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Dana A. Powers - 3/30/99

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE ACRS SUBCOMMITTEE MEETING
ON FIRE PROTECTION
JANUARY 20-21, 1999
ROCKVILLE, MARYLAND

INTRODUCTION

The Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on Fire Protection held a meeting on January 20-21, 1999, in Room T-2B3, 11545 Rockville Pike, Rockville, Maryland, with representatives of the U.S. Nuclear Regulatory Commission (NRC) staff, the Nuclear Energy Institute (NEI), the National Fire Protection Association (NFPA), and the Boiling Water Reactor Owners Group (BWROG). The meeting was to held to gather information regarding the insights gained in the fire protection area from the reviews of the Individual Plant Examination from External Events (IPEEE) submittals, the findings of the Pilot Fire Protection Functional Inspections (FPFIs), Post-Fire Safe Shutdown Circuit Analysis Issues (specifically in the area of hot shorts), Comprehensive Fire Protection Regulatory Guide (CFPRG), proposed NFPA Fire Protection 805 Standard, and related matters. The entire meeting was open to the public. Mr. Amarjit Singh was the cognizant ACRS staff engineer for this meeting. The meeting was convened at 8:30 a.m. on January 20, 1999, and adjourned on January 21, 1999 at 12:15 p.m.

ATTENDEES

ACRS Members

D. Powers, Chairman
G. Apostolakis
T. Kress
D. Miller
R. Seale

Principal NRC Speakers

G. Holahan, Office of Nuclear Reactor Regulation (NRR)
E. Connell, NRR
P. Madden, NRR
L. Marsh, NRR
A. Rubin, Office of the Nuclear Regulatory Research (RES)
N. Siu, RES
S. West, NRR

Industry Speakers

V. Bacanskas, BWROG
R. Bielen, NFPA

RS01

F. Emerson, NEI

No written comments or requests for time to make oral statements were received from members of the public. A complete list of meeting attendees is kept in the ACRS Office File and will be made available upon request. A list of those who registered is available in the ACRS office. The handouts and the presentation slides used during the meeting are attached to the office copy of these minutes.

CHAIRMAN'S OPENING REMARKS

Dr. Dana A. Powers, Chairman of the Fire Protection Subcommittee, convened the meeting at 8:30 a.m. He stated that the purpose of this meeting was to discuss the staff's action related to the insights gained in the fire protection area from the reviews of IPEEE submittals, the results of the FPFIs, Post-Fire Safe shutdown Circuit Analysis, the CFPRG, proposed NFPA 805 Standard and related matters.

NRC STAFF PRESENTATIONS

Opening Remarks - Ledyard B. Marsh, NRR

Mr. Marsh stated that there three main forces have guided the staff in the area of fire protection. The first force is the agency's emphasis on becoming more risk- informed and the second is the new assessment process, which has a strong influence on the FPFI program. The third force is the Commission's interactions with the stakeholders. Mr. Marsh presented an overview of the FPFI program and stated that, as expected, the staff found some weaknesses in the FPFI program. The staff plans to submit its final report to the Commission by the end of March 1999; it will contain an analysis of FPFI findings, a discussion of regional follow-up activities, and recommendations for the type and level of future reactor fire protection inspection program.

Comprehensive Fire Protection Regulatory Guide (CFPRG) - Edward A. Connell, NRR

Mr. Connell presented the history of the existing NRC fire protection guidance, which is scattered over 125 generic letters (GLs), information notices (INs), Bulletins, branch technical positions (BTPs), standard review plan (SRP), and internal memoranda. He stated that some of the existing fire protection guidance conflicts specifically in the areas of water supply, hose length, and fire protection electrical raceways. In SECY- 98-058, "Development of a Risk-informed, Performance-based Regulation for Fire Protection at Nuclear Power Plants, " the staff proposed the development of a CFPRG. In accordance with SECY-98-058 and the staff requirements memorandum (SRM), the staff was directed to develop a CFPRG. With technical assistance from Pacific Northwest National Laboratory (PNNL), the staff has completed the outline for the CFPRG. The copy of the outline was provided to NEI for their review and comments. The staff has met several times with NEI and stakeholders and received comments. The staff plans to address public comments and issue the final regulatory guide in early October 1999. The staff also plans to address the implementation of the regulatory guide and the relationship with NFPA 805 Standard.

