FirstEnergy

Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, Ohio 43449-9760

Guy G. Campbell
Vice President - Nuclear

419-321-8588
Fax: 419-321-8337

Attachments Contain Proprietary
Material Per 10 CFR 2.790

Docket Number 50-346

License Number NPF-3

Serial Number 2741

October 30, 2001

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Responses to Requests for Additional Information Concerning NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles"

Ladies and Gentlemen:

This letter provides responses to the Nuclear Regulatory Commission (NRC) staff's requests for additional information (RAIs) concerning the Davis-Besse Nuclear Power Station (DBNPS) response (FirstEnergy Nuclear Operating Company (FENOC) letter Serial Number 2731, dated September 4, 2001) to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles." These RAIs were provided by facsimile transmission on October 19, 2001, to the DBNPS. The RAIs concerned the DBNPS response to NRC Bulletin 2001-01 and two reports that were transmitted from the DBNPS staff by electronic mail to the NRC staff on October 12, 2001 (Structural Integrity Associates, Inc. calculation file number W-ENTP-11Q-306, "Finite Element Gap Analysis of CRDM Penetrations" and Framatome-ANP Document Number 51-5012567-01, "RV Head Nozzle and Weld Safety Assessment"). Responses to these RAIs were generally discussed at the public meeting conducted at the NRC offices on October 24, 2001.

The transmittal of the aforementioned Structural Integrity Associates, Inc. and Framatome-ANP documents was also made by FENOC letter Serial Number 2735, dated October 17, 2001.

A001
G/97

Please be advised that Attachment 1 and Attachment 4 contain material (i.e., responses to RAIs; BAW-10190P, Addendum 2, dated 12/97; FRA-ANP Document 51-5013250-00,dated 6/01; FRA-ANP Document 32-5013346-01, dated 8/01; BAW-2213, dated 6/94; and FRA-ANP Document 32-5012403-00, dated 4/01) that is proprietary to Framatome ANP and should be withheld from public disclosure. In accordance with 10 CFR 2.790, affidavits providing the basis for withholding this information from public disclosure are provided in Attachment 5.

If you have any questions or require further information, please contact Mr. David H. Lockwood, Manager-Regulatory Affairs, at (419) 321-8450.

Very truly yours,

RMC/s

Enclosure
Attachments

cc: J. E. Dyer, Regional Administrator, NRC Region III
S. P. Sands, DB-1 NRC/NRR Project Manager
D. S. Simpkins, DB-1 Acting Senior Resident Inspector
Utility Radiological Safety Board

SUPPLEMENTAL INFORMATION

IN RESPONSE TO

NRC BULLETIN 2001-01

FOR

DAVIS-BESSE NUCLEAR POWER STATION

UNIT NUMBER 1

This letter is submitted pursuant to 10 CFR 50.54(f) and contains supplemental information concerning the response (Serial 2731, dated September 4, 2001) to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," for the Davis-Besse Nuclear Power Station, Unit Number 1.

I, Guy G. Campbell, state that (1) I am Vice President - Nuclear of the FirstEnergy Nuclear Operating Company, (2) I am duly authorized to execute and file this certification on behalf of the Toledo Edison Company and The Cleveland Electric Illuminating Company, and (3) the statements set forth herein are true and correct to the best of my knowledge, information and belief.

By: _____
Guy G. Campbell, Vice President - Nuclear

Affirmed and subscribed before me this 30th day of October, 2001.

_____
Notary Public, State of Ohio - Nora L. Flood
My commission expires September 4, 2002.

10 CFR 2.790 Affidavits

a) Serial Number 2741 Attachment 1 Affidavit (3 Pages)
b) Serial Number 2741 Attachment 5 Affidavit (3 Pages)

AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

1. My name is C. M. Powers. I am Vice President, Quality for Framatome ANP ("FRA-ANP"), and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by FRA-ANP to determine whether certain FRA-ANP information is proprietary. I am familiar with the policies established by FRA-ANP to ensure the proper application of these criteria.

3. I am familiar with the FRA-ANP information included in the Attachment to the letter, Serial No. 2741 from Guy G. Campbell to the Document Control Desk. These materials are referred to herein as "Documents." Information contained in these Documents has been classified by FRA-ANP as proprietary in accordance with the policies established by FRA-ANP for the control and protection of proprietary and confidential information.

4. These Documents contain information of a proprietary and confidential nature and is of the type customarily held in confidence by FRA-ANP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in these Documents as proprietary and confidential.

5. These Documents have been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in the Documents be withheld from public disclosure.

6. The following criteria are customarily applied by FRA-ANP to determine whether information should be classified as proprietary:

(a) The information reveals details of FRA-ANP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

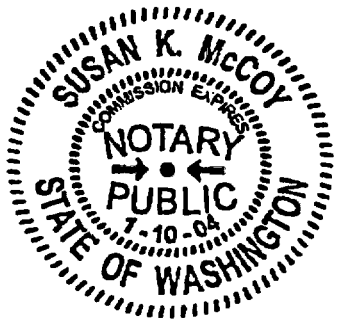
7. In accordance with FRA-ANP's policies governing the protection and control of information, proprietary information contained in these Documents has been made available, on a limited basis, to others outside FRA-ANP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. FRA-ANP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

C M Powers

SUBSCRIBED before me this 30th day of October, 2001.



Susan K. McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/04

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is James F. Mallay. I am Director, Regulatory Affairs, for Framatome ANP ("FRA-ANP"), and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by FRA-ANP to determine whether certain FRA-ANP information is proprietary. I am familiar with the policies established by FRA-ANP to ensure the proper application of these criteria.

3. I am familiar with the FRA-ANP information included in the attachment to the response to the RAI set forth in FRA-14. A number of the reports included in this attachment contain material that is proprietary to FRA-ANP: specifically, BAW-10190P, Add. 2 (dated 12/97); 51-5013250-00 (6/01); 32-5013346-01 (8/01); BAW-2213 (6/94); and 32-5012403-00 (4/01). These reports are referred to herein as "Documents." Information contained in these Documents has been classified by FRA-ANP as proprietary in accordance with the policies established by FRA-ANP for the control and protection of proprietary and confidential information.

4. These Documents contain information of a proprietary and confidential nature and is of the type customarily held in confidence by FRA-ANP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in these Documents as proprietary and confidential.

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(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

7. In accordance with FRA-ANP's policies governing the protection and control of information, proprietary information contained in these Documents has been made available, on a limited basis, to others outside FRA-ANP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. FRA-ANP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 19th
day of October, 2001.

