

Dominion Nuclear Connecticut, Inc.  
Millstone Power Station  
Rope Ferry Road  
Waterford, CT 06385



November 10, 2004

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555

Serial No. 04-582  
Docket Nos. 50-336/50-423  
License Nos. DPR-65/NPF-49

**DOMINION NUCLEAR CONNECTICUT, INC.**  
**MILLSTONE POWER STATION UNITS 2 AND 3**  
**REQUEST FOR ADDITIONAL INFORMATION**  
**BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON**  
**EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER**  
**REACTORS" (TAC NOS. MB9588, MB9589)**

In a letter dated August 7, 2003, Dominion Nuclear Connecticut, Inc. (DNC) provided the 60-day response to Bulletin 2003-01 for the Millstone Power Station, Units 2 and 3. The bulletin requested DNC to either (1) state that the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in the bulletin and are in compliance with all existing applicable regulatory requirements, or (2) describe any interim compensatory measures that have been implemented or that will be implemented to reduce the interim risk associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete.

In letters dated September 14, 2004, the Nuclear Regulatory Commission (NRC) staff requested additional information to complete its review. Attachments 1 and 2 of this letter provide the responses to the requests for additional information for Millstone Units 2 and 3, respectively.

There are no commitments contained within this letter.

Should you have any further questions regarding this matter, please contact Mr. Paul R. Willoughby at (804) 273-3572.

Very truly yours,

A handwritten signature in black ink, appearing to read "L. Hartz", is written over a faint, illegible typed name.

Leslie N. Hartz  
Vice President – Nuclear Engineering

Attachments: (2)

cc: U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406-1415

Mr. V. Nerses  
Senior Project Manager, Millstone Unit 2  
U.S. Nuclear Regulatory Commission  
One White Flint North  
11555 Rockville Pike  
Mail Stop 8C2  
Rockville, MD 20852-2738

Mr. G. F. Wunder  
Senior Project Manager, Millstone Unit 3  
U.S. Nuclear Regulatory Commission  
One White Flint North  
11555 Rockville Pike  
Mail Stop O8-B-1A  
Rockville, MD 20852-2738

Mr. S. M. Schneider  
NRC Senior Resident Inspector  
Millstone Power Station



**ATTACHMENT 1**

**BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON  
EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER  
REACTORS"**

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
MILLSTONE POWER STATION UNIT 2 (TAC NO. MB9588)**

**DOMINION NUCLEAR CONNECTICUT, INC.  
MILLSTONE POWER STATION UNIT 2**

**BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON  
EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER  
REACTORS"**  
**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**  
**(TAC NO. MB9588)**

In a letter dated August 7, 2003, Dominion Nuclear Connecticut, Inc. (DNC) provided the 60-day response to Bulletin 2003-01 for the Millstone Power Station, Unit 2. The bulletin requested DNC to either (1) state that the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in the bulletin and are in compliance with all existing applicable regulatory requirements, or (2) describe any interim compensatory measures that have been implemented or that will be implemented to reduce the interim risk associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete.

In a letter dated September 14, 2004, the Nuclear Regulatory Commission (NRC) staff requested additional information to complete its review of DNC's submittal. Below is the response to the request for additional information for Millstone Power Station Unit 2.

**NRC Question 1**

On page 2 of Attachment 3 of your Bulletin 2003-01 response, you listed refueling water storage tank refill and four bulletized "WOG [Westinghouse Owners Group] strategies" as being considered as procedural changes. However, your response does not completely discuss the operator training to be implemented. Please provide a detailed discussion of the operating procedures to be implemented, the indications of sump clogging that the operators are instructed to monitor, and the response actions the operators are instructed to take in the event of sump clogging and loss of emergency core cooling system recirculation capability.