Post-Fire Safe Shutdown Circuit Analysis Issues - Steven West, NRR

Mr. West discussed the concerns associated with the post-fire circuit analysis in the area of hot shorts. He stated that the issues involve potential fire-induced electrical circuit failures that could either prevent the operation, or lead to the malfunction, of equipment needed to achieve and maintain post-fire safe shutdown, or in some manner could interfere with the achievement of post-fire safe shutdown. The staff has focused on safety, technical, and regulatory issues; the assumptions that are made in circuit analysis; and the terminology used to discuss the issues. He further stated that some licensees may not have adequately considered fire-induced failures in performing their associated circuit analysis. NRC and industry have held different views on this issue. There have been strong regulatory disagreements between the staff and the industry on some of the issues associated with circuit analysis; that is why, has been so difficult to resolve this issue.

The staff has sought various paths to resolve this issue. In July 1998, the staff conducted a circuit analysis workshop at which, NEI committed to form an issues resolution task force. In September 1998, the staff and its contractors met with BWROG's Appendix R Committee and the NEI Circuit Analysis Task Force to discuss the efforts of these industry groups to develop PSA circuit analysis tools (NEI) and a non–PSA related circuit analysis issues guidance document (BWROG). NEI plans to submit its technical proposals for staff review in early June of 1999 and BWROG plans to submit a topical report for staff review in early October 1999.

Fire Protection Functional Inspection Pilot Program and Summary of Inspection Findings - Patrick Madden, NRR

Mr. Madden presented the background, objectives, scope, and findings of the pilot fire protection functional inspections (FPFIs) conducted at River Bend Station, Crystal River, Prairie Island, and Susquehanna Steam Electric Station.

Objectives :

- Reevaluate the scope of the reactor fire protection inspection program.
- Develop a coordinated approach for fire protection and post-fire safe shutdown system inspections.
- Provide a strong, broadly based, coherent inspection program that is commensurate with the safety significance of the subject.
- Provide clear guidance to the staff and industry regarding oversight of reactor fire protection programs.
- Provide an immediate safety benefit arising from renewed industry attention to nuclear power plant safety.

Scope of FPFI Inspection Procedure :

- The primary purpose was to use a risk-informed approach to assess implementation effectiveness of defense-in-depth principles in fire-risk- sensitive plant areas;
- Place added focus on configuration management processes; and
- Develop assessment capabilities for fire-related vulnerabilities.

The summary results of the pilot FPFIs include the following findings:

Strengths

- Cable re-route modifications, which provide positive fire separation between redundant safe-shutdown functions;
- Identification of the lack of the required fire barrier protection for service water cable;
- Implementation of a motor-operated valve (MOV) modification, which eliminates the fire-induced spurious actuation and functional operation concerns;
- Technical personnel, corporate history, and consistency (Personnel know the plant and its systems);
- Scope and depth of operator training on post-fire safe shutdown operations from outside the control room;
- Emergency lighting, good aiming of lights, which are marked and easily identifiable;
- Strong response to the fire performance technical issues associated with Kaowool raceway fire barrier systems, including Thermo-Lag resolution; and
- Addressing of associated circuits and fire-induced spurious equipment operations (e.g., a MOV modification eliminating fire-induced spurious actuation and functional operation concerns).

Weaknesses

- Control of combustibles;
- Manual fire-fighting capability (fire brigade);
- Fire watches and operability;

- Post-fire safe-shutdown capability;
- Plant safety (fire-induced transient and spurious operation of 16 safety relief valves)
- Feasibility of certain cold-shutdown repairs;
- Potential for water hammer on the high-pressure coolant injection, reactor core isolation cooling, core spray system, and the residual heat removal discharge piping;
- IPEEE fire analysis;
- Scope and depth of quality assurance audits;
- Use of automatic depressurization system and its capability to meet Appendix R reactor performance parameters; and
- Compliance of fire protection plant features with industry fire protection codes and standards.