Danita R. Kidd
NOTARY PUBLIC, STATE OF VIRGINIA
MY COMMISSION EXPIRES: 12/31/04

COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station (DBNPS) in this document. Any other actions discussed in the submittal represent intended or planned actions the DBNPS. They are described only for information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs (419-321-8450) at the DBNPS of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
The recommended crack growth rate developed by the MRP expert panel will be used by the DBNPS to verify and/or update RPV CRDM nozzle evaluations to determine if any aspects of the current plans may require refinement.	Ongoing until March 2002 RFO

Rel

Nozzle No.	Core Locat.	Quadrant	1996 Inspection results	1998 Inspection results	2000 Inspection results
			See Note 1.0		
1	H8	1		*Flange Leak Evident*	*Flange Leak Evident*
2	G7	4		*Flange Leak Evident*	*Flange Leak Evident*
3	G9	1		***Flange Leak Evident***	***Flange Leak Evident***
4	K9	2		*Flange Leak Evident*	*Flange Leak Evident*
5	K7	3		Flange Leak Evident	Flange Leak Evident
6	F8	1		**Flange Leak Evident**	**Flange Leak Evident**
7	H10	2		Flange Leak Evident	Flange Leak Evident
8	L8	3		No Leak Observed	No Leak Observed
9	H6	4		No Leak Observed	No Leak Observed
10	F6	4		No Leak Observed	No Leak Observed
11	F10	1		**Flange Leak Evident**	**Flange Leak Evident**
12	L10	2		No Leak Observed	No Leak Observed
13	L6	3		No Leak Recorded	No Leak Observed
14	E7	4		Flange Leak Evident	Flange Leak Evident
15	E9	1		Flange Leak Evident	Flange Leak Evident
16	G11	1		Flange Leak Evident	Flange Leak Evident
17	K11	2		No Leak Observed	No Leak Observed
18	M9	2		No Leak Recorded	No Leak Observed
19	M7	3		No Leak Observed	No Leak Recorded
20	K5	3		No Leak Observed	No Leak Observed
21	G5	4		No Leak Observed	No Leak Observed
22	D8	1		Flange Leak Evident	Flange Leak Evident
23	H12	2		No Leak Observed	No Leak Observed
24	N8	3		No Leak Recorded	No Leak Recorded
25	H4	4		No Leak Recorded	No Leak Observed
26	E5	4		No Leak Recorded	No Leak Observed
27	E11	1		Flange Leak Evident	Flange Leak Evident
28	M11	2		No Leak Recorded	No Leak Observed
29	M5	3		No Leak Recorded	No Leak Observed
30	D6	4		No Leak Observed	No Leak Observed
31	D10	1		**Flange Leak Evident**	**Flange Leak Evident**
32	F12	1		Flange Leak Evident	Flange Leak Evident
33	L12	2		No Leak Recorded	No Leak Observed
34	N10	2		No Leak Recorded	No Leak Observed
35	N6	3		No Leak Recorded	No Leak Recorded
36	L4	3		No Leak Recorded	No Leak Observed
37	F4	4		No Leak Recorded	No Leak Observed
38	C7	4		No Leak Recorded	Flange Leak Evident
39	C9	1		Flange Leak Evident	Flange Leak Evident
40	G13	1		Flange Leak Evident	Flange Leak Evident
41	K13	2		No Leak Recorded	No Leak Observed
42	O9	2		No Leak Recorded	No Leak Recorded

Nozzle No.	Core Locat.	Quadrant	1996 Inspection results	1998 Inspection results	2000 Inspection results
43	O7	3		No Leak Recorded	No Leak Recorded
44	K3	3		No Leak Recorded	No Leak Observed
45	G3	4		No Leak Recorded	No Leak Observed
46	D4	4		No Leak Recorded	No Leak Observed
47	D12	1		Flange Leak Evident	Flange Leak Evident
48	N12	2		No Leak Recorded	No Leak Observed
49	N4	3		No Leak Recorded	No Leak Observed
50	C5	4		No Leak Recorded	No Leak Observed
51	**C11**	**1**		**Flange Leak Evident**	**Flange Leak Evident**
52	E13	1		No Leak Recorded	Flange Leak Evident
53	M13	2		No Leak Recorded	No Leak Observed
54	O11	2		No Leak Recorded	No Leak Observed
55	O5	3		No Leak Recorded	No Leak Recorded
56	M3	3		No Leak Recorded	No Leak Observed
57	E3	4		No Leak Recorded	No Leak Observed
58	B8	1		No Leak Recorded	Flange Leak Evident
59	H14	2		No Leak Recorded	No Leak Observed
60	P8	3		No Leak Recorded	No Leak Recorded
61	H2	4		No Leak Recorded	No Leak Observed
62	B6	4		No Leak Recorded	No Leak Observed
63	B10	1		No Leak Recorded	Flange Leak Evident
64	F14	1		No Leak Recorded	Flange Leak Evident
65	L14	2		No Leak Recorded	No Leak Observed
66	P10	2		No Leak Recorded	No Leak Recorded
67	P6	3		No Leak Recorded	No Leak Recorded
68	L2	3		No Leak Recorded	No Leak Observed
69	F2	4		No Leak Recorded	No Leak Observed

Notes:

1 In 1996 during 10 RFO, the entire RPV head was inspected. Since the video was void of head orientation narration, each specific nozzle view could not be correlated.

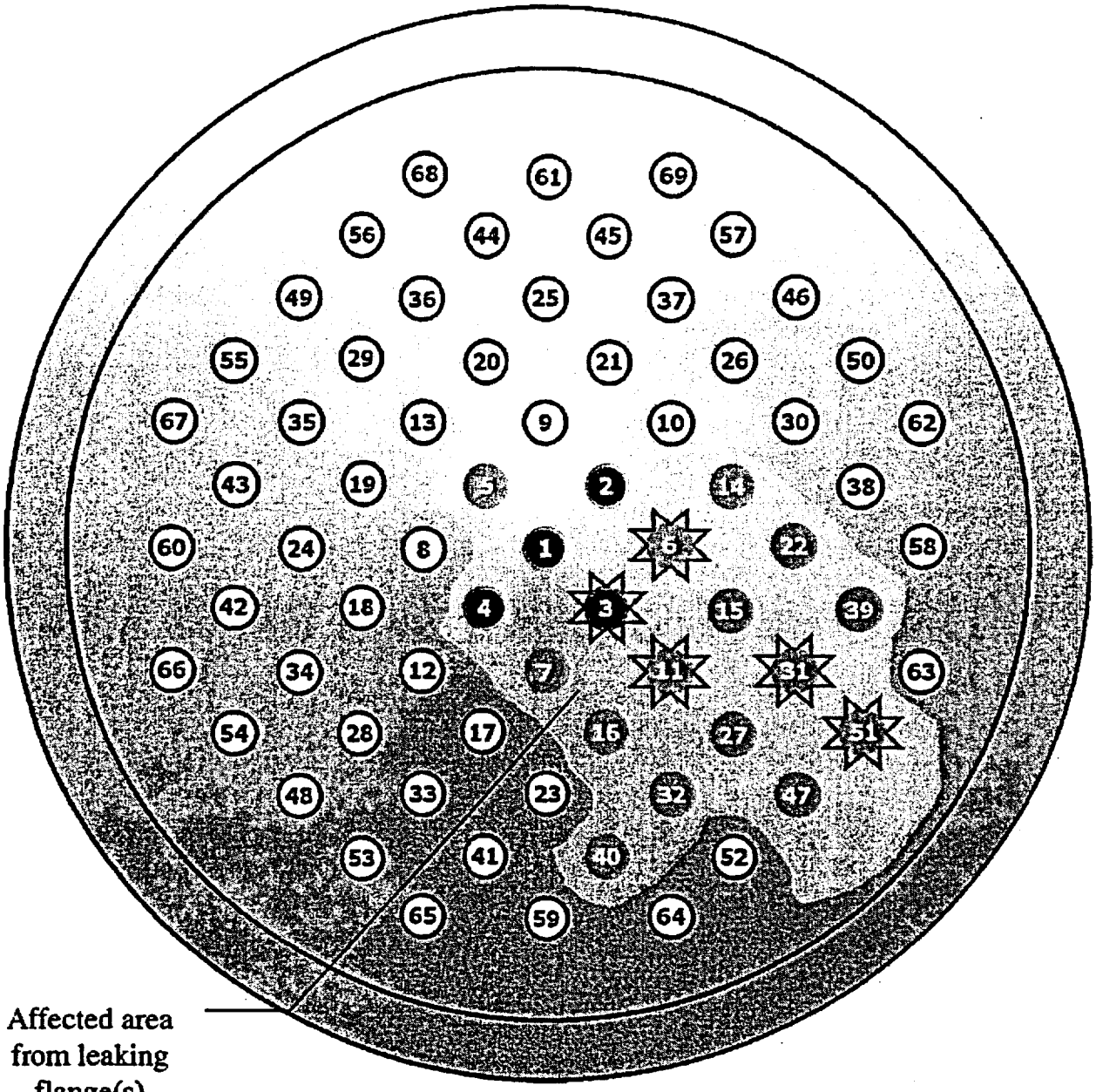
Bold letters indicate leaking CRDM bolting flanges discovered and repaired during 12 RFO (April 2000).
No Leak Observed = Visual Inspection Satisfactory, No Video Record Required.
No Leak Recorded = Nozzle inspection recorded on videotape
Italicized text indicates nozzles that are not expected to show leakage due to insufficient gap.

