May 3, 2000

Mr. John B. Cotton
Vice President, TMI Unit 1
AmerGen Energy Company, LLC
Three Mile Island Nuclear Station
PO Box 480
Middletown, Pennsylvania 17057-0480

SUBJECT: NRC INTEGRATED INSPECTION REPORT NO. 05000289/2000-002

Dear Mr. Cotton:

On April 1, 2000, the NRC completed an integrated inspection at your Three Mile Island Unit 1 reactor facility. The enclosed report presents the results of that inspection which the resident inspectors discussed with you and your staff during the April 11, 2000, exit meeting.

Your staff operated the unit safely during the inspection period. The power reduction for main condenser tube repairs was well planned and executed. The conduct of routine maintenance and surveillance testing was generally effective.

You identified several human performance issues during the inspection period that were entered into your corrective action process for resolution. While none of the events individually had any risk significance, the continued recurrence of these and similar low level human performance errors over the last several months is of concern and warrants your continued attention.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and enclosure will be placed in the NRC Public Document Room (PDR).

No reply to this letter is necessary. We appreciate your cooperation.

Sincerely,

/RA/

John F. Rogge, Chief
Projects Branch 7
Division of Reactor Projects

Docket No.: 05000289
License No.: DPR-50

Enclosure: NRC Inspection Report No. 05000289/2000-002

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REGION 1

Docket No.	05000289
License No.	DPR-50
Report No.:	2000-002
Licensee:	AmerGen Energy Company, LLC (AmerGen)
Facility:	Three Mile Island Station, Unit 1
Location:	PO Box 480 Middletown, PA 17057
Dates:	February 27, 2000 through April 1, 2000
Inspectors:	Wayne L. Schmidt, Senior Resident Inspector Craig W. Smith, Resident Inspector Stephen M. Pindale, Reactor Engineer, DRS
Approved by:	John F. Rogge, Chief Projects Branch 7 Division of Reactor Projects

EXECUTIVE SUMMARY

Three Mile Island Nuclear Power Station
Report No. 05000289/2000-002

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a five week period of resident inspection supplemented by a reactor safety inspector from the Region I office.

AmerGen Energy Company, LLC (AmerGen) operated Three Mile Island Unit 1 (TMI) safely at 100 percent power throughout the inspection period with the exception of a reduction to 50 percent power on March 10 - 13, 2000, for main condenser tube repair.

Operations

The planned power reduction for the main condenser tube testing and repair was well planned and executed. The unit was returned to full power operation. (Section O1.1)

AmerGen's evaluation associated with Generic Letter 98-02, "Loss of Reactor Coolant Inventory and Associated Loss of Emergency Mitigation Functions While in a Shutdown Condition," concluded that TMI was not susceptible to the Wolf Creek event. The inspector found the evaluation appropriate and NRC's review of Generic Letter 98-02 is closed. (Section O7.1)

Maintenance

Plant operators shut down the B emergency diesel generator prior to completing the full surveillance run due to an exhaust manifold leak. The cause of the leakage was improper assembly of the exhaust manifold during the previous maintenance inspection. Engineering determined the diesel remained operable even with the exhaust leakage. (Section M1.1)

AmerGen was not able to determine a cause for the reactor river water strainer motor tripping on thermal overload. The maintenance work procedure and vendor technical manual provided insufficient detail to direct maintenance activities on the strainer or to aid in troubleshooting efforts. Proceduralized contingencies were put into place directing plant operators to monitor the strainer motor during operation and to operate the strainer manually in the event the motor tripped. Engineering was developing an action plan to determine and correct the cause of the motor tripping. (Section M2.1)

A human performance error by two maintenance technicians during performance of a routine calibration activity resulted in the inadvertent trip of the C reactor protection system channel. There were no actual consequences that resulted and the risk significance of the event was minor. (M4.1)

