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

August 3, 1988

NRC INFORMATION NOTICE NO. 88-55: POTENTIAL PROBLEMS CAUSED BY SINGLE FAILURE OF AN ENGINEERED SAFETY FEATURE SWING BUS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to potential problems caused by single failure of an engineered safety features swing bus. 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:

On January 28, 1988, while Robinson Unit 2 was operating at full power, Carolina Power and Light reported to the NRC Operations Center, in compliance with 10 CFR 50.72, that a single failure in the system supplying electrical power to the three safety injection pumps could cause two of them to fail to perform their intended function. On the following day, the licensee reported to the NRC Operations Center that Robinson Unit 2 was being shut down in compliance with its technical specifications.

As shown in Figure 1, each of two class 1E buses supplies power to a safety injection pump. One of these buses also supplies power to a third safety injection pump via a swing bus. The swing bus is normally supplied with power by bus E1; however, if bus E1 fails to supply power to the swing bus, then the swing bus is automatically transferred to bus E2. An interlock prevents the swing bus from being supplied simultaneously from both of its supply buses. As originally designed, a safety injection signal causes all three safety injection pumps to start automatically.

During the licensee's review of the emergency electrical distribution system, including dc control power, which was done in response to an NRC request, the licensee identified several postulated single failures that could result in loss of two of the three safety injection pumps. For example, loss of dc control power for train B would cause loss of safety injection pumps B and C. However, the analysis of record for the loss-of-coolant accident (LOCA)

assumed that a single failure would cause only one safety injection pump to fail. Pending resolution of this problem, the auto-start capability for the swing pump was defeated, the plant was derated to 60 percent of full power, and the allowable power-peaking factor was reduced from 2.32 to 2.26.

Subsequently, the licensee performed a new LOCA analysis assuming that only one safety injection pump operates to mitigate the consequences of a LOCA. Calculation of emergency core coolant flow was based on system test performance degraded by 5 percent. Using acceptable models, the licensee found that peak cladding temperature, local metal-water reaction, and total metal-water reaction would be within the acceptance criteria of 10 CFR 50.46 with the reactor operating at 100 percent power with the power peaking factor at 2.32 before the accident. On the basis of these results, NRC permitted the licensee to resume full power operation after removing the auto-start capability of the swing pump and after the limiting conditions for operation were changed to require that two safety injection pumps be operable, each capable of automatic initiation from a separate emergency bus.

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

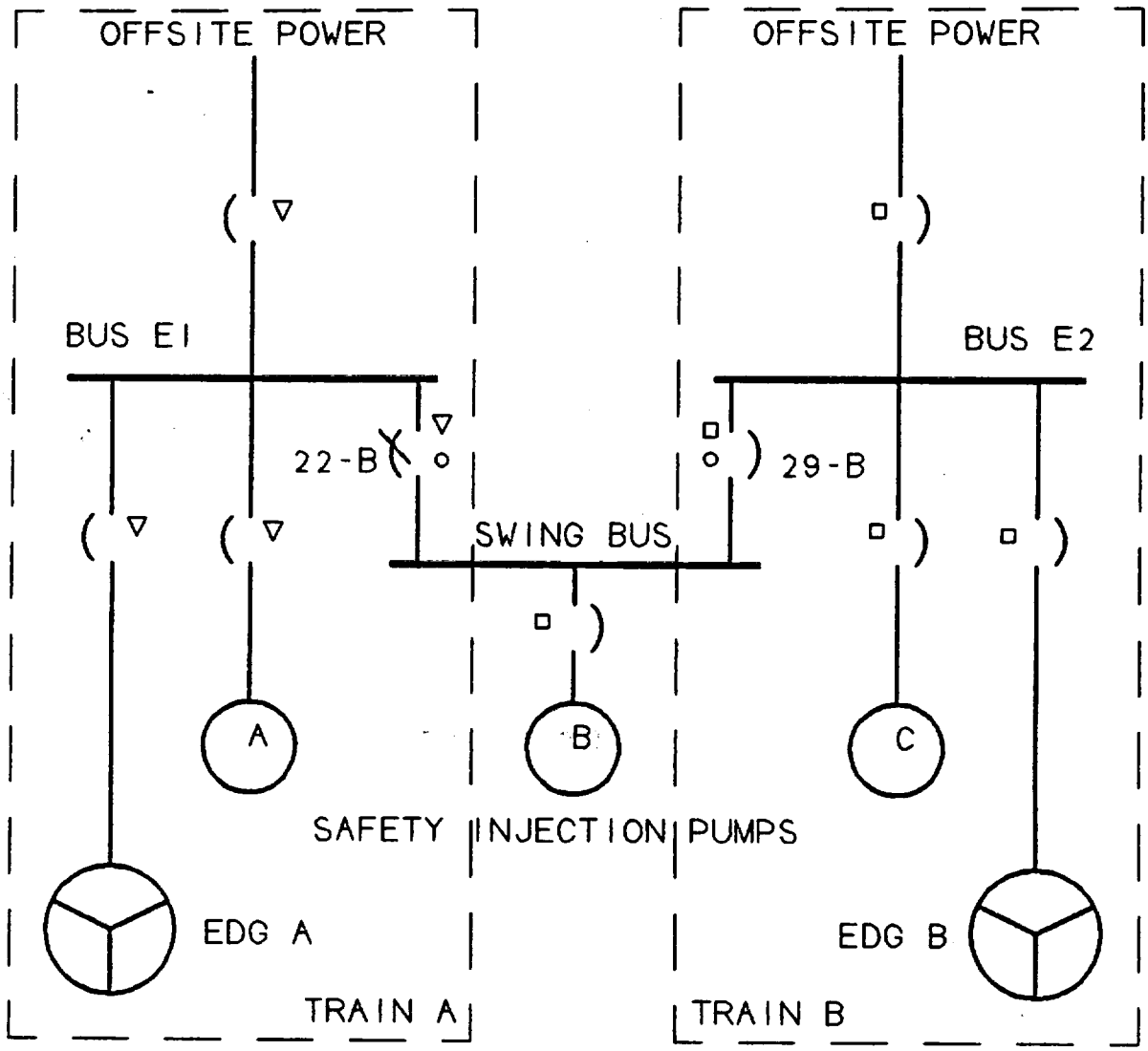
Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Roger Woodruff, NRR
(301) 492-1180