Mr. Madden stated that the distribution of the FPFI findings is as follows:

- Procedures, 10%
- Alternate safe-shutdown implementation, 5%
- Emergency lighting, 5%
- Communication, 2%
- Fire prevention, 5%
- Fixed suppression, 12%
- Fire brigade, 13%
- Fire detection, 4%
- Passive fire barriers, 10%
- Review of the IPEEE results, 8%
- Evaluations of plant transients, 4%
- Safe-shutdown Analysis, 22%

Mr. Madden also presented the following FPFI program insights:

- Implementation of the fire protection plan was not reviewed as part of initial Appendix R inspections. Integration of fire protection/Appendix R program elements was not validated.
- The application of quality assurance principles to Appendix R implementation was not assessed by the initial Appendix R inspections.
- Pre-FPFI inspection procedures did not verify Appendix R safe-shutdown analysis (SSA) compliance, which was being audited and maintained by licensee programs.
- Administrative controls (fire prevention measures) are overly emphasized by the core inspection program.
- Engineering of plant fire protection systems, their design basis, and compliance with minimum industry fire protection standards is not an area addressed by pre-FPFI inspection procedures.
- Fire brigade performance and NRC expectations are not fully inspected by core inspection procedures.
- The engineering adequacy of plant fire protection features and fire barriers used to protect safe-shutdown (SSD) functions, including their design and licensing basis, is not addressed by pre-FPFI inspection procedures.
- The initial Appendix R inspection did not contain any guidance for confirming the adequacy of SSA/SSD methodology and assumptions.
- The NRC core inspection procedure does not include Appendix R program elements.
- 10 CFR 50.59, post-fire SSD operability, configuration management, and reportability program areas were not fully addressed by pre-FPFI inspection procedures.
- Additional guidance is needed to fully assess the adequacy of fire risk analysis, its assumptions, methodology and the perceived results.

Mr. stated that the assessment of risk and safety significance of inspection findings indicates that FPFI program concerns may exist in one or more elements of defense-in-depth at any given plant. He concluded that the safety significance of individual findings is dependent on overall fire protection program effectiveness and should be judged in a plant-wide context.

INDUSTRY PRESENTATIONS Nuclear Energy Institute (NEI) - Fred Emerson

Mr. Emerson stated that during the past year NRC and the industry NRC have taken significant steps to resolve a number of issues. With the current high level of regulatory and industry activity, it is important to prioritize and focus NRC and industry activities to maximize the opportunities for success. The industry has focused on the four issues and their significance to the industry include: (1) fire protection inspection and assessment; (2) fire protection standards and guidance development; (3) fire-induced circuit failures; and (4) application of risk information to resolving fire protection issues.

Fire protection inspection and assessment:

Mr. Emerson presented the background information on the proposed assessment process improvements which is stated in SECY-99-007, " Recommendations for Reactor Oversight Process Improvements," and addressed the way fire protection is captured therein. SECY-99-007 describes seven cornerstones which support the NRC's overall mission. Performance in these cornerstones is monitored by licensees where performance indicators have been developed, and the NRC's risk-informed baseline inspection program where performance indicators have not been developed. The conceptual model for assessing performance in each area, and determining appropriate action based on results in all areas, involve four response bands:

- Green - Licensee Response Band: Where all performance inputs (performance indicators and cornerstone inspection areas) are Green, cornerstone objectives are fully met. Licensees monitor performance and perform necessary corrective action, and NRC performs risk-informed baseline inspections in areas where there are no performance indicators.

- White - Increased Regulatory Response Band: When one performance input is White, or two White in different cornerstones, the cornerstones objectives are considered to be fully met. Licensees perform corrective action with NRC oversight, and NRC conducts an inspection follow-up.

- Yellow - Required Regulatory Response Band: When two or three performance inputs are White, or one is Yellow, in any cornerstone, that cornerstone is degraded (cornerstone objectives are met with minimal reduction in safety margin). Licensees perform self-assessment with NRC oversight, and NRC conducts an inspection focused on the causes of degradation. When there is a repetitive degraded cornerstone, or multiple Yellow inputs, cornerstones are met with a significant reduction in safety margin. Licensees implement a Performance Improvement Plan with NRC oversight, NRC conducts a team inspection focused on the cause of degradation.