Engineering

Engineering's review and resolution of findings associated with an environmental qualification program self-assessment were acceptable. The timeliness of planned and completed corrective actions was commensurate with safety. Minor lapses in the overall work management of some of the evaluations and associated corrective actions were being addressed by the on-site engineering staff. (Section E7.1)

Plant Support

AmerGen identified several examples of poor radiological work practices. The events were documented in the corrective action process and management took actions to reenforce expectations with plant workers. (Section R1.1)

TABLE OF CONTENTS

I. Operations 1
O1 Conduct of Operations 1
O1.1 Power Reduction for Condenser Tube Repairs 1
O7 Quality Assurance in Operations 1
O7.1 Response to Generic Letter 98-02 1

II. Maintenance 2
M1 Conduct of Maintenance 2
M1.1 Emergency Diesel Generator Shutdown During Surveillance Testing . . 2
M2 Maintenance and Material Condition of Facilities 3
M2.1 Reactor River Water Pump Outlet Strainer Tripped During Surveillance Testing 3
M4 Maintenance Staff Knowledge and Performance 4
M4.1 Reactor Protection System Channel Trip Following Maintenance 4

III. Engineering 5
E7 Quality Assurance in Engineering 5
E7.1 Follow-up for Previously Identified Equipment Qualification Deficiencies 5
E8 Miscellaneous Engineering Issues 7
E8.1 (CLOSED) Licensee Event Report 99-03-01: Condition Outside Design Basis for Control Room Habitability 7
E8.2 (CLOSED) Unresolved Item 99-08-02: Decay Heat Removal Heat Exchanger Testing 7

IV. Plant Support 8
R1 Radiological Protection and Chemistry (RP&C) Controls 8
R1.1 Poor Radiological Work Practices 8

V. Management Meetings 8
X1 Exit Meeting Summary 8

INSPECTION PROCEDURES USED 9

ITEMS OPENED, CLOSED AND DISCUSSED 9

LIST OF ACRONYMS USED 9

Report Details

Summary of Plant Status

AmerGen Energy Company, LLC (AmerGen) operated Three Mile Island Unit 1 (TMI) at 100 percent power throughout the inspection period with the exception of a reduction to 50 percent power on March 10 - 13, 2000, for main condenser tube repair.

I. Operations

O1 Conduct of Operations (71707)

O1.1 Power Reduction for Condenser Tube Repairs

a. Inspection Scope

The inspector observed activities involving a planned reduction to 50 percent power on March 10 - 13, 2000, to investigate a suspected tube leak in the B main condenser.

b. Observations and Findings

Operators exhibited good control over the power reduction and subsequent return to 100 percent power. AmerGen developed a detailed schedule of work activities to be completed during the power reduction greater than 72 hours before the power reduction. Operations management was actively involved in directing the work activities and the control room operators were well informed of upcoming evolutions. A leaking tube was identified and repaired. The cause of the tube leak was mechanical wear of the tube against a tube support structure. No other evidence of similar wear indications was identified on other tubes.

c. Conclusions

The planned power reduction for the main condenser tube testing and repair was well planned and executed. The unit was returned to full power operation.

O7 Quality Assurance in Operations (Temporary Instruction 2515/142)

O7.1 Response to Generic Letter 98-02

a. Inspection Scope

The inspector reviewed AmerGen's efforts taken to determine whether potential draindown paths from the reactor coolant system (RCS) could be created by operator or equipment error similar to the September 1994 occurrence at Wolf Creek as discussed in NRC Generic Letter (GL) 98-02, "Loss of Reactor Coolant Inventory and Associated Loss of Emergency Mitigation Functions While in a Shutdown Condition."

b. Observations and Findings

By internal memorandum dated October 8, 1998, the licensee documented their assessment of GL 98-02. Engineering evaluated potential flow paths and system alignments for the RCS, emergency core cooling systems (ECCS) (including the decay heat removal (DH) system), and the borated water storage tank (BWST) to determine if TMI was susceptible to a common cause failure and associated consequences similar to the 1994 Wolf Creek event. Although the ECCS share a common suction supply, Engineering concluded that TMI was not susceptible to voiding because the recirculated reactor coolant does not enter the shutdown cooling or other ECCS between the BWST outlet and pump suctions. Any recirculated fluid is routed directly to the BWST.

