

Indian Point 3  
Nuclear Power Plant  
P.O. Box 215  
Buchanan, New York 10511  
914 736.8001



John H. Garrity  
Resident Manager

December 1, 1993  
IPN-93-151

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Station PI-137  
Washington, D.C. 20555

Subject: Indian Point 3 Nuclear Power Plant  
Docket No. 50-286  
Licensee Event Report 93-046-00  
"Low Temperature for Criticality Placing the  
Plant Outside Design Basis Due to Personnel  
Error"

Dear Sir:

The attached Licensee Event Report (LER) 93-046-00 is hereby submitted in accordance with the requirements of 10CFR50.73. This event is of the type defined in the requirements pursuant to 10 CFR 50.73(a)(2)(ii)(B). Also attached are the commitments made by the Authority in this LER.

Very truly yours,

A handwritten signature in dark ink, appearing to read 'John H. Garrity', with a long horizontal flourish extending to the right.

John H. Garrity  
Resident Manager  
Indian Point Three Nuclear Power Plant

JHG/JC/vjm

cc: See next page

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9312080166 931201  
PDR ADOCK 05000286  
S PDR

A handwritten signature in dark ink, appearing to read 'JE22', with a vertical line extending downwards from the end.

Docket No. 50-286

IPN-93-151

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Mr. Thomas T. Martin  
Regional Administrator  
Region 1  
U.S. Nuclear Regulatory Commission  
475 Allendale Road  
King Of Prussia, Pennsylvania 19406-1415

INPO Records Center  
700 Galleria Parkway  
Atlanta, Georgia 30339-5957

U.S. Nuclear Regulatory Commission  
Resident Inspectors' Office  
Indian Point Unit 3

Attachment  
List of Commitments

Number	Commitment	Due
IPN-93-151-01	Operations will revise procedures involving operation at low temperature, including operators' aids and graphs, as needed to prohibit critical operation with T-Average below 540 degrees F	Prior to plant startup
IPN-93-151-02	Reactor Engineering will submit a proposed Technical Specification amendment to the NRC to identify the minimum temperature for criticality as 540 degrees F.	Prior to plant startup
IPN-93-151-03	Reactor Engineering will work with Westinghouse to revise the Westinghouse Reload Safety Analysis Checklist to incorporate minimum temperature for criticality as one of its standard parameters. This is part of an ongoing generic review, conducted by the Authority and Westinghouse, of all safety analysis parameters, in order to identify discrepancies and inconsistencies.	January 31, 1994

## LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNB 7714), 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.

FACILITY NAME (1) Indian Point Unit 3 DOCKET NUMBER (2) 05000286 PAGE (3) 1 OF 6

TITLE (4) Low Temperature for Criticality Placing the Plant Outside Design Basis Due to Personnel Error

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
11	02	93	93	-- 046 --	00	12	01	93	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	000	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)				
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)				
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER				
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)				
		20.405(a)(1)(iv)	✓ 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)					
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)					

## LICENSEE CONTACT FOR THIS LER (12)

NAME Floyd Gumble, Senior Reactor Engineer I TELEPHONE NUMBER (Include Area Code) (914) 681-6724

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

## SUPPLEMENTAL REPORT EXPECTED (14)

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

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

On November 2, 1993, at approximately 1200 hours, with the reactor in cold shutdown, the Authority made a four hour notification under 10 CFR50.72(b)(2)(i) and 10CFR50.72(b)(2)(iii)(A) based on a review of a Westinghouse Electric Corporation letter stating that 540 degrees F is the minimum temperature (T-Average) for criticality supportable by the current licensing basis safety analyses. The Indian Point 3 (IP3) Technical Specifications do not prohibit critical operation with T-Average below 540 degrees F. The reactor has been brought critical at a temperature below 540 degrees F on several occasions between 1976 and 1987. The cause of the event was personnel error involving misjudgment and the misinterpretation of information. Westinghouse proposed Technical Specifications are apparently inconsistent with safety analyses for indeterminate reasons and the Authority failed to identify this discrepancy during routine audits and reviews of the Westinghouse cycle-specific Reload Safety Analysis Checklists (RSACs). Corrective actions include revising IP3 operating procedures, the Technical Specifications, and the Westinghouse RSAC.

