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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

May 9, 1980

Docket Nos. 50-03
50-247

Consolidated Edison Company of
New York, Inc.
ATTN: Mr. W. J. Cahill, Jr.
Vice President
4 Irving Place
New York, New York 10003

Gentlemen:

The enclosed IE Bulletin No. 80-12, "Decay Heat Removal System Operability," is forwarded to you for action. A written response is required. If you desire additional information regarding this matter, please contact this office.

Sincerely,

Robert T. Carlson
for Boyce H. Grier
Director

Enclosures:
1. IE Bulletin No. 80-12 with Attachment
2. List of Recently Issued IE Bulletins

CONTACT: W. H. Baunack
(215-337-5253)

cc w/encls:
L. O. Brooks, Project Manager, IP Nuclear
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ENCLOSURE 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

SSINS No.: 6820
Accession No.:
8005050053

IE Bulletin No. 80-12
Date: May 9, 1980

DECAY HEAT REMOVAL SYSTEM OPERABILITY

Introduction:

The intent of this Bulletin is to improve nuclear power plant safety by reducing the likelihood of losing decay heat removal (DHR) capability in operating pressurized water reactors (PWRs). PWRs are most susceptible to losing DHR capability when their steam generators or other diverse means of removing decay heat are not readily available. Such conditions often occur when the plants are in a refueling or cold shutdown mode, and during which time concurrent maintenance activities are being performed.

There is a need to assure that all reasonable means have been taken to provide redundant or diverse means of DHR during all modes of operation. (Note: A redundant means could be provided by having DHR Train A AND Train B operable; a diverse means could be provided by having either DHR Train A OR Train B operable AND a steam generator available for DHR purposes.) There is also need to assure that all reasonable means have been taken to preclude the loss of DHR capability due to common mode failures during all modes of operation.

Background: On several occasions, operating PWRs have experienced losses of DHR capability. In each instance, except that of the Davis-Besse Unit 1 incident of April 19, 1980, DHR capability was restored prior to exceeding the specified RCS temperature limit for the specific mode of operation. Nonetheless, the risk and frequency associated with such events dictate that positive actions be taken to preclude their occurrence or at least ameliorate their effects.

The most noteworthy example of total loss of DHR capability occurred at Davis-Besse Unit 1 on April 19, 1980. (See IE Information Notice No. 80-20, attached hereto as Attachment 1). Two factors identified as major contributors to the Davis-Besse event in the Information Notice are: (1) extensive maintenance activities which led to a loss of redundancy in the DHR capability, and (2) inadequate procedures and/or administrative controls which, if corrected, could have precluded the event or at least ameliorated its effects.

ACTIONS TO BE TAKEN BY LICENSEES OF PWR FACILITIES:

1. Review the circumstances and sequence of events at Davis-Besse as described in Attachment 1.

2. Review your facility(ies) for all DHR degradation events experienced, especially for events similar to the Davis-Besse incident.

3. Review the hardware capability of your facility(ies) to prevent DHR loss events, including equipment redundancy, diversity, power source reliability, instrumentation and control reliability, and overall reliability during the refueling and cold shutdown modes of operation.

4. Analyze your procedures for adequacy of safeguarding against loss of redundancy and diversity of DHR capability.

5. Analyze your procedures for adequacy of responding to DHR loss events. Special emphasis should be placed upon responses when maintenance or refueling activities degrade the DHR capability.

6. Until further notice or until Technical Specifications are revised to resolve the issues of this Bulletin, you should:

   a. Implement as soon as practicable administrative controls to assure that redundant or diverse DHR methods are available during all modes of plant operation. (Note: When in a refueling mode with water in the refueling cavity and the head removed, an acceptable means could include one DHR train and a readily accessible source of borated water to replenish any loss of inventory that might occur subsequent to the loss of the available DHR train.)

   b. Implement administrative controls as soon as practicable, for those cases where single failures or other actions can result in only one DHR train being available, requiring an alternate means of DHR or expediting the restoration of the lost train or method.

