error between the outage supervisor and the reactor engineer. The reactor engineer understood that an incorrect bundle had been removed from the core, and replaced in the core, in its original position. In reality, the bundle had not yet been returned to the core. As a result, the reactor engineer did not state that the bundle should not be replaced in the core. The outage supervisor believed that he had communicated to the reactor engineer that he intended to return the fuel bundle to that location from which it had been removed. In the absence of receiving any prohibition from the reactor engineer concerning this action the outage supervisor directed the fuel to be returned to the core.

The SRO on the bridge in charge of refueling activities, having recognized that an incorrect fuel bundle had been withdrawn from the core, terminated the fuel movement and communicated to the control room his recommendation that the fuel be placed in a location in the fuel pool that had been reserved for placement of fuel in emergency conditions. When the outage supervisor directed the fuel to be returned to the location within the core from which it had been withdrawn, the SRO understood this decision to have been made based upon consultation with Reactor Engineering and as a result he did not question the decision.

2. OPERATOR VIGILANCE

Interviews with operators involved in the four events revealed that the majority of these individuals described their refueling bridge duties as "boring" and "monotonous." Although reflecting a professional attitude regarding their responsibilities, most of the individuals interviewed indicated that they generally did not look forward to assignments on the bridge. The novelty and enjoyment of working on the bridge quickly was supplanted by boredom, and it became difficult to maintain the level of concentration required by the task. In contrast, a small minority of the operators interviewed stated that they enjoyed refueling bridge assignments. Most of the interviewees indicated that they had been assigned to refueling bridge activities. Many of them also indicated that they would like refueling bridge assignments to be voluntary.

The opinions of the individuals regarding refueling activities did not appear to be affecting the professionalism of the staff in completing refueling activities. However, the boredom experienced by the operators can be a direct precursor to lapses in attention. Whereas lapses in attention due to the repetitive nature of the task did not appear to be causal factors in these recent events, such lapses in attention can be reasonably expected to degrade the performance of the operators in conducting refueling activities.

3. WORK SCHEDULES

Many operators noted that the length of time that individuals were assigned to refueling bridge operations had been decreasing in recent years and that during the current refueling outage Ros were assigned to be on the bridge for two 3-hour stints during their 12-hour shift. Time off the bridge was considered rest periods. SROs are now assigned 4-hour stints on the bridge. The reduced number of consecutive hours on the bridge was viewed positively by the individuals interviewed, considering their views concerning the repetitive nature of the job.

4. HUMAN SYSTEM INTERFACE

The inspector examined the refueling bridge controls while the bridge was under quarantine and consequently not operating and displays not illuminated. The inspector interviewed an RO and SRO on the bridge regarding their tasks during bridge operations, and the controls and indications used to perform these tasks.

4.1 Uncontrolled Operator Aid

The inspector observed a placard hung at the controls of the refueling bridge which had numbers written in grease pencil that gave the operators information, including mast height required for clearing the transfer canal with no load on the mast, and mast extension points at which operators need to slow down. However, derivation and controls on the use of this operator aid could not be determined.

4.2 Team Work

Events 2 and 3, and an event from the 1992 Unit 2 refueling outage (SOOR 2-192-127) in which the mast struck the flange protector, all demonstrated inadequate team work. In these cases, the SROs were performing activities related to fuel movement, but failed to provide timely verification that the Ros were operating the bridge and mast clear of obstructions.

4.3 Task Design/Equipment Configuration

Events have occurred while using the other unit's refueling bridge. For example, a Unit 2 1992 refueling outage event (SOOR 2-192-127) involved the Unit 1 bridge "backing" into the transfer canal with the mast extended.

Using the bridge of the opposite unit for fuel movement activities results in the operator "backing" a bridge from the reactor vessel into the transfer canal. As a result, operators turn their attention from the mast (Z coordinate) to verify proper X and Y coordinate alignment with the transfer canal. Consequently, such configurations increased the probability that the bridge operator could lose track of mast status and approach the transfer canal with the mast inadvertently extended.

AGENDA

PP&L/NRC MANAGEMENT MEETING:

FUEL HANDLING AIT

November 18, 1993

MANAGEMENT PERSPECTIVE ..... R. G. Byram

LESSONS LEARNED/
CORRECTIVE ACTIONS ..... H.G. Stanley

SUMMARY ..... R. G. Byram

MANAGEMENT PERSPECTIVE

- The NRC AIT provided a valuable independent perspective.