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.

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

**DESCRIPTION OF THE EVENT**

On November 2, 1993, with the plant in a cold shutdown condition, the Authority received a facsimile from the Energy Systems department of the Westinghouse Electric Corporation stating that 540 degrees F is the minimum temperature (T-Average) for criticality supportable by the current licensing basis safety analyses for Indian Point 3. This letter was prepared at the Authority's request. At 1200 hours on November 2, the Shift Supervisor concluded that the conditions described in this letter were reportable under 10CFR50.72, and a 4-hour report was accordingly made.

In the spring of 1993, the Senior Resident Inspector verbally advised the Authority of a 10 CFR Part 21 notification made by Commonwealth Edison (Zion Units 1 and 2). The Authority had received no notification from Westinghouse of the Zion 10 CFR Part 21 report. The Zion Technical Specifications allowed criticality as low as 500 degrees F which was outside their analyzed design basis. A report from INPO's Nuclear Network roughly describing the event was also received. A preliminary review at that time by Authority Reactor Engineering personnel concluded that it was not reportable, based on reasons which included:

- The INPO Nuclear Network item was primarily concerned with a low-temperature permissive which did not exist at Indian Point 3;
- Low-temperature criticality was no longer a practical action at Indian Point 3;
- Authority evaluation indicated that design basis accidents in general become less limiting at lower temperatures. Furthermore, where applicable, low-temperature operation had been already evaluated (such as for protection from positive moderator temperature coefficient, and maintenance of shutdown margin);
- The plant was currently in a cold shutdown condition for a Performance Improvement Plan outage, allowing time to review the issue in greater detail.

**LICENSEE EVENT REPORT (LER)**  
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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

It was therefore felt that adequate protection existed in the Indian Point 3 safety analyses and Technical Specifications to preclude non-conservative response at low temperature for any design basis event. However, subsequent investigation, which included telephone conversations with Commonwealth Edison personnel in mid-August, revealed a potential non-conservatism in Nuclear Instrumentation System (NIS) response at low temperatures, prompting a review in greater detail.

On August 24, 1993, an NRC Inspector requested additional information on this issue, and this item was identified as Unresolved Item, URI 93-16-09. On September 1, 1993, the Authority requested Westinghouse to provide the minimum analyzed critical T-Average consistent with current safety analyses. Westinghouse identified 540 degrees F as the minimum critical T-Average consistent with current safety analyses and communicated this to Indian Point 3 by facsimile on November 2, 1993. Westinghouse stated that operating with the reactor critical at temperatures below 540 degrees F did not necessarily place the plant in a non-conservative position with respect to the applicable safety analyses. However, additional evaluations were required to identify the minimum temperature bounded by the safety analyses. Westinghouse also noted that analyzed accidents, in general, tend to be less severe at lower temperatures.

The original Technical Specifications (TS) for Indian Point 3 included no restrictions on low-temperature operation other than criticality limit pressure-temperature curves designed to protect the vessel from an overpressure event when the vessel was in the nil-ductility range during Reactor Coolant System heatup and cooldown.

The evaluation by Reactor Engineering of operating history for 1976 to 1987 conservatively estimated nine times when the reactor was critical with T-Average < 540 degrees F. During the first three operating cycles at Indian Point 3 (1976 through mid-1982), it was occasionally advantageous to bring the reactor critical at a temperature below the normal Hot-Zero-Power (HZIP) temperature of 547 degrees F. The lower temperature provided a "reactivity boost" effect by adding positive reactivity to the core, particularly at times late in cycle life, when returning to critical from a reactor trip while xenon was increasing. In later cycles, post-trip procedures and surveillance requirements made it difficult to return to criticality prior to xenon peaking and significantly reduced the occasions when low-temperature criticality would be advantageous. However, there were two occasions after Cycle 3, in 1985 and 1987, when low-temperature criticality was performed during recoveries from low-power trips. There were no subsequent low-temperature criticality events after 1987.

