

Reference (1214)

PDR: R. Ennit

APR 24 1989

to Ennit

MEMORANDUM FOR: Victor Stello, Jr.  
Executive Director for Operations

FROM: Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

SUBJECT: CLOSEOUT OF GI 101, "BOILING WATER REACTOR WATER LEVEL  
REDUNDANCY"

Enclosed for your information please find a copy of the resolution package for GI 101. This package was concurred in by NRR, CRGR and ACRS. No new or additional requirements are proposed.

➔ To complete the closeout of this issue, NRR has been requested and has agreed to issue the enclosed generic letter and NUREG/CR-5112 for information to all BWR licensees and applicants.

For further information on this matter contact Andrew Szukiewicz, GI 101 Task Manager (X23914).

ORIGINAL SIGNED BY

Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

Enclosures:

1. Closeout memo from E. S. Beckjord to T. E. Murley
2. Resolution and closeout memo from T. Speis to E. S. Beckjord
3. Generic letter
4. NUREG/CR-5112

Distribution w/o enclosures

RES Chron  
RES Circ  
EIB r/f  
E. Beckjord  
T. Speis  
W. Houston  
W. Minners  
R. Baer  
G. Barber  
D. Thatcher  
A. Szukiewicz

when this is  
done, then issue  
is close.

MEMO BECKJORD TO STELLO/GI101

\*SEE PREVIOUS CONCURRENCE

E. Szukiewicz/mb  
04/17/89\*

EIB:DSIR  
DThatcher  
04/18/89\*

EIB:DSIR  
R. Baer  
04/19/89\*

DD:DSIR  
WMinners  
04/20/89\*

D:DSIR  
WHouston  
04/20/89\*

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TSpeis  
04/21/89

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EBeckjord  
04/24/89

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Office of the Executive Director  
for Operations

FROM: Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

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Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

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MEMO BECKJORD TO STELLO/GI101

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EBeckjord  
04/ /89

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Enclosure 1

FEB 09 1989

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

FROM: Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

SUBJECT: CLOSEOUT OF GI 101, "BOILING WATER REACTOR WATER LEVEL  
REDUNDANCY"

Enclosed please find a copy of the resolution package for GI 101. This resolution package was concurred in by your staff (memorandum from F. Gillespie to T. Speis dated October 19, 1988). No new requirements or specific actions by licensees are required. In order to complete the resolution of this issue, NRR is requested to issue the enclosed generic letter and NUREG/CR 5112 to all BWR licensees and applicants for their information.

For further information on this matter, contact Andrew Szukiewicz, GI 101 Task Manager, (x23914).

ORIGINAL SIGNED BY

Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

Enclosures

1. Proposed resolution and close out  
memo from T. Speis to E. Beckjord
2. Generic Letter
3. NUREG/CR 5112

Distribution

RES Chron	E. Beckjord
RES Circ	T. Speis
EIB r/f	W. Houston
PDR	W. Minners
M. Taylor	R. Baer
G. Barber	D. Thatcher
F. Gillespie	A. Szukiewicz

[MEMO BECKJORD TO MURLEY/GI 101]

FC:EIB:DSIR :EIB:DSIR :EIB:DSIR :DD:DSIR:RES:D:DSIR:RES:DD:RES :NRR:D :  
NAME:ASzukiewicz:DThatcher :RBAer :WMinners :WHouston :TSpeis :EBeckjord  
DATE:01/7/89 :01/7/89 :01/7/89 :01/7/89 :01/7/89 :01/9/89 :01/10/89 :

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JAN 9 1989

MEMORANDUM FOR: Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research

FROM: Themis Speis, Deputy Director  
for Generic Issue Resolution  
Office of Nuclear Regulatory Research

SUBJECT: PROPOSED RESOLUTION AND CLOSEOUT OF GENERIC ISSUE 101  
"BOILING WATER REACTOR WATER LEVEL REDUNDANCY"

The staff has completed its review of Generic Issue (GI) 101 "Boiling Water Reactor Water Level Redundancy." Results of the staff evaluation and the proposed generic letter are presented in the enclosures to this letter. These documents incorporate comments provided by NRR, OGC and AEOD.