- Recurring problems with fuel handling practices have caused us to examine the effectiveness of our assessment and corrective action programs.

- We've completed a comprehensive review to identify issues and take corrective actions.

- Short term corrections, including generic issues, have been implemented.

- Intermediate (by March, 1994 Unit 2 RFO) corrections have been identified and are in progress.

- A long term evaluation of the broader implications is being performed.

- We are confident that the results will be effective for the long term, and as a result will strengthen our organization.

MANAGEMENT PERSPECTIVE

PP&L has a strong record regarding the resolution of issues related to the design and operation of Susquehanna.

- We take aggressive measures where safety is challenged.
- Our people do high quality work.
- Our management is involved.

MANAGEMENT PERSPECTIVE

PP&L recognizes that our actions have been ineffective in resolving long standing problems with fuel handling activities.

- The individual events had broader safety implications.
- Our actions were inconsistent with our philosophy on shutdown risk.
- We did not provide our people with the tools they needed to succeed.

We have not met our values in this area; we are changing our standards.

MANAGEMENT PERSPECTIVE

The duration of a refueling outage is defined by the time it takes to ensure the safe performance of all activities and safe operation for the next cycle.

- Questioning attitudes will ensure safety remains our top priority.

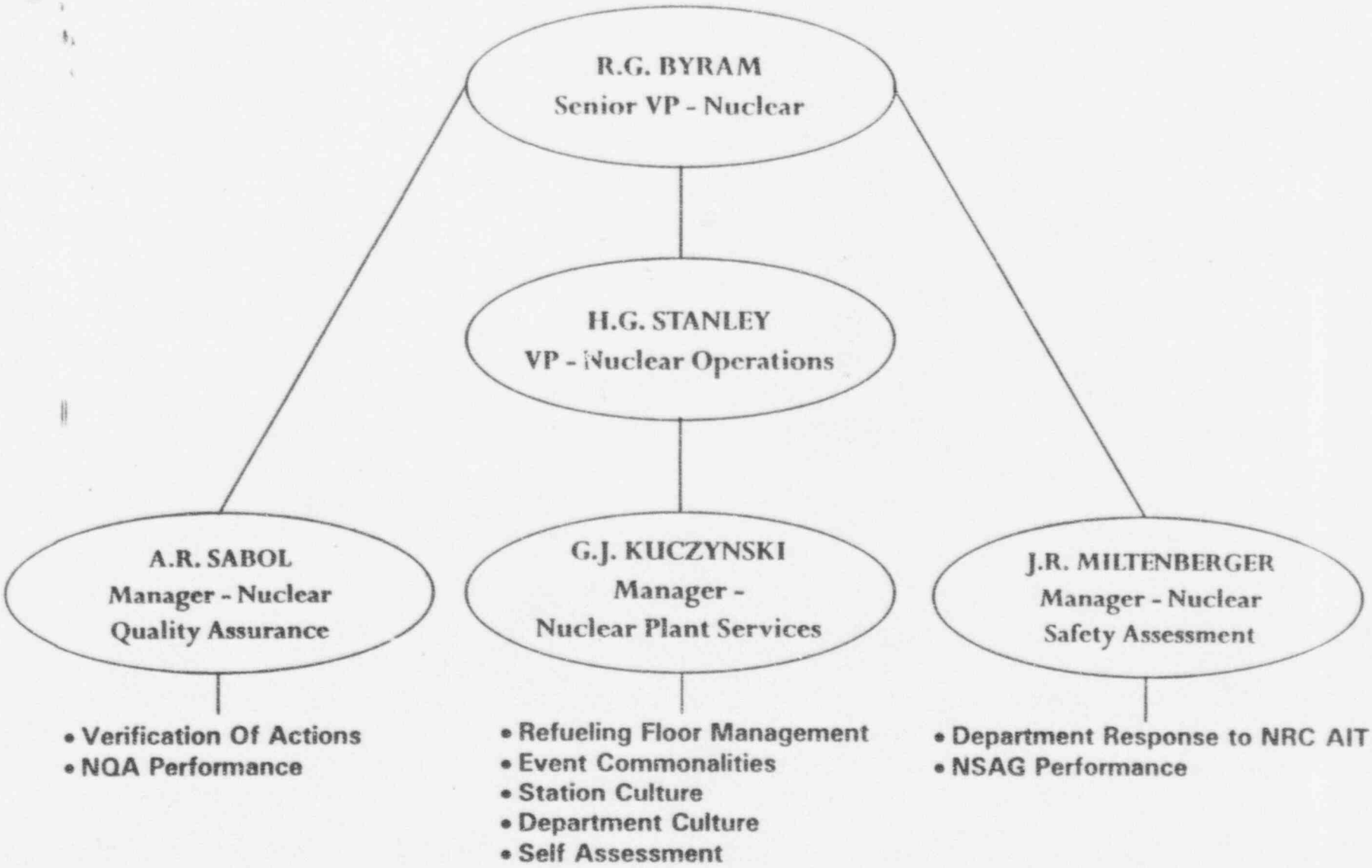
- Reinforcement of this expectation is a required response to the internally driven pressure of highly motivated people.

