

November 30, 2001  
NG-01-1344

Office of Nuclear Reactor Regulation  
U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Station 0-P1-17  
Washington, D.C. 20555-0001

Subject: Duane Arnold Energy Center  
Docket No: 50-331  
Op. License No: DPR-49  
Licensee Event Report #2001-005-00  
File: A-120

Dear Sirs/Madams:

Please find attached the subject Licensee Event Report (LER) submitted as a voluntary report. There are no new commitments made in this report.

Should you have any questions regarding this report, please contact this office.

Sincerely,



Rob Anderson,  
Plant Manager - Nuclear

cc: Mr. James Dyer  
Regional Administrator, Region III  
U. S. Nuclear Regulatory Commission  
801 Warrenville Road  
Lisle, IL 60532

NRC Resident Inspector – DAEC

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**LICENSEE EVENT REPORT (LER)**

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

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose 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.

<b>FACILITY NAME (1)</b> Duane Arnold Energy Center	<b>DOCKET NUMBER (2)</b> 05000331	<b>PAGE (3)</b> 1 of 3
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**TITLE (4)**  
Licensed Power Level Exceeded Due to Use of Non-conservative Constant in Heat Balance Calculation

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	03	2001	2001	005	00	11	30	2001	FACILITY NAME	DOCKET NUMBER

<b>OPERATING MODE (9)</b> 1	<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)</b>									
<b>POWER LEVEL (10)</b> 100	20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)						
	20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)						
	20.2203(a)(1)	50.36(c)(1)(i)(A)	50.73(a)(2)(iv)(A)	73.71(a)(4)						
	20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)						
	20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	<input checked="" type="checkbox"/> OTHER						
	20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	Specify in Abstract below or in NRC Form 366A						
	20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	50.73(a)(2)(v)(D)							
	20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(vii)	Licensed Power Level Exceeded (voluntary)						
20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)								
20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)								

**LICENSEE CONTACT FOR THIS LER (12)**

<b>NAME</b> Hai Tran, Nuclear Licensing	<b>TELEPHONE NUMBER (Include Area Code)</b> 319-851-7491
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**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
				N					

<b>SUPPLEMENTAL REPORT EXPECTED (14)</b>					<b>EXPECTED SUBMISSION DATE (15)</b>		
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE).	<input checked="" type="checkbox"/> X	<input type="checkbox"/> NO	MONTH	DAY	YEAR		

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

On October 3, 2001, with the plant at 100 percent (%) power, plant personnel discovered that the input constant for the moisture carryover fraction used in the process computer for heat balance calculation was non-conservative. The constant used was 0.1%, whereas, a report from the fuel vendor states that the value is close to zero. In addition, based on recent plant Sodium-24 test data, the value is less than 0.007%. This error caused the reactor power calculation to be 1.3 megawatts thermal (MWth) lower than actual. The reactor power was administratively reduced by 2 MWth to ensure the licensed maximum power level was not exceeded. The heat balance calculation software has been subsequently revised to use a more accurate value for the moisture carryover fraction. As a long-term corrective action, a comprehensive review of the reactor heat balance calculation in the process computer will be performed. Although the error resulted in a non-conservative reactor power calculation, the event was not significant due to its small magnitude (less than 0.1% of rated thermal power). In addition, per the fuel vendor report, use of the carryover fraction of 0.1%, while non-conservative, does not represent a safety issue. The event did not have an adverse consequence to the public health and safety.

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

**I. Description of Event:**

On October 3, 2001, the plant was operating at the licensed limit of 1658 megawatts thermal (MWth) with no Limiting Condition for Operation (LCO) in effect. After reviewing the NRC daily event report, a report from the fuel vendor, and recent plant Sodium-24 (NA<sup>24</sup>) test data, plant personnel discovered that the input constant for the moisture carryover fraction used in the process computer for heat balance calculation was non-conservative. The constant value used was 0.1%; however, based on recent plant NA<sup>24</sup> test data, the more accurate value is less than 0.007%. The non-conservative constant caused the reactor power calculation to be 1.3 MWth lower than actual (non-conservative). As an immediate corrective action, reactor power was lowered by 2 MWth to 1656 MWth to account for the non-conservative constant.

General Electric (GE) Report, Titled, "Impact of Steam Carryover Fraction on Process Computer Heat Balance Calculation", dated September 2001, documents a non-conservative constant for moisture carryover fraction in the equation used to calculate plant heat balance. The report states that a number of later model GE Boiling Water Reactor (BWR) plants have moisture carryover fractions close to zero.

**II. Cause of Event:**

Subsequent investigation identified that the non-conservative constant had been used since the initial plant startup in 1974. The constant was a design value based on the steam dryer specifications by the fuel vendor. Further investigation identified that during the initial plant startup test, the moisture carryover fraction was determined to be 0.002%. The cause of the heat balance calculation error was due to the use of the non-conservative design value instead of the more accurate actual test data in the process computer. The reason why the actual test data was not used in 1974 cannot be determined. The event was discovered during a review of the industry operating experience.

**III. Assessment of Safety Consequences:**

The non-conservative constant resulted in a lower core thermal power calculation. The error was not significant due to its small magnitude (1.3 MWth or less than 0.1% of rated thermal power). Per the fuel vendor report, while use of 0.1% for the carryover fraction is non-conservative, it does not represent a safety issue.

10CFR50 Appendix K requires accident analysis from 102% reactor power to allow for instrument inaccuracy. This maximum analyzed power level was 1691.16 MWth for the plant. Actual instrument accuracy at the plant is better than that assumed in the regulations. This event did not have an adverse consequence to the public health and safety.

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

**III. Assessment of Safety Consequences (continued):**

Due to fluctuations in the reactor power level for BWR plants, the shift average reactor power level is typically less than the rated thermal power license limit. However, because the error has existed for an extended period of time and the plant is usually operated at its maximum power level, it is believed that the licensed maximum power level has been exceeded in the past. Therefore, this event is reported as a violation of the maximum power level in Section 2.C.(1) of the plant's operating license. A historical search for actual shift average power levels to quantify the number of occurrences in the past is not considered necessary.

**IV. Corrective Actions:**

Completed Corrective Actions:

- Upon the discovery of the error on 10/3/01, reactor power was administratively reduced by 2 MWth to ensure the licensed maximum power level was not exceeded.
- On 10/28/01, a 0% value for the moisture carryover fraction was inserted in the appropriate software for heat balance calculation and the administrative restriction was cancelled.

Long-Term Corrective Action:

- A comprehensive review of the reactor heat balance calculation in the process computer including the inputs and assumed constants will be performed to assure future accurate heat balance calculation (Action Request # 28648).

**V. Additional Information:**

Previous Similar Occurrences:

A review of LERs at the plant over the last five years did not identify any previous similar events.

EIIS System and Component Codes:

There was no component failure in this event. The cause of the heat balance calculation error was due to the use of the non-conservative design value instead of the more accurate actual test data in the process computer.

This report is submitted as a voluntary report of a violation of the licensed maximum power level in Section 2.C.(1) of the plant's operating license.