AmerGen

AmerGen Energy Company, LLC
Three Mile Island Unit 1
Route 441 South, P.O. Box 480
Middletown, PA 17057

Telephone: 717-944-7621

An Exelon/British Energy Company

May 24, 2001
5928-01-20127

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Dear Sir or Madam:

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)
OPERATING LICENSE NO. DPR-50
DOCKET NO. 50-289
LICENSEE EVENT REPORT (LER) NO. 2001-001-01, SUPPLEMENT 1,
"EMERGENCY FEEDWATER PUMP 2A INOPERABLE GREATER THAN THE TECHNICAL SPECIFICATION ALLOWABLE OUTAGE TIME DUE TO AN INCORRECT OPERABILITY DETERMINATION"

This letter transmits supplemental LER No. 2001-001-01, regarding the discovery of a condition prohibited by the Technical Specifications. For a complete description of the evaluated condition, refer to the text of the report provided on Forms 366 and 366A.

This condition did not adversely affect the health and safety of the public. For additional information regarding this LER contact Mr. Adam Miller of TMI Unit 1 Regulatory Assurance at (717) 948-8128.

Sincerely,

George H. Gellrich
Plant Manager

GHG/awm

ATTACHMENT: List of Regulatory Commitments

cc: TMI Senior Resident Inspector
Administrator, Region I
TMI-1 Senior Project Manager
File No. 01036

IE22

SUMMARY OF AMERGEN ENERGY CO. L.L.C. COMMITMENTS

The following table identifies commitments made in this document by AmerGen Energy Co. L.L.C. (AmerGen). Any other actions discussed in the submittal represent intended or planned actions by AmerGen. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITED DATE OR "OUTAGE"
The Operability Determination Process will be revised to clarify the methods for evaluating and documenting the operability of plant structures, systems, and components.	Completed
Recurring training for PORC members, Shift Managers, Senior Reactor Operators, and Responsible Technical Reviewers will be established, regarding the revised Operability Determination Process.	August 31, 2001
The bearing housings with gasketed joints on safety related pumps that have the potential for loose fasteners, which could impact operability, will be identified. A sampling of these fasteners will be checked to ensure appropriate tightness. If loose fasteners are found, then the sample will be expanded. Those components with loose fasteners will be evaluated for periodic Preventive Maintenance.	August 31, 2001
A Preventive Maintenance task will be established to periodically check the tightness of the bearing housing fasteners on all three emergency feedwater pumps.	August 31, 2001
The vibration monitoring program/procedures will be strengthened regarding equipment monitoring, including specifying the appropriate actions to take when indications deviate from expected levels.	August 31, 2001
The Inservice Test Program will be revised to emphasize prompt investigation and repair of components that fall into the Alert or Required Action ranges. This revision will include specific guidance if an IST parameter goes into the Alert or Required Action range.	July 31, 2001
Revised IST program training for engineers will be established.	August 31, 2001
System Engineering guidelines will be revised to require review of IST data, vibration data, and oil leakage data periodically as part of their System Monitoring process.	August 15, 2001
Auxiliary Operator logs will be revised to include criteria that constitutes excessive oil additions to oilers or reservoirs on safety related equipment.	August 15, 2001
A database will be implemented to allow tracking and trending of operator visual inspection data on safety related equipment.	March 15, 2002
Procedure requirements will be implemented to specify that shiftly operator visual inspections continue to be performed on accessible emergency equipment after an accident.	July 31, 2001
Recurring training on the operation of oilers, the importance of maintaining proper oiler levels, and the significance of low oil levels on component operability will be developed and presented to auxiliary operators and mechanical maintenance personnel.	December 31, 2001
A case study of this event will be developed and presented to the TMI-1 organization.	August 31, 2001

NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Three Mile Island, Unit 1	05000289	1 OF 8

TITLE (4)

Emergency Feedwater Pump 2A Inoperable Greater than the Technical Specification Allowable Outage Time Due to an Incorrect Operability Determination