The inspector independently reviewed system design and drawings as well as operating and test procedures, and determined that Engineering's conclusions were appropriate. Notwithstanding the licensee's conclusion that TMI was not susceptible to the Wolf Creek event, Engineering still evaluated system configurations that could potentially result in a reactor coolant system draindown (to the BWST). Several potential configurations were identified, and the associated assessment identified the existing administrative controls and operating practices that minimize the likelihood of draining the reactor coolant. The inspector identified some additional minor procedure weaknesses related to procedure coordination (possible simultaneous use of multiple procedures) and procedure clarity. In response, Engineering initiated engineering task tracking system (ETTS) items 30158 and 30161 to enhance the affected procedures. No further action was required based upon the results of AmerGen's assessment and the inspector's independent review.

c. Conclusions

AmerGen's evaluation associated with GL 98-02, "Loss of Reactor Coolant Inventory and Associated Loss of Emergency Mitigation Functions While in a Shutdown Condition," concluded that TMI was not susceptible to the Wolf Creek event. The inspector found the evaluation appropriate and NRC's review of GL 98-02 is closed.

II. Maintenance

M1 Conduct of Maintenance (62707)

M1.1 Emergency Diesel Generator Shutdown During Surveillance Testing

a. Inspection Scope

The inspector reviewed AmerGen's actions in response to plant operators shutting down the B emergency diesel generator (EDG) during routine surveillance testing on February 28, 2000, due to an exhaust manifold leak.

b. Observations and Findings

The plant operators identified an exhaust manifold leak on the B EDG during routine surveillance testing. The diesel was operating unloaded at the time of discovery and was shut down using the normal shutdown procedure before the surveillance was completed. The licensee determined the cause of the leak to be inadequate torque applied to the exhaust manifold fasteners during reassembly following a maintenance inspection conducted in March 1999. The fasteners came loose during subsequent operation, creating a leak path. AmerGen entered this event into its corrective action process (CAP) as event number 2000-0173.

Engineering determined the diesel generator remained operable, even with the exhaust manifold leak. Similar exhaust manifold flanges on the A and B EDG were inspected. No other loose connections were identified. The leaking exhaust manifold flange was repaired, and the surveillance testing on the B EDG was satisfactorily completed.

The inspector identified conflicting guidance in two different maintenance procedures concerning the proper assembly of the exhaust manifold flange. One procedure required a feeler gauge be used to ensure proper flange fit-up, and the other did not. Due to the physical arrangement of the flange, a torque wrench cannot be used to ensure proper fit-up. It could not be determined which procedure the maintenance technicians referenced during the March 1999 maintenance inspection.

c. Conclusions

Plant operators shut down the B emergency diesel generator prior to completing the full surveillance run due to an exhaust manifold leak. The cause of the leakage was improper assembly of the exhaust manifold during the previous maintenance inspection. Engineering determined the diesel remained operable, even with the exhaust leakage.

M2 Maintenance and Material Condition of Facilities (62707)

M2.1 Reactor River Water Pump Outlet Strainer Tripped During Surveillance Testing

a. Inspection Scope

The inspector followed AmerGen's action in response to the B reactor river water strainer (RR-S-1B) motor tripping on thermal overload during routine surveillance testing on February 22, 2000. Operators were able to restart the strainer motor and complete the surveillance test, but a job order was prepared to investigate the cause of the unexpected motor trip. On March 13, 2000, RR-S-1B was taken out of service to determine the cause of the motor tripping. The reactor river water system provides a source of heat removal for the reactor building environment through the reactor building emergency air coolers in the event of a large break loss of coolant accident.

b. Observations and Findings

AmerGen disassembled the strainer and determined the cause of the motor tripping to be mechanical interference between the strainer drum and basket and not an electrical problem with the motor. The manufacturer believed this was due to inadequate pre-load on the strainer bearing, which allowed the strainer to become misaligned during high flow conditions during reactor river water system operation. Maintenance technicians reassembled the strainer using guidance provided by the manufacturer's for pre-loading the strainer bearings.