Peter Kang, NRR
(301) 492-0812

Attachments:
1. Figure 1 - Robinson 2, Power Supply for Safety Injection Pumps
2. List of Recently Issued NRC Information Notices

FIGURE 1



NORMALLY OPEN

NORMALLY CLOSED

▽ CONTROL FROM TRAIN A DC BUS

□ CONTROL FROM TRAIN B DC BUS

○ INTERLOCKED TIE BREAKERS

ROBINSON 2

POWER SUPPLY FOR SAFETY INJECTION PUMPS

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-54	Failure of Circuit Breaker Following Installation of Amptector Direct Trip Attachment	7/28/88	All holders of OLs or CPs for nuclear power reactors.
88-53	Licensee Violations of NRC Regulations, Which Led to Medical Diagnostic Misadministrations	7/28/88	All manufacturers and distributors of radio-pharmaceuticals for human use, nuclear pharmacies, and medical licensees.
88-52	Failure of Intrauterine Tandem of Fletcher Applicator Brachytherapy Devices During Patient Treatment	7/27/88	Medical licensees.
88-46, Supplement 1	Licensee Report of Defective Refurbished Circuit Breakers	7/26/88	All holders of OLs or CPs for nuclear power reactors.
88-51	Failures of Main Steam Isolation Valves	7/21/88	All holders of OLs or CPs for nuclear power reactors.
88-50	Effect of Circuit Breaker Capacitance on Availability of Emergency Power	7/18/88	All holders of OLs or CPs for nuclear power reactors.
88-49	Marking, Handling, Control, Storage and Destruction of Safe-guards Information	7/18/88	All holders of OLs or CPs for nuclear power reactors and all other licensed activities involving a formula quantity of special nuclear material.
88-48	Licensee Report of Defective Refurbished Valves	7/12/88	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

FIRST CLASS MAIL
POSTAGE & FEES PAID
USNRC

PERMIT No. G-67

assumed that a single failure would cause only one safety injection pump to fail. Pending resolution of this problem, the auto-start capability for the swing pump was defeated, the plant was derated to 60 percent of full power, and the allowable power-peaking factor was reduced from 2.32 to 2.26.