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
02	01	2001	2001	- 001 -	01	05	24	2001	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)	100		20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Adam W.Miller of TMI-1 Regulatory Assurance	(717) 948-8128

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) **(16)**

On April 2, 2001, it was determined that EF-P-2A had been inoperable from February 1, 2001 through February 14, 2001. **Following further analysis of this event, it was determined on April 20, 2001 that the period of inoperability for EF-P-2A started on January 6, 2001 and lasted till February 14, 2001.** Technical Specifications provides a 72-hour allowable outage time, thus this event is reportable as a condition prohibited by Technical Specifications. It has been determined that the bolts fastening a cover of the outboard bearing housing had loosened sufficiently on **January 6, 2001** to impact operability. EF-P-2A may not have been able to perform its intended safety function, due to oil leakage and shaft vibration concerns, until the bolts were tightened on February 14, 2001. Operability determinations regarding the oil leakage and vibration conditions made previous to April 2, 2001 concluded incorrectly that EF-P-2A remained operable. The root cause of the incorrect operability determination was a failure to consider all the available information regarding the status of the component against its design basis requirements. Immediate corrective actions include: (1) procedure for operability determination revised, (2) initiated briefings for operating crews, (3) verified that the bearing housing bolts on all three emergency feedwater pumps were tight, and (4) reviewed the status of all safety related pumps and verified no similar concerns. The long-term corrective actions **include revision of the operability determination process and establishment of recurring training regarding the revised operability determination process**. There were no adverse safety consequences from this event, and the event did not affect the health and safety of the public.

I. Plant Operating Conditions Before The Event:

TMI Unit 1 was operating at 100% power at the time of the event.

II. Status of Structures, Components, or Systems That Were Inoperable At The Start Of The Event And That Contributed To The Event:

None.

III. Event Description:

On April 2, 2001 CAP T2001-0305 was generated to document that EF-P-2A *[BA/P] had been inoperable from February 1, 2001 through February 14, 2001. **Following further analysis of this event, it was determined on April 20, 2001 that the period of inoperability for EF-P-2A started on January 6, 2001 and lasted till February 14, 2001.** This condition is reportable under 10 CFR 50.73(a)(2)(i)(b) as a condition prohibited by Technical Specifications (TS). TS 3.4.1.1.a (1) prohibits having any one of the three Emergency Feedwater Pumps inoperable for greater than 72 hours. The other two Emergency Feedwater Pumps, EF-P-2B and EF-P-1, were operable during the time-period of **January 6, 2001 through February 14, 2001 except for allowed brief periods during TS required surveillances performed on January 6, 2001 and January 31, 2001**.

The operability determination was based on the effects of loose bolts fastening the **inner** cover of the **outboard** bearing housing. The bolts had loosened enough on January 6, 2001 to cause increased oil leakage and increased shaft vibration concerns of sufficient significance that EF-P-2A may not have been able to perform its intended safety function.

The Emergency Feedwater (EFW) system supplies feedwater to the Steam Generators, removing heat from the Reactor Coolant System to allow safe shutdown of the reactor. The system is not required for normal plant operations, normal startups or normal shutdowns. The system is used only during emergency conditions and periodic testing. There was no maintenance performed which would have caused or identified the loose bolt condition. Operators perform a visual inspection once per shift to verify no abnormal conditions exist, which include an oil level check. These visual inspections and any oil additions were documented on the Secondary Auxiliary Operators (AO) Log. There was no trending process in place to identify oil usage rate.

The following is a chronological description of the event.

During performance of a Heat Sink Protection System (HSPS) surveillance test on January 6, 2001, EF-P-2A was started and run for a few minutes.

An In-Service Test (IST) for EF-P-2A was performed on February 1, 2001 at which time, the pump axial vibration was found to be in the Alert Range. The oil addition rate increased from about once every two weeks before the test to once every two days after the test.