- Management must lead by example, listen, and be vigilant to ensure that critical path never supersedes safety.

MANAGEMENT PERSPECTIVE

PP&L is taking aggressive actions to resolve identified problems, and to continue to assess the broader implications.

- We have anaiyzed the information both specifically and generically.
- Short term corrective actions have been implemented that address both the specific events and their commonalities.
- Intermediate and longer term actions have been identified.
- Independent, outside insight will be sought and utilized.


R.G. BYRAM
Senior VP - Nuclear
H.G. STANLEY
VP - Nuclear Operations
A.R. SABOL
Manager - Nuclear
Quality Assurance
G.J. KUCZYNSKI
Manager -
Nuclear Plant Services
J.R. MILTENBERGER
Manager - Nuclear
Safety Assessment
• Verification Of Actions
• NQA Performance
• Refueling Floor Management
• Event Commonalities
• Station Culture
• Department Culture
• Self Assessment
• Department Response to NRC AIT
• NSAG Performance

MANAGEMENT PERSPECTIVE

LESSONS LEARNED

- Clearly set forth management expectations.
- Solve recurrent problems
- Preserve and enhance strong Susquehanna safety culture.

EVENT SUMMARY

October 6, 1993	Core Offload Error
October 26, 1993	Unit 1 Refueling Bridge Mast Non-Load Bearing Telescoping Section Dropped
October 27, 1993	Double Control Rod Blade Guide Impacted Vessel Wall While Being Moved
October 28, 1993	Difficulty Experienced With Aligning Fuel Bundle In Core
	Unit 2 Refueling Bridge Mast Non-Load Bearing Telescoping Section Dropped
	V.P.- Nuclear Operations Stopped All Refueling Activities
	(Later, Same Day) AIT Announced By NRC Region I With Confirmatory Action Letter

INVESTIGATION AND ANALYSIS

- Seven Event Reviews
- Station Management Review Of Each Event
- NSAG Assessments During Event Reviews
- Management Review Teams
  - Management Of Refuel Floor
  - Look For Commonalities With Other Station Operating Events
  - Station Culture
  - Department Culture
  - Effectiveness Of Self-Assessment

REFUELING OPERATIONS HISTORICAL PERSPECTIVE

- Several Previous Occurrences Of Bent Mast Assemblies At Susquehanna
- Higher Frequency Of Occurrences At Susquehanna Compared To Industry
- Each Event By Itself Was Not Judged To Be Significant
  - Incomplete Determination Of Root Causes
  - Did Not Identify Adverse Trends
  - Generic Implications Not Assessed

BASIC ROOT CAUSES

- Management Oversight

  - Command and Control
  - Structured Monitoring Of Fuel Handling Activities
  - Followup On Corrective Actions
  - Communication Of Management Expectations
  - Self Assessment

- Procedures

  - Design Limitations/Operating Constraints
  - Off Normal Procedure
  - Comprehensiveness (Operations And Maintenance)
  - User Friendliness

BASIC ROOT CAUSES (continued)

- Training
  - Consistency With Management Direction And Expectations
  - Monitoring
  - Significance Of Refueling Activities

- Culture
  - Threshold For Taking Management Action
  - Acceptance Of Human Error As Root Cause Without Further Inquiry
  - Perception Of Expectations For Critical Path Activities
  - Integrated Management Structure For Refuel Floor Activities
  - Follow-Up On Implementation Of Corrective Actions

