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5.0 PERMITS AND APPROVALS

5.1 Introduction and Scope

The major approval action required to permit operation of the Browns Ferry Nuclear Plant (BFN) units to continue after their current operating licenses expire is for the Nuclear Regulatory Commission (NRC) to issue renewed operating licenses for each unit. The current operating licenses for Units 1, 2, and 3 expire at midnight on December 20, 2013, June 28, 2014, and July 2, 2016, respectively. If the NRC approves Tennessee Valley Authority (TVA)'s license renewal application, each unit's renewed license would permit operation for an additional 20-year period beyond these expiration dates.

Most of the equipment involved in the alternatives addressed in this Supplemental Environmental Impact Statement (SEIS) is already in place, having been completed under the various construction and operation permits applicable during initial plant construction approximately 30 years ago. Other than the operating licenses issued by the NRC, no new permits or approvals are required for the potential cooling tower capacity additions, the dry cask storage facility, or the new site worker facilities (Administration Building, Modifications Fabrication Building) considered in this SEIS. However, continued operation will require BFN to maintain the following permits:

- Air Permits (for the Emergency Diesel Generators, Auxiliary Boilers, and Fueling Facility (i.e., the site gasoline pumping station),
- Construction/Demolition Waste Landfill Permit, and
- NPDES Permit

5.2 Overview of Required Permits/Approval

This section provides a brief background discussion and synopsis of the considerations involved for each type of permit or approval required for the alternatives discussed in this SEIS.

5.2.1 Operating License Renewal

5.2.1.1 License Renewal Background

The NRC published 10 CFR Part 54 in December 1991, establishing the regulatory requirements governing nuclear plant license renewal. Since publishing the original license renewal rule (hereinafter referred to as the Rule), the NRC and the industry worked together on the

interpretation and implementation of the requirements of the Rule. These efforts led to an amending of the Rule, with the publication of the amended Rule in May 1995.

Subsequently, the Nuclear Energy Institute (NEI), (an industry-sponsored advocacy organization) embarked on a program to provide more definition and clarity to the process. This program led to the development of the Electric Power Research Institute (EPRI) License Renewal Technical Guidelines. Subsequently NEI published NEI 95-10, "Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," to provide the industry with a consistent implementation process for the Rule. The industry used a demonstration program to further verify that the use of this generic guidance document in the development of a license renewal application would satisfy the requirements of the Rule. NRC and industry interaction during and following the demonstration program identified issues requiring additional guidance. In August 1996, the NRC issued a draft regulatory guide DG 1047, endorsing NEI 95-10, revision 0, with specific caveats, as an acceptable basis for preparing a license renewal application. In addition, both the NRC and NEI hosted workshops in October 1996, which provided additional guidance to interested utilities.

To implement the requirements of 10 CFR Part 54, several documents must be prepared for submittal to the NRC. The systems, structures and components within the scope of license renewal and their intended functions that are the basis for their inclusion must be identified. An Integrated Plant Assessment (IPA) to identify applicable passive, long-lived structures and components or commodity groupings must be developed and an aging management review must be performed. Time-Limited Aging Analyses (TLAAs) and exemptions must be evaluated and their applicability must be justified.

5.2.1.2 License Renewal Documentation

There are certain regulatory requirements that must be satisfied in order to obtain a renewed operating license that allows continued operation of a nuclear power plant beyond its original license term. The license renewal application contains general information, technical information, information regarding technical specifications, and environmental information, each of which is addressed below. The application must be filed no earlier than 20 years prior to the expiration of the operating license currently in effect.

General information concerns the plant site and the plant owner, TVA. This includes administrative information similar to the information filed with the original application for an operating license. The required information is specified in 10 CFR 50.33 (a) through (e), (h) and (I). The application must also include conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license.

Technical information includes: (1) the IPA, which is the demonstration that the effects of aging on long-lived, passive structures and components are being adequately managed such that the intended functions are maintained, consistent with the Current Licensing Basis, in the renewal period; (2) the listing of Structures and Components subject to Aging Management Review; (3) results of the Aging Management Review; (4) the listing and evaluation of TLAAs and any

exemptions in effect which are based on TLAAs; (5) a supplement to the plant's Final Safety Analysis Report (FSAR), which contains a summary description of the programs and activities that are cited as managing the effects of aging and the evaluation of TLAAs; and (6) changes to the Current Licensing Basis of the plant.

Information regarding Technical Specifications must include any changes or additions to the plant's technical specifications that are necessary to manage the effects of aging during the period of extended operation.

The license renewal application will contain a supplement or a revision to the original Environmental Report that complies with the requirements of 10 CFR Part 51. This document contains environmental information required by NRC from TVA and which is used by NRC to compose the site-specific supplement to their Generic Environmental Impact Statement for License Renewal of Nuclear Plants. The information comprising this document will largely be excerpted from TVA's National Environmental Policy Act (NEPA) review (i.e., this SEIS).

5.2.2 NPDES Permit

In accordance with the Federal Water Pollution Control Act, the Alabama Water Pollution Control Act, and the Alabama Environmental Management Act, BFN has a permit to discharge various plant effluents into the Tennessee River. This permit, which must be renewed every five years, covers the effluents and discharge points listed in Table 5.2.2-1. The permit specifies discharge limitations and monitoring requirements at each discharge point (Discharge Serial Number). The current permit was issued December 29, 2000, by the Alabama Department of Environmental Management (ADEM); it became effective on February 1, 2001, and will expire January 31, 2006.

5.2.3 Air Pollution Control Permits

BFN has Permits To Operate its three Babcock and Wilcox Auxiliary Boilers (Permit No. 708-0003-Z001) and its eight Emergency Diesel Generators (Permit No. 708-0003-Z002). These permits were jointly issued by the Tri-County District Health Service, Air Pollution Control Program, and the Alabama Air Pollution Control Commission, on October 5, 1978; there is no expiration date.

BFN also has an Air Permit for its Gasoline Dispensing Facility (Permit No. 708-0003-Z003). This permit was issued by the ADEM on August 28, 1995; there is no expiration date.

Table 5.2.2-1 Discharge Points and Effluents of NPDES Permit	
Discharge Point	**Effluent**
Diffuser Outfall (DSN001)	Condenser Circulating Water, Raw Cooling Water, Turbine Building station sump, Liquid Radwaste System effluent, Intake Building sump
DSN005	Residual heat removal service effluent
DSN012	Intake screen backwash
DSN013	Storm water runoff from the Biothermal Facility
DSN013a	Storm water runoff from switchyard drainage ditch
DSN013a(1)	Treated domestic wastewater, medical lab photo developing waste, blowdown from Training Center chiller system, flush water from the Standby Liquid Control System, flush water from cooler/air compressor cleaning, filtered waste from insulator showers (for personnel involved in periodic asbestos stripping and handling operations), and rainwater
DSN013b	Sedimentation pond discharge
DSN014	Storm water runoff from west perimeter drainage ditch
DSN017	Air conditioner condensate and storm water runoff from Training Center and Live Well Center areas
DSN018	Storm water runoff from Materials and Procurement
DSN024	Storm water from the northeast and east permiters (includes adjacent farmland, vehicle service shop and mechanic shop)
DSN019	Storm water from the east side of plant (includes Fire Training Area, Low Level Radwaste storage facility, inert landfill and Hazardous Waste storage area

5.2.4 Solid Waste Disposal Permit

BFN has a Construction/Demolition Landfill Permit for its solid waste disposal landfill located on the site (Permit No. 42-02, Facility Location: Northwest quarter of the Northwest quarter of Section 18, Township 4 South, Range 5 West, Limestone County). ADEM issued the current permit on March 17, 2000, with an effective date of May 17, 2000, and an expiration date of May 16, 2005. This permit, which must be renewed every five years, allows BFN to dispose of the following materials in its landfill: "Non-hazardous, non-radioactive solid wastes including scrap lumber, bricks, sandblast grit, crushed metal drums, glass, wiring, non-asbestos insulation, roofing materials, building siding, scrap metal, concrete with reinforcing steel, and similar construction and demolition wastes."

The possibility exists that one or more cooling towers might be refurbished or replaced with larger, more efficient cooling towers, in their approximate present locations. To demolish the existing cooling towers, a Notice of Demolition to ADEM would be required and would be initiated by the Environmental staff at BFN. The advance notice requirement is that this written notification must be post marked in the mail at least ten days before the work is actually started. Also, for the cooling towers that contain asbestos, the workers that remove the asbestos panels will also have to be trained and certified by the State of Alabama in asbestos regulation compliance.

5.3 New Permits and Approvals Not Required, Not Applicable, or Indirectly Applicable

5.3.1 Land Use

The Farmland Protection Policy Act directs federal agencies to identify and take into account the adverse effects of federal programs on the preservation of farmland. The Act requires that Form AD 1006, "Farmland Conversion Impact Rating," be completed with assistance from the USDA-NRCS if prime farmland is to be permanently converted to nonagricultural use as a result of a proposed federal action.

As a federal agency, TVA is not subject to state or local zoning requirements. Land use impacts are assessed in this SEIS. Because the new structures and relocated spoils associated with the SEIS Alternatives would be located on previously disturbed soils and the plant site is classified as built-up land, their associated impacts would be insignificant.

5.3.2 Wetlands

If wetland determinations indicate that "jurisdictional" wetlands would be modified or significantly altered to accommodate development of the proposed project, requisite permits must be obtained from both the U. S. Army Corps of Engineers (USACE) and the Alabama Department of Environmental Monitoring. Wetlands are also subject to Executive Order 11990 (Protection of Wetlands).

It is unlikely that any activity associated with the SEIS Alternatives, including the footprint of either the project facilities or related appurtenances, will affect jurisdictional wetlands.

5.3.3 Floodplains

Executive Order 11988 (Floodplain Management) requires flood hazard assessments of proposed activities and requires consideration of alternatives for actions that would occur within a floodplain or floodway. TVA has conducted a class review of certain repetitive actions that occur in floodplains. See 46 Fed. Reg. 22845 (1981). The use of measures to minimize floodplains impacts as identified in TVA's 1981 class review would ensure that the floodplains are not adversely impacted by these repetitive actions.

