

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

May 26, 1994

NRC INFORMATION NOTICE 94-40: FAILURE OF A ROD CONTROL CLUSTER ASSEMBLY TO FULLY INSERT FOLLOWING A REACTOR TRIP AT BRAIDWOOD UNIT 2

Addressees

All holders of operating licenses or construction permits for pressurized-water reactors (PWRs).

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a potential for one or more rod control cluster assemblies to fail to fully insert following a reactor trip due to unwelded or failed cap welds of in-core thermocouple column funnel nozzle pins. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On April 5, 1994, Braidwood Unit 2 was operating at 99-percent power. At 3:39 p.m. (CST), the turbine-generator tripped as a result of an internal fault in the 2E main power transformer. The turbine trip generated a reactor trip. Following the valid trip signal, the control rod (rod control cluster assembly and drive shaft) located in core position K-2 inserted only to step 210 from step 231, as indicated by the digital rod indicator system. Further evaluation confirmed that the rod control cluster assembly had indeed failed to fully insert. All other equipment responded as expected.

A series of special tests indicated that an obstruction under the K-2 spider body vane No. 14 at guide card No. 7 prevented the rod control cluster assembly from inserting past step 210. Inspection with a fiber boroscope showed a cylindrical, metallic object, approximately 7.94 mm (5/16-inch) in diameter and 22.23 mm (7/8-inch) long. The K-2 rod control cluster assembly was removed to the spent fuel pool and the foreign object was removed. The object recovered from the top of guide card No. 7 was identified as an in-core funnel pin from the head nozzle of a thermocouple column in the reactor vessel.

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Discussion

The vessel head has five in-core column nozzles and each nozzle has a funnel to aid in-core column and vessel head alignment during assembly. Each in-core thermocouple column reactor vessel head nozzle funnel is threaded onto the nozzle and pinned to prevent the funnel from rotating (see Figure 1). The design calls for the two pins per funnel, installed during original construction, to be secured by a cap weld. However, the cap weld for the pin that fell into the core upper internals appeared to be missing or may have failed. The funnel pin caps were welded on site by Nuclear Installation Services Corporation (NISCO). Additional inspections found that the pin adjacent to the missing pin was loose and that a pin from another funnel was missing. The second missing pin was recovered from the top surface of the reactor upper internal components.

The failure or lack of the weld was an intermediate cause of the stuck rod control cluster assembly. Because the pin was apparently not welded, it worked loose from the nozzle/funnel assembly, dropped into the guide tube access hole for control rod K-2, and came to rest in a position where it prevented the rod control cluster assembly from inserting past step 210. The most probable root cause of the failure of control rod K-2 to fully insert is improper installation or other personnel error; the pin cap appeared not to be welded, as required by design drawings, and the condition remained undetected during subsequent inspections.

The licensee performed initial acid etching that suggested that the loose funnel pins had never been welded. The licensee is having additional tests performed on the affected pins to more narrowly define the root cause, such as lack of sufficient weld material, failure of the weld, or missing weld.

The licensee reworked all Unit 2 in-core thermocouple column nozzle funnels by adding welds in three places around the top of the funnel to nozzle interface circumference. In addition, all of the original cap welds were reinforced to preclude their failure, should the root cause subsequently be determined to be weld failure.

Video tapes from the last refueling outage on Braidwood Unit 1 indicate that the funnel pins in the instrumentation nozzles were in place; however, the licensee has committed to a direct inspection of all instrumentation nozzle funnel attachments during the next refueling outage.

Failure of the cap welds on in-core thermocouple column funnel pins or failure to perform the welding during original construction may lead to loose parts in the reactor coolant system which have the potential to jam rod control cluster assemblies or cause impact wear on fuel and other system components.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

SH Weiss for

Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Rolf A. Westberg, RIII
(708) 829-9732

Edward D. Kendrick, NRR
(301) 504-2891

Attachments:

1. Figure 1 - In-Core Thermocouple Column
2. List of Recently Issued NRC Information Notices

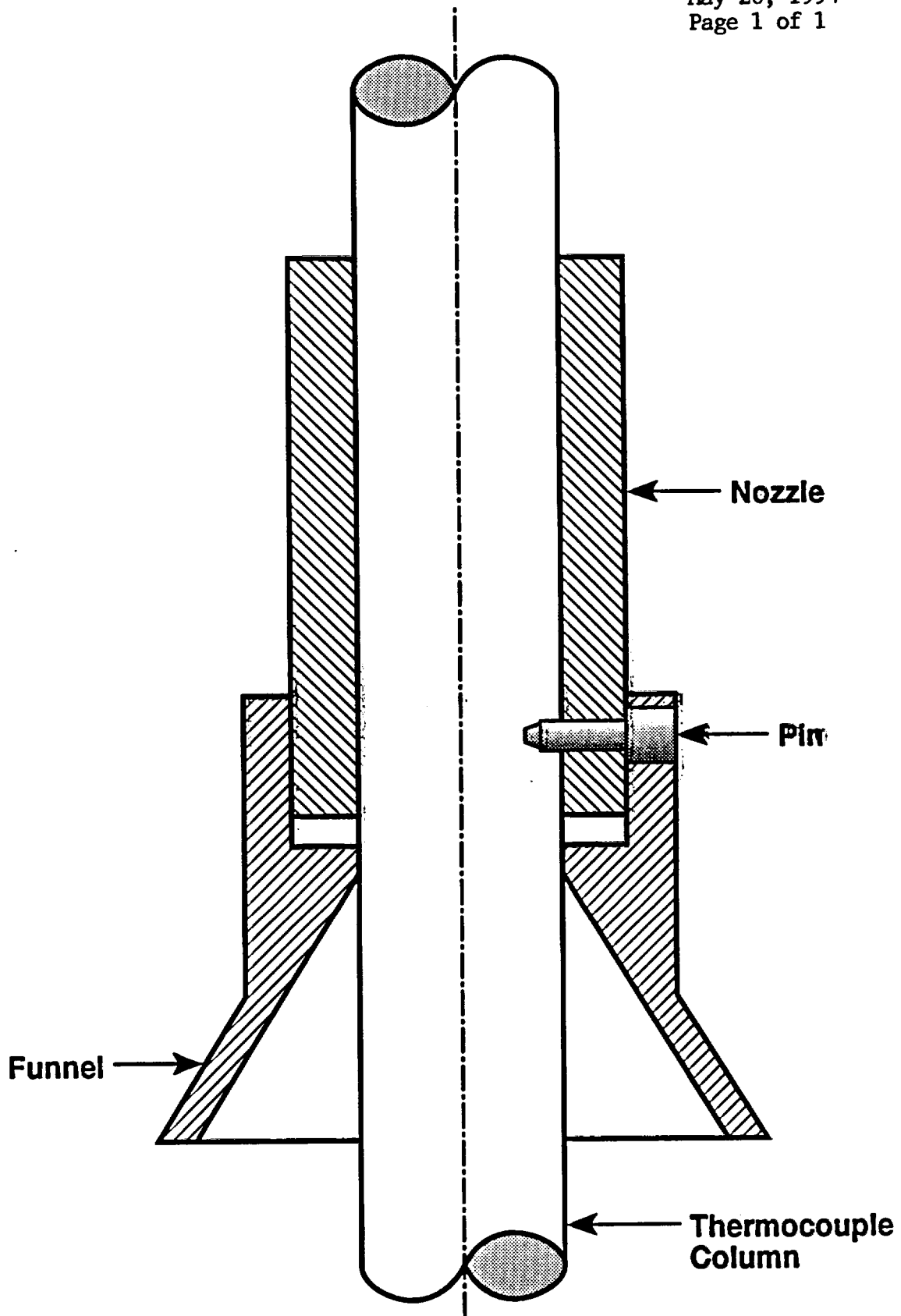


Figure 1 – In-Core Thermocouple Column

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-39	Identified Problems in Gamma Stereotactic Radiosurgery	05/31/94	All U.S. Nuclear Regulatory Commission Teletherapy Medical Licensees.
94-38	Results of a Special NRC Inspection at Dresden Nuclear Power Station Unit 1 Following a Rupture of Service Water Inside Containment	05/27/94	All holders of OLs or CPs for NPRs and all fuel cycle and materials licensees authorized to possess spent fuel.
94-37	Misadministration Caused by a Bent Interstitial Needle during Brachytherapy Procedure	05/27/94	All U.S. Nuclear Regulatory Commission Medical Licensees authorized to use brachytherapy sources in high-, medium-, and pulsed-dose-rate remote afterloaders.
94-36	Undetected Accumulation of Gas in Reactor Coolant System	05/24/94	All holders of OLs or CPs for nuclear power reactors.
91-81, Supp. 1	Switchyard Problems that Contribute to Loss of Offsite Power	05/19/94	All holders of OLs or CPs for nuclear power reactors.
94-35	NIOSH Respirator User Notices, "Inadvertent Separation of the Mask-Mounted Regulator (MMR) from the Facepiece on the Mine Safety Appliances (MSA) Company MMR Self-Contained Breathing Apparatus (SCBA) and Status Update"	05/16/94	All holders of OLs or CPs for nuclear power reactors, and all licensed fuel facilities.
94-34	Thermo-Lag 330-660 Flexi-Blanket Ampacity Derating Concerns	05/13/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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original signed by S.H. Weiss

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1. Figure 1 - In-Core Thermocouple Column
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*See previous concurrence **Vis EMail

OFFICE	TECH ED*	DSSA\SRXB*	SC:DSSA/SRXB	AC:DSSA/SRXB	AD:DSSA*
NAME	RSanders	EKendrick	LEPhillips*	TECollins*	MJVirgilio
DATE	05/23/94	05/25/94	05/25/94	05/25/94	05/25/94

REGION III*	OGCB/DORS*	AC:OGCB/DORS*	<i>B:DOFSL</i>
RAWestberg	NECampbell	AJKugler	BKGrimes <i>for</i>
05/25/94**	05/25/94	05/26/94	05/26/94

DOCUMENT NAME: 94-40.IN

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** Via Email

267

OFFICE	TECH ED*	DSSA\SRXB	OGCB\SRXB	AC:DSSA\SRXB	AD:DSSA
	RSanders	EKendrick	LEPhillips	TECollins	MJVirgo
DATE	05/23/94	05/25/94	05/25/94	05/25/94	05/25/94

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RAWestberg	NECampbell	AJKugler	BKGrimes
05/25/94 **	05/25/94	05/26/94	05/ /94

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Failure of the cap welds on in-core thermocouple column funnel pins or failure to accomplish these welds during original construction may lead to loose parts in the Reactor Coolant System which have the potential to jam rod control cluster assemblies or cause impact wear on fuel and other system components.

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