- Red - Unacceptable Performance: Plant performance significantly outside design basis; loss of confidence of ability of plant to provide assurance of public health and safety with continued operation; unacceptable margin to safety. When the performance reaches the Red band, the licensee will not normally be permitted to operate the plant.

Mr. Emerson stated that the fire protection assessment and inspection are captured within the "Initiating Events" and "Mitigating Systems" cornerstones. Fire protection inspection is provided through risk-informed NRC baseline inspections, since no performance indicators have yet been recommended. These risk-informs baseline inspections include a review of ignition sources, control of combustible materials, and fire protection systems and equipment.

NEI recommends that industry and NRC should implement performance indicators in appropriate fire protection and safe shutdown areas. NRC core inspections would be conducted in areas where performance indicators are not available. NRC core baseline inspections should utilize regulatory requirement modules developed from FPFI inspection guidance. He further stated that NEI request plants who have not performed recent self-assessments to determine whether near term self-assessments are needed to prepare for integration into proposed assessments process improvements.

Fire protection standards and guidance development:

Mr. Emerson stated that the Commission directed the NRC staff to work closely with the NFPA so that NFPA 805 Standard is developed on an expedited basis, and to assure that proper risk-informed, performance-based approach is maintained. The staff is participating extensively on the NFPA Technical Committee on Nuclear Facilities (TCNF) which is developing this standard. NEI also has a representative on the TCFN and fully supports the development of the standard. NEI will propose to the NFPA that TCFN make the standard flexible enough to support utility applications. He concluded that NEI is monitoring very closely regarding the development of CFPRG. NEI plans to provide comments on the CFPRG to the staff as indicated by Mr. Connell.

Fire-Induced Circuit Failures:

NEI has formed a Circuit Failures Issue Task Force (ITF) to provide NRC staff near term proposals for addressing circuit failure issues based on safety significance. The staff has agreed to consider these proposals. The methods being developed by the Circuit Failure ITF to include the following features:

- Apply a generic method for addressing potential multiple failures involving cable to cable and other interactions. This method screens out a number of potential circuit interactions based on a better understanding of mechanistic circuit failure modes. The ITF supports this method with a combination of cable test information, mechanistic analysis, and experience with actual cable fires.

- Analyze remaining potential failures through traditional deterministic analysis methods. If a potential circuit interaction does not screen out, it will be deemed safety significant.

- Appropriate documentation of the analysis and any resulting actions is necessary.

The NEI Circuit Failures ITF expects to propose the methods described above in NEI guidance by end of May 1999. The BWROG Appendix R Subcommittee is also developing a detailed guidance on performing circuit analysis. Although the guidance is primarily deterministic, NEI expects that it will reference the NEI guidance described above. A final decision on the use of NEI guidance within the BWROG guidance will be made by the BWROG.

Application of risk information to resolving fire protection issues:

NEI and the industry support the increased use of risk information in resolving fire protection issues. The applications described in draft NUREG-1521, "Technical Review of Risk-Informed, Performance-Based Methods for Nuclear Power Plant Fire Protection Analyses, " are promising examples of such use. NEI and the nuclear industry propose to work with the NRC staff to develop further these and other applications.

National Fire Protection Association (NFPA), Proposed NFPA 805 Fire Protection Standard - Richard P. Bielen

Mr. Bielen presented an overview of the purpose and the progress report on the NFPA 805 Standard. The NFPA has developed standards in the areas of electrical installation, building fire protection and life safety, fire protection systems and equipment, and chemicals and hazardous materials and has worked with various professional organizations in the development of other codes and standards. NFPA codes and standards have been developed at three levels: Federal, State, and local. NFPA standards have been adopted and used by various agencies of the Federal Government and the States, building code organizations, and the insurance industry, and by such individuals as architects, engineers, and designers. NFPA has various technical committees that are involved in developing codes and standards. The NFPA 805 committee for nuclear facilities has the primary responsibility for documents on the safeguarding of life and property from fire in which radiation or other effects of nuclear energy might be a factor. The NFPA standards committee is comprised engineering specialists from various engineering firms, nuclear utilities, the Federal Government, and nuclear insurers. The NFPA 805 committee has proposed a new performance-based standard for light-water- reactor electric generating plants.