All changes to site facilities associated with the SEIS alternatives would be located above the Probable Maximum Flood. Therefore, no identification of preferable options or determination of "no practicable alternative" per Executive Order (EO) 11988 is required.

5.3.4 Biological

Alabama has a list of protected species that overlap and extend beyond those protected by the federal Endangered Species Act (ESA). Potential impacts on state listed species are considered in this SEIS. In addition, per Section 7 of the ESA, a more structured consultation process with the U. S. Fish and Wildlife Service (USFWS) may be required if a "may affect" situation exists. The Fish and Wildlife Coordination Act also requires that aquatic species be considered in project planning and would be a requirement of the USACE and state permitting processes. The USFWS usually combines both consultative processes.

There are no impacts to endangered or threatened species that would result from any actions associated with the alternatives being considered in this SEIS. Therefore, no further reviews by state or federal agencies are required.

5.3.5 Cultural Resources

All federal agencies are mandated under the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act (ARPA) of 1979 to protect significant archaeological resources and historic properties located on TVA lands or affected by undertakings. In response to this federal legislation, TVA conducts surveys to record historic properties. A historic property is "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places."

As discussed in Section 4.3.18.1, a Phase II archaeological survey will be required if the site identified in Area 1 (see Figure 2.2-7) cannot be avoided by either Alternative 1 or Alternative 2 activities.

5.3.6 Air Navigation

Coordination with the Federal Aviation Administration (FAA) is required when it becomes necessary to ensure that the highest structures associated with the project do not impair the safety of aviation. Submission of a letter of notification (with accompanying maps and project description) to the FAA would result in a written response from the FAA certifying that no hazard exists or recommending project changes and/or the installation of warning devices such as lighting.

The BFN site facilities elevation is dominated by the 600-foot high Off-Gas Stack, which has quadrant strobe lights near the top and constant red warning lights mid-way up the stack. No new structures associated with the Alternatives in this SEIS would be as high as or higher than existing structures; therefore, no new notifications to the FAA are required.

5.3.7 Noise

Noise impacts and mitigation plans are addressed in this SEIS. Although federal regulations apply to only certain pieces of construction equipment, any local regulatory requirements on noise would have to be considered and met. However, no applicable local noise ordinances were identified for Limestone County.

5.3.8 Emergency Planning and Community Right-to-Know

The proposed plant notification and reporting under the Emergency Planning and Community Right-to-Know Act (EPCRA) goes into effect when the plant becomes operational rather than as a preconstruction process. Provisions of EPCRA flow down to designated Alabama and local officials and to the managers of the plant itself. Being a federal agency, TVA is not subject to EPCRA; however, as a matter of policy and consistent with EO 12856, TVA complies with EPCRA to the same extent as other utilities.

5.3.9 Health and Safety

The federal Occupational Safety and Health Administration (OSHA) governs the occupational safety and health of the construction workers and the operational staffs. As a federal agency, TVA is not directly subject to regulation from OSHA; however, it must comply with OSHA's substantive requirements, as these are incorporated in its occupational health and safety practices. Contractors would continue to be subject to these substantive requirements.

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6.0 PUBLIC PARTICIPATION AND COORDINATION EFFORTS

Public participation and interagency coordination/review are part of the National Environmental Policy Act (NEPA) process during the preparation of an Environmental Impact Statement (EIS). The public and appropriate federal, state, and local agencies were invited to provide input during the scoping process and the Draft Supplemental EIS (SEIS) was made available for review and comment. Section 6.1 describes the scoping process to determine the content of the SEIS and Section 6.2 describes the public participation and agency review of the Draft SEIS. Section 6.3 defines the role of lead and cooperating agencies in the preparation of this SEIS.

6.1 TVA Scoping and Public Participation Process

One activity in EIS preparation is the description of what the evaluation will cover, or rather, the scope of the EIS. An important part of this "scoping" process is the solicitation of public participation in the determination of the issues to be evaluated and the inclusion of that information in the evaluation process. This section summarizes TVA's efforts to solicit public comments which helped to define the content of the EIS.

6.1.1 Public Involvement

On Thursday, February 15, 2001, a Notice of Intent (NOI) was published in the *Federal Register* (TVA, 2000a). The NOI provided a project summary, as well as details on the project description; TVA's Integrated Resource Plan; the proposed issues to be addressed in the EIS; the alternatives to be evaluated; and a description of the scoping process. A copy of the NOI is provided in Appendix D.

TVA conducted a public meeting on March 6, 2001, in Decatur, Alabama, on the campus of Calhoun Community College to solicit comments on the scope of the SEIS. The meeting was announced via paid newspaper announcements in the March 4, 2001, Sunday editions of *The Decatur Daily*, *The Athens News-Courier*, *The Huntsville Times*, and *The Florence Times Daily*. The paid newspaper announcement also appeared on March 6, 2001, in *The Athens News-Courier*. In addition to the paid announcements, TVA provided a news release about the project and upcoming meeting to the local media on March 4 and 6, 2001. *The Athens News-Courier* carried an article about the project and the public scoping meeting in the February 25, 2001, Sunday edition. *The Decatur Daily* carried an article about the project and the public meeting in its Sunday edition on March 4, 2001. *The Florence Times Daily* also carried an article about the project and the public scoping meeting on March 5, 2001.

The paid announcements included a map which illustrated the location of Browns Ferry Nuclear Plant (BFN), as well as the location of the public meeting. The announcements and the news release stated that the meeting was being held to obtain public input on the proposed plans to apply for renewal of the operating licenses for Units 1, 2, and 3 at BFN. They further stated that written comments on the project would be received through March 23, 2001. Copies of the paid announcements and news releases are in Appendix D.

Approximately 80 persons attended the meeting, including representatives from the following newspapers: *The Huntsville Times*, *The Birmingham News*, *The Knoxville News-Sentinel*, *The Athens News-Courier*, *The Decatur Daily*, and *The Florence Times Daily*. Representatives from WVNN/WZYP radio and WVNN-TV, both from Athens, Alabama, were also present. A representative for TVA addressed those in attendance to provide information about the proposed project and to explain that the purpose for the scoping was to obtain input from the public regarding what issues should be included as part of the DSEIS. Following the public address, the attendees were divided into four different break-out groups to allow those in attendance to verbally express their ideas, concerns, and/or questions. Each of the break-out sessions was facilitated by a representative of TVA or a member of the faculty from Calhoun Community College.

Comments received during the public meeting were noted and later reviewed to help identify environmental issues that should be addressed in the DSEIS as well as those minor issues which do not warrant detailed evaluation. On March 7, 2001, several newspapers published follow-up articles. *The Knoxville News Sentinel* published a follow up article entitled, "TVA gets citizens' input on extending life of BFN." *The Birmingham News* published an article entitled, "High consumption TVA's woe, not power shortage, critic says." *The Florence Daily Times* published a follow up article entitled, "TVA plan gets mixed reaction from residents." *The Athens News-Courier* published an article entitled, "TVA looks at 20 more years." On March 8, 2001, *The Maryville Times* of Maryville, Tennessee, published a follow up article entitled "TVA's BFN restart proposal finds criticism, support." Also on March 8, 2001, Reuters released an article entitled, "TVA mulls reviving mothballed Alabama Nuclear power plant."

6.1.2 Major Issues of Public Concern

From comments received during the public meeting, received in responses to letters sent, and from internal TVA scoping of the project, environmental issues pertinent to the proposed actions and the comparison of alternatives and alternatives were identified. These are listed below and have been addressed in this SEIS:

- Air Quality,
- Surface Water Quality,
- Groundwater Quality,
- Floodplain Impacts and Flood Risk,
- Terrestrial Ecology,
- Aquatic Ecology,
- Threatened and Endangered Species,
- Wetlands,
- Socioeconomics,
- Land Use/Soils,
- Transportation Resources,

- Visual Resources,
- Aesthetics and Recreation,
- Cultural Resources,
- Environmental Noise, and
- Health and Safety

6.2 Public and Agency Review of the DSEIS

The Draft SEIS was issued for public review on December 5, 2001. A copy of the Draft SEIS and a letter were formally transmitted to the United States Environmental Protection Agency (EPA) on December 6, 2001. On December 14, 2001, the EPA issued a Notice of Availability (NOA) for the document in the Federal Register (Volume 66, Number 241, Pages 64818 through 64819; EIS No. 010519). The issuance of the NOA formally opened a 45-day period for receiving public comments on the Draft SEIS. The comment period officially closed on January 30, 2002. The NOA listed the name of the document, the closing date for the comment period, as well as a TVA point of contact. A copy of the NOA is included in Appendix D.

Copies of the full Draft SEIS or a 28-page Executive Summary of the Draft SEIS were mailed to federal, state, and local officials, and members of the public, depending on expressed or anticipated interest. A list of the recipients of each document is provided in Chapter 8. More than 40 copies of the full Draft SEIS and more than 80 copies of the Executive Summary of the Draft SEIS were distributed. A full copy of the Draft SEIS, which contains the Executive Summary, was provided to each of the following libraries:

- Athens-Limestone Public Library - Athens, Alabama
- Florence-Lauderdale Public Library - Florence, Alabama
- Huntsville Times Library - Huntsville, Alabama
- Muscle Shoals Public Library - Muscle Shoals, Alabama

TVA issued a press release to the local and regional media on January 10, 2002, announcing the time and location of the public meeting scheduled for January 17, 2002, to receive public comments on the Draft SEIS. The news release also included a brief description of the project, the availability of the Draft SEIS, and a TVA point of contact. A copy of the press release is included in Appendix D.

In addition to the press release, TVA placed an advertisement regarding the Draft SEIS and the scheduled public meeting in the following newspapers with the corresponding publication dates:

- The Athens News-Courier, January 10 and 15, 2002
- The Decatur Daily, January 10 and 14, 2002
- The Huntsville Times, January 10 and 14, 2002
- The Florence Times Daily, January 10 and 14, 2002
- The Hartselle Enquirer, January 10 and 17 2002

The paid announcement provided the date and time of the public meeting, a map illustrating the location of the meeting and the plant site, and the availability of the Draft SEIS. It further stated that written comments would be received through January 30, 2002, and provided appropriate points of contact. A copy of one of the advertisements is provided in Appendix D.