RPV Head Inspection Results

From 10RFO, 11RFO, and 12RFO

(3 Pages Follow)

RPV Head 11 RFO Inspection Results



Affected area from leaking flange(s)

61 - No leakage identified

4 - Evaluated not to have sufficient gap to exhibit leakage

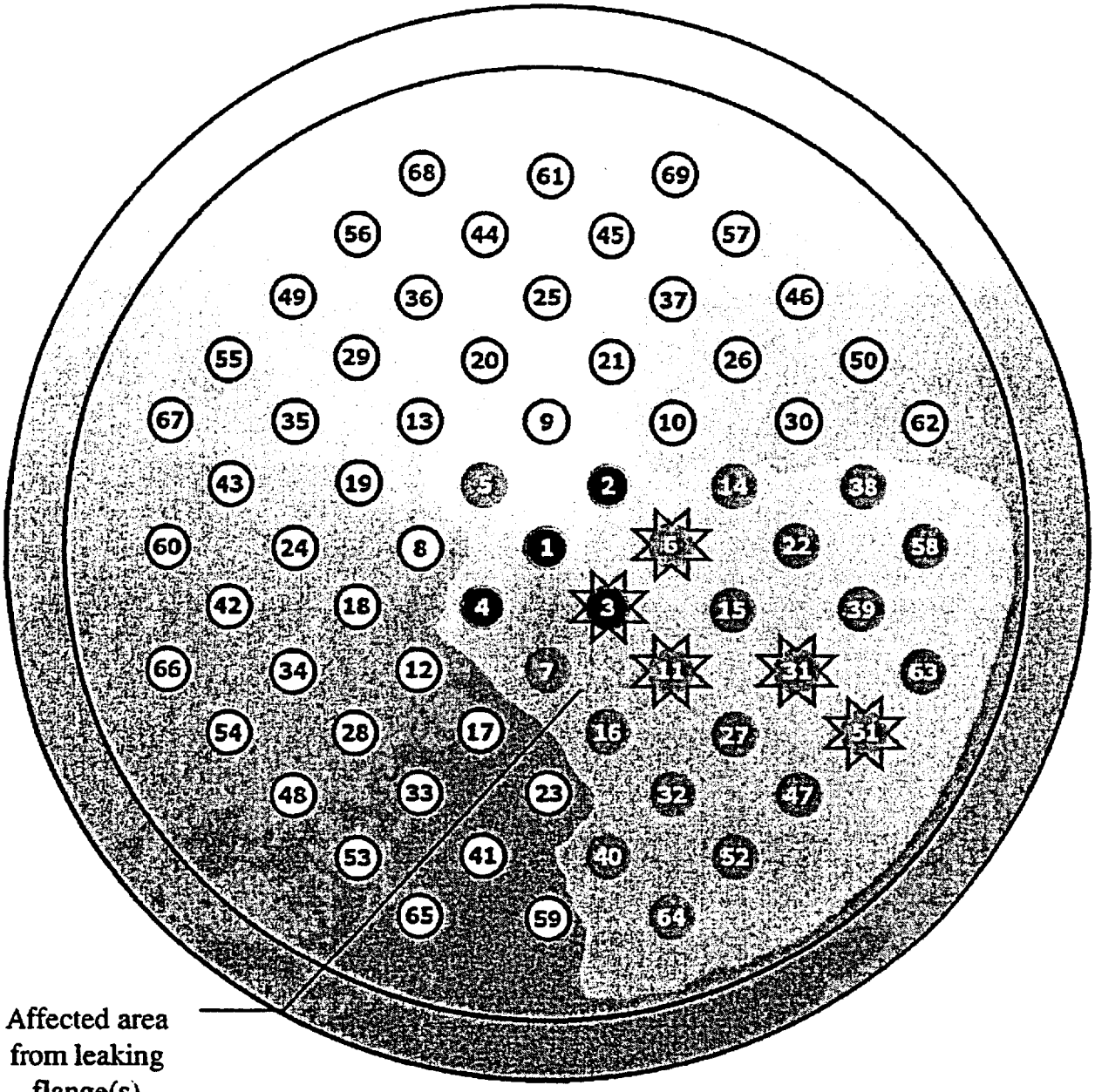
3 - Insufficient gap with leaking flange

5 - Nozzle obscured by boron

6 - Nozzle obscured by boron with leaking flange

C 01

RPV Head 12 RFO Inspection Results



Affected area from leaking flange(s)