The NFPA 805 committee has completed the proposed 805 Standard and the draft NFPA 805 Standard 6.3 was issued for public comment on November 25, 1998. The comment period will end on February 19, 1999. The NFPA 805 committee believes that it has prepared a sound action plan for addressing performance-based fire protection for nuclear power plants, which is being implemented by a balanced committee of experts who are organized under the umbrella

of an accredited national standards process. The NFPA committee plans to hold meetings to act on the proposals received from various organizations and the public. Mr. Bielen briefly discussed the overview of the draft NFPA 805 Standard 6.3. He stated that the standard consists of five chapters and three Appendices. The risk-informed methods will be discussed in Appendix B, which is not complete at this point. In organizing the standard, the following general approach was taken into consideration:

- Establish a core fire protection program.
- Select the performance objective to be considered.
- Identify the performance criteria necessary to achieve this objective.
- Evaluate whether the deterministic or performance-based requirements associated with the performance criteria are satisfied.
- Perform the engineering analysis to demonstrate that performance-based requirements are satisfied when applying a performance-based approach.
- Perform a site-wide fire-risk evaluation.
- Develop a monitoring program to monitor plant fire risk.
- Document and control fire protection design-basis configurations.

Mr. Bielen concluded that the project is on schedule. The NFPA plans to publish NFPA 805 Standard in September 1999 for public comment. During the May 14-18, 2000, NFPA meeting the membership will vote on the standard. In July 2000, the standard will be issued.

Boiling Water Reactor Owners Group (BWROG) Appendix R Subcommittee, Associated Circuit Analysis - Vincent P. Bacanskas

Mr. Bacanskas presented the background of the BWROG Appendix R Subcommittee. The subcommittee was formed in the fall of 1997 in response to FPFI and other inspection issues. The subcommittee's objective is to develop consistent and technically supportable guidance for Appendix R circuit analysis requirements, which will be captured in a document for NRC staff approval. This generic guidance document will address many of the issues that the NRC staff has identified in its Appendix R Circuit Analysis Resolution Plan, as well as other important fire protection issues. This document will discuss BWROG positions related to requirements, clarifications of conflicting guidance, and the necessary criteria for determining generic compliance. Mr. Bacanskas stated that the BWROG subcommittee is working closely with NEI and NRC staff to develop this document and plans to submit it to NRC staff for review and approval as a topical report by October 1999.

ADDITIONAL NRC STAFF PRESENTATIONS - Proposed NFPA 805 Standard - Edward A. Connell, NRR

Mr. Connell presented the background, scope and goals, performance objectives, and performance criteria of NFPA 805 Standard.

On March 26, 1998, the staff submitted SECY-098-58, which proposed that the staff defer the fire protection rulemaking and instead work with the NFPA and the industry to develop a performance-based, risk-informed consensus standard for fire protection for nuclear power plants. This standard, if successfully developed, could be endorsed by the staff in a future rulemaking as an alternative method meeting NRC fire protection requirements. The staff briefed the Commission on March 31, 1998, regarding its proposal. In the SRM dated June 30, 1998, the Commission approved the staff's proposal and directed the staff to keep the Commission informed on the status of the NFPA activities, and to provide an assessment of progress and direction.

The scope and goals of NFPA 805 Standard is to prepare a comprehensive fire protection standard to protect the safety of the public, the environment, and plant personnel, as well as to limit the potential for economic loss during and after a fire. The scope of the standard is limited to establishing the minimum requirements for existing light-water reactors during all phases of plant operation (e.g., power operation, shutdown, decommissioning, and degraded conditions). To accomplish its purpose, the NFPA has established the following four performance goals for NFPA 805 Standard:

1. Nuclear Safety - Protect the reactor fuel located anywhere at the plant site (e.g., reactor vessel, spent fuel pool, or dry storage) from direct or indirect damage resulting from a fire during all plant modes and configurations.