On January 17, 2002, TVA conducted a public meeting to receive comments on the draft Supplemental Environmental Impact Statement (SEIS) for Operating License Renewal of the Browns Ferry Nuclear Plant. The meeting was held on the campus of Calhoun Community College near Decatur, Alabama, in the new Aerospace Technology Center. Forty-five people signed the attendance roster, including six newspaper reporters and several community leaders and union officials.

As people entered the building for the meeting, they were encouraged to register, to provide a record of their attendance. While registering, attendees were asked if they wanted to receive a copy of the Final SEIS or the Executive Summary (when published). They were also asked if they wished to speak during the comment forum portion of the meeting. The attendees included representatives of the City of Decatur, Decatur Chamber of Commerce, Morgan County Chamber of Commerce, Alabama Emergency Management Agency (EMA), Florence-Lauderdale County EMA, Morgan County EMA, Huntsville-Madison County EMA, Southern Nuclear, Calpine-Decatur Energy Center, Holiday Inn, and Stone & Webster. Union representatives included Alabama Carpenters Local 1274, IBEW, Laborers Local 366, and Painters Local 1293. Reporters from the Huntsville Times, Decatur Daily, Athens News-Courier, and the Florence Times Daily were also in attendance.

Approximately 35 TVA personnel supported the meeting, most of whom were subject matter experts who manned display tables during the "open house" portion of the meeting, representing the following topics addressed in the SEIS: License Renewal, Unit 1 Recovery, Air & Water Resources, Plant Effluents, Socioeconomics, Visual Resources & Environmental Noise, Aquatic & Terrestrial Ecology, Accident Analysis, Decommissioning & Spent Fuel Storage, and Overall SEIS.

During the concluding "discussion forum" portion of the meeting, three individuals spoke and all were in favor of the project, especially the option of restarting Unit 1. Four written comments were received at the meeting, and again all were favorable and supportive of Unit 1 recovery. These comments, as well as all other comments received during the 45-day comment period, have been identified and addressed in the Final SEIS. Appendix E lists the agencies and individuals who provided written comments to TVA regarding the Draft SEIS. Appendix F contains TVA's responses to all comments received during the comment period, both written and oral.

Several articles appeared in local newspapers as follow-up stories to the news release and the public meeting.

- January 20, 2002 *The Decatur Daily* - "Nuclear power making comeback with public"
- January 20, 2002 *Athens News-Courier* - "Why wasn't Athens present at hearing?"
- January 22, 2002 *Athens News-Courier* - "TVA still seeking input from public"
- January 18, 2002 *The Huntsville Times* - "Most at hearing favor relicensing nuclear reactors"
- January 18, 2002 *The Decatur Daily* - "TVA hears 3 people speak in favor of Unit 1 restart"

- January 18, 2002 *Florence Times Daily* - "Committee recommends Unit 1 restart"
- January 16, 2002 *The Decatur Daily* - "Shelby: Nuclear power safe"
- January 18, 2002 *Athens Post Athenian* - "TVA seeks input on Browns Ferry future"

6.3 Lead and Cooperating Agencies

TVA is the lead agency in preparing this SEIS. No cooperating agencies were identified. However, other federal, state, and local agencies were coordinated with during the DSEIS review period, as appropriate, including the following:

- Alabama Department of Environmental Management, Montgomery, Alabama
- Environmental Protection Agency, Region 4, Atlanta, Georgia
- Department of the Interior, U.S. Fish & Wildlife Service

7.0 LIST OF PREPARERS

Dennis Baxter
Position: Senior Specialist/ Aquatic Biologist
Education: B A., Biology; A S., Aquaculture
Experience: 15 years experience in large river biomonitoring and cold water fisheries.

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Position: Engineering Specialist
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Experience: 14 ½ years experience in the nuclear engineering field.

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Position: Engineer – Transmission Planning
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Experience: 2 ½ years experience in transmission planning with TVA.

John B. Brellenthin
Position: Environmental Supervisor, Browns Ferry Nuclear Plant
Education: B A., Biology
M S., Wildlife Biology
Experience: 23 years experience with TVA in Environmental Research and Compliance Programs; 2 years experience with the Dept. of Energy - Clean Coal Technology Program; 4 years experience with the Carolina Power and Light Company - Env. Program; 1 years Env. Consulting.

Roy V. Carter
Position: Project Engineer
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B.S.C.E., Civil Engineering
M.S.E., Environmental Engineering
Experience: 23 years experience in air pollution and environmental engineering at TVA. Previous experience includes air pollution engineering and air quality monitoring. Registered Professional Engineer (MD).

J. Leo Collins
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Position: Program Administrator, TVA Regional Natural Heritage Project
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James H. Eblen
Position: Economist
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Nancy Fraley
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Stephen J. Fraley
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Kenny D. Gardner

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J. Bennett Graham

Position: Senior Archaeologist
Education: M.A., Anthropology
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Walter Harper

Position:
Education: B.S., Mechanical Engineering, Christian Brothers College, 1969
M.S., Mechanical Engineering, University of Tennessee Space Institute, 1971
Experience: 25 years experience in analysis of problems in environmental fluid mechanics, hydrothermo-dynamics and computational fluid dynamics, numerical modeling, contaminant transport, heat and mass transfer.

Phillip Harris

Position: Plant Spokesman/ Communications Consultant
Education: Master's Degree in English (Linguistics)
Experience: 8 years experience with TVA as Communications Manager for the Generating Group.

T. Hill Henry

Position: Terrestrial Zoologist
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Experience: 10 years experience assessing impacts to threatened and endangered terrestrial animals.

John M. Higgins

Position: Program Manager
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Paul N. Hopping

Position: Technical Specialist
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M.S., Civil Engineering;
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Don Hutson

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Education: MSNE
Experience: 30 years experience in nuclear industry.

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Position: Civil Engineer
Education: M.S., Civil Engineering (Hydrogeology)
B.S., Civil Engineering (Environmental Engineering)
Experience: 29 years experience in hydrogeology and groundwater Science, TVA; 7 years experience in environmental engineering, Wiedeman and Singleton, Inc., Registered Professional Engineer and Geologist (TN).

William Keeler
Position: GIS Specialist
Education: B. S., Communications, Geographic Information and Technology Certification
Experience: 11 years experience in Geographic Information Systems.

Jimmie J. Kelsoe
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Experience: 25 years experience with TVA in soil fertility, land reclamation, and waste utilization research.

Major C. R. Mccullough
Position: Principal Scientific Analyst (Geographic); Chief Cartographer
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M.A., Anthropology
Ph.D. Anthropology (Archaeology)
Experience: 23 years experience in cartography.

John J. McFeters
Position: Industrial Hygienist
Education: B.S., Mechanical Engineering
M.S., Engineering
Experience: 26 years experience in industrial hygiene, 17 years conducting environmental noise reviews and impact evaluations. Certified Industrial Hygienist.

Roger A. Milstead
Position: Manager, Flood Risk and Data Management
Education: B.S., Civil Engineering
Experience: 25 years experience with TVA in floodplain and environmental impact evaluation. Registered Professional Engineer.

Cherie M. Minghini
Position: Civil Engineer
Education: B.S., Civil Engineering
Experience: 6 years experience with TVA Fossil Engineering performing transportation and civil engineering studies. Registered Professional Engineer (TN).

Ralph E. Mosely
Position: Senior Consultant, Mosely and Associates, Division of Scott Management Group
Education: M.B.A., B.S.
Experience: Former president for over 13 years of industrial and environmental safety consulting firm and over 30 years experience in noise control.

Jeffrey W. Munsey
Position: Civil Engineer - Seismology
Education: M.S., Geophysics
B.S., Geophysics
Experience: 13 years experience with TVA as a Seismologist and Geologist; 3 years experience as a Exploration Geophysicist for Standard Oil, 13 years as seismologist at TVA. Registered Professional Geologist (TN).

Norris Nielsen

Position: Meteorologist
Education: B.S., Meteorology
M.S., Meteorology
Experience: 26 years experience with TVA in applied meteorology for power programs and environmental assessments. Previous experience as Meteorology Group Leader at Radian Corporation; and as National Weather Service weather observer.

Dale W. Nix

Position: Chemist (Nuclear Specialist)
Education: Ph.D.
Experience: 25 years, responsible for the plant Offsite Dose Calculation Manual and related programs. Detection of Radioactive Effluents and reporting of radioactive effluent activity and related doses to the public.

George Peck

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Education: M.S., Biology
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APPENDIX A

BFN SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS

Abbreviations and Acronyms

AC..... Alternating Current

ADS ..... Automatic Depressurization System

AFW..... Auxiliary Feed Water

ATWS ..... Anticipated Transient Without Scram

BFN ..... Browns Ferry Nuclear Plant

BWR..... Boiling Water Reactor

CDF ..... Core Damage Frequency

CFR ..... Code of Federal Regulations

CRD..... Control Rod Drive

CS..... Core Spray

CV..... Check Valve

DC ..... Direct Current

DW ..... Dry Well

ECCS..... Emergency Core Cooling System

EECW..... Emergency Equipment Cooling Water

ENMKCTT ..... ATWS Core Damage End State

EOP..... Emergency Operating Procedure

EPU ..... Extended Power Uprate

HFO..... High Winds, Floods, Transportation and Other External Events

HP..... High Pressure

HPCI..... High Pressure Coolant Injection

HPGTET ..... High Pressure General Transient (Event Tree)

HVAC..... Heating, Ventilation and Air Conditioning

IPE ..... Individual Plant Examination

IPEEE ..... Individual Plant Examination of External Events

ISLOCA ..... Interfacing System Loss Of Coolant Accident

LERF ..... Large Early Release Frequency

LLOCA ..... Large Loss Of Coolant Accident (Event Tree)

LOCA ..... Loss Of Coolant Accident

LPGTET ..... Low Pressure General Transient Event Tree

MAAP ..... Modular Accident Analysis Program

MLOCA ..... Medium Loss Of Coolant Accident (Event Tree)

