January 28, 2004

NRC REPORT TO IEEE/NPEC

1.0 Key Topics

1.1 License Renewal

The Tennessee Valley Authority filed a license renewal application in January 2004 for its Browns Ferry units, including the long shut-down unit 1, which TVA plans to start by May 2007 at an estimated cost of about $ 1.8 B. TVA asked the Commission to add 20 years to the current Browns Ferry operating licenses, which expire in December 2013 for unit 1, June 2014 for unit 2, and July 2016 for unit 3.

Status of License Renewal (attachment 1-routed).

Status of License Renewal Interim Staff Guidance Issues (attachment 2-routed).

1.2 Fire Protection Rulemaking:

A final rule is expected to be published in February 2004. The implementation guidance document for NFPA requires rework.

1.3 Risk-Informed Regulation Implementation Plan

The staff provided to the Commission an update of the risk-informed regulation implementation plan (see SECY-03-181 dated October 27, 2003).

1.4 PRA Quality

A divided Commission approved a four-phased approach to answer the question of how good a licensee's probabilistic risk assessment (PRA) should be as the agency develops its risk-informed regulatory regime.

1.5 Review Standard for Extended Power Uprates

See attachment 3 (routed) for a listing of (a) Approved Applications for Power Uprates, (b) Pending Applications for Power Uprates, and (3) Expected Applications for Power Uprates.

If the staff approved the power uprate applications it has under review and those it expects to receive over the next 5 years, about 2045 megawatts electric would be added to nuclear generation capacity.

2.0 Research Activities:

2.1 Confirmation of Associated Circuits Items for Fire Protection Inspections

The staff recently completed its evaluation of associated circuits technical items. An associated circuit is a circuit corresponding to a component directly outside of the Appendix R, protected safe shutdown path that can fail the protected train. Based upon the existing state of knowledge, the staff confirmed the risk categorization of cable and circuit analysis features in the draft Regulatory Issue Summary: "Risk-Informed Inspection Guidance for Post-Fire Safe-Shutdown Associated Circuits Inspections." The response also provides the technical basis for this categorization. The draft Regulatory Issue Summary (RIS) informs licensees of the risk-informed inspection criteria that will be used by NRC inspectors to perform future post-fire safe-shutdown associated circuits inspections. Not only does it enable fire protection inspectors to focus inspections on higher-risk cable and circuit analysis features, but it also identifies those features of lower or indeterminate risk.

3.0 NRC Rulemaking and Regulatory Guide Activities:

3.1 Final Regulatory Guide 1.53, Revision 2, "Application of the Single-Failure Criterion to Safety Systems," was issued in November 2003. It endorses IEEE Std. 379-2000.

3.2 Draft Regulatory Guide DG-1079 (Regulatory Guide 1.32, Revision 3) on Criteria for Power Systems was issued for public comment in April 2003. This draft guide endorses IEEE Std. 308-2001. The final guide is expected to be published by April 2004.

3.3 Draft Regulatory Guide DG-1121, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants according to their Safety Significance," is under development.

3.4 Draft Regulatory Guide DG-1122, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," is under development.

See SECY-03-122 dated July 18, 2003. It is the staff's intention to issue (by February 2004) the regulatory guide for trial use and test the guide in one or more pilot applications.

Energy Northwest plans to submit a license amendment request to extend the allowed outage time for a diesel generator at Columbia from 72 hours to 14 days. Southern California Edison anticipates submitting a license amendment request to extend the allowed outage time for a battery charger at San Onofre.Dominion wants to use the new reg guide to test its categorization of components at Surry. Exelon will use the reg guide to propose risk-informed changes to surveillance requirements at Limerick.

3.5 Final Regulatory Guide 1.168, Revision 1 "Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants," expected to be published within next 3 months.

3.6 Final Regulatory Guide 1.180, Revision 1, “Guidelines for Evaluating EMI/RFI in Safety-Related I&C Systems”, was issued in October 2003.

3.7 Draft Regulatory Guide on IEEE Std 802.x, regarding low-level data communication protocols is under development.

3.8 Draft Regulatory Guide on IEC 61158, regarding Profibus is under development.

3.9 Draft Regulatory Guide DG-1128, which is a revision of Regulatory Guide 1.97, "Instrumentation for Nuclear Power Plants to Assess Plant and Environment Conditions During and Following and Accident," is under development.

3.10 Draft Regulatory Guide DG-1129, “Criteria for Independence of Electrical Safety Systems,”was issued for public comment in December 2003. The comment period will expire on March 12, 2004. This draft guide endorses IEEE Std 384-1992.