2. Radiological Release - Provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel, or the environment.

3. Life Safety - Ensure the safety of plant personnel by providing adequate notification and means of egress in the event of a fire.

4. Property Damage/Business Interruption - Control the potential for economic loss due to a fire within the limits established by the plant owner/operator.

Each of these four performance goals is coupled to corresponding performance objectives and criteria that must be satisfied in order to comply with the requirements of the standard. The performance objectives that define the series of actions necessary to meet the goals, are stated in more specific terms than the goals, but are measured in a more qualitative than quantitative basis (e.g., achieve and maintain shutdown reactivity conditions and decay heat removal capability). The specific performance criteria are quantifiable and are stated in engineering terms (e.g., k-effective <.99 and reactor coolant temperature < 177 °C (350 °F)).

Within the framework of NFPA 805 Standard, the plant owner/operator is given the option of selecting a deterministic approach (e.g., Appendix R to 10 CFR Part 50 and NFPA *Life Safety Code*) or a performance-based approach (e.g., engineering analysis, fire modeling, and probabilistic safety assessment) for satisfying the criteria.

The standard is risk informed in that a site-wide risk evaluation is required to assess the overall level of plant fire safety. The specific risk criterion (i.e., fire-induced core damage frequency) established by the plant owner/operator is subject to the acceptance of the authority having jurisdiction (e.g., the NRC). To meet the requirements of the standard, the performance criteria specified in the standard and the risk criteria established by the plant owner/operator must be satisfied. Acceptable methods for conducting the site-wide risk assessment and the performance-based approaches will be contained within the standard. Alternative analytical methods not included in the standard may be used, provided that they are acceptable to the authority having jurisdiction.

Several outstanding issues must be resolved by the NFPA technical committee in the near term to support the aggressive schedule. The following major issues were identified by the staff and must be resolved: (1) documentation requirements; (2) the scope of the base fire protection program (the minimum fire protection systems and features that are applicable to all plants, e.g., water supply, fire brigade); (3) monitoring of system and program performance and feedback of those indicators into the program; (4) fire protection provided during degraded plant conditions; (5) roles of the authorities having jurisdiction (other than the NRC), and (6) developing acceptable methods for evaluating compliance with the performance and risk criteria established by the standard.

The staff expects that additional analysis, beyond that currently documented by licensees, will be required if licensee choose to adopt NFPA 805 Standard. The level of analysis required for each plant will depend upon the degree to which performance-based approaches are adopted over the existing deterministic approaches. The site-wide risk evaluation required by the standard is anticipated to be an enhancement of the plant's existing fire-risk evaluation conducted as part of the IPEEE.

Mr. Connell concluded that NFPA plans to issue 805 Standard on schedule following the May 2000 annual NFPA meeting.

Fire Risk Research Program: Status - Nathan Siu , RES

Dr. Siu presented the objectives and the status of the development of the fire-risk research program, and the process that RES had been using to prioritize issues and grouped them into topic areas that need to be addressed through this program. The objective of this program was to identify areas in which improvements are needed in fire-risk analysis methods and data to gain a better understanding of the risk contribution of fires in nuclear power plants and to support improved decision making regarding fire protection at nuclear power plants. The following few areas possibly requiring further research:

- Fire frequency analysis, which includes rated versus unrated cables, the effect of plant operations, compensatory measures, and transient-fueled fires.
- Frequency-magnitude relationship for fires.
- Single and multi-compartment analysis, including cable tray fires, electrical cabinet fires, large oil fires, hot gas layer development, and flash over.
- Smoke generation and transport analysis.
- Detection analysis.
- Suppression analysis, including automatic and manual suppression effectiveness, effect of compensatory measures, and scenario-specific analysis.
- Fire barrier reliability, including penetration seals.
- Human reliability analysis, especially the effect of fire on cognitive behavior and the identification and detection of precursors

Dr. Siu stated that the research activities on these issues are being performed by national laboratories. Although there is little argument about the potential importance of fires, the magnitude of the fire risk and the specific measures to efficiently manage this risk are not clear when considering individual plants. This uncertainty reflects uncertainties in the current state of knowledge concerning the initiation, growth, suppression, and impacts on the plant of fire-induced plant accident scenarios. These latter uncertainties are reflected by the variability in methods and data used by current fire-risk assessments (which contribute significantly to variations in predicted fire risk magnitude and profiles) and by the ongoing discussions between representatives of the nuclear industry and the NRC staff regarding the usefulness of current fire-risk assessment tools in supporting plant changes and risk-informed, performance-based approaches to fire protection.