MOV ..... Motor Operated Valve

MSIV ..... Main Steam Isolation Valve

NLERF ..... "No" Large Early Release Frequency

NPSH ..... Net Positive Suction Head

PORV ..... Power Operated Relief Valve

PSA ..... Probabilistic Safety Analysis

PSW ..... Plant Service Water

PWR ..... Pressurized Water Reactor

RBCCW ..... Reactor Building Closed Cooling Water

RCP ..... Reactor Coolant Pump

RCIC ..... Reactor Core Isolation Cooling

RHR ..... Residual Heat Removal

RHRSW ..... Residual Heat Removal Service Water

ROM ..... Rough Order of Magnitude

RPV ..... Reactor Pressure Vessel

RWCU ..... Reactor Water Clean Up

RWST ..... Reactor Water Storage Tank

SAMA..... Severe Accident Mitigation Alternative

SBO ..... Station Blackout

SG ..... Steam Generator

SGTR..... Steam Generator Tube Rupture

SLC..... Standby Liquid Control

SQUG ..... Seismic Qualification Utility Group

SRV ..... Safety/Relief Valve

TRANCDBIN..... Event Tree for Binning Transient Core Damage Sequences

TVA..... Tennessee Valley Authority

UFSAR..... Updated Final Safety Analysis Report

USNRC..... United States Nuclear Regulatory Commission

UV..... Under Voltage

Contents

Tables

Figures

I. Methodology

The methodology selected for this analysis involves identifying those Severe Accident Mitigation Alternatives (SAMA) candidates that have the most potential for reducing core damage frequency and person-rem risk. The phased approach consists of:

- Extending the Browns Ferry Nuclear Plant (BFN) Probabilistic Safety Analysis (PSA) results to a Level 3 analysis by determining offsite dose and economic baseline risk values.
- Determining the maximum averted risk that is possible based on the BFN baseline risk.
- Identifying potential SAMA candidates based on BFN PSA results, the USNRC, and industry documents.
- Screening out potential SAMA candidates that are not applicable to the BFN design or are of low benefit in boiling water reactors.
- Screening out SAMA candidates whose estimated cost exceeds the maximum possible averted risk.
- Performing a more detailed cost estimate and Level 3 dose and economic risk evaluation of remaining candidates to see if any have a benefit in risk aversion that exceeds the expected cost.

II. Level 3 PSA Analysis

The MACCS2 code was used to perform the Level 3 consequence analysis for the BFN. Plant-specific release data includes the time-nuclide distribution of releases, release frequencies, and release locations. The behavior of the population during a release (evacuation/sheltering parameters) was based on the generic MACCS2 model. This data was used in combination with site-specific meteorology and population data to simulate the impact risks (exposure and economic) to the surrounding (within 50 miles) population from the release accident sequences at the BFN.

A. Population

Population estimates for the year 2036 within 50 miles of the BFN plant were provided by TVAN (Reference 11) and are shown in Tables II-1 and II-2.

B. Meteorological Data Sampling Method

The atmospheric dispersion of radioactive material from a postulated accident depends on the meteorological conditions that exist from the start of the accident through a period of tens to hundreds of hours following the accident. Since the weather that could occur coincident with the accident is diverse, representative meteorological data sequences are selected as input to the dispersion model to reflect the dependence of the transport and dispersion process on the site weather. The selection process is done by means of sampling techniques from a full year of hourly weather data taken from the BFN on-site meteorological tower. For this analysis, the technique referred to as weather bin sampling in the MACCS2 V1.12 code was used for the 1980 year of data. This year was selected because it was deemed to be a representative year of meteorological data from the site area. The data recovery rate for all pertinent parameters was nearly 100%. Wind roses and joint frequency distributions that were run on this year of data all showed that it was typical for Browns Ferry. In general, annual meteorology does not vary markedly from year to year. Each year will have some anomalies, but as long as the site instrumentation was working properly one year should be as representative as the next.

This sampling method ensures a complete coverage of diurnal, seasonal, and 4-day cycles without the statistical noise of methods that utilize random sampling and includes the important "rain tails" (deposition due to delayed rain).

The meteorological data assessment is done by sorting the weather sequence into categories that provide a realistic representation of the year's weather without overlooking weather conditions that are instrumental in producing major consequences. A set of 40 weather categories has been selected for the MACCS2 V1.12 model to reflect these requirements. Up to eight meteorological scenarios are selected for each category, limited by the number of meteorological scenarios available for that category.

Table II-1. Estimated Population Distribution Within a 10-Mile Radius of BFN, Year 2036

Sector	0-1 mile	1-2 miles	2-3 miles	3-4 miles	4-5 miles	5-10 miles	10 miles total
N	2	18	203	379	501	2,501	3,604
NNE	0	5	33	379	521	1,931	2,869
NE	2	10	65	114	278	8,350	8,819
ENE	6	82	365	289	432	2,273	3,447
E	11	54	25	13	53	5,170	5,326
ESE	5	9	208	0	0	86	308
SE	2	0	0	0	2	7,626	7,630
SSE	0	0	1	0	1	16,037	16,039
S	0	3	29	59	25	1,768	1,884
SSW	0	2	12	235	343	3,708	4,300
SW	0	0	3	90	381	1,523	1,997
WSW	0	0	70	122	79	168	439
W	0	55	200	15	3	69	342
WNW	0	0	1	4	2	85	92
NW	0	2	8	4	33	640	687
NNW	52	467	272	84	104	3,104	4,083
TOTAL	80	707	1,495	1,787	2,758	55,039	61,866

Reference 11.

Table II-2. Estimated Population Distribution Within a 50-Mile Radius of BFN, Year 2036

Sector	0-10 mile	10-20 miles	20-30 miles	30-40 miles	40-50 miles	50 miles total
N	3,604	2,710	6,269	19,130	8,662	40,375
NNE	2,869	10,929	3,393	3,965	5,432	26,588
NE	8,819	21,034	23,783	16,920	17,488	88,044
ENE	3,447	35,534	69,528	63,014	10,840	182,363
E	5,326	5,731	136,377	105,268	12,263	264,965
ESE	308	1,096	4,229	20,885	17,799	44,317
SE	7,630	40,473	12,373	11,248	36,295	108,019
SSE	16,039	28,541	26,702	36,087	42,023	149,392
S	1,884	7,038	4,083	8,813	15,505	37,323
SSW	4,300	12,873	1,467	2,417	6,519	27,576
SW	1,997	6,376	3,318	4,075	19,955	35,721
WSW	439	3,957	3,895	29,617	4,376	42,284
W	342	3,855	17,460	37,892	4,842	64,391
WNW	92	3,124	28,974	51,789	11,954	95,933
NW	687	11,805	9,717	6,912	4,615	33,736
NNW	4,083	3,232	3,110	24,997	16,467	51,889
TOTAL	61,866	198,308	354,678	443,029	235,035	1,292,916

Given a postulated large accident, large numbers of early fatalities and injuries are normally associated with relatively low probability weather events such as rainfall or wind speed slowdowns within 50 miles of the plant site or with stable weather and moderate wind speeds at the start of the release. In MACCS2 V1.12, these weather data types have been selected to be among the 40 categories utilized in the assessment process.

With this information, weather sequences can be sampled to reflect the weather data for the full year. This ensures representation of each type of weather sequence, those important to realistic representation of the weather data set, and those important to the occurrence of the most serious accident consequences due to rainout in high population areas.

C. Atmospheric Transport and Dispersion

The dispersion model implemented in MACCS2 V1.12 is described in detail in NUREG/CR-4691, Volume 2. It is a Gaussian, time-dependent, plume segment model that has been in use for consequence assessments since the Reactor Safety Study (RSS) in 1975. The plume is assumed to be transported in a straight line downwind in accordance with the measured wind direction.

For each start hour selected by the meteorological sampling technique, the MAACS2 V1.12 dispersion model uses the subsequent meteorological conditions to predict the dispersion and transport of the released plume of radioactive material. The sequence of hourly recordings is used to account for changing meteorological conditions.

In MACCS2 V1.12, the effects of release duration, mixing layer depth, building wake, plume rise due to sensible heat buoyancy, and dry and wet removal processes are included. The ground concentration is calculated from the air concentration and the deposition rate.

D. Nuclide Release

The current design basis core inventory is provided in Table II-3 (Reference 9). Data from three district fuel types each representing Extended Power Uprate (EPU) conditions are found in the table. Each of the major hypothetical accidents identified in the IPE study (Reference 12) was assigned to one of several release categories based on the primary system and containment responses to the accident conditions calculated by the Modular Accident Analysis Program (MAAP). Each release category has associated release fractions of the initial core radionuclide inventory, which are used as input data to the consequence analysis model. In addition to the release magnitude, the parameters that characterize the various releases due to hypothetical accident sequences are time of release, duration of release, warning time for evacuation, height of release, and energy content of the released radioactive plume.

The time of start of release was taken from MAAP runs and refers to the time interval between the start of the hypothetical accident and the release of radioactive material from the containment building to the atmosphere. This parameter is used to calculate the decay of radioactivity as well as timing used in computing dose accumulated by evacuees in relation to plume location and deposited material. The duration of release is the total time during which radioactive material is emitted into the atmosphere; it is used to account for continuous releases by adjusting for horizontal dispersion due to changes in wind direction.