7. Report to the NRC within 30 days of the date of this Bulletin the results of the above reviews and analyses, describing:

   a. Changes to procedures (e.g., emergency, operational, administrative, maintenance, refueling) made or initiated as a result of your reviews and analyses, including the scheduled or actual dates of accomplishment; (Note: NRC suggests that you consider the following: (1) limiting maintenance activities to assure redundancy or diversity and integrity of DHR capability, and (2) bypassing or disabling, where applicable, automatic actuation of ECCS recirculation in addition to disabling High Pressure Injection and Containment Spray preparatory to the cold shutdown or refueling mode.)

   b. The safeguards at your facility(ies) against DHR degradation, including your assessment of their adequacy.

The above information is requested pursuant to 10 CFR 50.54(f). Accordingly, written statements addressing the above items shall be signed under oath or affirmation and submitted within the time specified above. Reports shall be submitted to the director of the appropriate NRC regional office, and a copy forwarded to the Director, Division of Reactor Operations Inspection, NRC Office of Inspection and Enforcement, Washington, D. C. 20555.

Approved by GAO, B180225 (R0072); clearance expires 7-31-80. Approval was given under a blanket clearance specifically for identified generic problems.

Attachment:
IE Information Notice
No. 80-20

ENCLOSURE 1

SSINS No.: 6870
Accession No.:
8002280671

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D. C. 20555

IE Information Notice 80-20
Date: May 8, 1980

LOSS OF DECAY HEAT REMOVAL CAPABILITY AT DAVIS-BESSE UNIT 1 WHILE IN A REFUELING MODE

Description of Circumstances:

On April 19, 1980, decay heat removal capability was lost at Davis-Besse Unit 1 for approximately two and one-half hours. At the time of the event, the unit was in a refueling mode (e.g., RCS temperature was 90F; decay heat was being removed by Decay Heat Loop No. 2; the vessel head was detensioned with bolts in place; the reactor coolant level was slightly below the vessel head flanges; and the manway covers on top of the once through steam generators were removed). (See Attachment A, Status of Davis-Besse 1 Prior to Loss of Power to Busses E-2 and F-2 for additional details regarding this event.)

Since the plant was in a refueling mode, many systems or components were out of service for maintenance or testing purposes. In addition, other systems and components were deactivated to preclude their inadvertent actuation while in a refueling mode. Systems and components that were not in service or deactivated included:

> Containment Spray System; High Pressure Injection System; Source Range Channel 2; Decay Heat Loop No. 1;
> Station Battery 1P and 1N; Emergency Diesel-Generator No. 1; 4.16 KV Essential Switchgear Bus C1; and 13.8 KV Switchgear Bus A (this bus was energized but not aligned).

In brief, the event was due to the tripping of a non-safeguards feeder breaker in 13.8 KV Switchgear Bus B. Because of the extensive maintenance and testing activities being conducted at the time, Channels 1 and 3 of the Reactor Protection System (RPS) and Safety Features Actuation System (SFAS) were being energized from only one source, the source emanating from the tripped breaker. Since the SFAS logic used at Davis-Besse is a two-out-of-four input scheme in which the loss (or actuation) of any two input signals results in the actuation of all four output channels (i.e., Channels 1 and 3, and Channels 2 and 4), the loss of power to Channels 1 and 3 bistables also resulted in actuation of SFAS Channels 2 and 4. The actuation of SFAS Channels 2 and 4, in turn, affected Decay Heat Loop No. 2, the operating loop.

Since the initiating event was a loss of power event, all five levels of SFAS were actuated (i.e., Level 1 - High Radiation; Level 2 - High Pressure Injection; Level 3 - Low Pressure Injection; Level 4 - Containment Spray; and

Level 5 - ECCS Recirculation Mode). Actuation of SFAS Level 2 and/or 3 resulted in containment isolation and loss of normal decay heat pump suction from RCS hot leg No. 2. Actuation of SFAS Level 3 aligned the Decay Heat Pump No. 2 suction to the Borated Water Storage Tank (BWST) in the low pressure injection mode. Actuation of SFAS Level 5 represents a low level in the BWST; therefore, upon its actuation, ECCS operation was automatically transferred from the Injection Mode to the Recirculation Mode. As a result, Decay Heat Pump No. 2, the operating pump, was automatically aligned to take suction from the containment sump rather than from the BWST or the reactor coolant system. Since the emergency containment sump was dry, suction to the operating decay heat pump was lost. As a result, the decay heat removal capability was lost for approximately two and one-half hours, the time required to vent the system. Furthermore, since Decay Heat Loop No. 1 was down for maintenance, it was not available to reduce the time required to restore decay heat cooling.