CORRECTIVE ACTIONS

- Near Term (Prior To Commencing Unit 1 Core Reload)

- Intermediate Term (Prior To Unit 2 6th Refueling Outage - March '94)

- Long Term

NEAR TERM CORRECTIVE ACTIONS

MANAGEMENT

- Establish Refueling Floor Manager
  - SRO Certified
  - Recognized Leader
  - Technically Competent
  - Reinforces Chain of Command
- Strengthen Engineering Support For Refueling Floor Activities
  - System Engineer Assigned
  - Implement Short Term Recommendations
- Leadership
  - Listening
  - Communication
  - Teamwork
  - Resolution of Concerns

NEAR TERM CORRECTIVE ACTIONS

PROCEDURES

- Upgrade Maintenance Procedures For Maintaining The Refueling Bridge
- Develop Integrated Single Procedure For Conducting The Unit 1 7th Refuel Outage Core Reload
- Develop Specific Procedure For Off Normal Refueling Bridge Operations
- Revise And Perform Specific Surveillance Procedures For Refueling Bridge Operability
- Institute Refueling Floor Management Administrative Procedure/Program

NEAR TERM CORRECTIVE ACTIONS

TRAINING

- Complete Training For Operations On Refueling Bridge Operation And Procedure For Unit 1 7th Refuel Outage Core Reload

NEAR TERM CORRECTIVE ACTIONS

CULTURE

- Communicate Expectations To Station Personnel
  - High Standards
  - Zero Defect Goals
  - Supervisory Follow-Up And Monitoring
  - Teamwork
  - Listening And Acting On Issues
  - Management Visibility
  - Schedule Pressure
- Institutionalize The Concept That Root Causes Attributed To Human Error Will Be Probed Deeper To Determine Why Human Error Occurred

INTERMEDIATE TERM CORRECTIVE ACTIONS (PRIOR TO UNIT 2 6TH REFUEL OUTAGE)

MANAGEMENT

- Critique Unit 1 7th Refuel Outage Core Reload With Refueling Floor Manager Concept/Adjust Program For Unit 2
- Select/Train Permanent Personnel For Refueling Floor Management
- Assess Operation Support Staff Performance, Training, Qualifications And Organization
- Evaluate Actions Required On The List Of Other Equipment/System Issues For Unit 2 6th Refuel Outage Work
- Implement Short-Term Engineering Recommendations On The Unit 2 Refueling Bridge
- Communicate Lessons Learned To Industry

INTERMEDIATE TERM CORRECTIVE ACTIONS (PRIOR TO UNIT 2 6TH REFUEL OUTAGE)

PROCEDURES

- Review Fuel And Core/Fuel Pool Handling Procedures To Be Used For Unit 2 6th Refuel Outage and Revise Accordingly

- Enhance Refueling Bridge Test Weight Issues

  - Tech Spec Changes

  - Procedures/Work Controls For Weights

INTERMEDIATE TERM CORRECTIVE ACTIONS (PRIOR TO UNIT 2 6TH REFUEL OUTAGE)

TRAINING

- Identify Specific Training Needs For Fuel Handling/Core Component Handling Activities And Adjust/Conduct Training Accordingly

INTERMEDIATE TERM CORRECTIVE ACTIONS (PRIOR TO UNIT 2 6TH REFUEL OUTAGE)

CULTURE

- Perform A 'DACUM' Process For Supervisory Training In Areas Of:

  - Listening
  - Follow-Up
  - Monitoring
  - High Standards

(Include In Employee Concerns Module)

INTERMEDIATE TERM CORRECTIVE ACTIONS
(PRIOR TO UNIT 2 6TH REFUEL OUTAGE)

Culture (Cont.d)

- Communicate Expectations To Department Personnel
  - High Standards
  - Zero Defect Goals
  - Supervisory Follow-Up And Monitoring
  - Teamwork
  - Listening And Acting On Issues
  - Management Visibility
  - Schedule Pressure

INTERMEDIATE TERM CORRECTIVE ACTIONS
(PRIOR TO UNIT 2 6TH REFUEL OUTAGE)

Culture (Cont.d)