The plant staff did not initially relate the pump vibration to the oil leak. The plant staff focused upon the evaluation of the pump vibration readings, which were in the Alert Range. Since the vibration

levels were below the Required Action Range (in which the pump is required to be declared inoperable) the pump was determined to be operable.

A work request to repair the oil leak on EF-P-2A was submitted on February 10, 2001 when an AO recognized the oil addition rate had increased. The AO was aware that the leak had been previously identified on November 15, 2000 and wanted to increase the priority for repair. Following a discussion of this work request at the 06:30 planning meeting on February 12, 2001, the site resident NRC inspector observed EF-P-2A and noticed that the outboard pump bearing oiler bulb was empty and notified the Control Room. The oiler was filled and CAP T2001-0160 was initiated to address the empty oiler bulb. At that time EF-P-2A was determined to be operable based on the level of oil in the standpipe from the oiler.

On February 14, 2001, the bolts on the bearing housing cover were tightened and the oil leak stopped. Tightening of the bolts corrected the pump vibrations. A more detailed evaluation of operability for the time-period of February 1, 2001 through February 14, 2001 was then prepared. This evaluation took credit for operator action to maintain the oil level in the pump and did not consider any further loosening of the bolts during emergency operation.

As a result of the investigation under CAP T2001-0160, a Plant Operations Review Committee (PORC) meeting was convened on March 28, 2001 to review operability during the time-period of February 1, 2001 through February 14, 2001. PORC requested additional information regarding the internal configuration of the pump and further information relative to procedurally mandated operator action. At the subsequent PORC meeting held on April 2, 2001, the credit for operator action and the failure to consider further loosening of the bolts was found to be inconsistent with GL 91-18 guidance. The PORC concurred with the Engineering recommendation that EF-P-2A was inoperable from February 1, 2001 through February 14, 2001 and made that recommendation to the Plant Manager. The Plant Manager concurred with the PORC recommendation.

During the investigation under CAP T2001-0305, a PORC meeting was convened on April 20, 2001 to review operability of EF-P-2A prior to February 1, 2001. An analysis of data and discussion with the pump vendor indicated that the vibration associated with pump starts is much larger than vibration from low flow operations. Therefore, the pump starts are postulated to provide the jolt to the bearing cover, which over time loosened the bolts. The available data indicates that the HSPS test start on January 6, 2001 resulted in sufficient loosening of the bearing cover bolts such that the next pump start would result in further loosening and loss of lubrication to consider the pump inoperable. The PORC concurred with the Engineering analysis that EF-P-2A should be considered inoperable from the conclusion of the HSPS test start on January 6, 2001 till the successful tightening of the outer bearing housing bolts on February 14, 2001. The Plant Manager concurred with the PORC recommendation on April 20, 2001.

IV. Assessment of Safety Consequences & Implications of the Event:

Since plant conditions did not require operation of EF-P-2A during the **January 6, 2001** through February 14, 2001 time period, there were no actual safety consequences for this event. The other two Emergency Feedwater Pumps, EF-P-2B and EF-P-1, were operable during **the time-period of January 6, 2001 through February 14, 2001 except for allowed brief periods during TS required surveillances performed on January 6, 2001 and January 31, 2001.** Additionally, a diverse method of providing core cooling via high-pressure injection was available.

To evaluate the potential safety significance of this event, a risk evaluation of this event was performed. **AmerGen Calculation C-1101-424-E220-070, Rev. 1, "EF-P-2A SDP Risk Evaluation for the February 2001 Event," evaluated the core damage frequency (CDF) risk significance of EF-P-2A remaining out of service for 39 days during January and February 2001**. The internal event contribution to CDF was calculated using the updated TMI PRA internal events model.

