



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

March 31, 1986

TO: ALL LICENSEES OF OPERATING BWRs AND PWRs AND LICENSE APPLICANTS

GENTLEMEN:

SUBJECT: TECHNICAL RESOLUTION OF GENERIC ISSUE NO. B-59-(N-1) LOOP
OPERATION IN BWRs AND PWRs (GENERIC LETTER NO. 86-09)

The staff has been studying (N-1) loop operation in BWRs and PWRs under Generic Issue No. B-59. We have recently completed our review of this issue and the purpose of this letter is to inform you of our findings on the resolution of Generic Issue No. B-59.

The majority of the presently operating BWRs and PWRs are designed to operate with less than full reactor coolant flow. If a PWR reactor coolant pump or a BWR recirculation pump becomes inoperative, the flow provided by the remaining (N-1) loops is sufficient for steady state operation at a power level less than full power. Although the FSARs for the licensed BWRs and PWRs present (N-1) loop calculations showing allowable power and protective system trip set-points, the NRC staff has disallowed this mode of operation for most plants primarily because of insufficient ECCS analyses as well as thermal-hydraulic stability concerns associated with BWRs. At present, the Technical Specifications for most BWRs and PWRs require shutdown within several hours if one of the reactor coolant loops becomes inoperable.

The staff recently completed a safety evaluation report (SER) (Ref. 1) for the request by Beaver Valley Unit 1 for (N-1) loop operation. Based on that SER, it is expected that Beaver Valley Unit 1 will be authorized to operate with (N-1) loops when the Technical Specifications are revised and updated appropriately in the near future. The review by the staff of the Beaver Valley Unit 1 submittal has not identified any unacceptable consequences associated with (N-1) loop operation. Therefore, other PWR owners may wish to evaluate the merits of (N-1) loop submittals for their plants based on the Beaver Valley 1 experience or on the approval of (N-1) loop operation for Millstone 3 (Docket No. 50-423), including technical specifications, in conjunction with its operating license review. However, the specific design characteristics of each plant must be reviewed in the same detail as Beaver Valley 1 and Millstone 3 to assure that all safety considerations relative to (N-1) loop operation are evaluated. Some examples of PWR considerations which are highly plant specific in nature are:

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1. the impact of the down loop on instrumentation and control systems, including contributions of the down loop instruments to voting logic;
2. human factors considerations of indications and alarms from instruments in the down loop;
3. effects of the down loop on operational systems such as pressurizer spray;
4. effects of the down loop on safety systems such as steam to turbine driven safety pumps;
5. considerations relating to piping and status of valves for systems connecting to the down loop;
6. effects on core flow distribution, potential for cold water reactivity insertion, etc.

Plant specific aspects of the safety analyses, including considerations relating to plants which do not have loop isolation valves, may identify safety questions which could affect decisions regarding the desirability of (N-1) loop operation. Both PWR plants reviewed for (N-1) loop operation were equipped with loop isolation valves.

The review of BWR (N-1) loop operation has been complicated by potential thermal-hydraulic instability and jet pump vibration problems during single loop operation (SLO). In low flow operating regions, it has been necessary to develop special operating procedures to assure that General Design Criteria 10 and 12 are satisfied in regard to thermal-hydraulic instabilities. Technical Specifications consistent with these procedures have been accepted by the staff for reactors which are not demonstrably stable based on analyses using approved analytical methods; details of the operating limitations were developed for the General Electric Safety Information Letter (SIL) 380 and contributed to the technical resolution of Generic Issue B-19, which is the subject of our Generic Letter No. 86-02 (Ref. 2). In addition, in an effort to resolve certain plant specific concerns about jet pump vibration or thermal hydraulic instability in the single loop operating mode at Browns Ferry Unit 1, TVA completed tests for that reactor on February 9, 1985, and those concerns have been resolved. These tests demonstrated that SLO has similar stability characteristics as two loop operation under the same power/flow operating conditions. They also confirmed the staff's finding that Technical Specifications based on GE SIL 380 which have been proposed for some BWRs are appropriate for the detection and suppression of thermal hydraulic instabilities. Recently Technical Specifications based on GE SIL 380 were

submitted for Duane Arnold. Permanent SLO has been approved for Duane Arnold (Ref. 3), and the staff expects to approve permanent SLO for other owners who have submitted SLO ECCS analysis as soon as Technical Specification changes similar to those for Duane Arnold are submitted.

This Generic Letter does not involve any reporting requirements so that no OMB clearance is necessary.

Sincerely,

Original Signed by
H. R. Denton

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

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REFERENCES

1. Letter from S. Varga (NRC) to J. J. Carey (Duquesne Light Company), "Beaver Valley Unit 1 - Operation with Two Out of Three Reactor Coolant Loops - Safety Evaluation", dated July 20, 1984, Docket No. 50-334.
2. Generic Letter 86-02, "Technical Resolution of Generic Issue B-19, Thermal Hydraulic Stability," dated January 23, 1986
3. Letter from Mohan Thadani (NRC) to L. Liu (Iowa Electric Light and Power Company), dated May 28, 1985, Docket No. 50-331.