The inspectors found the maintenance work procedures and vendor technical manual did not provide adequate guidance to the maintenance technicians. There was a heavy reliance on skill-of-the-craft to ensure proper alignment of the strainer basket during reassembly. No dimensional tolerances were required to be recorded. Therefore, the as-found conditions when the strainer motor tripped could not be compared against the as-left conditions from last time the strainer was overhauled, to aid in the troubleshooting efforts.

Following reassembly, the surveillance test was re-performed and the RR-S-1B motor tripped after approximately two minutes of operation. AmerGen was unable to determine an exact cause. Proceduralized contingencies were put into place directing plant operators to monitor the strainer motor during operation and to operate the strainer manually in the event the motor tripped. AmerGen was developing an action plan to disassemble the strainer and conduct a detailed dimensional tolerance inspection and repair as needed to determine and correct the cause of the motor tripping.

c. Conclusions

AmerGen was not able to determine a cause for the reactor river water strainer motor tripping on thermal overload. The maintenance work procedure and vendor technical manual provided insufficient detail to direct maintenance activities on the strainer or to aid in troubleshooting efforts. Proceduralized contingencies were put into place directing plant operators to monitor the strainer motor during operation and to operate the strainer manually in the event the motor tripped. Engineering was developing an action plan to determine and correct the cause of the motor tripping.

M4 Maintenance Staff Knowledge and Performance (62707)

M4.1 Reactor Protection System Channel Trip Following Maintenance

a. Inspection Scope

The inspector observed AmerGen's response to the inadvertent tripping of the C reactor protection system (RPS) channel upon returning the system to service following maintenance on March 3, 2000.

b. Observations and Findings

During routine calibration of the power range nuclear instrument, in accordance with the approved procedure, the technicians placed the C RPS channel in manual bypass to prevent the test signals from actuating the reactor protection circuitry. Upon completion of the calibration activity, the technicians took the C RPS channel out of manual bypass, and the channel inadvertently actuated. Operators placed the channel back in manual bypass to determine the cause of the inadvertent actuation. The technicians found that the channel Power/Flow/Imbalance trip module had not been reset as required by procedure prior to taking the channel out of manual bypass.

The cause of the actuation was maintenance technicians failing to properly complete the required independent verification that all the trip modules were reset prior to taking the channel out of manual bypass. In addition, the shift manager must give his permission prior to returning the channel to service, providing another opportunity to verify the status of the trip modules. The other three RPS channels were operable at all times during this event. There was no associated Technical Specification violation. The risk significance of this event was minor. Failure to complete a proper independent verification required by procedure constituted a violation of minor significance not subject to formal enforcement action. AmerGen entered this event into its CAP as event number 2000-0183.

c. Conclusions

A human performance error by two maintenance technicians during performance of a routine calibration activity resulted in the inadvertent trip of the C reactor protection system channel. There were no actual consequences that resulted and the risk significance of the event was minor.

