



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

JUN 08 1988

MEMORANDUM FOR: Thomas E. Murley, Director  
Office of Nuclear Reactor Regulation

Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

FROM: Edward L. Jordan, Director  
Office for Analysis and Evaluation  
of Operational Data

SUBJECT: AEOD CONCERNS REGARDING THE MARCH 9, 1988 POWER  
OSCILLATION EVENT AT LASALLE 2

Enclosed is an AEOD Special Report detailing our concerns about the LaSalle 2 power oscillation event of March 9, 1988. We have reviewed calculations performed by Brookhaven on the BWR Nuclear Plant Analyzer, as well as the licensee's LER and other foreign and U.S. information. Although this is the first event of this type at a domestic reactor, similar events have occurred in foreign reactors. Based on this review, we classify this event as an important precursor event with significant safety concerns. Our most significant concerns and associated recommendations are described below.

1. The LaSalle event raises questions about the adequacy of the analysis used to meet the core stability requirements of GDC-12 when both recirculation pumps are tripped. The event also points out the difficulties the operators face in rapid diagnosis of and response to an event which readily promotes significant complicating factors such as subsequent loss of feedwater heating and reactor water level fluctuations. Simple and unambiguous procedures are needed to assure prompt proper operator response which ensures compliance with GDC-12. GE SIL 380 does not provide adequate guidance.
2. During startup and shutdown, BWRs routinely enter regions of potential thermal-hydraulic-neutron kinetics instability. This operation can be avoided without large impact on plant operations by modifying plant operating procedures to increase recirculation flow slightly early in the startup and by inserting control rods sooner during shutdown. Several foreign reactors operate with power/flow operating restrictions that avoid the unstable region. Additionally, reduction or loss of forced recirculation flow during plant transients can result in the plant entering regions of potential instability. Prudent operator action is needed to restore stable plant operation and to avoid actions which could initiate events with more significant consequences. For example, restart of recirculation pumps following loss of feedwater heating or MSIV closure could result in additional reactivity insertion while the reactor was exhibiting power oscillations.
3. This event has implications regarding the reactor transient response to a recirculation pump trip during an ATWS. In particular, the power oscillations may substantially exceed previously predicted values and thus raise questions regarding previous fuel integrity evaluations.

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Conclusion

The March 9 LaSalle event indicates serious deficiencies in the core stability analysis for LaSalle and perhaps other BWRs. Further, such undamped power oscillations call for prompt operator recognition and action, yet at LaSalle, operators were not trained to recognize or respond to such oscillations. Adequate plant procedures did not exist at LaSalle, and few, if any, plant simulators in the U.S. are capable of modeling these types of oscillations.

It is not at all clear at this time that we understand the nature and potential consequence of such power oscillations considering such factors as improper or no operator action, alternative core configurations and equipment failures, or divergent localized power oscillations. Since it will take time to thoroughly analyze and understand the LaSalle event and its implications on other BWRs, we conclude that, at least in this interim period, action is warranted to minimize the potential for core instability. Our recommendations in this regard are presented below.

*Boiler  
plate* →

Recommendations

1. Pending a full understanding of the LaSalle event and its implications, we believe that all BWRs should be required to:
  - (a) Immediately insert control rods to below the 80% rod line following loss of all recirculation flow or other transients which result in entry into potentially unstable regions of the power/flow map.
  - (b) Increase recirculation flow during routine reactor startups and insert some control rods prior to reducing recirculation flow below 50% during shutdowns to avoid operation in potentially unstable areas of the power/flow map.
  - (c) Immediately scram the reactor if (a) or (b) above are not successful.
2. <sup>FCS</sup> NRR should revisit GIs B-19 and B-59 and ATWS mitigation in light of the LaSalle operating experience.

Please let me know if we can provide any clarification or additional assistance. If you have questions regarding the enclosed Engineering Evaluation, please call Jack Rosenthal on x24440.

Edward L. Jordan, Director  
Office for Analysis and Evaluation  
of Operational Data

Enclosure: As stated

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*Excellent report!*  
*EJ*  
*Too long concurrence*

- 3. This event has apparent implications regarding reactor response to recirculation pump trip during an ATWS. In particular, it is not clear where the power oscillations would peak and whether fuel would be damaged.

Recommendation

Issue a generic communication which would require all BWRs to:

- a) Immediately insert control rods to below the 80% rod line following loss of all recirculation flow, trip of a recirculation pump, or loss of feedwater heating
- b) Increase recirculation flow during routine reactor startups and insert some control rods prior to reducing recirculation flow during shutdowns to avoid operation in potentially unstable areas of the power/flow map.
- c) Immediately scram the reactor if a) or b) above are not successful in preventing and suppressing oscillations.

Under separate correspondence, we are recommending that RES revisit GIs B-19 and B-59 and ATWS mitigation in light of the LaSalle operating experience.

Conclusion

Adequate justification exists for an appropriate generic communication that ensures prudent operations. In addition, adequate justification exists for revisiting the technical bases of previously resolved issues in light of the LaSalle operating experience.

Edward L. Jordan, Director  
Office for Analysis and Evaluation  
of Operational Data

Enclosure:  
As stated

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PDR	MTaylor	CHeltemes	AEOD R/F	JKauffman
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Recommendation

Issue a generic communication which would require all BWRs to:

Immediately implement procedures to scram the plant on loss of all forced circulation.

Based on the LaSalle event, immediately train plant operators regarding the magnitude of the power oscillations observed, the short time to onset of these oscillations, and the factors which contribute to core instability.

Immediately implement the requirements of GE SIL 380, regardless of calculated decay ratio, until improved analytical methods are approved by the NRC.

Implement procedures which prevent routine operation in or near the unstable region and which address operator response to transients which put the reactor in the unstable region.

Recommendation

Because of current reliance on operator action to meet GDCs 10 and 12, perform a thorough, integrated review of procedures, operator training, Control Room aids, and instrumentation used for response to and identification of power oscillation events.

Recommendation

On a lower priority, revisit Generic Issues B-19 and B-59 and the BWR ATWS mitigation studies in light of the LaSalle operating experience.

Conclusion

Adequate justification exists for an appropriate generic communication that ensures prudent operations. In addition, adequate justification exists for revisiting the technical bases of previously resolved issues in light of the LaSalle operating experience and for performing a review of items required for adequate operator response to power oscillation events.

Edward L. Jordan, Director  
Office for Analysis and Evaluation  
of Operational Data

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