NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Point Beach Nuclear Plant, Unit 1	05000266	1 of 6

TITLE (4)

Boron Dilution Analysis Did Not Address All Water Flow Paths; Inappropriate Alarm Control

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									Unit 2	05000301
09	14	1998	1998	026	00	10	09	1998	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	100		20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
			20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)	X	OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Jack Gadzala, Senior Regulatory Compliance Engineer	(920) 755-6093

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On September 14, 1998, we determined that operation of the Potential Dilution in Progress alarm was not controlled in accordance with the intent of Technical Specifications. The specification requires that operability of the alarm be verified prior to placing the plant in cold shutdown. Although the alarm was verified operable as required prior to placing the plant in cold shutdown, we believe that the intent is also for the alarm to remain operable as long as the plant remains in cold shutdown, even though this is not stated in Technical Specifications. However, procedure OP-1A, "Cold Shutdown to Hot Shutdown," directed operators to deactivate the alarm during plant heatup prior to leaving cold shutdown. While our evaluation determined that such operation could be justified based on the safety analysis, a conservative interpretation of Technical Specifications indicates that the alarm is to remain in service until the plant leaves the cold shutdown condition. We also discovered that the safety analysis for the inadvertent boron dilution accident did not consider all flow paths for unborated water. Specifically, the analysis did not address that the reactor makeup water pumps could deliver water through an idle charging pump. However, our subsequent analysis determined that the 15-minute criteria for loss of shutdown margin was not compromised.

Event Description:

On September 14, 1998, we determined that operation of the Potential Dilution in Progress alarm was not controlled in accordance with the intent of Technical Specification Table 15.4.1-2, Item 32. This specification requires that operability of the alarm be verified prior to placing the plant in cold shutdown. This requirement is contained only in the Surveillance section of the Technical Specifications and there is no corresponding operability requirement in the Limiting Condition for Operation section.

Although the alarm was verified operable as required prior to placing the plant in cold shutdown, we believe that the intent is also for the alarm to remain operable as long as the plant remains in cold shutdown, even though this is not stated in Technical Specifications. However, procedure OP-1A, "Cold Shutdown to Hot Shutdown," directed operators to deactivate the alarm during plant heatup prior to leaving cold shutdown. While our evaluation determined that such operation could be justified based on the safety analysis, a conservative interpretation of Technical Specifications concludes that the alarm is to remain in service until the plant leaves the cold shutdown condition.

We also discovered that the safety analysis for the inadvertent boron dilution accident did not consider all flow paths for unborated water. Specifically, the analysis did not address that the reactor makeup water pumps could potentially deliver unborated water through an idle charging pump. However, our subsequent analysis determined that the 15-minute criteria for loss of shutdown margin was not compromised by these conditions.

Cause:

During the early 1990s, we sequentially added several requirements to our Technical Specifications to address systems that were credited as being operable in our safety analysis but which had previously not been required to be operable by Technical Specifications. During January 1996, we discovered that the Potential Dilution in Progress alarm, one of the newly added requirements, was not being verified operable prior to placing the plant into cold shutdown as required. As corrective action, procedure changes were implemented to test and place the alarm

in service prior to placing the plant in cold shutdown. Although these corrective actions addressed plant cooldown procedures to place the alarm in service, we failed to address plant heatup procedures to ensure that the alarm remained in service until after the plant was no longer in a cold shutdown condition.

The cause for the second condition, the failure to consider the reactor makeup water pumps delivering unborated water through an idle charging pump, is believed to be an oversight during preparation of the original plant safety analysis of the inadvertent boron dilution accident.

Corrective Actions:

- A revision was initiated to Procedure OP-1A, "Cold Shutdown to Hot Shutdown." This revision relocates the step that directs securing the Potential Dilution in Progress alarm, to a section of the procedure where the plant is no longer in a cold shutdown condition.

- The ongoing conversion to Improved Technical Specifications at Point Beach is expected to clarify both operability and surveillance requirements on the Potential Dilution in Progress alarm.