**DNC Response**

As a result of the issuance of Bulletin 2003-01, the following Millstone Unit 2 Emergency Operating Procedure (EOP) changes were made to address the potential for debris blockage of the sump:

1. EOP 2532 "Loss of Coolant Accident" was modified to address the potential for sump screen blockage. Monitoring of stable high pressure safety injection (HPSI) pump discharge pressure and adequate suction pressure was added as indication of adequate post-sump recirculation

HPSI flow. The EOP already included monitoring of flow and stable motor current. If sump blockage leads to inadequate HPSI flow, steps are specified for stopping containment spray, throttling HPSI to the minimum needed for decay heat removal and re-filling the refueling water storage tank (RWST). These changes were modeled after the Westinghouse Nuclear Steam Supply System (NSSS) Emergency Response Guidelines (ERGs).

2. Similar changes were made to EOP 2540CI "Functional Recovery of RCS Inventory Control."

These procedure changes were demonstrated to be effective through simulator validation. The changes were approved by the Site Operations Review Committee (SORC) on February 11, 2004 and became effective on March 31, 2004.

Operator training for the sump blockage issue and the procedure changes included classroom and simulator training.

In January 2004, as part of Generic Fundamentals refresher training, a Thermodynamics Refresher module was presented addressing various aspects of pumps with specific emphasis on net positive suction head (NPSH), cavitation and indications for both. The sump clogging issues and their effect on pump performance was addressed as part of this topic. This classroom training, taught in Training Cycle 1 of 2004, was attended by Millstone Unit 2 licensed and non-licensed operators.

In February-March 2004, simulator training was provided to licensed operators and shift technical advisors (STAs). The simulator scenario included a large break loss of coolant accident (LOCA) with debris blockage of the sump screens. Planned training timeouts were conducted to demonstrate indications of debris blockage of the containment sump screens and to discuss both the short-term and potential long-term procedure changes planned to mitigate the effects of containment sump screen blockage. Operators were trained on use of the new EOP curve for throttling emergency core cooling system (ECCS) flow based on decay heat. Feedback from these training sessions was collected for the EOP changes approved on February 11 and is currently under evaluation for potential enhancements to the EOPs using the routine EOP updating process.

### **NRC Question 2**

On page 3 of Attachment 3 of your Bulletin 2003-01 response you state that certain procedural changes/strategies would be in conflict with Combustion Engineering Owners Group emergency procedural guideline. The WOG has developed operational guidance in response to Bulletin 2003-01 for

Westinghouse and Combustion Engineering type pressurized-water reactors. Please provide a discussion of your plans to consider implementing this new WOG guidance. Include a discussion of the WOG-recommended compensatory measures that have been or will be implemented at your plant, and the evaluations or analyses performed to determine which of the WOG-recommended changes are acceptable at your plant. Provide technical justification for those WOG-recommended compensatory measures not being implemented by your plant. Also include a detailed discussion of the procedures being modified, the operator training being implemented, and your schedule for implementing these compensatory measures.

### **DNC Response**

Subsequent to the approval of the Millstone Unit 2 EOP changes described above, the Westinghouse Owners Group (WOG) published WCAP-16204, Revision 1, "Evaluation of Potential ERG and EPG Changes to Address NRC Bulletin 2003-01 Recommendations (PA-SEE-0085)," March 2004. The WCAP consists of three volumes: Volume 1 describes the engineering evaluations of potential Emergency Response Guideline (ERG) changes; Volume 2 presents proposed changes to the Westinghouse ERGs; and, Volume 3 presents proposed changes to the Combustion Engineering Emergency Procedure Guidelines (EPGs). Volumes 1 and 3 are applicable to Millstone Unit 2.

The WOG recommendation was to implement some changes to CEN-152 "Combustion Engineering Emergency Procedure Guidelines." The changes have been compared to changes already made to the Millstone Unit 2 EOPs. The strategy changes incorporated into CEN-152 were addressed in the Millstone Unit 2 EOP changes with one exception. CEN-152 recommends the early termination of one containment spray train. The Millstone Unit 2 radiological analysis credits containment spray operation for two hours for iodine removal from the containment atmosphere. Early termination of one train of containment spray would make the plant vulnerable to a subsequent single failure of the operating train that would place the plant in an unanalyzed condition. Thus, this change has not been implemented as an interim action. However, it is being assessed for long term consideration.