4.0 Research Activities in I&C Area:

4.1 RETRANS Assessment Tool:
Teleperm XS is a digital system that will provide the Reactor Protection System (RPS) and Engineered Safety Features Actuation System (ESFAS) functions. Current research will use a 3rd party tool called RETRANS to analyze the plant specific functions of the Teleperm XS system. The analysis will look at how the tool could assist the staff in plant specific review of the system.

4.2 Halden Reactor Project Digital System Safety Research Program
The Halden Reactor Project is an OECD Research program that is funded by 21 countries, whose purpose is to conduct research in a number of areas of interest to the NRC. The Digital System Safety research program at Halden is organized along similar lines as the current NRC research program (SECY-01-0155). Halden’s ongoing work in this area includes the development of a procedure for assessment of safety critical systems using BBN's, integration of formalized and none formalized assessments into a safety assessment system, investigation on how to use operational data in the assessment of COTS and security aspects of digital I&C systems. Recent accomplishments include guidance on use of formal methods and automated code generation. Planned accomplishments for the next six months include reports on model-based risk assessment of digital systems, and security aspects of digital systems.

4.3 COMPSIS Program
The Nuclear Energy Agency of the OECD is developing a database for operating experience of computer bases systems in nuclear power plants around the world (COMPSIS). The objectives of the COMPSIS Project are to, collect software and hardware fault experience in safety critical NPP systems (COMPSIS events) in a structured, quality assured and consistent database, generate qualitative insights into the root causes and contributors of COMPSIS events which can then be used to derive approaches or mechanisms for their prevention or for mitigating

their consequences, establish a mechanism for an efficient feedback of experience gained in connection with COMPSIS events including the development of defenses against their occurrence, such as diagnostics, tests & inspections, and record event attributes and dominant contributors so that a basis for national risk analysis of computerized systems is established. The project will take full benefit of the experience gained in national event databanks and Licensee Event Report (LER) collection systems. In 1999, the COMPSIS group issued a guideline document, NEA/CSNI/R(99)14 - "COMPSIS, Computer-Based Systems Important to Safety Reporting Guidelines" which will also be used to set up the project. Currently the project is actively collecting additional events to populate the database. A new version of the database should be available in late 2004.

4.4 Advanced Reactor Instrumentation and Control Lessons Learned Project

This project investigated experience with digital instrumentation and controls (I&C) technology in evolutionary nuclear power plants. In particular, this effort evaluated regulatory approaches employed by the international nuclear power community for licensing advanced I&C systems and identified lessons learned. The program reviewed modern I&C technologies employed at numerous evolutionary nuclear power plants, identified performance experience derived from those applications, evaluated regulatory processes employed and issues that have arisen, and developed suggested anticipated issues that may arise from international near-term deployment of reactor concepts. The project is complete and the final report from this project, in the form of a NUREG/CR is expected to be published in April 2004.

4.5 Advanced Reactor Instrumentation and Control Modeling Project

This project is designed to develop new models for advanced control, instrumentation, and protection systems technologies and human system interfaces that may be used as part of new reactor designs. Development of models and modeling methods for the analysis of these I&C systems will be included. This research is designed to provide the staff with the capability to understand these new methods and systems sufficiently well to develop review criteria, and to support the ability to preform check calculation as part of reviews. Currently the staff has only limited capability to independently assess the failure modes, reliability or consequences of the failure of digital systems. This program will provide that capability for instrumentation and control systems likely to be used in advance reactor applications. The first versions of these models are expected to be completed in late CY 2004.

4.6 Smart Sensor Project

Several instrument vendors have "smart sensors" on the market with a range of features based on varying degrees of computational power. Some of these products offer dual outputs to accommodate the digital information (e.g., health, validity, quality, correction for non-linearities or other known characteristics) while offering the option of accessing traditional analog signals. In the 1990s, one nuclear vendor devised a split architecture configuration that would allow the

sensing element to be placed in harsh environments (e.g., containment) while permitting the microprocessor-based electronics to be situated in a separate, milder location. Based on market considerations and the likely performance benefits smart sensors offer, it is reasonable to expect expanding use of this technology for non safety-related nuclear power applications in the near term and eventual migration of the technology into safety-related nuclear power applications. This research will investigate the acceptable level of safety and requisite QA programs associated with the use of smart sensors in power plant applications and the potential impact of smart sensor technology on the NRC standard review plan for instrumentation and control. A report on this work is expected to be issued in early CY 2005

4.7 Large Scale Validation of a Methodology for Assessing Software Quality Project

Software reliability is essentially determined by product characteristics and operational environment. Product characteristics are further determined by project characteristics such as the type of application, the project's functional size, etc. and by development characteristics such as the development team's skill level, the schedule, the tools and development methods, etc. All the above characteristics can be explicitly or implicitly reflected by software engineering measures. Therefore, one obvious inference is that software engineering measures determine software reliability. An initial study performed for the NRC and the University of Maryland ranked 40 software engineering measures with respect to their ability to predict reliability. In addition, a methodology to bridge the gap between these measures and reliability was introduced. A small initial validation study was performed to validate the ranking of the measures and the reliability prediction theory. This research program is the next step, i.e., a large scale validation of the approach and its application to a nuclear power plant reactor protection system. A report in the form of a NUREG/CR documenting the earlier small scale validation will be issued in June 2004. The large scale validation is expected to be completed in late CY 2005.