- Lower The Threshold For Writing SOORs and Improve Corrective Action For Repeat Events
- Lower The Threshold For Conducting NSAG Investigations
- Revise Scheduling 'Terminology'
- Conduct Thorough Human Factors Review Of SSES Refueling Platforms

LONG TERM CORRECTIVE ACTIONS

MANAGEMENT

- Benchmark The Industry For The Best Refueling Floor Management
- Conduct/Host An INPO Assist Visit On Refueling Floor Management
- Institutionalize Refueling Floor Assessment And Monitoring
- Strengthen The Operations Staff Support Function
- Implement The Results Of Evaluation Performed For List Of Other Equipment/System Issues
- Implement The Long Term Engineering Recommendations On The Refueling Bridges
- Review Root Cause/Corrective Action Process and Recommend Changes

LONG TERM CORRECTIVE ACTIONS

PROCEDURES

- Perform A Review Of Related Refueling Floor Procedures And Upgrade Accordingly

- Perform A Review Of Work Controls (Preventive And Corrective) For Refueling Floor Work And Upgrade Accordingly

LONG TERM CORRECTIVE ACTIONS

TRAINING

- Review And Upgrade Training Programs For Personnel Who Perform Work Activities On The Refuel Floor

LONG TERM CORRECTIVE ACTIONS

CULTURE

- Conduct Re-training For All Personnel On Nuclear Department Supervisory Training Matrix On The Expectations Of:

  - Listening
  - Follow-Up
  - Monitoring
  - High Standards
  - Employee Concerns

- Institutionalize A More Stringent Corrective Action Program For Dealing With Repeat Events

- Implement Human Factors Review Recommendations On Both Refueling Platforms

WHAT HAVE WE LEARNED?

- Clearly Set Forth Management Expectations
  - Communicate Individual Performance Objective Of Zero Defects
  - Conduct Verifications With Questioning Attitude
  - Provide Checks And Balances Through Effective Oversight
  - Reinforce Teamwork
  - Lead By Example
- Solve Recurrent Problems
  - Lower Threshold To Initiate Action
  - Identify True Root Causes - Particularly For Human Performance
  - Strengthen Ability To Detect Recurring Problems
  - Generic Implications
  - Status Control

WHAT HAVE WE LEARNED? (continued)

- Preserve And Enhance Strong Susquehanna Safety Culture
  - Reconfirm Commitment That Safety Is Not Compromised By Schedule
  - Better Utilize Assessment Resources And Listen To Their Messages
  - Strengthen Elements Of Defense-In-Depth (Training, Procedures, Design) Commensurate With Expectations

MANAGEMENT PERSPECTIVE

PP&L is committed to learning from these issues and strengthening our organization for the long term.

- We are taking a comprehensive, aggressive look at ourselves.
- We will listen, and face the facts openly as they unfold.
- We are setting new standards, and will take steps to ensure behavioral changes occur.
- The results will be effective for the long term, and ensure an environment of cooperation, communication, and teamwork.

ATTACHMENT 8

U.S. NUCLEAR REGULATORY COMMISSION

REGION I

SUSQUEHANNA AUGMENTED INSPECTION TEAM EXIT

NOVEMBER 22, 1993

PURPOSE OF AN AIT

- LOWEST LEVEL OF NRC INCIDENT INVESTIGATION PROGRAM FOR RESPONSE TO OPERATIONAL EVENTS
- CONDUCT A TIMELY AND THOROUGH INSPECTION WITH THE EMPHASIS ON FACT-FINDING
- COLLECT AND ANALYZE THE FACTS TO DETERMINE CAUSE(S) OF THE EVENT
- ASSESS THE SAFETY SIGNIFICANCE OF THE EVENT

AN AIT DOES NOT:

- DETERMINE WHETHER NRC RULES WERE VIOLATED OR RECOMMEND ENFORCEMENT ACTION
- ADDRESS THE APPLICABILITY OF GENERIC CONCERNS TO OTHER PLANTS

EXIT AGENDA

- AIT CHARTER
- EVENTS DISCUSSION AND FINDINGS
- ADEQUACY OF CORRECTIVE ACTIONS IN LIGHT OF PREVIOUS SIMILAR EVENTS
- FUEL HANDLING PROCEDURES
- SAFETY SIGNIFICANCE OF FUEL HANDLING ACTIVITIES
- MANAGEMENT OVERSIGHT AND CONTROL OF FUEL HANDLING ACTIVITIES
- MAINTENANCE ASSESSMENT
- GENERIC IMPLICATIONS
- POST AIT ACTIVITIES