III. Engineering

E7 Quality Assurance in Engineering (37551)

E7.1 Follow-up for Previously Identified Equipment Qualification Deficiencies

a. Inspection Scope

The inspector reviewed the AmerGen efforts taken after an independent self-assessment of TMI's environmental qualification (EQ) program identified several individual and program deficiencies. The NRC previously reviewed the licensee's Environmental Qualification Self-Assessment (Technical Data Report No. 1241, dated May 1999) in NRC Inspection Report 99-005, which concluded the self-assessment was a comprehensive effort. During this inspection, the inspector reviewed AmerGen's extent of condition efforts to determine whether the self-assessment findings had similar impact on other equipment or other postulated accidents. The inspector reviewed the list of the deficiencies, interviewed responsible personnel, and evaluated the characterization, status, and timeliness of the associated corrective actions.

b. Observations and Findings

The May 1999 self-assessment conducted a vertical slice review and included 12 of the 60 EQ files. Sixty-five issues were identified, although the findings did not result in any equipment being inadequately qualified for its intended safety function. The individual issues from the self-assessment were captured by the CAP and/or ETTS items.

To address the broader aspects of the individual findings, AmerGen implemented several corrective actions. These included developing an EQ File Release Checklist (to be used to ensure existing EQ files satisfy 10CFR50.49 requirements), revising the administrative procedure that governs the EQ program (to address program deficiencies identified by the self-assessment), and evaluating and updating the Environmental Parameters database. AmerGen is in the process of reviewing all 60 EQ files against the revised parameters and the EQ File Release Checklist. During this review, additional items were identified and have been corrected. One item identified during the extent of condition review reached the threshold for entering it into the CAP (event number 1999-0670) and was related to position indication for three motor-operated containment isolation valves. Engineering's review of the CAP determined that the valves remained operable.

Although all items were captured by CAP or ETTS items, there were some discrepancies relative to correlating the issues, responsible individuals and corrective action due dates. The inspector informed Engineering of the discrepancies, who acknowledged that it was difficult to correlate the above items in order to demonstrate positive control and management of the issues. Further, the inspector found that ownership of issues and associated resolution responsibilities were not maintained by a single individual. To address the above items, Engineering stated that they were reviewing all self-assessment deficiencies and related EQ issues to develop a current and comprehensive matrix to correlate issues, responsibilities, due dates, and status of resolution.

The inspector reviewed selected CAP and ETTS items and found that the issues were being evaluated adequately and in a timely fashion. Based on the review of several individual self-assessment findings, the inspector determined that Engineering was providing acceptable attention to the EQ self-assessment findings.

c. Conclusions

Engineering's review and resolution of findings associated with an environmental qualification program self-assessment were acceptable. The timeliness of planned and completed corrective actions was commensurate with safety. Minor lapses in the overall work management of some of the evaluations and associated corrective actions were being addressed by the on-site engineering staff.

E8 Miscellaneous Engineering Issues (92903)

E8.1 (CLOSED) Licensee Event Report 99-03-01: Condition Outside Design Basis for Control Room Habitability

NRC Inspection Report 1999-004 documented in detail the technical issues surrounding the initial licensee event report (LER). Supplement 01 to the LER updated the corrective actions taken by AmerGen to bring the control building ventilation system back into compliance with the design basis of the facility.

AmerGen completed testing in August 1999 that supported changes to the control room ventilation system operating procedure. The procedure changes removed the potential for the condition described in the LER. The inspector found that the test report and procedure changes adequately addressed the issue described in the LER. This LER is closed.

E8.2 (CLOSED) Unresolved Item 99-08-02: Decay Heat Removal Heat Exchanger Testing

This item was open to review the operability justification for the DH system heat exchangers following testing during the 13R refueling outage in the Fall of 1999. During 13R, AmerGen conducted testing that indicated that the B DH heat exchanger overall heat transfer coefficient was about 78 percent of the Updated Final Safety Analysis Report (UFSAR) design value of 407 BTU/hr °F Ft^2. After a chemical cleaning of the B DH heat exchanger, AmerGen conducted a heat removal comparison test between the A DH and B DH heat exchangers finding them essentially equivalent. To justify the equivalence AmerGen used a 12 R test that showed that the A DH heat exchanger heat transfer coefficient was at about 96 percent of the UFSAR design value of 407 BTU/hr °F Ft^2. The design value overall heat transfer coefficient was used as an input to calculate the maximum reactor building temperature and pressure following a large break loss of coolant accident (LBLOCA), to ensure that the EQ requirements were bounding. AmerGen evaluated this issue in CAP 2000-0202