Subsequently, the licensee performed a new LOCA analysis assuming that only one safety injection pump operates to mitigate the consequences of a LOCA. Calculation of emergency core coolant flow was based on system test performance degraded by 5 percent. Using acceptable models, the licensee found that peak cladding temperature, local metal-water reaction, and total metal-water reaction would be within the acceptance criteria of 10 CFR 50.46 with the reactor operating at 100 percent power with the power peaking factor at 2.32 before the accident. On the basis of these results, NRC permitted the licensee to resume full power operation after removing the auto-start capability of the swing pump and after the limiting conditions for operation were changed to require that two safety injection pumps be operable, each capable of automatic initiation from a separate emergency bus.

No specific action or written response is required by this information notice. If you have questions about this matter, please contact one of the technical contacts 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 Contacts: Roger Woodruff, NRR
(301) 492-1180

Peter Kang, NRR
(301) 492-0812

Attachments:
1. Figure 1 - Robinson 2, Power Supply for Safety Injection Pumps
2. List of Recently Issued NRC Information Notices

*see previous concurrence

EAB:NRR	EAB:NRR	EAB:NRR	TECH:ED	C:EAB:NRR	D:DEST:NRR	C:GCB:NRR
RCid*	RWoodruff*	DFischer*	BCalure*	WLanning*	LShao*	CHBerlinger*
7/14/88	7/14/88	7/14/88	7/15/88	7/19/88	7/20/88	7/22/88
D:DOEA:NRR						
CERossi						
/ /88						

Subsequently, the licensee performed a new LOCA analysis assuming that only one safety injection pump operates to mitigate the consequences of LOCA. Calculation of emergency core coolant flow was based on system test performance degraded by 5 percent of the design values. Using acceptable models, the licensee found that peak cladding temperature, local metal-water reaction, and total metal-water reaction would be within the acceptance criteria of 10 CFR 50.46 with the reactor operating at 100 percent power with the power peaking factor at 2.32 before the accident. On the basis of these results, NRC permitted the licensee to resume full power operation after removing the auto-start capability of the swing pump and after the limiting conditions for operation were changed to require that two safety injection pumps be operable, each capable of automatic initiation from a separate emergency bus.

No specific action or written response is required by this information notice. If you have questions about this matter, please contact one of the technical contacts 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 Contacts: Roger Woodruff, NRR
(301) 492-1180

Peter Kang, NRR
(301) 492-0812

Attachments:
1. Figure 1 - Robinson 2, Power Supply for Safety Injection Pumps
2. List of Recently Issued NRC Information Notices

*see previous concurrence

EAB:NRR	EAB:NRR	EAB:NRR	TECH:ED	C:EAB:NRR	D:DEST:NRR	C:GCB:NRR
RCid*	RWoodruff*	DFischer*	BCalure*	WLanning	LShao	CHBerlinger
/ /88	/ /88	/ /88	/ /88	7/19/88	7/20/88	7/22/88

D:DOEA:NRR
CERossi
/ /88

to fail to function. Pending resolution of this problem, the auto start capability for the swing pump was defeated, the plant was derated to 60% full power, and the allowable power peaking factor was reduced from 2.32 to 2.26.

Subsequently, the licensee performed a new LOCA analysis assuming that only one safety injection pump operates to mitigate the consequences of LOCA. Calculation of emergency core coolant flow was based on the configuration of as-built piping and a minimum pump performance curve based on system test performance degraded by 5% of the design values. Using acceptable models, the licensee found that peak cladding temperature, local metal-water reaction, and total metal-water reaction would be within the acceptance criteria on 10 CFR 50.46 with the reactor operating at 100% of full power and with the power peaking factor at 2.32 prior to the accident. Based on these results, NRC permitted the licensee to resume operation at 100% of full power after removing the auto start capability of the swing pump and after the limiting conditions for operation were changed to require that two safety injection pumps are operable, each capable of automatic initiation from a separate emergency bus.

No specific action or written response is required by this information notice. If you have questions about this matter, please contact one of the technical contacts 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 Contacts: Roger Woodruff, NRR
(301) 492-1180

Peter Kang, NRR
(301) 492-0812

Attachments:
1. Figure 1 - Robinson 2, Power Supply for Safety Injection Pumps
2. List of Recently Issued NRC Information Notices

EAB:NRR	EAB:NRR	EAB:NRR	C:EAB:NRR	D:DEST:NRR	C:GCB:NRR	TECH:ED
RCid	RWoodruff	DFischer	WLanning	LShao	CBerlinger	~~AThomas~~ B. Calure
7/14/88	7/14/88	7/14/88	7/ /88	7/ /88	7/ /88	7/15/88

D:DOEA:NRR
CERossi
7/ /88