Table II-3. BFN Core Inventory

Isotope Number	Isotope Name	Release Group	Activity, Bq		
			GE Uprated 35 GWD/MTU	Framatome Commercial 37 GWD/MTU	Framatome Blended LEU 37 GWD/MTU
1	Cr-51	6	1.733959E+17	1.888302E+17	1.690426E+17
2	Mn-54	6	9.240809E+15	1.419054E+16	1.413400E+16
3	Mn-56	6	3.508059E+17	4.014056E+17	3.618304E+17
4	Fe-55	6	5.283289E+16	6.162424E+16	5.597064E+16
5	Co-58	6	2.133386E+16	2.100312E+16	2.128580E+16
6	Co-60	6	2.124906E+16	1.014821E+16	9.469780E+15
7	As-78	4	2.493803E+16	2.730689E+16	2.725035E+16
8	Ge-78	4	2.430765E+16	2.696767E+16	2.691114E+16
9	Se-81	4	2.229497E+17	2.040950E+17	2.066391E+17
10	Se-81m	4	6.230267E+15	1.452975E+16	1.458629E+16
11	Se-83	4	1.985262E+17	2.326456E+17	2.374512E+17
12	Br-82	2	2.410412E+16	1.215524E+16	1.175949E+16
13	Br-83	2	5.110854E+17	4.946900E+17	5.059972E+17
14	Br-84	2	8.935515E+17	9.215368E+17	9.498048E+17
15	Kr-83m	1	5.119335E+17	4.975168E+17	5.116508E+17
16	Kr-85	1	5.356786E+16	5.286116E+16	5.370920E+16
17	Kr-85m	1	1.093124E+18	1.034609E+18	1.071357E+18
18	Kr-87	1	2.108227E+18	2.080525E+18	2.156848E+18
19	Kr-88	1	2.970967E+18	2.883336E+18	2.996408E+18
20	Rb-86	3	9.503702E+15	6.925660E+15	6.840856E+15
21	Rb-88	3	3.016196E+18	2.968140E+18	3.081212E+18
22	Rb-89	3	3.875543E+18	3.872716E+18	4.042324E+18
23	Sr-89	5	3.997417E+18	4.014169E+18	4.155507E+18
24	Sr-90	5	4.271295E+17	4.635952E+17	4.720756E+17
25	Sr-91	5	4.980885E+18	5.031732E+18	5.201340E+18
26	Sr-92	5	5.359613E+18	5.314384E+18	5.483992E+18
27	Y-90	7	4.533537E+17	4.840330E+17	4.896018E+17
28	Y-91	7	5.122977E+18	5.173762E+18	5.343362E+18
29	Y-91m	7	2.891816E+18	2.911604E+18	3.024676E+18
30	Y-92	7	5.384116E+18	5.371140E+18	5.512477E+18
31	Y-93	7	6.185039E+18	4.070594E+18	4.155398E+18
32	Y-94	7	6.207698E+18	6.416896E+18	6.529967E+18
33	Y-95	7	6.642980E+18	6.671248E+18	6.756052E+18

Table II-3. BFN Core Inventory (Continued)

Isotope Number	Isotope Name	Release Group	Activity, Bq		
			GE Uprated 35 GWD/MTU	Framatome Commercial 37 GWD/MTU	Framatome Blended LEU 37 GWD/MTU
34	Zr-95	7	7.233216E+18	7.205513E+18	7.279010E+18
35	Nb-95	7	7.262049E+18	7.228128E+18	7.304451E+18
36	Nb-95m	7	5.266046E+16	8.002671E+16	8.076168E+16
37	Zr-97	7	7.387842E+18	7.052866E+18	7.041559E+18
38	Nb-97	7	7.444378E+18	7.081134E+18	7.098095E+18
39	Nb-97m	7	7.004245E+18	6.688209E+18	6.705170E+18
40	Mo-99	6	7.588759E+18	7.519596E+18	7.491320E+18
41	Mo-101	6	6.788063E+18	6.756120E+18	6.699582E+18
42	Tc-99m	6	6.628846E+18	6.642980E+18	6.642980E+18
43	Tc-101	6	6.790889E+18	6.756120E+18	6.699582E+18
44	Tc-104	6	4.921459E+18	4.918632E+18	4.692488E+18
45	Ru-103	6	6.049352E+18	6.105888E+18	5.908012E+18
46	Rh-103m	6	5.450070E+18	6.105888E+18	5.908012E+18
47	Ru-105	6	4.008402E+18	4.042324E+18	3.816180E+18
48	Rh-105	6	3.779432E+18	3.816180E+18	3.618304E+18
49	Ru-106	6	2.176919E+18	2.219038E+18	2.060737E+18
50	Rh-106	6	2.336916E+18	2.385819E+18	2.202077E+18
51	Rh-106m	6	7.194206E+16	7.434484E+16	6.247228E+16
52	Rh-107	6	2.245045E+18	2.303842E+18	2.114446E+18
53	Pd-109	6	1.192344E+18	1.325769E+18	1.207044E+18
54	Ag-109m	6	1.191779E+18	1.325769E+18	1.207044E+18
55	Ag-110m	6	1.578485E+16	1.263580E+16	1.057223E+16
56	Ag-111	6	2.589349E+17	2.202077E+17	2.015508E+17
57	Ag-112	6	1.373825E+17	1.011994E+17	9.384976E+16
58	Cd-115	6	7.198474E+16	3.109480E+16	2.939872E+16
59	Cd-117	6	4.053691E+16	3.081212E+16	2.939872E+16
60	In-113m	6	5.515087E+15	1.158988E+16	1.125066E+16
61	In-115m	6	7.211167E+16	3.109480E+16	2.939872E+16
62	In-116m	6	3.129323E+16	1.984414E+16	1.851554E+16
63	In-117m	6	4.737773E+16	2.823973E+16	2.688287E+16
64	In-117	6	3.742913E+16	2.304144E+16	2.188243E+16
65	Sn-113	4	5.515087E+15	1.156161E+16	1.125066E+16
66	Sn-121	4	8.791065E+16	5.303077E+16	5.113681E+16
67	Sn-123m	4	6.024632E+16	3.280366E+16	3.138964E+16

Table II-3. BFN Core Inventory (Continued)

Isotope Number	Isotope Name	Release Group	Activity, Bq		
			GE Uprated 35 GWD/MTU	Framatome Commercial 37 GWD/MTU	Framatome Blended LEU 37 GWD/MTU
68	Sn-127	4	2.649842E+17	1.325769E+17	1.263580E+17
69	Sn-128	4	6.456411E+17	5.512260E+17	5.399188E+17
70	Sb-125	4	7.809883E+16	4.576589E+16	4.418288E+16
71	Sb-131	4	3.341278E+18	3.137748E+18	3.137748E+18
72	Sn-125	4	6.875060E+16	1.970280E+16	1.901023E+16
73	Sb-127	4	4.169530E+17	3.307356E+17	3.166016E+17
74	Sb-129	4	1.261318E+18	1.257926E+18	1.232485E+18
75	Sb-130	4	4.079072E+17	4.183664E+17	4.098860E+17
76	Te-125m	4	1.681805E+16	9.995565E+15	9.647868E+15
77	Te-127	4	4.135640E+17	3.279102E+17	3.137761E+17
78	Te-127m	4	5.549027E+16	5.540528E+16	5.314384E+16
79	Te-129	4	1.241813E+18	1.192910E+18	1.167468E+18
80	Te-129m	4	1.856077E+17	2.408434E+17	2.351898E+17
81	Te-131m	4	5.704482E+17	7.688896E+17	7.462752E+17
82	Te-131	4	3.533500E+18	3.363892E+18	3.335624E+18
83	Te-132	4	5.673388E+18	5.710136E+18	5.653600E+18
84	Te-133	4	4.799906E+18	4.466344E+18	4.494612E+18
85	Te-133m	4	3.033156E+18	3.703108E+18	3.703108E+18
86	Te-134	4	6.883258E+18	7.321412E+18	7.406216E+18
87	I-128	2	5.017583E+16	3.505232E+16	3.250820E+16
88	I-130	2	1.324921E+17	8.084648E+16	7.208340E+16
89	I-131	2	3.980134E+18	3.957520E+18	3.900984E+18
90	I-132	2	5.758192E+18	5.794940E+18	5.766672E+18
91	I-133	2	8.189240E+18	8.254256E+18	8.225988E+18
92	I-134	2	9.011838E+18	9.158832E+18	9.158832E+18
93	I-135	2	7.660628E+18	7.830236E+18	7.801968E+18
94	Xe-131m	1	4.449383E+16	5.286116E+16	5.201312E+16
95	Xe-133	1	8.209027E+18	7.915040E+18	7.886772E+18
96	Xe-133m	1	2.545533E+17	2.586522E+17	2.566734E+17
97	Xe-135	1	2.863548E+18	2.660019E+18	2.939872E+18
98	Xe-135m	1	1.589510E+18	1.693253E+18	1.670639E+18
99	Xe-138	1	6.812588E+18	7.067000E+18	7.095268E+18
100	Cs-134	3	8.505841E+17	7.123536E+17	6.586444E+17
101	Cs-134m	3	2.184834E+17	1.537779E+17	1.413400E+17

Table II-3. BFN Core Inventory (Continued)

Isotope Number	Isotope Name	Release Group	Activity, Bq		
			GE Uprated 35 GWD/MTU	Framatome Commercial 37 GWD/MTU	Framatome Blended LEU 37 GWD/MTU
102	Cs-135m	3	1.007472E+17	1.305982E+17	1.116586E+17
103	Cs-136	3	2.894643E+17	2.374512E+17	2.374512E+17
104	Cs-137	3	5.622505E+17	6.021084E+17	5.992816E+17
105	Cs-138	3	7.536249E+18	7.632360E+18	7.660628E+18
106	Ba-137m	9	5.325691E+17	5.710136E+17	5.681868E+17
107	Ba-139	9	7.352507E+18	7.293144E+18	7.321412E+18
108	Ba-140	9	7.115056E+18	7.321412E+18	7.321412E+18
109	Ba-141	9	6.676902E+18	6.614712E+18	6.642980E+18
110	Ba-142	9	6.348993E+18	6.303764E+18	6.360300E+18
111	La-140	7	7.372294E+18	7.801968E+18	7.801968E+18
112	La-141	7	6.707996E+18	6.671248E+18	6.699516E+18
113	La-142	7	6.495986E+18	6.529908E+18	6.558176E+18
114	La-143	7	6.227440E+18	6.218960E+18	6.303764E+18
115	Ce-141	8	6.764532E+18	6.699516E+18	6.727784E+18
116	Ce-143	8	6.267016E+18	6.275496E+18	6.332032E+18
117	Ce-144	8	5.565969E+18	5.653600E+18	5.681868E+18
118	Pr-142	8	3.106653E+17	2.301015E+17	2.103139E+17
119	Pr-143	7	6.117195E+18	6.077620E+18	6.134156E+18
120	Pr-144	7	5.597064E+18	5.681868E+18	5.710136E+18
121	Pr-144m	7	6.688209E+16	7.915040E+16	7.999844E+16
122	Pr-145	7	4.257161E+18	4.268468E+18	4.296736E+18
123	Pr-147	7	2.673022E+18	2.674153E+18	2.676980E+18
124	Nd-147	7	2.693940E+18	2.693940E+18	2.693940E+18
125	Nd-149	7	1.535518E+18	1.517992E+18	1.498204E+18
126	Nd-151	7	7.765220E+17	7.660628E+17	7.434484E+17
127	Pm-147	7	6.914353E+17	9.469780E+17	9.922068E+17
128	Pm-148	7	1.175666E+18	7.151804E+17	6.784320E+17
129	Pm-148m	7	1.758552E+17	1.438841E+17	1.450148E+17
130	Pm-149	7	2.348505E+18	2.295362E+18	2.219038E+18
131	Pm-150	7	1.885193E+16	1.778057E+16	1.520818E+16
132	Pm-151	7	7.782180E+17	7.745432E+17	7.519288E+17
133	Sm-153	7	1.823569E+18	1.713043E+18	1.597144E+18
134	Sm-155	7	1.447322E+17	1.382310E+17	1.294679E+17
135	Sm-156	7	8.915727E+16	8.593472E+16	7.971576E+16

