AEOD TECHNICAL REVIEW REPORT

UNITS: Multiple
DOCKET NOS: Multiple
LICENSEES: Multiple
NSSS/AE: Multiple

TR REPORT NO.: AEOD/T90-11
DATE: August 13, 1990
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SUBJECT: EFFECT OF HIGH ENERGY LINE BREAKS ON CHILLED WATER SYSTEMS AT NUCLEAR POWER PLANTS

SUMMARY

Gilbert/Commonwealth, the Architectural Engineer for the Summer plant, identified that in the event of an high energy line break (HELB) in the intermediate (auxiliary) building at Summer, both chilled water trains could potentially be rendered inoperable. A postulated HELB could provide additional heat loads on cooling coils in area air handling units (AHUs) which were exposed to the steam environment. As the chilled water system supplies cooling water to these area AHUs, the heat from the HELB steam could have placed excessive heat loads on the chillers, rendering both trains of chilled water inoperable.

Vital equipment cooled by the chilled water system includes the charging pumps, component cooling water pump motors, and room cooling AHUs for various vital components.

A search of the LER data base for the time period of 1985 to the present identified no other LERs that are relevant to the subject of this study. Gilbert/Commonwealth revealed that Crystal River 3 is the only other Gilbert/Commonwealth designed plant that had problems similar to Summer's.

Accordingly, AEOD concludes no additional generic action in this regard is warranted.

DISCUSSION

1. Description of the Event

On February 9, 1990, Gilbert/Commonwealth informed South Carolina Electric & Gas Company that in the event of an HELB in the intermediate (auxiliary) building at the Summer plant, both chilled water trains could potentially be rendered inoperable. The chilled water system is a closed system, transferring heat from various vital systems to the service water system. A previous evaluation of the effects of an HELB on the chilled water system at Summer addressed the effects of directly exposing the chiller units to an HELB. However, it was later recognized that a postulated HELB would also provide additional heat loads on cooling coils in area AHUs which were exposed to the steam environment. As the chilled water system supplies cooling water to both trains of these area AHUs, the heat from the HELB could have placed excessive heat loads on the two chillers, tripping the chillers, and rendering both trains of chilled water inoperable.

In order to obtain more detailed information on this event for analysis and evaluation, the author visited the Summer site on July 12, 1990, to discuss the occurrence with plant personnel and examined the affected plant areas and components.

The subject AHUs are located in area 412 of the intermediate building above the two motor driven auxiliary feedwater pumps, and in an area near the service water booster pumps. These AHUs could be subject to previously un-evaluated heat loads from HELBs as follows:

- Area 412 contains three 3-inch steam generator blowdown lines positioned in close proximity to the two motor-driven auxiliary (emergency) feedwater pumps.

- An adjoining, but separate, room contains a 4-inch main steam line to the auxiliary feedwater pump Terry turbine. An open fire damper with fusible links is installed in the wall separating this room from Area 412. In the event of a HELB in this room, steam would propagate into the 412 area through the open fire damper, as steam temperature would not be high enough to melt the fusible links.

A break in any of the identified steam lines would accordingly cause additional heat loads on both trains of the AHUs located in Area 412. This additional un-accounted for heat load would be transferred to both trains of the chilled water system, and ultimately trip both chillers on high refrigerant pressure or low condenser suction pressure (the chiller units utilize freon to transfer heat from the chilled water system to the service water system). This would render both trains of the chilled water system inoperable.

Vital equipment cooled by the chilled water system are:

- Charging pumps gear and lube oil coolers,
- Component cooling water pump motors
- Auxiliary building switchgear rooms AHUs,
- Charging pump room AHUs,
- Control room AHUs,
- Emergency feedwater area AHUs,
- ESF switchgear rooms AHUs,
- Relay room AHUs,
- RHR/Containment spray pump room AHUs,
- Service water booster pump room AHUs,
- Speed switch room AHUs, and
- Vital battery rooms AHUs.

Licensee corrective actions at Summer included balancing the chiller units to evenly distribute heat loads created by a HELB, and isolation of the previously mentioned AHUs in Area 412. Licensee analysis verified the AHUs were not necessary to keep the Area 412 temperatures below acceptable values. As a long term corrective action, the licensee is evaluating the need for permanent design modifications to correct the identified deficiencies.

2. Operational Data

A search of the LER data base, utilizing the NUDOCS system, was performed for the time period of 1985 to the present. The full text search focused on LERs containing the words "chilled water" and "line break." This search strategy assures all occurrences of HELBs and other steam line breaks impacting the chilled water system are identified. Only the Summer LER identified in this report was found to be applicable to this study.

The Events Assessment Branch (EAB) of NRR has also investigated the possibility of other plants being suspectable to this type of failure. An EAB discussion with Gilbert/Commonwealth revealed that Crystal River 3 is the only other Gilbert/Commonwealth designed plant that had problems similar to Summer's. A discussion with plant personnel at Crystal River revealed that corrective actions have been taken to assure affected AHUs are isolated from the chilled water system in the event of an HELB.

FINDINGS AND CONCLUSIONS

A full text search of the LER data base was performed for the time period of 1985 to the present to identify instances of HELBs rendering chilled water trains inoperable. Only the Summer LER identified in this report was found to be applicable to this study.

Information obtained from Gilbert/Commonwealth indicates that Crystal River 3 is the only other Gilbert/Commonwealth designed plant that had problems similar to Summer's. Accordingly, no further AEOD action in this regard is recommended at this time.

REFERENCE

1. South Carolina Electric & Gas Company, "Manual Reactor Trip Due to Pressurizer Safety Valve Failure," Licensee Event Report 89-11, Revision 1, Docket 50-395, January 23, 1990.