Generic Issue 101 involves the ability of BWRs to mitigate an instrument sensing line leak or break that could affect both the control and protection systems. A previously resolved issue, GI 50, "Reactor Vessel Level Instrumentation in BWRs," addressed several areas of concern that also involved BWR level instrumentation. Resolution of GI 50 involved voluntary improvement to reactor vessel water level instrumentation. These improvements included preventing overheating of the reference legs, reducing the sensing length in the drywell and, improving level indication accuracy. The potential for break or leak in an instrument sensing line in conjunction with a single failure was excluded from GI 50 and designated as a separate generic issue, i.e., GI 101.

BWR water level measurement systems have provided adequate water level information for various conditions of reactor operation. However, there have been several incidents where interactions between plant control systems and protection systems have occurred due to the level measurement systems. To various degrees, BWR designs are vulnerable to these interactions since sensors and instrument sensing lines that monitor vessel level are common to both the protection systems and the non-safety-related control systems. A search of operating experience has not identified the occurrence of any instrument line breaks. However, there have been 10 instances of small instrument line leaks. A break or significant leak in the instrument sensing line connected to the reference leg would cause a false reactor vessel high water level indication. This would automatically reduce the feedwater flow into the vessel and cause the actual water level in the vessel to decrease. The presence of this false high level indication may also prevent automatic operation of the emergency safety systems, such as HPCI/HPCS or RCIC in some designs, and could confuse the operator in assessing the actual water level in the vessel.

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JAN 9 1989

To address this concern an evaluation was performed on the reactor water level instrumentation systems. All BWR plant designs were placed into one of five groups, based on their system characteristics. A plant from each group was then evaluated assuming an instrument sensing line break and an additional single failure of either a safety-related protection system or a non-safety-related control system. A total of six scenarios were identified that could lead to core melt, with probabilities ranging of  $1E-6$  or less per reactor year. A number of alternatives for possible safety improvements were evaluated during the resolution process. None were found to be cost effective. The value impact analyses of the alternatives considered are presented in Enclosure 2.

Based on the low probability of core melt and the high cost/benefit ratio to reduce public risk, the staff's resolution of GI 101 does not call for any additional actions for BWR licensees and applicants. The staff has concluded that all BWR designs already provide acceptable protection, in conjunction with operator training and procedures, in the event of an instrument line break in any of the reactor vessel water level instrument systems. The staff believes that emergency procedures exist on all plants for the operator to identify and mitigate the consequences of instrument line breaks and that the reactor operators are trained to achieve safe shutdown, if needed. The technical basis for this conclusion is documented in NUREG/CR 5112 (Enclosure 2).

Although the staff is not proposing any actions to the BWR licensees and applicants, the staff is proposing to issue a generic letter (Enclosure 1) to all licensees and applicants of BWR plants that provides results of the analysis and evaluations. The generic letter and NUREG/CR 5112, including the value impact analyses of all alternatives considered for BWR plants designs, are provided for information only.

Each BWR plant licensee is expected to 1) review the information to verify that the design of its facility has been correctly represented and 2) maintain appropriate procedures and operator training to mitigate the consequences of an instrument line leak or break, should they take place.

Since no new design requirements or backfits are proposed, we are not requesting a CRGR review of this issue. However, a copy of this memorandum and the enclosures will be sent to the chairman of CRGR for information. In addition, a brief memorandum will be sent to the ACRS advising them of the staff's proposed action and offering to provide a briefing if they desire.

The closeout of this issue will be implemented by NRR issuing the enclosed generic letter to all BWR plants. It is our intention to issue the generic letter without soliciting public comments.

The proposed resolution package has been reviewed and concurred in by the Office of Nuclear Reactor Regulation (NRR) and the Office for Analysis and Evaluation of Operational Data (AEOD). The Office of the General Counsel (OGC) has reviewed this package and has no legal objections.

Eric S. Beckjord

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JAN 9 1989

For further information on this matter, contact Andrew Szukiewicz, GI 101 Task Manager (x23914).