Table II-3. BFN Core Inventory (Continued)

Isotope Number	Isotope Name	Release Group	Activity, Bq		
			GE Uprated 35 GWD/MTU	Framatome Commercial 37 GWD/MTU	Framatome Blended LEU 37 GWD/MTU
136	Eu-154	7	4.692347E+16	3.218594E+16	3.162907E+16
137	Eu-155	7	3.293420E+16	1.344002E+16	1.275678E+16
138	Eu-156	7	5.975629E+17	7.840978E+17	6.897957E+17
139	Eu-157	7	7.997017E+16	8.028112E+16	7.123536E+16
140	Eu-158	7	3.386506E+16	3.109480E+16	2.855068E+16
141	Gd-159	7	9.078890E+17	6.689622E+17	6.417401E+17
142	W-187	6	1.594598E+16	1.583008E+16	1.540606E+16
143	Pu-238	8	1.485766E+16	1.274887E+16	4.183664E+16
144	Np-239	8	7.756739E+19	7.293144E+19	6.812588E+19
145	Pu-239	8	1.765619E+15	1.763923E+15	1.840247E+15
146	Pu-240	8	2.288295E+15	2.580868E+15	2.448009E+15
147	Pu-241	8	6.637326E+17	6.303764E+17	6.162424E+17
148	Am-241	7	8.127050E+14	8.112916E+14	8.112916E+14
149	Cm-242	7	1.819328E+17	1.840247E+17	1.648024E+17
150	Cm-244	7	8.497361E+15	7.717164E+15	6.049352E+15

** From Reference 9.*

The warning time for evacuation was estimated based on review of the accident sequences. This time is the interval between awareness of impending core melt and the release of radioactive material from the containment building. Finally, the height of release and the energy content of the released plume affect the manner in which the plume would be dispersed in the atmosphere.

E. Evacuation and Other Protective Measures

Evacuation and other protective measures (i.e., sheltering and relocation) are taken to avoid or reduce immediate exposure to the passing radioactive plume and ground contamination. Evacuation is potentially the most effective method of avoiding radiation exposure and can provide essentially total protection if completed prior to arrival of the plume.

The evacuation model does not account for actual road networks, road capacity limitations, or lateral travel possibilities (evacuation is assumed to be in a straight-line radially away from the plant).

F. Results

The results of the Level 3 consequence analysis provide projected offsite radiation doses and offsite economic costs (in 2016 dollars) as a function of accident conditions (Reference 9). This information forms part of the input data to the economic model described in Section III of this analysis. In the exposure and economic cost evaluation of each base case and each SAMA, for each plant damage state, the maximum (as determined by the mean value) dose and offsite cost from the three fuel types was selected.

III. Determination of Present Value

This section explains how the Tennessee Valley Authority (TVA) calculated the monetized value of the status quo (i.e., accident consequences without SAMA implementation). TVA also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all BFN risk. The following costs are included in the analysis:

1. Offsite exposure cost
2. Offsite economic cost
3. Onsite exposure cost
4. Onsite cleanup cost
5. Replacement power cost

The cost will be determined independently for both Unit 2 and Unit 3. Two real discount rates will be used in the calculations. A 7% discount rate will be used to reflect a "base case" discount rate and 3% will be used to provide analysis sensitivity to the discount rate, in accordance with Reference 10.

The sum of these costs will be used to screen out SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeds the maximum benefit, then it will be discarded from further analysis. Exceeding this threshold would mean that a SAMA would not have a positive net value even if it could eliminate all severe accident costs.

For the purposes of this analysis, the "present" is considered to be the year 2016. All constant dollar values from Reference 10 have been recalculated to the Year 2016 using a 3% inflation rate. Specifics are noted in the text to this section.

A. Offsite Exposure Cost

The baseline annual offsite exposure risk was converted to dollars using the United States Nuclear Regulatory Commission (USNRC) conversion factor of $2,000 per person-rem (Reference 10, Section 5.7.1.2), and discounting to present value using the USNRC standard formula (Reference 10, Section 5.7.1.3):

$$W_{pha} = C \times Z_{pha}$$

Where:

W_{pha} = monetary value of public health risk after discounting

C = $[1-\exp(-rt_f)]/r$

t_f = years remaining until end of facility life = 20 years

r = real discount rate (as fraction) = either 0.03 or 0.07/year

Z_{pha} = monetary value of public health (accident) risk per year before discounting ($/year)

The calculated value for C using 20 years with a 3% discount rate is 15.04 and with a 7% discount rate is 10.76. Therefore, calculating the discounted monetary equivalent of accident risk involves multiplying the dose (person-rem per year) by monetary value of unit dose (1 person/rem) and by the C value (Reference 10 Section 5.7.12). Since the "present" for this analysis is the Year 2016, the future value of $2,000 at a 3% inflation rate was calculated to be $3,097, which was used in this calculation. The calculated offsite exposure cost is for each of the units is presented in Table III-1.

Table III-1. Calculated Offsite Exposure Cost for Units 2 and 3.

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
C	15.04	10.76	15.04	10.76
Z_{pha}	$9,373	$9,373	$19,449	$19,449
W_{pha}	$140,970	$100,853	$292,513	$209,271

B. Offsite Economic Cost

The Level 3 analysis showed an annual offsite economic risk for the two units and discount rates is presented in Table III-2. Calculated values for offsite economic costs caused by severe accidents must be discounted to present value as well. This is performed in the same manner as for public health risks and uses the same C value. The resulting values are also presented in Table III-2.

Table III-2. Calculated Offsite Economic Cost for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
C	15.04	10.76	15.04	10.76
Sum of Annual Economic Risk	$6,500	$6,500	$13,700	$13,700
Offsite Economic Costs	$97,760	$69,940	$206,048	147,412

C. Onsite Exposure Cost

TVA evaluated occupational health using the USNRC methodology in Reference 10, Section 5.7.3, which involves separately evaluating "immediate" and long-term doses.

Immediate Dose - For the case where the plant is in operation, the equation that the USNRC recommends using (Reference 10, Sections 5.7.3 and 5.7.3.3) is:

$$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\} \{[1 - \exp(-rt_f)]/r\}$$

Where:

W_{IO} = monetary value of accident risk avoided due to immediate doses, after discounting

R = monetary equivalent of unit dose ($/person-rem)

F = accident frequency (events/yr)

D_{IO} = immediate occupational dose (person-rem/event)

S = subscript denoting status quo (current conditions)

A = subscript denoting after implementation of proposed action

r = real discount rate

t_f = years remaining until end of facility life.

The values used in the BFN analysis are:

R = $3,097/person-rem ($2,000 inflation at 3% to 2016 values)

r = 0.03 and 0.07

D_{IO} = 3,300 person-rem/accident (best estimate)

t_f = 20 years (license extension period)

F = 1.05E-6 for Unit 2 and 1.90E-6 for Unit 3 (total core damage frequency)

For the basis discount rate, assuming $(FD_{IO})_A$ is zero, the best estimate of the immediate dose cost is:

$$W_{IO} = R\,(FD_{IO})_S\,\{[1 - \exp(-rt_f)]/r\}$$

The results of the immediate dose cost calculations are presented in Table III-3.

Table III-3. Immediate Dose Cost for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
Core Damage Frequency (per year)	1.05E-6	1.05E-6	1.90E-6	1.90E-6
Immediate Dose Cost	$161	$115	$292	$209

Long-Term Dose - For the case where the plant is in operation, the USNRC equation (Reference 10, Sections 5.7.3 and 5.7.3.3) is:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\}\,\{[1 - \exp(-rt_f)]/r\}\{[1 - \exp(-rm)]/rm\}$$

Where:

W_{LTO} = monetary value of accident risk avoided long-term doses, after discounting, $

m = years over which long-term doses accrue

The values used in the BFN analysis are:

R = $3,097/person-rem ($2,000 inflated at 3% to 2016 values)

r = 0.03 AND 0.07

D_{LTO} = 20,000 person-rem/accident (best estimate)

m = "as long as 10 years"

t_f = 20 years (license extension period)

F = 1.05E-6 for Unit 2 and 1.90E-6 for Unit 3 (total core damage frequency)

For the basis discount rate, assuming $(FD_{LTO})_A$ is zero, the best estimate of the long-term dose is:

$$W_{LTO} = R\,(FD_{LTO})_S\,\{[1 - \exp(-rt_f)]/r\}\,\{[1 - \exp(-rm)]/rm\}$$

The results of the long-term dose cost calculations are presented in Table III-4.

Table III-4. Long-Term Dose Cost for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
Core Damage Frequency (per year)	1.05E-6	1.05E-6	1.90E-6	1.90E-6
Long-term Dose Cost	$845	$503	$1,527	$910

Total Occupational Exposure - Combining Equations 1 and 2 above and using the above numerical values, the total accident related on-site (occupational) exposure avoided (W_O) is presented in Table III-5.

$$W_O = W_{IO} + W_{LTO}$$

Table III-5. Total Occupational Exposure Cost for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
Immediate Dose Cost	$161	$115	$292	$209
Long-term Dose Cost	$845	$503	$1,527	$910
Total Occupational Exposure Cost	$1,006	$618	$1,819	$1,119

It should be noted that if the maximum exposures were used in the above calculations, there would be a negligible impact on the overall conclusions.