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

During each of the low temperature criticalities noted above, reactor coolant temperature was raised to normal levels for the commencement of power ascension (i.e., going above 3 percent on the NIS Power Range Detectors).

The advantages of low-temperature criticalities were reduced further with the advent of Cycle 8, which carried severe operating restrictions (rod withdrawal limits) at low temperatures. The withdrawal limits for Cycle 9 (the current operating cycle) are still more restrictive, effectively eliminating the likelihood of future criticalities at temperatures below 540 degrees F.

**CAUSE OF THE EVENT**

The cause of this event is human error of an indeterminate origin involving misjudgment and the misinterpretation of information. Westinghouse proposed original plant Technical Specifications are apparently inconsistent with safety analyses for indeterminate reasons, and the Authority failed to identify this discrepancy during routine audits and reviews of the Westinghouse cycle-specific Reload Safety Analysis Checklists (RSACs).

**LICENSEE EVENT REPORT (LER)**  
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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

**CORRECTIVE ACTION**

The following corrective actions will be performed to prevent recurrence of this event:

- Operations will revise procedures involving operation at low temperature, including operators' aids and graphs, as needed to prohibit critical operation with T-Average below 540 degrees F. This will be completed prior to plant startup.
- Reactor Engineering will submit a proposed Technical Specification amendment to the NRC to identify the minimum temperature for criticality as 540 degrees F. This will be completed prior to plant startup.
- Reactor Engineering will work with Westinghouse to revise the Westinghouse Reload Safety Analysis Checklist to incorporate minimum temperature for criticality as one of its standard parameters. This will be completed by January 31, 1994. This is part of an ongoing generic review, conducted by the Authority and Westinghouse, of all safety analysis parameters, in order to identify discrepancies and inconsistencies.

**ANALYSIS OF THE EVENT**

This event is reportable under 10 CFR 50.73(a)(2)(ii)(B). The licensee shall report any condition that was outside the design basis of the plant. In addition, a four hour notification was made on November 2, 1993, under 10CFR50.72(b)(2)(i) and 10CFR50.72(b)(2)(iii)(A). 10CFR50.72(b)(2)(i) requires that a four hour notification be made if, "any event, found while the reactor is shut down, that, had it been found while the reactor was in operation, would have resulted in the nuclear power plant...being in an unanalyzed condition that significantly compromises plant safety." 10CFR50.72(b)(2)(iii)(A) requires a four hour notification to the NRC following, "any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition."

No similar events have been reported in an LER to date.



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**SAFETY SIGNIFICANCE**

This event did not affect the health and safety of the public. Westinghouse identified five design basis accidents that could be affected by the lowering of critical T-Average. These are:

1. Rod Cluster Control Assembly (RCCA) Ejection
2. Uncontrolled RCCA Withdrawal from Subcritical Condition
3. Feedwater Malfunction from Zero Power Conditions
4. Rupture of a Steam Pipe
5. Chemical and Volume Control System (CVCS) Malfunction

Of these five, the first two become less severe at lower temperatures due to the reduced Doppler power feedback. The effects of the Feedwater Malfunction Event and the Steam Pipe Rupture Event beginning at a lower temperature are mitigated, as the cooldown resulting from these accidents will be smaller, with a correspondingly smaller reactivity insertion. For the CVCS event, a lower initial temperature increases the time from alarm to criticality, due to the reduction in specific volume of the reactor coolant. Westinghouse verifies in their letter that these effects are valid for T-Averages as low as 540 degrees F, but requires more detailed analysis to confirm that the effects continue to become less limiting at lower temperatures. Nonetheless, a qualitative examination of these events suggests that, were T-Average to be reduced further, the expected results would get no worse than for T-Average of 540 degrees F.

For design basis accidents requiring NIS response, it has been noted that a lower T-Average non-conservatively reduces the NIS reading, due to the increased density of the coolant in the Reactor Vessel. However, Westinghouse has taken the increased coolant density into account in their review of the affected design basis accidents.