MAJOR CONTRIBUTORS TO THE EVENT:

The rather extended loss of decay heat removal capability at Davis-Besse Unit 1 was due to three somewhat independent factors, any one of which, if corrected, could have precluded this event. These three factors are:

(i) Inadequate procedures and/or administrative controls;
(ii) Extensive maintenance activities; and
(iii) The two-out-of-four SFAS logic.

Regarding inadequate procedures and/or administrative controls, it should be noted that the High Pressure Injection Pumps and the Containment Spray Pumps were deactivated to preclude their inadvertent actuation while in the refueling mode. In a similar vein, if the SFAS Level 5 scheme had been by-passed or deactivated while in the refueling mode, or if the emergency sump isolation valves were closed and their breakers opened, this event would have been, at most, a minor interruption of decay heat flow.

Regarding the extensive maintenance activities, it appears that this event would have been precluded, or at least ameliorated, if the maintenance activities were substantially reduced while in the refueling mode.. For example, if the maintenance activities had been restricted such that two SFAS channels would not be lost by a single event (e.g., serving Channels 1 and 3 from separate sources), this event would have been precluded. Likewise, if maintenance activities had been planned or restricted such that a backup decay heat removal system would have been readily available, the consequences of the loss of the operating decay heat removal loop would have been ameliorated.

Regarding the two-out-of-four SFAS logic used at Davis-Besse, even under normal conditions, it appears that this type of logic is somewhat more susceptible to spurious actions than other logic schemes (e.g., a one-out-of-two taken-twice scheme). This susceptibility is amplified when two SFAS channels are served from one source. Consequently, when the source feeding SFAS Channels

1 and 3 was lost, all five levels of SFAS were actuated. As stated previously, this particular event would have been precluded if SFAS Channels 1 and 3 were being served from separate and independent sources. In a similar vein, this specific event would have been precluded by a one-out-of-two taken twice type of logic that requires the coincident actuation of or loss of power of an even numbered SFAS Channel and an odd numbered SFAS Channel.

Since each LWR can be expected to be in a refueling mode many times during its lifetime, licensees should evaluate the susceptibility of their plants to losing decay heat removal capability by the causes described in this Information Notice. No specific action or response is requested at this time. Licensees having questions regarding this matter should contact the director of the appropriate NRC Regional Office.

Attachment A

DAVIS-BESSE EVENT OF APRIL 19, 1980

STATUS OF DAVIS-BESSE 1 PRIOR TO LOSS OF POWER TO BUSSES E-2 AND F-2:

1. Refueling mode with RCS temperature at 90°F and level slightly below vessel head flange. Head detensioned with bolts in place. Manway cover on top of OTSG removed. Tygon tubing attached to lower vents of RCS hot leg for RCS level indication. Decay heat loop 2 in service for RCS cooling.

2. All non-nuclear instrument (NNI) power and Static Voltage Regulator YAR supplied from 13.8 KV Bus B via HBBF2. 13.8 K Bus A energized but not connected. RPS and SFAS Channels 1 and 3 being supplied from YAR.

3. Equipment Out of Service

   a. Source Range Channel 2 - Surveillance

   b. Emergency Diesel Generator 1 - Maintenance.

   c. Decay Heat Loop 1 - Maintenance.