The revision to CEN-152 also includes enhancements to the Functional Recovery Guidelines. The wording and the logic of the steps in the CEN-152 revision are being reviewed by DNC to determine if enhancements are needed for the steps in EOP 2532. The routine EOP updating process will be utilized for those enhancements considered for incorporation into the Millstone Unit 2 EOPs.

The potential risk benefit of the Millstone Unit 2 procedure changes has been estimated and was reported in Los Alamos National Laboratory technical report LA-UR-02-7562, "The Impact of Recovery from Debris-Induced Loss of ECCS

Recirculation on PWR Core Damage Frequency,” published in February 2003. This report was cited in NRC Bulletin 2003-01 as a major reason for issuing the bulletin and recommending compensatory measures that provide operators with instructions for recovery. Section 4.0 of the report concluded “it is evident that recovery actions reduce substantially the CDF with debris effects for all plants.” The potential risk due to sump clogging could be reduced by approximately one order of magnitude when allowing for recovery.

A plant specific calculation has been performed to quantify the benefits of the implemented EOP changes. The plant specific core damage frequency (CDF) considering containment sump blockage without recovery was reduced by a factor of approximately 12 when the analysis considered the effect of recovery by operator actions. The Millstone Unit 2 EOP changes provide sufficient risk reduction as described in LA-UR-02-7562.

Procedure modifications and operator training are addressed in the response to NRC Question 1 above.

### **NRC Question 3**

NRC Bulletin 2003-01 provides possible interim compensatory measures licensees could consider to reduce risks associated with sump clogging. In addition to those compensatory measures listed in Bulletin 2003-01, licensees may also consider implementing unique or plant-specific compensatory measures, as applicable. Please discuss any possible unique or plant-specific compensatory measures you considered for implementation at your plant. Include a basis for rejecting any of these additional considered measures.

### **DNC Response**

Procedural modifications that would conflict with the current design basis analysis by placing the plant in an unanalyzed condition have not been implemented for Millstone Unit 2. This includes such actions as shutting down redundant pumps, since this would make the plant vulnerable to a single failure subsequent to the shutdown of the redundant train. Early termination of containment spray would affect assumptions made for iodine removal from the containment atmosphere and the pressure and temperature profile assumed for the qualification of electrical equipment inside containment.

These changes have not been pursued as interim actions because of the necessity of detailed containment analyses and potentially, license and technical specification amendments. However, these types of changes are being pursued to obtain NPSH margin in the long term. Containment analyses have been commenced to evaluate the benefits of termination of containment spray following initiation of recirculation. Implementation of this type of change may

require hardware modifications as well as revised containment analysis and technical specifications amendments. These types of changes are being considered for the long-term integrated resolution of the sump debris issue.

**ATTACHMENT 2**

**BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON  
EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER  
REACTORS"**

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
MILLSTONE POWER STATION UNIT 3 (TAC NO. MB9589)**

**DOMINION NUCLEAR CONNECTICUT, INC.  
MILLSTONE POWER STATION UNIT 3**

**BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON  
EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER  
REACTORS"**  
**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**  
**(TAC NO. MB9589)**

In a letter dated August 7, 2003, Dominion Nuclear Connecticut, Inc. (DNC) provided the 60-day response to Bulletin 2003-01 for the Millstone Power Station, Unit 3. The bulletin requested DNC to either (1) state that the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in the bulletin and are in compliance with all existing applicable regulatory requirements, or (2) describe any interim compensatory measures that have been implemented or that will be implemented to reduce the interim risk associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete.

In a letter dated September 14, 2004, the Nuclear Regulatory Commission (NRC) staff requested additional information to complete its review of DNC's submittal. Below is the response to the request for additional information for Millstone Power Station Unit 3.