Original Signed By  
Themis P. Speis

Themis Speis, Deputy Director  
for Generic Issue Resolution  
Office of Nuclear Regulatory Research

Enclosures:

1. Generic Letter
2. NUREG/CR-5112

Distribution: w/o enclosure 2 except where indicated \*

RES Chron  
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PDR  
E. Beckjord  
T. Speis  
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D. Thatcher \*  
A. Szukiewicz\*  
R. Baer \*  
E. Jordan\*  
T. Murley \*  
F. Gillespie \*  
W. Parler  
M. Taylor  
S. Lewis \*  
W. Hodges \*  
S. Newberry \*  
M. Chiramal \*  
G. Barber \*  
J. Conyon  
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RBAer  
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WMinners  
1/4/89

D:DSIR DD:GTR  
WHouston TSpeis  
1/4/89 1/19/89





Enclosure 3

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

ENCLOSURE 1

GENERIC LETTER

(REFERENCE GI 101)

TO: All licensees of Operating Boiling Water Reactors, Applicants for Operating Licenses and Holders of Construction Permits for Boiling Water Reactor Power Plants.

Gentlemen:

SUBJECT: RESOLUTION OF GENERIC ISSUE 101 "BOILING WATER REACTOR WATER LEVEL REDUNDANCY".

This generic letter is being issued:

- (1) to inform you of the staff's resolution of the subject generic safety issue, and
- (2) to request that you continue to maintain appropriate procedures and training for the operators so that they may readily identify and mitigate the consequences of a reactor water level instrument line leak or break.

For resolution of GI 101, "Boiling Water Reactor (BWR) Water Level Redundancy", instrument line breaks coupled with an additional independent single failure in a control or protection system were evaluated. For the purposes of this evaluation, all BWR plant designs were placed into one of five groups, based on system characteristics. A plant from each group was then evaluated.

The reactor water level measurement systems in BWRs consist of a reference water leg, a variable water leg and a differential pressure measuring transmitter. The reference water leg is connected to a condensing chamber and to the reactor vessel steam space. The variable water leg is connected to the reactor vessel at an elevation below the expected normal range of water level. The actual water level in the reactor vessel is then determined by measuring the differential pressure between the reference water leg and the variable water leg. These pressure sensors provide input to the protection and to the control systems.

The GI 101 concern is that a leak or break in the instrument sensing line connected to the constant head condensing chamber could cause the reference water leg level to decrease. This decrease in the reference water leg level could cause all the differential pressure instruments connected to that line to indicate a false high reactor water level. Under these conditions the feedwater system may automatically reduce the feedwater flow into the reactor vessel and the actual reactor water level would decrease. The presence of this false high water level signal might also prevent automatic operation of the emergency safety systems such as HPCI/HPCS, RCIC or ADS in some designs, and may confuse the operator in assessing the actual water level in the vessel.

The NRC staff has completed its evaluation of Generic Issue 101 and has concluded that all BWR designs, in conjunction with operator training and procedures, provide adequate protection in the event of an instrument line break in any of the reactor vessel water level instrument systems. The staff believes that emergency procedures exist at all plants for the operator to identify and mitigate the consequences of instrument line breaks and that the reactor operators are being trained to achieve safe shutdown, if needed. The technical basis for this conclusion is documented in NUREG/CR-5112, a copy of which is enclosed.

The NRC is, therefore, not proposing any action to the BWR licensees and applicants. The staff is, however, providing to all licensees and applicants of BWR plants the results of the analysis conducted for this review. This information is presented in NUREG/CR 5112. Plant specific design features, such as common sensing lines for the water level instrumentation, automatic initiation logic for vital protection systems, inhibition of vital protection systems, and additional single failures of safety related and non-safety related systems were considered. The results, including the value impact analyses of the alternatives considered for plant improvements for BWR plant designs, are provided for information. Each BWR Plant licensee is expected to review the information to verify that the design of its facility has been correctly represented. It may also be prudent for some licensees to consider a reassessment of plant procedures and operator training to ensure that plant operators can readily detect and mitigate a leak or break of a sensing line.

No written response or specific action is required by this letter. Therefore, no clearance from the Office of Management and Budget is required.

If you have any questions on this matter, please contact your project manager.

Sincerely,

Dennis M. Crutchfield, Acting  
Associate Director for Projects  
Office of Nuclear Reactor Regulation

Enclosure:  
NUREG/CR-5112