

File

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

May 25, 1988

NRC INFORMATION NOTICE NO. 88-31: STEAM GENERATOR TUBE RUPTURE ANALYSIS  
DEFICIENCY

Addressees:

All holders of operating licenses or construction permits for Westinghouse (W)- and Combustion Engineering (CE)-designed nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to potential problems resulting from a non-conservatism in the safety analysis for rupture of a steam generator tube which may increase offsite dose consequences. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Following the steam generator tube rupture at North Anna Unit 1 on July 15, 1987, the Virginia Electric and Power Company (VEPCO) modified the flow resistance of the steam generator downcomers at North Anna by the addition of flow baffle plates. This modification necessitated the reanalysis of certain design basis events including rupture of a steam generator tube. The new analysis utilized a revised Westinghouse method for calculating steam generator water mass and indicated that during the event, the water level on the secondary side could fall below the top of the steam generator tubes for a 10-minute period at the beginning of the event.

Steam generator tube uncover is significant because, if the break location becomes uncovered, a direct path might exist for fission products contained in the primary coolant to be released to the atmosphere without partition with the secondary coolant. VEPCO and Westinghouse reanalyzed the design basis steam generator tube rupture accident for Surry using the revised methods and determined that the steam generator tubes at Surry could also become uncovered even though the Surry plants were not modified by the addition of flow baffle plates.

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The licensee further concluded that the offsite dose consequences exceeded those calculated in the Surry Updated Final Safety Analysis Report (UFSAR) because tube uncover could produce a direct path for fission product release. Based on the Surry results, the analysis of steam generator inventory during a steam generator tube rupture at other plants may show that the steam generator tubes may uncover. Thus, for those plants where the steam generator tubes were thought to remain covered following tube rupture, the previously calculated safety analysis offsite doses might be exceeded and since the primary coolant activity limit in Technical Specifications is based upon the occurrence of this accident, the allowable technical specification limit may be too high.

### Discussion

A postulated steam generator tube rupture is one of the design basis accidents analyzed in plant Safety Analysis Reports (SARs). Using conservative assumptions of single failure and loss of offsite power, it must be shown that the offsite dose consequences will be limited to the guideline doses of 10 CFR 100 or a fraction of the guideline doses depending on the assumptions made for iodine spiking. The iodine in the reactor coolant may be previously dissolved from allowable operational fuel failure or may result from an iodine spike which is the sudden increase in coolant iodine concentration produced by the transient conditions during the accident. Mechanisms for transport of the iodine that exits the reactor system to the atmosphere are discussed in Standard Review Plan (NUREG-0800) Section 15.6.3. In determining the amount of iodine that is transported to the atmosphere, credit may be given for "scrubbing" of iodine contained in the steam phase and in the atomized primary coolant droplets suspended in the steam phase for release points which are below the steam generator water level.

The Surry UFSAR assumed that the break is always covered with water so that 99% of the iodine would remain within the steam generator coolant and only 1% would be released through the atmospheric relief valves. The break location is assumed to be always covered in the UFSAR calculations because an initial steam generator water mass that may be non-conservatively large was assumed in order to conservatively account for the possibility of overflow and because steam generator tube failures were thought only to occur close to the tube sheet. The North Anna tube rupture demonstrated that steam generator tube failures can occur near the top of the tube bundle. The revised steam generator water mass calculations by Westinghouse with the assumption that the break occurs at the top of the tube bundle led to the conclusion that the break could be uncovered for a significant period of time. Tube uncover occurs because of the level shrink that accompanies reactor trip/turbine trip during the tube rupture event. The tubes would be recovered by the flow of auxiliary feedwater into the ruptured steam generator and by the reactor coolant which would be added due to the ruptured tube; however, the amount of iodine released from the ruptured steam generator could be larger than that previously calculated.

The NRC staff is evaluating the impact that these non-conservative assumptions may have on calculated offsite doses and the need for further generic action.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.



Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Technical Contact: Walton L. Jensen  
(301) 492-21190

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-30	Target Rock Two-Stage SRV Setpoint Drift Update	5/25/88	All holders of OLS or CPs for nuclear power reactors.
88-29	Deficiencies in Primary Containment Low-Voltage Electrical Penetration Assemblies	5/24/88	All holders of OLS or CPs for nuclear power reactors.
88-28	Potential for Loss of Post-LOCA Recirculation Capability Due to Insulation Debris Blockage	5/19/88	All holders of OLS or CPs for nuclear power reactors.
88-27	Deficient Electrical Terminations Identified in Safety-Related Components	5/18/88	All holders of OLS or CPs for nuclear power reactors.
85-35, Supplement 1	Failure of Air Check Valves to Seat	5/17/88	All holders of OLS or CPs for nuclear power reactors.
88-26	Falsified Pre-Employment Screening Records	5/16/88	All holders of OLS or CPs for nuclear power reactors and all major fuel facility licensees.
88-25	Minimum Edge Distance for Expansion Anchor Bolts	5/16/88	All holders of OLS or CPs for nuclear power reactors.
88-24	Failures of Air-Operated Valves Affecting Safety-Related Systems	5/13/88	All holders of OLS or CPs for nuclear power reactors.

OL = Operating License  
CP = Construction Permit

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\*see previous concurrence

EAB:NRR	EAB:NRR	CRPRB:NRR	C:EAB:NRR
WJensen:db*	RLobel*	LCunningham*	WLanning*
4/7/88	4/7/88	5/5/88	5/19/88
RSB:NRR	TECH:ED	C:GCB:NRR	D:DOEA:NRR
WHodges*	*	CHBerlinger	CERossi
5/17/88	/ 88	5/20/88	5/20/88

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EAB:NRR WJensen:db* / /88	EAB:NRR RLobel* / /88	CRPRB:NRR LCunningham* / /88	<del>CV</del> EAB:NRR WLanning 5/1/88
RSB:NRR WHodges* / /88	TECH:ED * / /88	C:GCB:NRR CHBerlinger / /88	D:DOEA:NRR CERossi / /88

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<i>[Signature]</i> RSB:NRR WHodges 5/17/88	D:DOEA:NRR CERossi / / 88				