Because the TMI external events models have not been updated since the TMI Individual Plant Examination for External Events (IPEEE) was submitted to the NRC in 1994, these models can only be used to estimate the impact on external event risks. A CDF was evaluated for seismic impact using the TMI IPEEE seismic model. Since the TMI IPEEE Fire analysis is a bounding analysis and not a full PRA model, only dominant IPEEE sequences were reviewed and identified, but no total CDF impact due to fires can be calculated using the available model.

The internal event's (including internal flooding) impact on core damage is calculated to be **greater than 1.0E-6, but less than 1.0E-5, supporting a significance level of WHITE. No sequence recovery actions were assumed to obtain this CDF value. The seismic CDF impact is evaluated to have a minimal effect, much less than 1.0E-6.**

If EF-P-2A had been required to operate in the degraded condition (loose bolts and oil leakage), it would have started. Based on oil leakage rate estimates, the looseness of the bolts, and the level of vibration; engineering judgement is that the pump would have operated at full capacity for at least several hours without operator action. Additionally, when the Emergency Feedwater system actuates, an AO is dispatched to the Emergency Feedwater flow control valves in accordance with procedure. The Emergency Feedwater flow control valves are within a few feet of EF-P-2A. Based on training and the scope of routine checks performed, it is reasonable to conclude that the AO would check EF-P-2A oil levels and add oil if required.

V. Previous Events & Extent of Condition:

There were two relevant previous events identified.

- LER 99-004 "Emergency Feedwater Pump Inoperable Longer Than Allowed by Technical Specifications Due to Lack of Lubrication Caused By A Loose Set Screw Resulting in Bearing Failure." The operability / reportability determination used during this event included an appropriate review of the available information regarding the component condition. The corrective actions addressed maintenance and the adequacy of monitoring of the equipment during testing. No weaknesses in the operability / reportability process were evident. Therefore, corrective actions for this event did not include any improvements to the operability / reportability process.

- LER 99-012 "Main Steam Isolation Valve, MS-V-1B, Valve Operator Motor Failure due to the Manufacturing Process." The initial operability / reportability determination used during this event involved a failure to utilize additional resources to support making the correct determination. During the MS-V-1B event, when additional resources were later involved, the correct determination was made. The corrective actions included revising the "Event Review

and Reporting Requirements" procedure to provide direction to the Shift Manager to utilize all available resources when making operability / reportability determinations. These corrective actions were inadequate to prevent the current event involving EF-P-2A since both the Shift Manager and the additional resources failed to consider all the available information regarding the status of the component against its design basis requirements.

The following actions were completed to determine the extent of the condition:

The bearing housing bolts on the other two emergency feedwater pumps were checked for tightness. They were found acceptably tight.

Vibration data was reviewed for safety related pumps and rotating equipment. There were no indications of loose fasteners.

The current oil consumption rates were reviewed for all safety-related pumps to identify any oil consumption trends that could potentially impact operability. A significant oil leak was identified on a nuclear services closed cooling water pump; however, that leak was previously identified and the pump was already removed from service to repair the leak. There were no other cases that affected operability.

All open corrective maintenance tasks and open Appendix B Corrective Action Program (CAP) issues for safety related SSCs were reviewed. There were no incorrect operability determinations identified.

VI. Identification of Root Cause

The root cause of the incorrect operability determination was a failure to consider all the available information regarding the status of the component against its design basis requirements. **The root cause of the loose bolts** was a lack of barrier(s) in place to detect or prevent inner cover bolt loosening.

There were three contributing causes, which provided missed opportunities to identify the bolt loosening at an earlier time. These contributing causes are as follows:

- **The failure to appropriately respond to the increased vibration in EF-P-2A is the result of a less than adequate In-Service Test (IST) program.**
- **The failure to appropriately respond to the increased bearing oil leakage in EF-P-2A is the result of a less than adequate Oil Monitoring and Trend program.**
- **There was insensitivity to degraded/abnormal conditions. Weaknesses in log-keeping and communication of expectations allowed the perception that oil additions were not indicative of equipment degradation.**

VII. Corrective Actions:

Immediate & Short Term Actions:

1. The bolts on the bearing housing cover on EF-P-2A were tightened. This stopped the oil leak and returned vibration to normal levels.