61 - No leakage identified

4 - Evaluated not to have sufficient gap to exhibit leakage

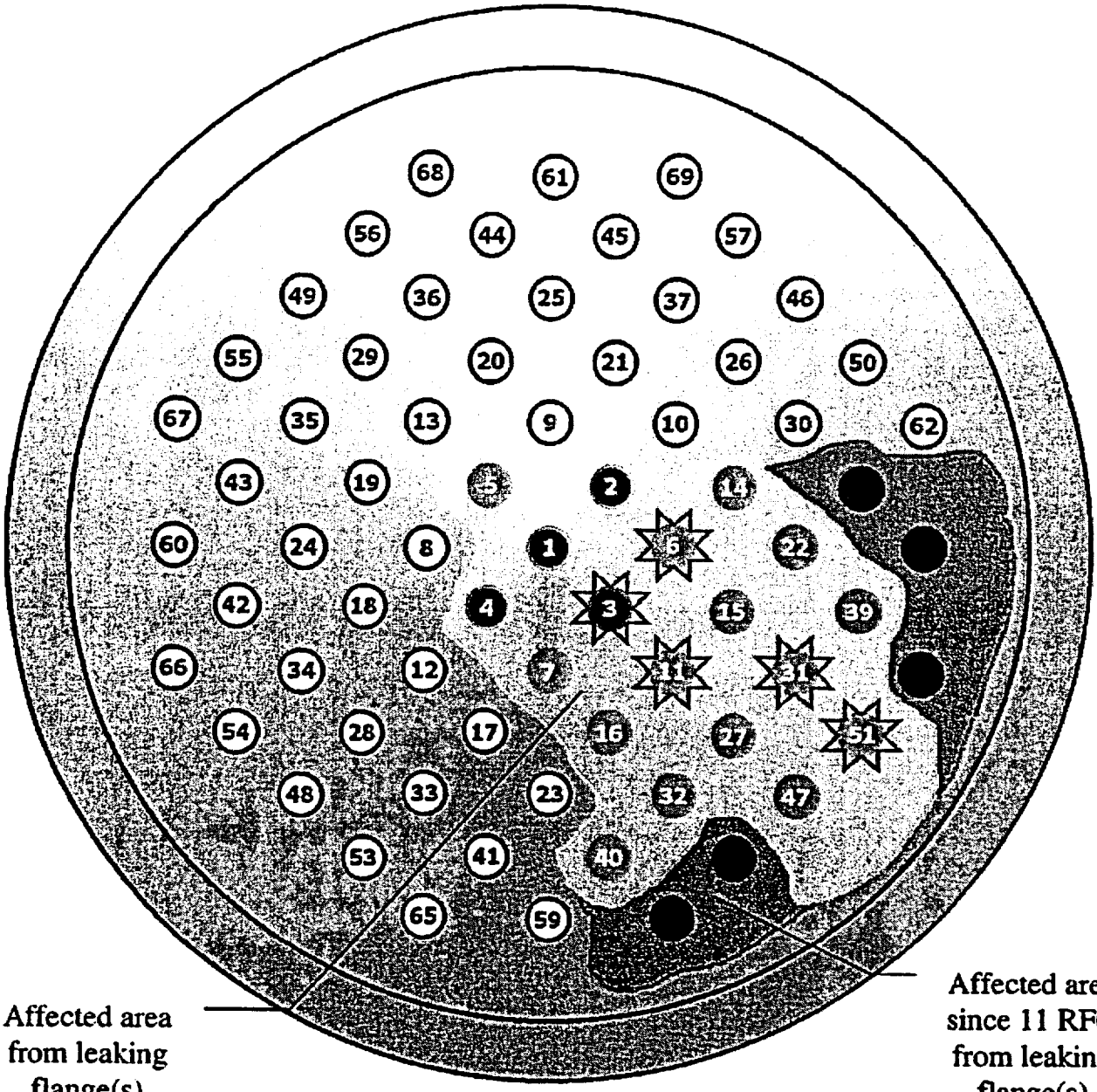
3 - Insufficient gap with leaking flange

5 - Nozzle obscured by boron

6 - Nozzle obscured by boron with leaking flange

C 02

RPV Head 11 & 12 RFO Inspection Results



Affected area from leaking flange(s)

Affected area since 11 RFO from leaking flange(s)

- 61 - No leakage identified
- 4 - Evaluated not to have sufficient gap to exhibit leakage
- 3 - Insufficient gap with leaking flange
- 5 - Nozzle obscured by boron
- 6 - Nozzle obscured by boron with leaking flange
- ● - Newly affected, since 11 RFO, by leaking flange(s)

C-3

51-5011639-00

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20440-8 (1/200

FRAMATOME ANP

ENGINEERING INFORMATION RECORD

Document Identifier 51 - 5011639 - 00

Title PT INSPECTION REPORT RESOLUTION

PREPARED BY:	REVIEWED BY:
Name FRED SNOW - Project Eng.	Name ROB SMITH-TASK LEADER
Signature Fred Snow Date 2/15/01	Signature R Smith II Date 2/15/01

Technical Manager Statement: Initials WKL

Reviewer is Independent.

Remarks:

Reference: PT Inspection Reports NDE-NCR-TC-2 (reissued 12/26/00) and NDE-NCR-TC-5 (12-24-00).

In the process of grinding to clear PT indications in the Oconne 1 RV head Thermal Couple nozzle partial penetratior welds for locations 2 and 5, the low alloy steel base material was exposed as reported in the above referenced NDE reports. However, to the best of our knowledge cracks had not grown into the base material. Base material was only exposed in the grinding operations.

PT Inspection Report NDE-NCR-TC-2 Reviewer: D TOKARSKY Date: 2/15/01

PT Inspection Report NDE-NCR-TC-5 Reviewer: Fh Snow for DAN LANGENFELD Date: 2/15/01
PER TELECON 2/15/01

Supporting Documents for RAI FRA-14

- BAW-10190P, Addendum 2, dated 12/97 (38 pages) Proprietary
- FRA-ANP Document 32-5012403-00, dated 4/01 (29 pages) Proprietary
- FRA-ANP Document 51-5011639-00, dated 2/01 (1 page)
- FRA-ANP Document 51-5013250-00, dated 6/01 (19 pages) Proprietary
- FRA-ANP Document 32-5013324-00, dated 6/01 (7 pages)
- FRA-ANP Document 32-5013346-01, dated 8/01 (63 Pages) Proprietary
- BAW-2213, dated 6/94 (45 pages), Proprietary

FRAMATOME ANP

CALCULATION SUMMARY SHEET (CSS)

Rel

Document Identifier 32 - 5013324 – 00

Title PROBABILITY THAT CRDM LEAKAGE IS UNDETECTED

PREPARED BY:	REVIEWED BY:
METHOD: ☒ DETAILED CHECK ☐ INDEPENDENT CALCULATION	
NAME STANLEY H. LEVINSON	NAME ROBERT S. ENZINNA
SIGNATURE Stanley H. Levinson	SIGNATURE Robert S Enzinna
TITLE ADVISORY ENG. I	TITLE PRINC. ENG. II
DATE 6/15/01	DATE 6-15-01
COST CENTER 41036	REF. PAGE(S) 6,7
TM STATEMENT: REVIEWER INDEPENDENCE	CWJolly

PURPOSE AND SUMMARY OF RESULTS:

The purpose of this calculation is to estimate the human error probability (HEP) for an individual (e.g., inpsector) failing to detect boron crystals (deposit) on the reactor vessel head that is indicative of a control rod drive mechanism (CRDM) nozzle leak. For an inspection at two years (after initiation) the HEP is estimated to be 6.0×10^{-2}. Considering dependencies, the HEP is estimated to be 6.5×10^{-2} for an inspection at four years, and to 1.1×10^{-1} at six years.