- *We will review our safety analysis of the inadvertent boron dilution accident and finalize the preliminary calculations that account for potential addition of unborated water from the reactor makeup water pumps. The Final Safety Analysis Report will be updated with the appropriate information reflecting the final results.*

Component and System Description:

The Chemical and Volume Control System controls the rate of dilution of the reactor coolant system (RCS). There is only a single source of unborated water from the reactor makeup water storage tank. The reactor makeup water pumps take suction from this tank and provide the only supply of makeup water to the RCS. A limit switch is installed on the valve for the reactor makeup water pump. When armed, this limit switch activates an alarm in the control room whenever the valve is not closed. The alarm light has a message that indicates "POTENTIAL DILUTION IN PROGRESS."

In order for makeup water to be added to the RCS, the reactor makeup water pumps must be running and lined up to the charging pumps. Two separate operations are required. First, the operator must place the control switch to the dilute mode. Second, the start switch must be actuated. Omitting either step would prevent dilution. This makes the possibility of inadvertent dilution very small. Information on the status of reactor makeup water is continuously available to the operator. Lights are provided on the control board to indicate the operating condition of pumps in the chemical and volume control system. In addition to the Potential Dilution in Progress alarm, alarms are actuated to warn the operator if boric acid or demineralized water flow rates deviate from preset values as a result of system malfunction.

Other indications available to alert the operator of a dilution in progress include nuclear source range audible count rate and periodic surveillance of the source range meters and trend recorders.

Safety Assessment:

The Chemical and Volume Control System is designed to limit, even under various postulated failure modes, the potential rate of dilution to a value which, after indication through alarms and instrumentation, provides the operator sufficient time to correct the situation in a safe and orderly manner.

The analysis of the boron dilution during cold shutdown event used conservative reactor coolant system (RCS) volumes (i.e., reduced or effectively reduced RCS inventory for the applicable primary system flow path). The most limiting condition was determined by the lowest boron concentration achieved by diluting the reduced RCS volume for 15 minutes. The reduced RCS inventory, where the primary system is in a half-pipe condition and on residual heat removal, was the resulting limiting condition.

The Potential Dilution in Progress alarm is provided to alert the operator whenever the discharge flow control valve for the reactor water makeup pump is not closed. This provides substantially more than 15 minutes warning to the operator because it will take approximately 5 minutes for the wave front to reach the core inlet after charging has been initiated and the alarm has been sounded.

Past practice had been to procedurally disable the Potential Dilution in Progress alarm once the plant was no longer in a reduced inventory condition and reactor coolant pumps were operating. The additional water inventory available when outside of these restrictive conditions and the alarm was disabled allowed substantially more time for operator action prior to loss of shutdown margin in the unlikely event of inadvertent dilution. These conditions are analogous to those that exist when the plant is in hot shutdown, wherein the alarm is no longer required to be operable by either the Technical Specifications or by the safety analysis. The amount of time available to mitigate a dilution under these conditions is more than adequate to meet the 15-minute requirement because the RCS volume is significantly greater than the value used in the analysis and there is forced circulation to ensure even mixing. Additionally, the operator also has prompt and definite indication of any boron dilution from the audible count rate instrumentation. There is ample time for the operator to recognize the audible high count rate signal and isolate the reactor makeup water source by closing valves and stopping the reactor makeup water pumps. Therefore, the health and safety of the public and plant personnel was not compromised by this event.

For the second condition, the assumptions in the safety analysis appeared to neglect the ability to pass unborated water through an idle charging pump. This potential exists whenever RCS pressure is below the shutoff head of the reactor makeup water pumps. A mitigating factor for such a condition, as stated in the safety analysis, is that the reactor makeup water pump discharge flow control valve (FCV-111) will limit flow to about 100 gallons per minute with the valve full open. This flow information is consistent with test data obtained in conjunction with installation of a recent plant modification (MWR 9409239). Our subsequent evaluation using worst case beginning of life data indicates that inadvertent dilution at 100 gpm would not result in loss of shutdown margin earlier than the 15 minutes specified in the safety analysis. A minimum of 15 minutes would still be available for operators to terminate the dilution before the critical boron concentration was reached. Consequently, this condition remains bounded by the existing accident analysis for boron dilution during cold shutdown and the health and safety of the public and plant personnel was not compromised.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

System and Component Identifiers:

Component/System	Identifier
Chemical and Volume Control System	CB
Potential Dilution in Progress Alarm	FA
Flow control Valve	FCV

Similar Occurrences:

None