2. The bearing housing bolts on the other two emergency feedwater pumps were checked for tightness. They were found acceptably tight.

3. Vibration data was reviewed for safety related pumps and rotating equipment. There were no indications of loose fasteners.

4. The "Conduct of Operations" procedure was revised to add improved guidance for performing operability determinations.

5. Initiated briefings for each on-coming operating crew to discuss the revisions to the "Conduct of Operations" procedure. The briefings cover recognition of degraded equipment, the importance of low oil levels and high oil consumption, proper operability determinations, safety function, and the acceptability of operator action for maintaining long-term emergency operation. These briefings **have been completed**.

6. The operator logs were changed to require a minimum level band for oilers on safety related pumps.

7. Operations implemented trending of oil consumption rates on all safety related pumps.

8. Oil consumption rates were reviewed for all safety-related pumps to identify any oil consumption trends that could potentially impact operability. A significant oil leak was identified on a nuclear services closed cooing water pump; however, that leak was previously identified and the pump was already removed from service to repair the leak. There were no other cases that impacted operability.

9. All open corrective maintenance tasks and open Appendix B Corrective Action Program (CAP) issues for safety related SSCs were reviewed. There were no incorrect operability determinations identified.

Long Term Corrective Actions:

1. **The Operability Determination Process will be revised to clarify the methods for evaluating and documenting the operability of plant structures, systems, and components. This action has been completed.**

2. **Recurring training for PORC members, Shift Managers, Senior Reactor Operators, and Responsible Technical Reviewers will be established, regarding the revised Operability Determination Process. This action will be completed by August 31, 2001.**

3. The bearing housings with gasketed joints on safety related pumps that have the potential for loose fasteners, which could impact operability, will be identified. A sampling of these fasteners will be checked to ensure appropriate tightness. If loose fasteners are found, then the sample will be expanded. Those components with loose fasteners will be evaluated for periodic Preventive Maintenance. This action will be completed by August 31, 2001.

4. A Preventive Maintenance task will be established to periodically check the tightness of the bearing housing fasteners on all three emergency feedwater pumps. This action will be completed by August 31, 2001.

5. The vibration monitoring program/procedures will be strengthened regarding equipment monitoring, including specifying the appropriate actions to take when indications deviate from expected levels. This action will be completed by August 31, 2001.

6. The Inservice Test Program will be revised to emphasize prompt investigation and repair of components that fall into the Alert or Required Action ranges. This revision will include specific guidance if an IST parameter goes into the Alert or Required Action range. This action will be completed by July 31, 2001.

7. Revised IST program training for engineers will be established. This action will be completed by August 31, 2001.

8. System Engineering guidelines will be revised to require review of IST data, vibration data, and oil leakage data periodically as part of their System Monitoring process. This action will be completed by August 15, 2001.

9. Auxiliary Operator logs will be revised to include criteria that constitutes excessive oil additions to oilers or reservoirs on safety related equipment. This action will be completed by August 15, 2001.

10. A database will be implemented to allow tracking and trending of operator visual inspection data on safety related equipment. This action will be completed by March 15, 2002.

11. Procedure requirements will be implemented to specify that shiftly operator visual inspections continue to be performed on accessible emergency equipment after an accident. This action will be completed by July 31, 2001.

12. Recurring training on the operation of oilers, the importance of maintaining proper oiler levels, and the significance of low oil levels on component operability will be developed and presented to auxiliary operators and mechanical maintenance personnel. This action will be completed by December 31, 2001.

13. A case study of this event will be developed and presented to the TMI-1 organization. This action will be completed by August 31, 2001.

* The Energy Industry Identification System (EIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, [SI/CFI] where applicable, as required by 10 CFR 50.73 (b)(2)(ii)(F).