The staff has examined the fire-risk analysis process has been performed to systematically identify the areas in which additional research is needed. This examination considered the treatment of fire initiation, fire scenario induced equipment damage, and plant response to the loss of equipment. The results of this examination have been supplemented with data from a several sources, such as the NRC's Fire Protection Task Action Plan and insights gained from the staff's review of IPEEE submittals. The RES staff is also coordinating its research activities with the other program offices and the industry.

Dr. Siu concluded that the FY 1999 schedule supports the overall program and objectives and the interactions with other programs is continuing. He further stated that he expects the substantial progress toward all current objectives will be completed by end of FY20 00.

Preliminary Fire Perspectives From the IPEEE Program - Alan Rubin, RES

Mr. Rubin presented the overview of the preliminary fire perspective from the IPEEE program and focused only on the fire area. Mr. Rubin covered three major topics: (1) the review process for the IPEEE; (2) the status of the IPEEE program, and (3) the schedule. Mr. Rubin discussed the general background of the program itself in which the licensees were requested to perform an IPEEE in response to Generic Letter (GL) 88-20, Supplement 4, dated June 28, 1991. The following objectives were considered in performing the IPEEE:

- To develop an appreciation of severe-accident behavior.
- To understand the most likely severe-accident sequences that could occur at the plant.
- To gain a qualitative understanding of the overall likelihood of core damage and fission product release.
- If necessary, to reduce the overall likelihood of core damage and fission product releases by modifying, when appropriate, hardware and procedures that would help prevent or mitigate severe accidents.
- To ensure that the IPEEE submittals were complete, focusing on whether the licensee met the intent of GL 88-20.

The preliminary IPEEE perspectives in the fire area indicated that the IPEEE program generally was successful in meeting the intent of GL 88-20. The staff identified the following significant points during the preliminary review of the IPEEE submittals:

- The comparison of quantitative core damage frequency (CDF) between plants was not straightforward because it varies in the methods used for analyses, data, and modeling assumptions by analysts, and in the level of detail provided in the analyses.
- The CDF contribution from fire events can, in some cases, approach (or even exceed) the contribution from internal events.
- The range of reported fire CDF is less than 1E-09 to 5E -03 per reactor-year.
- Only one licensee (Quad Cities) identified fire "vulnerability" from turbine building oil and electrical fires.
- About 50 percent of the licensees have implemented or proposed plant improvements, such as hardware changes, relocation of cables out of the fire area, upgrading of fire barriers, and improvement of fire suppression systems, and, improvement of the fire response procedures and modification of the procedures to control transient combustibles and active fire barriers.

The licensee identified vulnerability at Quad Cities from the postulated fires in the turbine building and from electrical fires, including the lack of separation of certain cables in the turbine building, reliance on alternate unit equipment, and complicated procedures for recovery actions, which led to high CDF. The licensee implemented an interim shutdown method by using an independent backup power supply for both units. The CDF was reduced to 7E-04 per reactor-year. The licensee evaluated long-term measures to further reduce the CDF by adding two independent pumps for reactor makeup powered by the station blackout diesel generator. The licensee plans to resubmit fire IPEEE to the staff for its review.

Status and Schedule:

Mr. Rubin stated that a total of 74 IPEEE submittals are expected, but to date, the staff has complete preliminary review of 70 submittals and has issued 10 safety evaluation reports (SERs). The staff is scheduled to complete all reviews and to issue plant-specific SERs by June 1999.

Mr. Rubin concluded that, overall, the IPEEE program is generally successful in meeting the intent of GL 88-20 and more specific and detailed reviews may be needed to apply information from IPEEEs to support risk-informed, performance-based regulation.

