March6, 2003

MEMORANDUM TO: John N. Hannon, Chief
Plant Systems Branch
Division of Systems Safety and Analysis

FROM: Eric Weiss, Chief**/RA/**
Fire Protection Engineering and Special Projects Section
Plant Systems Branch
Division of Systems Safety and Analysis

SUBJECT: ST. LUCIE HALON 1301 FIRE SUPPRESSION SYSTEM

The purpose of this memorandum is to provide you with risk-informed closeout of the gaseous suppression issues raised in the St. Lucie Regulatory Conference of June 20, 2002. Specifically, the issue is in regard to whether a backfit can be justified for the Halon 1301 gaseous suppression system so that it not only controls but extinguishes a deep-seated fire.

Background

Florida Power and Light (FPL), the licensee for the St. Lucie Nuclear Power Plant, attended a regulatory conference on June 20, 2002 in NRC headquarters. The regulatory conference addressed the configuration of the Halon 1301 system installed in the St. Lucie Unit 1 Cable Spreading Room (CSR). The regulatory conference concluded that the installed system was in compliance with the current licensing basis and thus no violation existed. Consequently, a compliance backfit was not indicated.

It is generally agreed that the installed Halon 1301 system provided concentrations sufficient to extinguish a surface fire but not extinguish a deep-seated fire. Should a deep-seated fire occur, the Halon 1301 system would likely control the rapid progression of fire until the halon concentration dissipated to ineffective levels but by which time the fire brigade would be available to extinguish the fire. My staff examined this issue in terms of both risk-significance and NFPA code compliance to determine whether a backfit was justified per 10 CFR 50.109.

NFPA Code Compliance

The licensee's Code of Record (COR) is NFPA 12A, *"Standard on Halon 1301 Fire Extinguishing Systems,"* 1980 edition, for the installation in their CSR. Previously, the Office of General Counsel (OGC) provided advice to my staff regarding this issue. That advice was that the relevant regulation (10 CFR 50 Appendix R IIIG.3) only required a suppression and not an extinguishment system. Further, the advice was that the language in NFPA12A as it relates to the halon concentrations necessary to extinguish a deep-seated fire was not mandatory and therefore not enforceable. To address the NFPA code compliance issue further and determine whether we had overlooked a compliance perspective, my staff consulted with the National Fire Protection Association (NFPA) and prepared a draft Formal Interpretation (FI) request regarding the requirements of NFPA 12A, *"Standard on Halon 1301 Fire Extinguishing*

Systems," 1980 edition. Three draft questions were prepared and informally sent to Mr. Mark Conroy, Sr. Fire Protection Engineer, and NFPA staff liaison for this standard (Attachments 1, 2, and 3). Mr. Conroy, representing the NFPA, determined that our request could not be processed since the sections of NFPA 12A that we were questioning, "Involves text that clearly and decisively provides the requested information." Mr. Conroy's written responses and the section of the NFPA Regulations Governing Committee Projects are Attachments 4 and 5. The NFPA response provided no basis to revisit the issue from a compliance backfit perspective.

Technical Assumptions and Analysis

From a risk perspective, the issue may be framed in terms of significance of control versus extinguishment of a hypothetical deep-seated fire in cables of the CSR. Underlying this analysis there are two key technical assumptions. One deals with the potential for a deep-seated fire and the other deals with the potential for ignition of the cable. Although another view was offered during the regulatory conference by the licensee's consultant, my staff is aware of data indicating that electrical cables may burn in a deep-seated manner. This data was developed in the NRC sponsored research conducted at Sandia National Laboratories (SNL) in the early 1980's. In "*Burn Mode Analysis of Horizontal Cable Tray Fires,"* (NUREG/CR-2431) the report concludes that, "Deep-seated fires were generated in the electrical cable tests by a hovering layer of burnt gas. In horizontal cable trays such hovering was caused by a descending fire ball and/or by a descending smoke blanket." This condition was the postulated fire scenario by both the staff and the licensee's consultant as presented at the Regulatory Conference. NUREG/CR-2431 further concludes that, "The use of fire retardant materials (Institute of Electrical and Electronic Engineers (IEEE)-383 cable qualifications, cable tray coatings) tend to increase the duration of deep-seated cable fires." These coatings are installed at St. Lucie. The abstract and conclusions of NUREG/CR-2431 are Attachment 6.

Another technical assumption involves the results of the fire modeling used in the risk analysis. The staff's calculation using Consolidated Model of Fire Growth and Smoke Transport (CFAST) predicted upper gas layer average temperatures in excess of 932 °F (500°C) while the licensee predictions were on the order of 698 °F (370 °C). The most realistic value is probably in between these temperatures. However, because the licensee's cables, which are non-qualified IEEE 383 thermoplastic electrical cables, ignite on the order of 425°F (218°C), both models predict conditions for electrical cable ignition.

Discussion of Risk Considerations

My staff reviewed the relevant risk information concerning St. Lucie Unit 1 CSR. Listed below are the key risk considerations.

1. Individual Plant Examination for External Events (IPEEE). FPL submittal dated December 15, 1994, "St. Lucie Units 1 and 2 NRC Generic Letter 88-20, Supplement 4, Individual Plant Examinations of External Events for Severe Accidents Vulnerabilities Report." (9412270272) In their report, FPL identified the CSR as one of the top three fire risk sensitive areas in the plant. The licensee took credit for the Halon 1301 system in their analysis. Nevertheless, the key issue is the change in core damage frequency (CDF) between the installed configuration and a configuration where the concentration of Halon 1301 would be sufficient to extinguish a deep-seated fire and this is reflected in the Phase III SDP finding.

2. In the 2001/2002 time frame SPSB and SPLB held meetings to discuss the Phase III SDP. A general consensus from the meetings indicated that the most appropriate classification for the 1301 Halon fire extinguishing system finding, giving the licensee credit for improvements made since the FPFI (e.g., procedure improvements, fire barrier replacement, fire brigade improvements, etc.) would be a “white” finding, consistent with a delta CDF of less than 10E-5 per reactor-year. (ML021020070)

3. During the Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on Fire Protection Meeting on September 11, 2002, Mr. Steven Nowlen who is a Distinguished Member of the Technical Staff of SNL and Dr. Graham B. Wallis, who is an ACRS subcommittee member made some remarks relative to the risk associated with the issue of fire control versus extinguishment. (See page 118 of transcript, Attachment 7 to this memo.) Dr. Wallis stated that hypothetically a fire “could have been decreased in size by some initial action which made it harmless but it still needs to be suppressed fully but the actual risk stops at an earlier stage than your final outcome.” Mr. Nowlen responded, “That's correct. There is a big debate about what we really mean by suppressing a fire. And in the risk context we typically are satisfied with controlling the fire to the point where it's not causing any further damage to my plant systems and components. So in a sense, we're really looking at fire control.”

Conclusion

Based upon the code compliance position of the NFPA, the SDP white finding and the opinion of experts in the area of risk analysis relative to significance of a fire suppression system that controls a fire, a backfit of the St. Lucie CSR Halon 1301 is not justified either from a compliance or a risk perspective. Therefore, in accordance with our commitment to evaluate the differing assumptions that the licensee presented (regarding CFAST modeling, fire risk analysis and grouped electrical cables fire hazard analysis) as documented in the July 11, 2002 letter to the licensee (ML021930434), no further action of the St. Lucie Halon 1301 fire suppression system is warranted.

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Attachments: As stated

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