THE FOLLOWING COMPUTER CODES HAVE BEEN USED IN THIS DOCUMENT:		THE DOCUMENT CONTAINS ASSUMPTIONS THAT MUST BE VERIFIED PRIOR TO USE ON SAFETY-RELATED WORK
CODE/VERSION/REV	CODE/VERSION/REV	
		☐ YES ☒ NO

Probability that CRDM Leakage is Undetected

1 Introduction

The human error probability (HEP) for an individual (e.g., inspector) failing to detect boron crystals (deposit) on the reactor vessel head that is indicative of a control rod drive mechanism (CRDM) nozzle leak is estimated. CRDM leakage will be detectable through the accumulation of boron crystals on the top of the reactor vessel head around the base of affected CRDMs. It is assumed that any CRDM crack is undetectable until a through-wall crack deposits boron crystals on the exterior of the CRDM. Critical to the risk assessment is when the boron crystallization will be visible relative to the growth of the circumferential cracking.

For outer-diameter (OD)-initiated above-the-weld cracks, the fracture mechanics model that is most relevant to the human reliability analysis is how long it takes, once wetted, for an OD crack to initiate and grow to the critical size for CRDM failure. This time will indicate how many opportunities (i.e., refueling outages) may be available to detect the boron crystals before catastrophic failure of the CRDM.

The primary water stress corrosion cracking (PWSCC) failure mechanism requires a moist environment from the presence of primary water in either the liquid or steam state. The primary leakage may initially be very small, e.g., a pinhole leak, or somewhat larger, but there can only be PWSCC only when there is a sufficient rate of leakage to keep the annulus area moist. Very small leaks are not likely to provide the appropriate environment initially, considering the temperatures and pressures on top of the reactor vessel. The rate of boron crystal deposition will also be dependent upon the size of the leak. Moderate-sized leaks will generate boron crystals rapidly. For smaller leaks, there may be some time before significant boron accumulates. However, as the boron crystals build up in and around the annulus, their presence will tend to trap moisture below. It is also possible that for a small leak there may be intermittent "leak plugging" and a weeping type leak as the buildup of boron crystals intermittently "vents." Hence, it is reasonable to conclude that the environment required for the initiation of PWSCC on the OD of the CRDM (i.e., above the weld), whether from a small or moderate leak, will coincide roughly with the presence of visible boron.

2 Reactor Vessel Head Inspections

The method of reactor vessel head inspection for indications of boron varies among the B&W Owners Group (B&WOG) plants. The methods vary from a simple visual inspection to the use of a mobile reactor vessel head robot with an attached video camera.

The reactor vessel head inspection is not proceduralized, that is, there is not a step-by-step written instruction for the inspection. However, the inspection process is simple, straightforward, and not too lengthy, such that a written procedure is not necessary for a successful inspection. For a visual inspection, the vessel head is observed through nine access

panels in the service structure with a high intensity portable light. The farthest an inspector would be from a CRDM nozzle is five feet. To ensure completeness, the inspection is carried out with a paper map of CRDM nozzle locations. The visual inspection method requires approximately two hours to complete.

Other methods, such as use of a boroscope (e.g., camera on a stick) or vessel head robot, result in a permanent record of the inspection on videotape. These methods also rely on the use of a paper map of CRDM nozzle locations to ensure completeness of the inspection. Typically, videotaped inspections are reviewed immediately by one or two other cognizant individuals.

Over the last five to seven years, the reactor vessel head inspections have become more meaningful because of utility efforts to clean the head of boron resulting from CRDM flange leakage, level instrumentation leakage, and other sources external to the head. A clean vessel head will make boron crystals at the head/nozzle interface more evident, and reduces the likelihood of masking an indication due to other sources of boron on the vessel head.

As a result of Generic Letter 97-01 [1], the licensees have made a commitment to perform timely inspections of CRDMs (and other vessel closure head penetrations). This commitment is maintained by the permanent addition of a task item/work order into the refueling outage schedule program. Discovery of (new) boron on the head will result in the finding being placed in the licensee's Corrective Action Program (CAP).

3 Elements/Estimation of Failure to Detect Boron

Based on the above discussion, there are three ways in which the inspection process can fail to detect boron crystals that are indicative of a CRDM nozzle leak:

(a) Failure to conduct the reactor vessel head inspection
(b) Failure to detect the boron crystals on the reactor vessel head when present
(c) Failure to identify boron crystals resulting from a CRDM nozzle leak due to masking by other sources of boron, i.e., from CRDM flange leakage

An estimate of each of these failures is developed and combined to estimate the total probability that boron crystals indicative of a CRDM nozzle leak are undetected. Since, inspections will occur over time, a time-dependent failure probability is estimated considering inspections to coincide with refueling outages on a two-year interval (e.g., inspection at two years, four years, six years, etc.).

Failure to conduct the reactor vessel head inspection

There exists the possibility that while included in the refueling outage schedule, that through an administrative error, the reactor vessel head inspection never occurs for a particular outage. From Table 16-1 in Swain and Guttman, NUREG/CR-1278 [2], the human error probability (HEP) to carry out scheduled tasks such as periodic tests or maintenance performed weekly, monthly, or longer intervals is estimated at 1×10^{-2}. Note that this refers to the failure to carry out the task, not performing the task incorrectly. Accordingly, this HEP is used to estimate that the

outage scheduling process failed to inform the reactor vessel system engineer that an inspection was required. This HEP is used in the "Perform Inspection" header of the event tree in Figure 1.

For subsequent inspections, e.g., at four years, six year, etc., there is a low dependency for failing to conduct a subsequent inspection if the preceding inspection was not carried out. This is assumed to be a low dependency, and using the treatment in Swain and Guttman [2] from Table 10-2, the HEP for four years is:

$$HEP = \frac{1 + 19*0.01}{20} = 5.95\times10^{-2}$$

Using the HEP at four years, with the same low dependency treatment, the HEP at six years is estimated to be 1.07×10^{-1}.

Failure to detect the boron crystals on the reactor vessel head when present

A simple bounding HEP estimation method based on an EPRI methodology [3] is used to estimate the probability that an inspector fails to detect boron crystals (indicative of a CRDM nozzle) leak during an inspection. This model uses four parameters, which are provided below with the "value" assumed:

- time frame/window: **intermediate** (approximately 1-4 hours window to make a decision)
- training/practice: **yes** (training and/or practice for this task is available)
- task complexity: **simple**
- environmental conditions: **poor**

Using the above "values" for these parameters, the HEP is estimated to be 5×10^{-2}. It is assumed that as time passes (and the amount of boron available to be detected increases), the probability of failing to detect the boron will decrease as each refueling outage passes. According, at the first inspection (at approximately two years after nozzle leakage occurs), the HEP will be 5×10^{-2}. Instead of developing a time-dependent function, it is assumed that by four years, the HEP reaches an asymptotic value of 5×10^{-3} (an order of magnitude less that at two years), and that this value is used for all subsequent inspections (i.e., at six years, eight years, etc.).