SUBCOMMITTEE RECOMMENDATIONS

The subcommittee Chairman recommended that the staff brief the ACRS on NFPA 805 Standard and the Comprehensive Regulatory Guide during 459th meeting.

CONCLUSIONS

The subcommittee decided to follow- up on the discussions on fire protection NFPA Standard and comprehensive regulatory guide during the 459th meeting of the ACRS and will recommend that a report be prepared to the commission on NFPA 805 Standard. The report was issued on February 18, 1999.

BACKGROUND MATERIAL PROVIDED TO THE SUBCOMMITTEE

- Memorandum to L. Joseph Callan, Executive Director for Operations, from John C. Hoyle, Secretary, Subject: Staff Requirements-SECY-97-127, "Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants," dated September 11, 1997

- SECY-97-127, Subject: Development of a Risk-Informed, Performance-Based Regulation for the Fire Protection at Nuclear Power Plants, dated June 19, 1997

- Letter to Mr. L. Joseph Callan, Executive Director for Operations, from Ralph E. Beedle, NEI, concerning the proposed NRC staff performance-based rulemaking for fire protection, dated August 20, 1997

- Letter to Dr. Robert L. Seale, Chairman, ACRS, from Mr. Richard P. Bielen, Chief Systems and Applications Engineer, NFPA, dated November 7, 1997
- Letter to George D. Miller, President and Chief Executive Officer, NFPA, from Samuel J. Collins, Director, NRR, response to the November 7, 1997 letter
- Letter to Mr. L. Joseph Callan, Executive Director for Operations, from Ralph E. Beedle, NEI, dated December 11, 1997
- SECY-98-247 Subject: Risk-Informed, Performance-Based Fire Protection at Nuclear Power Plants dated October 27, 1998
- SECY-98-230 Subject: Insights from NRC research on fire protection and related issues dated October 2, 1998
- SECY-98-058 Subject: Development of risk-informed, performance-based regulation for fire protection at nuclear power plants
- Circuit Analysis Resolution Plan dated April 7, 1998, Rev. 6
- Draft 6.3 dated November 25, 1998, NFPA 805 Standard Subject: Perfomance-based standard for fire protection for Light Water Reactor Electric Generating Plants
- Memorandum to Gary M. Holahan, Director, Division of Systems Safety and Analysis, NRR, from Ledyard B. Marsh, Chief Plant Systems Branch, NRR, Subject: Summary of July 23, 1998, NRC Workshop on post-fire safe shutdown circuit analysis, dated November 12, 1998
- Memorandum to Thomas H. Essig, Acting Chief, Generic Issues and Environmental Projects Branch, NRR from Stewart L. Magruder, Project Manager, Generic Issues and Environmental Projects Branch, NRR, Subject: Summary of September 17, 1998 meeting with the Nuclear Energy Institute (NEI) and The Boiling Water Reactor Owners Group (BWROG) regarding fire protection circuit analysis dated November 20, 1998
- Letter to David Walker, Comptroller General, General Accounting Office from Edward J. Markey, Member of Congress, dated December 9, 1998
- Memorandum to Gary M. Holahan, Director, Division of Systems Safety and Analysis, NRR, from Ledyard B. Marsh, Chief Plant Systems Branch, NRR, Subject: Summary of November 10, 1998, NRC Workshop on reactor fire protection inspection program, dated December 24, 1998

- Letter to David J. Modeen, Director, Nuclear Generation Division, NEI, from Ledyard B. Marsh, Chief, Plant Systems Branch, Division of Systems Safety and Analysis, NRR, Subject: Draft Regulatory Guide Outline dated December 24, 1998

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Note: Additional details of this meeting can be obtained from a transcript of this meeting available in the NRC Public Document Room, 2120 L Street, N.W. Washington, D.C. 20006, (202) 634-3274, or can be purchased from Ann Riley & Associates, Ltd., (Court Reporters and Transcribers) 1250 I Street, NW, Suite 300, Washington, D.C. Rhode Island Avenue, N.W. Washington, D.C. 20005 (202) 842-0034.