AIT CHARTER

- WHY THE AIT WAS CONDUCTED
- SCOPE AND OBJECTIVES
    - (1) Determine the cause(s) of each event
    - (2) Determine the adequacy of PP&L's response to each of the events
- ASSESS SAFETY SIGNIFICANCE
- DETERMINE ADEQUACY OF MANAGEMENT OVERSIGHT
- REVIEW ADEQUACY OF PROCEDURES AND TRAINING
- DETERMINE POSSIBLE GENERIC IMPLICATIONS

AIT MEMBERS

TEAM LEADER	**R. Temps** Project Engineer, DRP
TEAM MEMBERS	**R. Summers** Project Engineer, DRP
	D. Desaulniers Human Factors Specialist, NRR
	D. Mannai Resident Inspector, DRP
	C. Sisco Operations Engineer, DRS
	S. Morris Reactor Engineer, DRP

SAFETY SIGNIFICANCE OF FUEL HANDLING ACTIVITIES

- REFUELING OPERATIONS ARE SAFETY SIGNIFICANT
- TREATMENT OF FUEL HANDLING AS A SAFETY SIGNIFICANT ACTIVITY WAS LACKING IN PP&L's RESPONSE TO FUEL HANDLING PROBLEMS
- PAST EVALUATIONS STATED "NO SAFETY SIGNIFICANCE" OR "INCREASED OUTAGE TIME" AS A CONSEQUENCE
- RESOLUTION OF BENT MAST SECTIONS MORE CONCERNED WITH ECONOMIC FACTORS; i.e. MAINTAINING TIMELINESS OF CORE OFFLOAD/RELOAD
- SPARE MAST STAGED DURING REFUELINGS DUE TO HISTORY OF PROBLEMS
- CONTRACTOR's RECOMMENDATIONS MADE IN 1986 ON REDUCING WEAR & TEAR ON FUEL HANDLING EQUIPMENT WERE NOT IMPLEMENTED

MANAGEMENT OVERSIGHT OF FUEL HANDLING ACTIVITIES

- OPERATIONS MANAGEMENT OVERSIGHT OF FUEL HANDLING ASSESSED AS WEAK
- DELEGATION TO REFUELING BRIDGE SENIOR REACTOR OPERATOR
- UNAWARE OF BRIDGE OPERATOR's PRACTICES AND CONCERNS
- EXPECTATIONS NOT MET
- DESPITE PERFORMANCE PROBLEMS OVER THE YEARS, MANAGEMENT OVERSIGHT REMAINED UNCHANGED

MAINTENANCE ASSESSMENT

I. CURRENT ACTIVITIES:

- NON-"Q" COMPONENT USE
- INADEQUATE POST MAINTENANCE TEST
- LOAD CELL CALIBRATION AND RELATED ISSUES

II. MAINTENANCE HISTORY

- AIT FOUND 13 EVENTS OF BENT MASTS SINCE 1984
- NO CORRECTIVE MAINTENANCE TRENDING
- 1986 MAST BENDING EVENTS AND INVESTIGATION
- INTERVIEW RESULTS OF STAFF

POTENTIAL GENERIC CONCERNS

I. OPERATIONAL CONCERNS:

- ACCEPTABILITY OF THREE DIRECTION MOTION
- ACCEPTABILITY OF ACCELERATION & DECELERATION FORCES FOR FULLY EXTENDED MAST
- ACCEPTABILITY OF DRAG FORCES OF DOUBLE BLADE GUIDE MOVEMENT

I.. DESIGN CONCERNS:

- INTERFERENCE WITH DOUBLE BLADE GUIDE HANDLES IN SPENT FUEL POOL

NRC POST AIT ACTIVITIES

- COMPREHENSIVE REVIEW OF REVISED REFUELING AND RELATED PROCEDURES
- DIRECT OBSERVATION OF "DRY RUN" WALKTHROUGH OF REVISED PROCEDURE
- VERIFICATION AND VALIDATION OF OPERATOR TRAINING AND QUALIFICATION
- LICENSEE MANAGEMENT MEETING TO DISCUSS REFUELING EVENTS AND CORRECTIVE ACTIONS