As will be observed in the event tree discussion below, the total HEP for failing to detect boron crystals, after the first inspection, is dominated by the failure to perform the inspection (see above), and thus the results are not driven by the decreasing time-dependent HEP.

Failure to identify boron crystals resulting from a CRDM nozzle leak due to masking by other sources of boron, i.e., from CRDM flange leakage

The primary source of boron from leakage that could mask the presence of boron resulting from CRDM nozzle leakage is from the CRDM flange. This was the source of the boron that had to be cleaned from the reactor vessel head. CRDM flange leakage in the past was not considered to be unusual, however, once discovered, the CRDM was repaired to stop the leakage. Part of the

repair process was to replace the gasket. To date, nearly all of the B&WOG plant CRDM flange gaskets have been replaced with a stainless steel/graphite gasket, which, according to operating experience, are not prone to leakage. Therefore, in determining the likelihood of a flange leak masking a particular CRDM, the problem will exam CRDM flange with the new gasket, and with the old (original) gasket.

First consider CRDM flanges using the new gasket. The licensees have been repairing flanges and replacing gaskets since about May 1989 (more than 12 years). Since rate of change from the old to new gaskets was not uniform (less were replace in the earlier years, it is conservatively assumed that there have been four years of effective total new gasket use (i.e., four years when only new gaskets were used). Assuming 69 CRDMs for each of seven plants over four years, there have been a total of 1932 gasket-years of experience. This is slightly optimistic, since not every gasket has been replaced, therefore only 1900 gasket-years will be used. There has only been one suspected flange leak (of flanges with the new gaskets) at ANO-1: during 1R15 at CRDM E5 (as report in Framatome ANP's Lesson Learned, #789). Assuming this is a leaking flange (and it was discovered before masking was an issue), the likelihood of a leaking CRDM flange is $1/1900 = 5.3 \times 10^{-4}$ leaking flange/year. Since the inspection is looking at a specific CRDM, the likelihood that the associated CRDM flange (with a new gasket) is leaking is $(5.3 \times 10\text{-}4)(1/69) = 7.7 \times 10^{-6}$/year. This value is almost three orders of magnitude less than the failure to detect the boron crystals on the reactor vessel head when present (at any inspection) and therefore does not significantly contribute to the HEP estimation. Accordingly, no masking probability (for new gaskets) will be included in the HEP estimation below.

If a CRDM still has an old gasket, then this flange has not yet leaked, or else it would have been repaired and have a new gasket. Because there has been no leakage to date, any flange leak would be quite evident. (When a flange leaks, it starts slowly, so that there would be ample opportunity to identify a leaking flange prior to enough boron leaking out and down to nozzle to create a masking problem.) This is further reinforced since the reactor vessel heads are being regularly cleaned. The number of CRDMs (for all of the B&WOG plants) that still have the old gaskets is quite small (~2 at Oconee-3 and less than 10 at Crystal River-3). In the current regulatory environment, the licensees are more sensitive to CRDM leaks than in the past. One of these CRDMs would be repaired immediately (or prior to leakage, if they are scheduled for gasket replacement). For all these reasons, it is not considered credible that a CRDM flange with an old gasket could contribute to masking any boron from a CRDM nozzle leak.

Combining the failure probabilities

Thus if the contribution due to masking (with either new or old gaskets) is not included, then the total probability that an inspector would failure to detect boron crystals is simply the probability of missing the boron. A simple event tree is provided in Figure 1 that shows how the probability of failing to inspect and the probability of failing to detect boron to compute the total failure probability. The event tree in Figure 1 shows probabilities values for an inspection at two years. The total failure probability is the sum of endstate 2 and endstate 3. Table 1 shows the individual and total probabilities when inspections occur at four and six years.

Failure probability = endstate 2 + endstate 3

$= 0.99 \times (5\times10^{-2}) + 0.01 = 5.95\times10^{-2}$

This is the value reported in Table 1; similarly, the values for inspections at four, six, and eight years are computed and also reported in Table 1.

Figure 1
Event Tree for Detecting Boron from CRDM Nozzle Leakage Two Years after Initiation

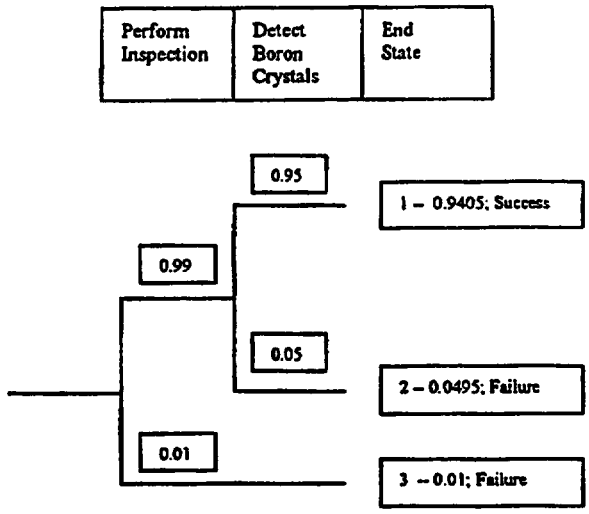

Table 1
Summary of HEP as a Function of Time

Time of inspection (since initiation)	Probability of failing to conduct an inspection	Probability that inspector will not detect boron crystals	Total HEP (sum of end states 2 and 3)
2 years	1.0×10^{-2}	5.0×10^{-2}	6.0×10^{-2}
4 years	6.0×10^{-2}	5.0×10^{-3}	6.5×10^{-2}
6 years	1.1×10^{-1}	5.0×10^{-3}	1.1×10^{-1}

References

[1] Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," U.S. Nuclear Regulatory Commission, Washington, D.C., April 1, 1997.

[2] A. D. Swain and H. E. Guttman, "Handbook of Human-Reliability Analysis with Emphasis on Nuclear Power Plant Applications/Final Report," Sandia National Laboratories, prepared for the U. S. Nuclear Regulatory Commission, SAND80-0200, NUREG/CR-1278, August 1983.

[3] W. Hannaman, "Human Cognitive Reliability Model for PRA Analysis," EPRI RP-2847-1, December 1984.

Rel

August 6, 2002

Mr. Howard W. Bergendahl
Vice President-Nuclear, Davis-Besse
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION - REQUESTS FOR WITHHOLDING INFORMATION FROM PUBLIC DISCLOSURE (TAC NO. MB4479)

Dear Mr. Bergendahl:

FirstEnergy has submitted a number of documents in response to Nuclear Regulatory Commission (NRC) Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," and the reactor vessel head examination plans for the current refueling outage that contain proprietary and restricted information. Accordingly, you have requested that these documents be withheld from public disclosure pursuant to 10 CFR 2.790, "Public inspections, exemptions, requests for withholding."