D. Onsite Cleanup and Decontamination Cost

The net present value (year 2001 dollars) that the USNRC provides for cleanup and decontamination for a single event is $1.1 billion, discounted over a 10-year cleanup period (Reference 10, Section 5.7.6.1). The USNRC uses the following equation in integrating the net present value over the average number of remaining service years:

$$U_{CD} = [PV_{CD}/r][1-\exp(-rt_f)]$$

Where:

PV_{CD} = Net present value of a single event

r = real discount rate

t_f = years remaining until end of facility life.

The values used in the BFN analysis are:

PV_{CD} = $1.714E+9 ($1.1E+9 inflated at 3% to 2016 values)

r = 0.03 and 0.07

t_f = 20

The resulting net present value of cleanup integrated over the license renewal term is multiplied by the total core damage frequency to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is presented in Table III-6.

Table III-6. Expected Value of Cleanup and Decontamination Costs for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
Net Present Value of Cleanup and Decontamination Costs	2.58+10	1.84E+10	2.58E+10	1.84E+10
Core Damage Frequency (per year)	1.05E-6	1.05E-6	1.90E-6	1.90E-6
Expected Value of Cleanup and Decontamination Costs	$27,090	$19,320	$49,020	$34,960

E. Replacement Power Cost

Long-term replacement power costs was determined following the USNRC methodology in Reference 10 Section 5.7.6.2. The net present value of replacement power for a single event, $P_{V_{RP}}$, was determined using the following equation:

$$PV_{RP} = [\$1.2E + 08/r] \cdot [1 - \exp(-rt_f)]^2 \qquad \text{(2001 dollars)}$$

$$PV_{RP} = [\$1.9E + 08/r] \cdot [1 - \exp(-rt_f)]^2 \qquad \text{(2016 dollars)}$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($). This yields a PV_{RP} for 2016 of $2.18E+9 at 3% and $1.52+9 at 7%.

r = 0.03 and 0.07

t_f = 20 years (license renewal period)

To attain a summation of the single-event costs over the entire license renewal period, the following equation is used:

$$U_{RP} = [PV_{RP} / r] \cdot [1 - \exp(-rt_f)]^2 \qquad (r > 5\%)$$

$$U_{RP}^2 = 1.9E+10 \qquad (r = 1\%, \text{ 2001 dollars})$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year). Reference 10, Section 5.6.7.2 provides a recommended discount rate value of between 1.9E+10 at 1% and 1.2E+10 at 5%. A linear extrapolation of 1.55E+10 was made to determine the current present value (2001) of replacement power at a 3% discount rate. This value was inflated to 2016 values. This yields a U_{RP} for 2016 of $2.41E+10 for 3% and $1.23+10 for 7%.

After applying a correction factor to account for BFN's size relative to the "generic" reactor described in NUREG/BR-0184 (i.e., 1190 MWe/910 MWe), the replacement power costs are presented in Table III-7.

Table III-7. Expected Replacement Power Costs for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
Net Present Value of Replacement Power over the Life of the Facility	2.41E+10	1.23E+10	2.41E+10	1.23E+10
Correction Factor for size	1.31	1.31	1.31	1.31
Replacement Power Cost	3.16E+10	1.61E+10	3.16E+10	1.61E+10
Core Damage Frequency (F)	1.05E-6	1.05E-6	1.90E-6	1.90E-6
Replacement power costs per accident damage frequency	$33,180	$16,905	$60,9040	$30,590

F. Baseline Screening

The sum of the baseline costs is presented in Table III-8.

Table III-8. Total Costs for Units 2 and 3

Real Discount Rate	Unit 2		Unit 3	
	3%	7%	3%	7%
Monetary Value of Public Health Risk After Discounting	$140,970	$100,853	$292,513	$209,271
Offsite Economic Costs	$97,760	$69,940	$206,048	$147,412
Total Accident on-site exposure avoided	$1,006	$619	$1,819	$1,118
Expected Value of Cleanup and Decontamination Costs	$27,090	$19,320	$49,020	$34,960
Replacement Power Costs	$33,180	$16,905	$60,040	$30,590
Total	$300,006	$207,637	$609,440*	$423,351

** The most conservative value in Table III-8 is $609,440. Including the effects of restart of Unit 1 (described in Section V.HH), the maximum value for the three-unit plant is $3.6 million. This value was conservatively rounded to $10 million for initial screening of SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeded $10 million, it was discarded from further analysis. Exceeding this threshold means that a SAMA would not have a positive net value even if it could eliminate all severe accident costs associated with all three units.*

IV. SAMA Candidates and Screening Process

An initial list of SAMA candidates was developed from lists of Severe Accident Mitigation Alternatives for Hatch Nuclear Plant (Reference 8) and, most importantly, from the plant specific risk profile as provided by the BFN PSA (References 2 and 3) and the BFN Individual Plant Examination of External Event (IPEEE) (References 4 through 7). This initial list was then screened to remove those that met the following criteria:

- does not apply to the BFN or to BWRs in general,
- already in place at BFN, or
- Rough order of magnitude (ROM) costs exceed the screening cost savings.

This screening process will leave unique SAMA candidates that are applicable to BFN and are of potential value in averting the risk of severe accidents. A preliminary cost estimate will be prepared for each of these candidates based on previous design/procedural modifications of similar scope to focus on those that had the possibility of having a positive benefit and to eliminate those whose costs were clearly beyond the possibility of any corresponding benefit.

A more detailed estimate will be prepared for those items that appear to be cost effective.

The initial list of candidates is provided in Tables IV-1 and IV-2.

Table IV-1. Initial Screening of Generic SAMAs

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
1	Cap downstream piping of normally closed component cooling water drain and vent valves.	SAMA to reduce the frequency of a loss of component cooling event, a large portion of which was derived from catastrophic failure of one of the many single isolation valves.	N/A	N/A
2	Enhance loss of component cooling procedure to facilitate stopping reactor coolant pumps.	SAMA to reduce the potential for RCP seal damage due to pump bearing failure.	B	N/A
3	Enhance loss of component cooling procedure to present desirability of cooling down RCS prior to seal LOCA.	SAMA would reduce the potential for RCP seal failure.	B	N/A
4	Additional training on the loss of component cooling.	SAMA would potentially improve the success rate of operator actions after a loss of component cooling (to prevent RCP seal damage).	B	N/A
5	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	SAMA would reduce effect of loss of component cooling by providing a means to maintain the centrifugal charging pump seal injection after a loss of component cooling.	B	N/A
5A	Procedure changes to allow cross connection of motor cooling for RHRSW pumps.	SAMA would allow continued operation of both RHRSW pumps on a failure of one train of PSW.	N/A	N/A
6	On loss of essential raw cooling water, proceduralize shedding component cooling water loads to extend component cooling heatup.	SAMA would increase time before the loss of component cooling (and reactor coolant pump seal failure) in the loss of essential raw cooling water sequences.	B	N/A
7	Increase CRD pump lube oil capacity.	SAMA would lengthen the time before control rod drive (CRD) pump failure due to lube oil	None	Phase II SAMA 01
8	Eliminate the RCP thermal barrier dependence on component cooling such that loss of component cooling does not result directly in core damage.	SAMA would prevent the loss of recirculation pump seal integrity after a loss of component cooling. Watts Bar Nuclear Plant IPE said that they could do this with essential raw cooling water connection to charging pump seals.	B	N/A
9	Add redundant DC Control Power for SW Pumps.	SAMA would increase reliability of SW and decrease core damage frequency due to a loss of SW. Relevant, potential concern at BFN is loss of DC-D	D	SAMA 57

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
10	Create an independent RCP seal injection system, with a dedicated diesel.	SAMA would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of component cooling or service water or from a station blackout event.	B	N/A
11	Use existing hydro test pump for RCP seal injection.	SAMA would provide an independent seal injection source, without the cost of a new system.	B	N/A
12	Replace ECCS pump motor with passively cooled motors.	SAMA would eliminate ECCS dependency on EECW.	None	Phase II SAMA 02
13	Install improved RCS pumps seals.	RCP seal O-ring constructed of improved materials would reduce probability of RCP seal LOCA	B	N/A
14	Install additional component cooling water pump.	SAMA would reduce probability of loss of component cooling leading to RCP seal LOCA.	B	N/A
15	Prevent centrifugal charging pump flow diversion from the relief valves.	If relieve valve opening causes a flow diversion large enough to prevent RCP seal injection, then the modification would reduce the frequency of the loss of RCP seal cooling.	B	N/A
16	Change procedures to isolate RCP seal letdown flow on loss of component cooling, and guidance on loss of injection during seal LOCA.	SAMA would reduce CDF from loss of seal cooling.	B	N/A
17	Implement procedures to stagger CRD pump use after a loss of service water.	SAMA would allow injection with CRD to be extended after a loss of service water.	None	Phase II SAMA 03
18	Use fire protection system pumps as a backup seal injection and high pressure make-up.	SAMA would reduce the frequency of the RCP seal LOCA and the SBO CDF.	B	N/A
19	Procedural guidance for use of cross-tied component cooling or service water pumps.	SAMA would reduce the frequency of the loss of component cooling water and service water.	None	Phase II SAMA 04
20	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	SAMA would potentially improve the success rate of operator actions subsequent to support system failures.	None	Phase II SAMA 05