The inspector found that the CAP provided adequate justification and explanation of the lack of test quality and the subjectiveness of the results per calculation C-1101-212-E540-067, rev 1. Further, the inspector found that AmerGen conducted calculation C-1101-823-5450-001, rev 6 to determine the effect on the EQ design profile for an overall heat transfer coefficient of 300 BTU/hr °F Ft^2. The results of this calculation showed that containment water temperature exceeded the EQ profile by a maximum of 1°F at between 15,000 and 30,000 seconds following a LBLOCA with the design 95°F river temperature. Further the design EQ profile was not exceeded with 85°F river temperature.

CAP 2000-0202 recommended reviewing the uncertainties in the overall heat transfer determination method and then developing a test method to address the uncertainties. The inspector found the operability justification acceptable and closed this item.

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls (71750)

R1.1 Poor Radiological Work Practices

a. Inspection Scope

The inspectors followed AmerGen's actions in response to the licensee identifying several examples of poor radiological work practices.

b. Observations and Findings

CAP event number 2000-0217 documented several examples of poor radiological work practices including: two instances involving workers reaching into potentially contaminated floor drains without proper radiological controls; spread of contamination in a clean area of a relief valve test room from an unknown source; and a worker disassembling a clogged sample line on a contaminated system without proper radiological controls. The last example resulted in the spread of contamination into a clean area and two clothing contaminations. Plant management interviewed the workers involved to gain an understanding of the underlying causal factors for each of the events. Plant management determined the events were caused by individuals ignoring radiological postings based on a presumption of the radiological conditions that existed at the time. Actions were taken to communicate to all plant workers management expectations concerning adherence to radiological postings and standards. These failures to adhere to radiation protection program and procedure requirements constituted violations of minor significance not subject to formal enforcement action.

c. Conclusions

AmerGen identified several examples of poor radiological work practices. The events were documented in the corrective action process and management took actions to reenforce expectations with plant workers.

V. Management Meetings

X1 Exit Meeting Summary

Following completion of the inspection period, the resident inspectors conducted an exit meeting with AmerGen managers on April 11, 2000. The Division of Reactor Safety inspector conducted a separate exit meeting on March 9, 2000. AmerGen staff comments concerning the issues in this report were documented in the applicable report sections. No proprietary information was included.

INSPECTION PROCEDURES USED

IP37551	Onsite Engineering
IP62707	Maintenance Observation
IP71707	Plant Operations
IP71750	Plant Support Activities
IP92903	Followup - Engineering
TI2515/142	Draindown During Shutdown and Common-Mode Failure (NRC Generic Letter 98-02)

ITEMS OPENED, CLOSED AND DISCUSSED

Opened:
None

Closed:

99-03-01	LER	Condition Outside Design Basis for Control Room Habitability (Section E8.1)
99-08-02	URI	Decay Heat Removal Heat Exchanger Testing (Section E8.2)

Discussed:
None

LIST OF ACRONYMS USED

AmerGen	AmerGen Energy Company, LLC
BWST	Borated Water Storage Tank
CAP	Corrective Action Process
DH	Decay Heat Removal
ECCS	Emergency Core Cooling Systems
EDG	Emergency Diesel Generator
EQ	Environmental Qualification
ETTS	Engineering Task Tracking System
GL	Generic Letter
IR	Inspection Report
LER	Licensee Event Report
LBLOCA	Large Break Loss of Coolant Accident
NRC	Nuclear Regulatory Commission
PDR	Public Document Room
RCS	Reactor Coolant System
RP&C	Radiological Protection and Chemistry (RP&C)
RPS	Reactor Protection System
TMI	Three Mile Island Unit 1
UFSAR	Updated Final Safety Analysis Report