Enclosures 1 through 5 to this letter describe five separate submittals containing proprietary and restricted information. Included in each enclosure is a brief description of each document, identification of the author of the individual affidavits, and the reasons why the information should be considered exempt from mandatory public disclosure. The submittals include:

- FirstEnergy letter dated October 30, 2001 (Serial Number 2741), "Responses to Requests for Additional Information Concerning NRC Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles." (Enclosure 1)

- FirstEnergy letter dated October 30, 2001 (Serial Number 2743), "Request for Withholding Previously Transmitted Document from Public Disclosure." It should be noted that this letter references information previously provided in FirstEnergy letter dated October 17, 2001 (Serial Number 2735) which was not submitted as proprietary but later determined to be proprietary. While the proprietary information was publicly accessible for approximately one month, the staff has subsequently withdrawn it from public access. (Enclosure 2)

- FirstEnergy letter dated November 30, 2001 (Serial Number 2747), "Supplemental Information in Response to the November 28, 2001, Meeting Regarding the Davis-Besse Nuclear Power Station Response to NRC Bulletin 2001-01." (Enclosure 3)

- FirstEnergy letter dated February 14, 2002 (Serial Number 2761), "Reactor Pressure Vessel Head Penetration Examination Plans for the Davis-Besse Nuclear Power Station." (Enclosure 4)

- FirstEnergy letter dated July 16, 2002 (Serial Number 2799), "FOIA - 2002-0229: Information to Assist the NRC in Determining Whether the Information in the Referenced Framatome ANP Viewgraphs Falls within Exemption (4) of the FOIA (5 U.S.C. 552(b)(4)) and 10 CFR 9.17(a)(4)." (Enclosure 5)

We have reviewed your submittals and the material in accordance with the requirements of 10 CFR 2.790. On the basis of statements included in the respective affidavits, we have determined, that the information sought to be withheld contains trade secrets or proprietary commercial information. Therefore, the information marked as proprietary and restricted in the above letters will be withheld from public disclosure pursuant to 10 CFR 2.790(b)(5) and Section 103(b) of the Atomic Energy Act of 1954, as amended.

Withholding from public inspection shall not affect the right, if any, of persons properly and directly concerned to inspect the document. If the need arises, we may send copies of this information to our consultants working in this area. We will, or course, ensure that the consultants have signed the appropriate agreements for handling proprietary information.

If the basis for withholding this information from public inspection should change in the future such that the information could then be made available for public inspection, you should promptly notify the NRC. You should also understand that the NRC may have cause to review this determination in the future, for example, if the scope of a Freedom of Information Act request includes your information. In all review situations, if the NRC needs additional information from you or makes a determination adverse to the above, you will be notified in advance of any public disclosure.

Sincerely,

/RA/

Douglas V. Pickett, Senior Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-346

Enclosures: As stated

cc w/encl: See next page

- FirstEnergy letter dated July 16, 2002 (Serial Number 2799), "FOIA - 2002-0229: Information to Assist the NRC in Determining Whether the Information in the Referenced Framatome ANP Viewgraphs Falls within Exemption (4) of the FOIA (5 U.S.C. 552(b)(4)) and 10 CFR 9.17(a)(4)." (Enclosure 5)

We have reviewed your submittals and the material in accordance with the requirements of 10 CFR 2.790. On the basis of statements included in the respective affidavits, we have determined, that the information sought to be withheld contains trade secrets or proprietary commercial information. Therefore, the information marked as proprietary and restricted in the above letters will be withheld from public disclosure pursuant to 10 CFR 2.790(b)(5) and Section 103(b) of the Atomic Energy Act of 1954, as amended.

Withholding from public inspection shall not affect the right, if any, of persons properly and directly concerned to inspect the document. If the need arises, we may send copies of this information to our consultants working in this area. We will, or course, ensure that the consultants have signed the appropriate agreements for handling proprietary information.

If the basis for withholding this information from public inspection should change in the future such that the information could then be made available for public inspection, you should promptly notify the NRC. You should also understand that the NRC may have cause to review this determination in the future, for example, if the scope of a Freedom of Information Act request includes your information. In all review situations, if the NRC needs additional information from you or makes a determination adverse to the above, you will be notified in advance of any public disclosure.

Sincerely,

Douglas V. Pickett, Senior Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-346
Enclosures: As stated
cc w/encl: See next page

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FIRSTENERGY LETTER DATED OCTOBER 30, 2001 (SERIAL NUMBER 2741)

RESPONSE TO REQUESTS FOR ADDITIONAL INFORMATION CONCERNING NUCLEAR REGULATORY COMMISSION (NRC) BULLETIN 2001-01, "CIRCUMFERENTIAL CRACKING OF REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES"

By letter from FirstEnergy dated October 30, 2001 (Serial Number 2741), Framatome ANP's (FRA-ANP) affidavits, executed by C. M. Powers, Vice President Quality, and James F. Mallay, Director Regulatory Affairs, dated October 30, and October 19, 2001, respectively, the following proprietary documents were submitted:

- Response to NRC Staff Request for Additional Information On Davis-Besse Control Rod Drive Mechanism (CRDM) Nozzle Submittals
- BAW-10190P, Addendum 2, dated 12/97, "Safety Evaluation for Control Rod Drive Mechanism Nozzle J-Groove Weld"
- FRA-ANP Document 32-5012403-00, "OC-3 CRDM Nozzle Circumferential Flaw Evaluations," dated April 2001
- FRA-ANP Document 51-5013250-00, "CHECKWORKS RHNM PWSCC Risk Assessment," dated June 2001
- FRA-ANP Document 32-5013346-01, " Monte Carlo Evaluation of Circ. Flaws in B&WOG CRDM Nozzles," dated August 2001
- BAW-2213, "Leakage Assessment Through CRDM Nozzle and Closure Head," dated June 1994

FRA-ANP requested that Attachments 1 and 4 of the above letter dated October 30, 2001, be withheld from public disclosure pursuant to 10 CFR 2.790. FRA-ANP stated that the information should be considered exempt from mandatory public disclosure for the following reasons:

(6)a The information reveals details of FRA-ANP's research and development plans and programs or their results.

(6)b Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(6)c The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(6)d The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(6)e The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

FIRSTENERGY LETTER DATED OCTOBER 30, 2001 (SERIAL NUMBER 2743)

REQUEST FOR WITHHOLDING PREVIOUSLY TRANSMITTED DOCUMENT FROM PUBLIC DISCLOSURE

FirstEnergy letter dated October 30, 2001 (Serial Number 2743), states that information previously included in the FirstEnergy letter dated October 17, 2001 (Serial Number 2735), and an electronic message from Dale Wuokko, FirstEnergy, to Stephen Sands, U.S. Nuclear Regulatory Commission, dated October 12, 2001, contained proprietary information but were not originally identified as containing proprietary information. The October 30, 2001, letter also included a copy of the proprietary information of concern. Included in the above letter dated October 30, 2001, was the Framatome ANP's (FRA-ANP) affidavit, executed by Jerald S. Holm dated October 19, 2001, describing the proprietary document included in the letters dated October 17, 2001 (Serial Number 2735), October 30, 2001 (Serial Number 2743), and the electronic message identified above:

- Structural Integrity Associates, Inc. Calculation, File Number W-ENTP-11Q-306, "Finite Element Gap Analysis of CRDM Penetrations (Davis-Besse)"

FRA-ANP requested that Attachment 5 to the above letter dated October 17, 2001, the electronic message, and the above letter dated October 30, 2001, be withheld from public disclosure pursuant to 10 CFR 2.790. FRA-ANP stated that the information should be considered exempt from mandatory public disclosure for the following reasons:

(6)a The information reveals details of FRA-ANP's research and development plans and programs or their results.