4.8 Risk Important Project

Over the past twenty-five years PRA has matured from a developmental analysis tool providing new insights into reactor safety, into a practical tool for guiding plant operations in a manner to minimize risk. Risk-informed regulation has improved the efficiency, effectiveness and realism of reactor regulation and surveillance. New reactors are being designed using PRA as a design tool to eliminate vulnerabilities and safety deficiencies before the plant is constructed. Nevertheless, PRA is far from perfect. The treatment of human error, assuring completeness, identifying design flaws, quantifying common cause failures, and quantifying uncertainties are well-known areas of weakness. Additionally, the inability to model real time digital systems in traditional static PRAs has been a roadblock to the use of risk methods in the design and assessment of plant upgrades using digital systems. The objective of this research program is to develop both policies and methods for inclusion of reliability models for digital systems into current generation nuclear power plant PRAs. The work will include a pilot study of the proposed methods. Additionally, the research will identify areas of particular concern to support development of review guidance for the

staff, and technical bases for the acceptance of risk informed applications in this area. The first version of reliability models should be completed in late CY 2004.

4.9 On-line Monitoring Project

Current commercial nuclear power plant technical specifications require that all redundant safety-related instrument channels be calibrated once each refueling cycle. These types of non optimal periodic maintenance practices are being replaced in other industries by condition-based techniques. The nuclear industry has been moving toward these condition-based practices to reduce manual calibration requirements. The staff has issued a safety evaluation report (SER) on EPRI Topical Report #104965: "On-Line Monitoring of Instrument Channel Performance." The EPRI report focused on the generic application of on-line monitoring techniques to be used as a tool for assessing instrument performance. It proposed to relax the frequency of instrument calibrations required by the technical specifications (TS) from once every fuel cycle to once in a maximum of eight years based on the on-line monitoring results. Several plants, which are participants in the EPRI On-Line Monitoring (OLM) Project, are moving toward implementation of these new technologies. Regulatory approval will be required in the form of a license amendment. The previous NUREG/CR-6343 "On –Line Testing of Calibration of Process Instrumentation Channels in Nuclear Power Plants," November 1995; does not discuss the important issues of uncertainty analyses. The discussion of uncertainty in section H.4.3 of TR-104965 argues that the past performance and a Monte Carlo analysis will provide the required evidence. The objective of this research is to provide the staff with a technical reference to support the review of On-Line Monitoring applications. A theoretical basis for the analysis of uncertainty including assumptions and their significance will be supplied, as well as a checklist to cross-reference review guidelines to standards, reports, or other documentation necessary for the proper review of safety concerns. It is expected that a report documenting this work, in the form of a NUREG/CR will be published in early CY 2005.

4.10 Advanced Instrumentation Project

Safe operation of a nuclear power plant depends, in part, on instrument channels (from process parameter sensors through instrumentation to the display and/or bistable device) operating correctly and accurately. The Commission's regulations pertaining to safety-related instrumentation and control (I&C) systems ensure the instruments are performing within their specified limits. For example, nuclear power plant technical specifications (TS) require time-directed calibration, a well known and understood process providing statistical control of instrument setpoints traceable to national standards, and, therefore, to relevant safety analyses. With the advent of digital technology, newer instruments improving reliability and accuracy while minimizing maintenance costs are finding their way into industrial systems. This project will identify and document limitations and potential regulatory concerns associated with the installation of advanced instruments measuring all data important to safety in the current generation nuclear power plants including flow, temperature, pressure, and neutron flux. It will also look into instrumentation expected to be incorporated

into next generation power plants that might be built in the near future. It is expected that a report documenting this work will, in the form of a NUREG/CR will be published in early CY 2005.