**NRC Question 1**

On pages 2 and 3 of Attachment 4 of your Bulletin 2003-01 response, you identified three procedural "enhancements" which would be implemented by March 31, 2004. However, your response does not completely discuss the operator training to be implemented. Please provide a detailed discussion of the operating procedures to be implemented, the indications of sump clogging that the operators are instructed to monitor, and the response actions the operators are instructed to take in the event of sump clogging and loss of emergency core cooling system recirculation capability.

**DNC Response**

As a result of the issuance of Bulletin 2003-01, the following Millstone Unit 3 Emergency Operating Procedure (EOP) changes were made to address the potential for debris blockage of the sump:

1. The foldout page for E-1 series "Loss of Reactor or Secondary Coolant" was modified to provide guidance for monitoring for sump screen blockage. This includes containment sump level indications that are not consistent with plant conditions and oscillating current, flow or discharge pressure indications for

any running recirculation spray system (RSS), charging and safety injection pumps taking suction directly or indirectly from the sump.

2. ECA-1.1 "Loss of Emergency Coolant Recirculation" was modified to address the potential for entry into this procedure due to sump screen blockage. A step was added to make up to the refueling water storage tank (RWST) with the potential for re-alignment to injection once adequate level was re-established in the RWST. The steps for termination of containment spray were moved to the beginning of the procedure. This includes re-starting recirculation with recirculation spray isolated, if recirculation could not be established due to sump blockage.
3. GA-10 "Filling RWST" was modified to include the possibility of re-filling the RWST from the spent fuel pool. It already included guidance for blended flow makeup from the chemical and volume control system (CVCS).

These procedure changes were demonstrated to be effective through simulator validation. The changes were approved by the Site Operations Review Committee (SORC) on February 11, 2004, and became effective on March 31, 2004.

Operator training for the sump blockage issue and these procedure changes included classroom and simulator training.

In January 2004, as part of Generic Fundamentals refresher training, a Thermodynamics Refresher module was presented addressing various aspects of pumps with specific emphasis on net positive suction head (NPSH), cavitation and indications for both. The sump clogging issues and their effect on pump performance were addressed as part of this topic. This classroom training, taught in training Cycle 1 of 2004, was attended by Millstone Unit 3 licensed and non-licensed operators.

In February-March 2004, simulator training was provided to licensed operators and shift technical advisors (STAs). The simulator scenario included a large break loss of coolant accident (LOCA) with debris blockage of the sump screens. Planned training timeouts were conducted to demonstrate indications of debris blockage of the containment sump screens and to discuss both short and potential long term procedure changes planned to mitigate the effects of containment sump screen blockage. Feedback from these training sessions was collected for the EOP changes approved on February 11, 2004, and is currently under evaluation for potential enhancements to the EOPs under the routine EOP updating process.

### **NRC Question 2/3**

On page 3 of Attachment 4 of your Bulletin 2003-01 response you state that certain other procedure changes had been considered, but that they would affect the strategies of the then current emergency operating procedures. You stated that such changes were to be evaluated by the Westinghouse Owner's Group (WOG) Procedures Working Group, that the process and schedule to change and issue revisions to the emergency response guidelines to address containment blockage issues is expected to be completed by March 31, 2004, and that Dominion Nuclear Connecticut will participate in the WOG activities and implement any recommended changes that are determined to be appropriate for Millstone Unit No. 3. The WOG has developed operational guidance in response to Bulletin 2003-01 for Westinghouse and Combustion Engineering type pressurized-water reactors. Please provide a discussion of your plans to consider implementing this new WOG guidance. Include a discussion of the WOG-recommended compensatory measures that have been or will be implemented at your plant, and the evaluations or analyses performed to determine which of the WOG-recommended changes are acceptable at your plant. Provide technical justification for those WOG-recommended compensatory measures not being implemented by your plant. Also include a detailed discussion of the procedures being modified, the operator training being implemented, and your schedule for implementing these compensatory measures.