(6)b Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(6)c The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(6)d The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(6)e The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

As described above, the Structural Integrity Inc. calculation, which was provided in both the FirstEnergy letter dated October 17, 2001 (Serial Number 2735) and the electronic message from Dale Wuokko to Stephen Sands dated October 12, 2001, was not submitted as proprietary but later determined to be proprietary. While the proprietary information was publicly accessible for approximately one month, the staff has subsequently withdrawn it from public access.

ENCLOSURE 2

FIRSTENERGY LETTER DATED NOVEMBER 30, 2001 (SERIAL NUMBER 2747)

SUPPLEMENTAL INFORMATION IN RESPONSE TO THE NOVEMBER 28, 2001 MEETING REGARDING THE DAVIS-BESSE NUCLEAR POWER STATION RESPONSE TO NRC BULLETIN 2001-01

By letter from FirstEnergy dated November 30, 2001 (Serial Number 2747), and Framatome ANP's (FRA-ANP) affidavit executed by Jerald S. Holm, Manager - Product Licensing, dated November 29, 2001, the following documents were submitted:

(2) Framatome ANP Document 51-5015816-00, "Stress Profile and K-Solution for DB Monte Carlo Analysis"

(3) Framatome ANP Document 51-5015818-00, "Davis-Besse CRDM Nozzle Heat Information"

FRA-ANP requested that Attachments 2 and 6 to the above letter dated November 30, 2001, be withheld from public disclosure pursuant to 10 CFR 2.790. FRA-ANP stated that the information should be considered exempt from mandatory public disclosure for the following reasons:

(6)a The information reveals details of FRA-ANP's research and development plans and programs or their results.

(6)b Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(6)c The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(6)d The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(6)e The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

In addition, the same letter from FirstEnergy dated November 30, 2001 (Serial Number 2747), included FirstEnergy's affidavit executed by Steven P. Moffitt, Director - Technical Services, dated November 30, 2001, identifying the following document:

(6) DBNPS CRDM Stress Analysis, Dominion Engineering, Inc. Calculation C-3206-00-1 (DBNPS Document 01-0761)

ENCLOSURE 3

FirstEnergy determined that Attachment 4 to the above letter dated November 30, 2001, be withheld from public disclosure pursuant to 10 CFR 2.790. FirstEnergy stated that the information should be considered exempt from mandatory public disclosure for the following reasons:

E(i) The Davis-Besse Nuclear Power Station, Unit 1 (DBNPS-1) Stress Calculations for the CRDM nozzles have been held in confidence by FirstEnergy Nuclear Operating Company (FENOC).

E(ii) The DBNPS-1 Stress Calculations for the CRDM nozzles contains information that is considered to be of a proprietary and confidential nature and is of the type customarily held in confidence by FENOC and not made available to the public. I (Steven P. Moffitt) am aware that other companies regard information of the kind contained in this document as proprietary and confidential.

E(iii) The DBNPS-1 Stress Calculations for the CRDM nozzles are being transmitted to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained within the document be withheld from public disclosure.

E(iv) The DBNPS-1 Stress Calculations for the CRDM nozzles is not available in public sources.

E(v) The DBNPS-1 Stress Calculation for CRDM nozzles contains confidential and technical information regarding a process, methodology, or component, the application which results in a competitive advantage to FENOC. This information cannot be easily acquired by others.

FIRSTENERGY LETTER DATED FEBRUARY 14, 2002 (SERIAL NUMBER 2761)

REACTOR PRESSURE VESSEL HEAD PENETRATION EXAMINATION PLANS FOR THE DAVIS-BESSE NUCLEAR POWER STATION

[It should be noted that the proprietary information included in the FirstEnergy letters dated February 14, 2002 (Serial Number 2761 and ENCLOSURE 4 to this letter) and July 16, 2002 (Serial Number 2799 and ENCLOSURE 5 to this letter) are identical.]

By letter from FirstEnergy dated February 14, 2002 (Serial Number 2761), Framatome ANP's (FRA-ANP) affidavit executed by James F. Mallay, Director Regulatory Affairs, dated February 4, 2001, the following proprietary document was submitted:

- Framatome ANP January 23, 2002, Presentation Slides UT Inspection Approach for Davis-Besse CRDM Nozzle Examinations

FRA-ANP requested that Attachment 2 to the above letter dated February 14, 2001, be withheld from public disclosure pursuant to 10 CFR 2.790. FRA-ANP stated that the information should be considered exempt from mandatory public disclosure for the following reasons:

(6)a The information reveals details of FRA-ANP's research and development plans and programs or their results.

(6)b Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(6)c The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(6)d The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(6)e The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.

FIRSTENERGY LETTER DATED JULY 16, 2002 (SERIAL NUMBER 2799)

FOIA - 2002-0229: INFORMATION TO ASSIST THE NRC IN DETERMINING WHETHER THE INFORMATION IN THE REFERENCED FRAMATOME ANP VIEWGRAPHS FALLS WITHIN EXEMPTION (4) OF THE FOIA (5 U.S.C. 552(b)(4)) AND 10 CFR 9.17(a)(4)

[It should be noted that the proprietary information included in the FirstEnergy letters dated February 14, 2002 (Serial Number 2761 and ENCLOSURE 4 to this letter) and July 16, 2002 (Serial Number 2799 and ENCLOSURE 5 to this letter) are identical.]

By letter from FirstEnergy dated July 16, 2002 (Serial Number 2799), Framatome ANP's (FRA-ANP) affidavit executed by James F. Mallay, Director Regulatory Affairs, dated July 10, 2001, the following proprietary document was submitted:

- Framatome ANP January 23, 2002, Presentation Slides UT Inspection Approach for Davis-Besse CRDM Nozzle Examinations

FRA-ANP requested that the information be withheld from public disclosure pursuant to 10 CFR 2.790. FRA-ANP stated that the information should be considered exempt from mandatory public disclosure for the following reasons:

(6)a The information reveals details of FRA-ANP's research and development plans and programs or their results.

(6)b Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(6)c The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FRA-ANP.

(6)d The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FRA-ANP in product optimization or marketability.

(6)e The information is vital to a competitive advantage held by FRA-ANP, would be helpful to competitors to FRA-ANP, and would likely cause substantial harm to the competitive position of FRA-ANP.