4.11 Other significant information of interest

4.11.1 4th International Topical Meeting on Nuclear Plant Instrumentation, Control and Human Machine Interface Technology (NPIC&HMIT '04)

The NRC is co-sponsoring the 4th International Topical Meeting on Nuclear Power Plant Instrumentation, Control and Human Machine Interface Technology, September19-22, 2004, in Columbus, Ohio. This the 4th in a series of conferences that are recognized as the premier meetings in nuclear power instrumentation, control and human machine interface technologies. Based on experience with first three meetings, about 225 papers will be presented and published in the proceedings. Program will include key note addresses from leaders in both government and industry, from around the world. The technical content of this meeting has always been very strong and the last meeting resulted in many of the authors being invited to expand their paper for publication in the Nuclear Technology journal.

4.11.2 International Workshop on International Workshop on Systems Software Engineering

The NRC will be co-sponsoring, with the NEA, an International Workshop on System Software Engineering in Istanbul, Turkey, on September 6-8, 2004. This work shop will bring together leading experts in the area of systems and software engineering disciplines from diverse engineering fields (Software Engineering, Risk and Reliability Engineering, Real Time Safety Critical Computing, Control Engineering and Cognitive Sciences) to present and discuss emerging and common technical methods and issues in this area. Of particular interest are methods for measuring effectiveness of various V&V approaches.

4.11.3 Update of the NRC Digital Systems Safety Research Plan

The staff is in the process of updating its Digital Systems Safety Research Program Plan. The last revision (SECY-01-0155), covered research planned for FY 01-04, and the new plan will cover research planned for FY 05- 08. As part of the development of the research plan, the NRC is planning to interact with interested stakeholders in the spring of 2004. This may include a public meeting in the April time frame.

4.11.4 The AP1000 could be certified up to five months ahead of the original December 2005 target.

4.11.5 IEC held its annual general standards meeting from October 12-17, 2003 in Montreal, Canada.

4.11.6 Topical day on cable aging in nuclear environments was organized by the Belgium Nuclear Research Center on December 9, 2003.

5.0 Human Factors:

5.1 NUREG/CR-6838 "Technical Basis for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements in 10 CFR 50.54(m)"

Draft NUREG-XXXX "Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements in 10 CFR 50.54(m)" Will be going out for public comment this quarter with a related SRP modification

The draft NUREG discusses a process for the NRC to review control room staffing exemption requests from 10 CFR 50.54(m). The SRP will reference the process covered in the NUREG. Publication of the final NUREG and SRP modification are anticipated in June '04.

A human performance software simulation tool and training is expected to be delivered by June '04. The human performance simulation software will increase the efficiency of the review process and allow the reviewer to look at the challenges in human performance from a system perspective by providing a comprehensive overview of the information submitted in support of the exemption request.

5.2 BNL Technical Report No. Y6646-T4-11/03, Rev. 1, "Human Performance Issues in Advanced Reactors," November 2003

5.3 NUREG/CR-6840, "The Technical Basis for the NRC's Guidelines for External Risk Communication."

5.4 NUREG/BR-0308, "Effective Risk Communication: The NRC's Guidelines for External Risk Communication,"

A companion to this document, is being developed for communication of risk information internal to the NRC.

5.5 NUREG-1764 (Final) Guidance for the review of changes to human actions- expected to be issued shortly.

5.6 NUREG-0800, Standard Review Plan, Chapter 18, "Human Factors Engineering";

5.7 NUREG-0711, *Human Factors Engineering Program Review Model.*

5.8 NUREG-0700, *Human-System Interface Design Review Guidelines.*

5.9 Safety Evaluation Report on, "Human Factors Engineering for Personnel Activities," for the Mixed Oxide Fuel Fabrication Facility (Construction Authorization)

5.10 Safety Evaluation Report on, "Human Factors for the USEC Lead Cascade Gas Centrifuge Facility," (COL).

5.11 The NRC has renewed its support to the OECD Halden Reactor Project for the 2003-2005 period. Several research efforts will be conducted on human system interface issues, such as HRA.

5.12 New Projects: (1) Human performance Performance Indicators (2) Managing undocumented expert knowledge, and (3) Workshop on Human Performance Issues in Advanced Reactors

6.0 Recent NRC Generic Communications

6.1 Generic Letter(s):

None.

6.2 Information Notice(s):

IN 03-11	Leakage found on Bottom-mounted Instrumentation Nozzles.
IN 03-14	Potential Vulnerability of Plant Computer Network to Worm Infection
IN 03-15	Importance of Follow-up Activities in Resolving Maintenance Issues
IN 03-17	Reduced Service Life of Automatic Switch Company Solenoid Valves with Buna-n Material
IN 03-18	General Electric Type SBM Control Switches with Defective Cam Followers

6.3 Regulatory Issue Summaries

RIS 03-009	Environmental Qualification of Low-Voltage Instrumentation & Control Cables
RIS 03-012	Clarification of NRC Guidance for Modifying Protective Actions

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