### **DNC Response**

Subsequent to the implementation of the Millstone Unit 3 EOP changes, the Westinghouse Owners Group (WOG) published WCAP-16204, Revision 1, "Evaluation of Potential ERG and EPG Changes to Address NRC Bulletin 2003-01 Recommendations (PA-SEE-0085)," March 2004. The WCAP consists of three volumes: Volume 1 describes the engineering evaluations of potential Emergency Response Guideline (ERG) changes; Volume 2 presents proposed changes to the Westinghouse ERGs; and, Volume 3 presents proposed changes to the Combustion Engineering Emergency Procedure Guidelines (EPGs). Volumes 1 and 2 are applicable to Millstone Unit 3.

The WOG recommendation was to implement the Sump Blockage Control Room Guideline (SBCRG) documented in Volume 2 to WCAP-16204, Revision 1, as an interim compensatory action to reduce the risk associated with sump blockage. The SBCRG is a generic procedure separate from the ERG network for responding to loss of recirculation due to debris blockage of the containment sump. Dominion has compared the SBCRG to the Millstone Unit 3 plant-specific EOP changes that were implemented in March 2004 and has concluded that the Millstone Unit 3 EOP changes encompass the strategies provided in the SBCRG. Specifically, the Background Information of the SBCRG identifies seven actions

in the High Level Action Summary. These high level actions were incorporated in the Millstone Unit 3 EOP changes made in March 2004.

The potential risk benefit of the Millstone Unit 3 procedure changes has been estimated in a similar fashion as was reported in Los Alamos National Laboratory technical report LA-UR-02-7562, "The Impact of Recovery from Debris-Induced Loss of ECCS Recirculation on PWR Core Damage Frequency," published in February 2003. This report was cited in NRC Bulletin 2003-01 as a major reason for issuing the bulletin and recommending compensatory measures that provide operators with instructions for recovery. Section 4.0 of the report concluded "it is evident that recovery actions reduce substantially the CDF with debris effects for all plants." The potential risk due to sump clogging could be reduced by approximately one order of magnitude when allowing for recovery.

A plant specific calculation has been performed to quantify the benefits of the implemented EOP changes. The plant specific core damage frequency (CDF) considering containment sump blockage without recovery was reduced by a factor of approximately 29 when the analysis considered the effect of recovery by operator actions. The Millstone Unit 3 EOP changes provide sufficient risk reduction as described in LA-UR-02-7562.

Procedure modifications and operator training are addressed in the response to NRC Question 1 above.

#### **NRC Question 4**

NRC Bulletin 2003-01 provides possible interim compensatory measures licensees could consider to reduce risks associated with sump clogging. In addition to those compensatory measures listed in Bulletin 2003-01, licensees may also consider implementing unique or plant-specific compensatory measures, as applicable. Please discuss any possible unique or plant-specific compensatory measures you considered for implementation at your plant. Include a basis for rejecting any of these additional considered measures.

#### **DNC Response**

Procedural modifications that would conflict with the current design basis analysis by placing the plant in an unanalyzed condition have not been implemented for Millstone Unit 3. This includes such actions as shutting down redundant pumps, since this would make the plant vulnerable to a single failure subsequent to the shutdown of the redundant train. Early termination of containment recirculation spray would affect assumptions made for iodine removal from the containment atmosphere and the pressure and temperature profile assumed for the qualification of electrical equipment inside containment.

These changes have not been pursued as interim actions because of the necessity of detailed containment analyses and potential license and technical specification amendments. However, these types of changes are being pursued to obtain net positive suction head (NPSH) margin in the long term. Containment analyses have been initiated to evaluate the benefits of delaying the initiation of containment recirculation spray. Implementation of this type of change would require hardware modifications as well as revised containment analysis and technical specifications amendments. These types of changes are being considered for the long-term integrated resolution of the sump debris issue.