4. Breakers for containment spray and HPI pumps racked out.

SEQUENCE OF EVENTS

TIME	EVENT	CAUSE/COMMENTS
2:00 p.m.	Loss of power to Busses E-2 and F-2 (non-essential 480 VAC)	Ground short on 13.8 KV breaker HBBF2 which caused breaker to open. This interrupted power to busses E-2 and F-2 which were supplying all non-nuclear instrument (NNI) power, channels 1 and 3 of the Reactor Protection System (RPS) and the Safety Features Actuation Signal (SFAS), the computer, and much of the control room indicators.
2:00 p.m.	SFAS Level 5 (recirculation mode) actuation.	Two out of four logic tripped upon loss of Busses E-2 and F-2. Actuation caused ECCS pump suction valves from containment sump to open and ECCS pump suction valves from Borated Water Storage Tank to close. During valve travel times, gravity flow path existed from BWST to containment sump.
2:02 p.m.	Decay Heat (low pressure safety injection) flow secured by operator	Operator turned off only operating DH pump to avoid spillage of RCS water to containment via the tygon tubing for RCS level indication and open SG manway.
2:33 p.m.	Partial restoration of power	Power to Bus E-2 and SFAS channels 1 and 3 restored along with one channel of NNI. This restored all essential power for RCS

TIME	EVENT	CAUSE/COMMENTS
2:44 p.m.	Attempt to reestablish DH flow	Started DH pump 1-2 then stopped it when it was determined that air was in suction line. Pump secured to prevent damage.
3:34 p.m.	Source Range Channel 2 energized.	
4:00 p.m. to 4:06 p.m.	Restoration of Busses (480 VAC) F-2, F-21, F-22, and F-23	Busses restored sequentually as efforts progressed to isolate ground fault.
4:25 p.m.	DH flow restored	DH pump 1-2 started after venting. RCS temperature at 170°F. DH flow bypassing cooler. Incore TC's being taken and maximum is 170°F.
4:46 p.m.	Containment sump pump breakers opened	Precautionary measure to assure containment sump water from BWST remained in containment. Incore TC's range from 161 to 164°F.
5:40 p.m.	Computer returned to service.	Incore TC's range from 158 to 160°F.
6:24 p.m.	DH flow directed through cooler	RCS cooldown established at less than 25°F per hour. RCS temperature at 150°F. Incore TC' range from 151 to 158°F.
9:50 p.m.	Power completely restored	RCS temperature at approximately 115°F.

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STATUS OF DAVIS-BESSE 1 AFTER RECOVERY FROM LOSS OF POWER TO BUSSES E-2 AND F-2:

1. Refueling mode with RCS temperature at 115°F and level slightly below vessel head flange. Head detensioned with bolts in place. Manway cover on top of OTSG removed. Tygon tubing attached to lower vents of RCS hot leg for RCS level indication. Decay heat loop 2 in service for RCS cooling.

2. Bus E-2 being supplied from 13.8 KV Bus A via breaker HAAE2 and Bus F-2 being supplied from 13.8 KV Bus B via breaker HBBF2.

3. Decay heat loop filled, all tags clear. Maintenance work restricted so restoration of system will be less than two hours.

4. ECCS pump suction valves (DH-9A and DH-9B) from containment sump closed and breakers racked out. This will prevent the suction of air into the decay

heat loop during a level 5 actuation (recirculation mode) when there is no water in the sump.

5. Equipment Out of Service:

   Emergency Diesel Generator 1 - maintenance

6. Breakers for containment spray and HPI pumps racked out.

ENCLOSURE 2

IE Bulletin No. 80-12
Date: May 9, 1980

RECENTLY ISSUED IE BULLETINS

Bulletin No.	Subject	Date Issued	Issued To
80-06	Engineered Safety Feature (ESF) Reset Controls	3/13/80	All Power Reactor Facilities with an Operating License (OL) (For Action) All Power Reactor Facilities with a Construction Permit (CP) (For Information)
79-03A	Longitudinal Weld Defects in ASME SA-312, Type 304 Stainless Steel Pipe	4/4/80	All Power Reactor Facilities with an OL or CP
80-07	BWR Jet Pump Assembly Failure	4/4/80	BWR 3 & 4's with OL (For Action) BWR's with CP (For Information)
80-08	Examination of Containment Liner Penetration Welds	4/7/80	All Power Reactor Facilities with an OL or CP
80-09	Hydromotor Actuator Deficiencies	4/17/80	All Power Reactor Facilities with an OL or CP
80-10	Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release to Environment	5/6/80	All Power Reactors with OL (for action) with CP (for information)
80-11	Masonry Weld Design	5/8/80	All Power Reactor Facilities with an OL, Except Salem 2