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
21	Improved ability to cool the residual heat removal heat exchangers	SAMA would reduce the probability of a loss of decay heat removal by implementing procedure and hardware modifications to allow manual alignment of the fire protection system or by installing a component cooling water crosstie.	None	Phase II SAMA 06
22	Provide reliable power to Control Building fans	SAMA would increase availability of control room ventilation on a loss of power.	N/A	Control Bay HVAC was not a critical function represented in the BFN models
23	Provide a redundant train of ventilation.	SAMA would increase the availability of components dependent on room cooling.	None	Phase II SAMA 07
24	Procedures for actions on loss of HVAC.	SAMA would provide for improved electrical equipment reliability upon a loss of Control Building HVAC)	C	N/A
25	Add a diesel building switchgear room high temperature alarm.	SAMA would improve diagnosis of a loss of switchgear room HVAC. Option 1: Install high temp alarm Option 2: Redundant louver and thermostat	None	Phase II SAMA 08
26	Create ability to switch fan power supply to direct current (DC) in an SBO event.	SAMA would allow continued operation in an SBO event. This SAMA was created for reactor core isolation cooling system room at Fitzpatrick Nuclear Power Plant.	N/A	N/A
27	Delay containment spray actuation after large LOCA.	SAMA would lengthen time of RWST availability.	N/A	N/A
28	Install containment spray pump header automatic throttle valves.	SAMA would extend the time over which water remains in the RWST, when full CS flow is not needed	N/A	N/A
29	Install an independent method of suppression pool cooling.	SAMA would decrease the probability of loss of containment heat removal.	D	SAMA 124
30	Develop an enhanced drywell spray system.	SAMA would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	D	SAMA 46
31	Provide dedicated existing drywell spray system.	SAMA would provide a source of water to the containment to control containment pressure, when used in conjunction with containment heat removal. This would use an existing spray loop instead of developing a new spray system.	C	N/A
32	Install an unfiltered hardened containment vent.	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products not being scrubbed.	C	N/A

Table IV-1. Initial Screening Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
33	Install a filtered containment vent to remove decay heat.	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products being scrubbed. Option 1: Gravel Bed Filter Option 2: Multiple Venturi Scrubber	E	Cost in excess of $5M per unit
34	Install a containment vent large enough to remove ATWS decay heat.	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	None	Phase II SAMA 09
35	Create/enhance hydrogen recombiners with independent power supply.	SAMA would reduce hydrogen detonation at lower cost, Use either a new, independent power supply, a nonsafety-grade portable generator, existing station batteries, or existing AC/DC independent power supplies.	N/A	N/A
35A	Install hydrogen recombiners.	SAMA would provide a means to reduce the chance of hydrogen detonation.	N/A	N/A
36	Create a passive design hydrogen ignition system.	SAMA would reduce hydrogen denotation system without requiring electric power.	N/A	N/A
37	Create a large concrete crucible with heat removal potential under the basemat to contain molten core debris.	SAMA would ensure that molten core debris escaping form the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt-through of the basemat.	E	Cost well in excess of $10M per unit
38	Create a water-cooled rubble bed on the pedestal.	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled.	E	Cost well in excess of $10M per unit
39	Provide modification for flooding the drywell head.	SAMA would help mitigate accidents that result in the leakage through the drywell head seal.	N/A	Containment failure dominated by wet well failure or dry well shell failure other than head region (BFN IPE NUREG-1150)*
40	Enhance fire protection system and/or standby gas treatment system hardware and procedures.	SAMA would improve fission product scrubbing in severe accidents.	C	N/A
41	Create a reactor cavity flooding system.	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	C	N/A

* *Reference 16*

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
42	Create other options for reactor cavity flooding.	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	D	SAMA 41
43	Enhance air return fans (ice condenser plants).	SAMA would provide an independent power supply for the air return fans, reducing containment failure in SBO sequences.	N/A	N/A
44	Create a core melt source reduction system.	SAMA would provide cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur.	E	Cost well in excess of $10M per unit
45	Provide a containment inerting capability.	SAMA would prevent combustion of hydrogen and carbon monoxide gases.	C	N/A
46	Use the fire protection system as a back-up source for the containment spray system.	SAMA would provide redundant containment spray function without the cost of installing a new system.	None	Phase II SAMA 10
47	Install a secondary containment filter vent.	SAMA would filter fission products released from primary containment.	C	N/A
48	Install a passive containment spray system.	SAMA would provide redundant containment spray method without high cost.	None	Phase II SAMA 11
49	Strengthen primary/secondary containment.	SAMA would reduce the probability of containment overpressurization to failure.	E	Cost well in excess of $10M per unit
50	Increase the depth of the concrete basemat or use an alternative concrete material to ensure melt-through does not occur.	SAMA would prevent basemat melt-through.	N/A	N/A
51	Provide a reactor vessel exterior cooling system.	SAMA would provide the potential to cool a molten core before it causes vessel failure, if the lower head could be submerged in water.	E	Cost well in excess of $10M per unit
52	Construct a building to be connected to primary/secondary containment that is maintained at a vacuum.	SAMA would provide a method to depressurize containment and reduce fission product release.	E	Cost well in excess of $10M per site
53	Not Used	None	N/A	N/A

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
54	Proceduralize alignment of spare diesel to shutdown board after Loss of Offsite Power and failure of the diesel normally supplying it.	SAMA would reduce the SBO frequency.	N/A	N/A
55	Not Used	None	N/A	N/A
56	Provide an additional diesel generator.	SAMA would increase the reliability and availability of onsite emergency AC power sources.	F	N/A
57	Provide additional DC battery capacity	SAMA would ensure longer batter capability during an SBO, reducing the frequency of long-term SBO sequences.	None	Phase II SAMA 12
58	Use fuel cells instead of lead-acid batteries.	SAMA would extend DC power availability in an SBO.	None	Phase II SAMA 12
59	Procedure to crosstie high pressure core spray diesel.	SAMA would improve core injection availability by providing a more reliable power supply for the high pressure core spray pumps.	N/A	N/A
60	Improve 4.16 kV bus crosstie ability.	SAMA would improve AC power reliability.	D	SAMA 132
61	Incorporate an alternate battery charging capability.	SAMA would improve DC power reliability by either cross-tying the AC buses, or installing a portable diesel-driven batter charger.	None	Phase II SAMA 13
62	Increase/improve DC bus load shedding.	SAMA would extend battery life in an SBO event.	None	Phase II SAMA 12
63	Replace existing batteries with more reliable ones.	SAMA would improve DC power reliability and thus increase available SBO recovery time.	None	Phase II SAMA 13
63A	Mod for DC Bus A reliability Loss of DC Bus A causes a loss of main condenser, prevents transfer from the main transformer to offsite power, and defeats one half of the low vessel pressure permissive for LPCI/CS injection valves.	SAMA would increase the reliability of AC power and injection capability.	N/A	Loss of DC bus does not cause plant trip at BFNP
64	Create AC power crosstie capability with other unit.	SAMA would improve AC power reliability.	C	N/A
65	Create a crosstie for diesel fuel oil.	SAMA would increase diesel fuel oil supply and thus diesel generator, reliability.	C	N/A

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
66	Develop procedures to repair or replace failed 4 kV breakers.	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16kV non-emergency busses from unit station service transformers, leading to loss of emergency AC power.	None	Phase II SAMA 14
67	Emphasize steps in recovery of offsite power after an SBO.	SAMA would reduce human error probability during offsite power recovery.	C	N/A
68	Develop a severe weather conditions procedure.	For plants that do not already have one, this SAMA would reduce the CDF for external weather-related events.	C	N/A
69	Develop procedures for replenishing diesel fuel oil.	SAMA would allow for long-term diesel operation.	C	BFN UFSAR 8.5.3.4
70	Install gas turbine generator.	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	E	Cost greater than $10M for site
71	Not Used	None	N/A	N/A
72	Create a back-up source for diesel cooling. (Not from existing system)	This SAMA would provide a redundant and diverse source of cooling for the diesel generators which would contribute to enhanced diesel reliability.	E	Cost greater than $10M for site
73	Use Fire Protection System as a back-up source for diesel cooling.	This SAMA would provide a redundant and diverse source of cooling for the diesel generators which would contribute to enhanced diesel reliability.	None	Phase II SAMA 15
74	Provide a connection to an alternate source of offsite power.	SAMA would reduce the probability of a loss of offsite power event.	F	N/A
75	Bury offsite power lines.	SAMA could improve offsite power reliability, particularly during severe weather.	E	Cost greater than $10M for site
76	Replace anchor bolts on diesel generator oil cooler. Millstone Nuclear Power Station found a high seismic SBO risk due to failure of the diesel oil cooler anchor bolts.	For plants with a similar problem, this would reduce seismic risk. Note that these were Fairbanks Morse DGs.	D	SAMA 138

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
77	Change Undervoltage (UV), Auxiliary Feedwater Actuation Signal (AFAS) Block and High Pressurizer Pressure Actuation Signals to 3-out-of-4, instead of 2-out-of-4 logic.	SAMA would reduce risk of 2/4 inverter failure.	N/A	N/A
78	Provide DC power to the 120/240 V vital AC system from the Class 1E station service battery system instead of its own battery.	SAMA would increase the reliability of the 120 VAC Bus.	N/A	N/A
79	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture (SGTR).	SAMA would enhance depressurization during a SGTR.	N/A	N/A
80	Improve SGTR coping abilities.	SAMA would improve instrumentation to detect SGTR, or additional system to scrub fission product releases.	N/A	N/A
81	Add other SGTR coping abilities.	SAMA would decrease the consequences of an SGTR.	N/A	N/A
82	Increase secondary side pressure capacity such that an SGTR would not cause the relief valves to lift.	SAMA would eliminate direct release pathway for SGTR sequences.	N/A	N/A
83	Replace steam generators (SG) with a new design.	SAMA would lower the frequency of an SGTR.	N/A	N/A
84	Revise emergency operating procedures to direct that a faulted SG be isolated.	SAMA would reduce the consequences of an SGTR.	N/A	N/A
85	Direct SG flooding after a SGTR, prior to core damage.	SAMA would provide for improved scrubbing of SGTR releases.	N/A	N/A
86	Implement a maintenance practice that inspects 100% of the tubes in an SG.	SAMA would reduce the potential for an SGTR.	N/A	N/A
87	Locate RHR inside of containment.	SAMA would prevent ISLOCA out the RHR pathway.	E	Cost greater than $10M per unit
88	Not Used.	None	N/A	N/A

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
89	Install additional instrumentation for ISLOCAs.	Pressure of leak monitoring instruments installed between the first two pressure isolation valves on low-pressure inject lines, RHR suction lines, and HPSI lines would decrease ISLOCA frequency.	A	N/A
90	Increase frequency for valve leak testing.	SAMA could reduce ISLOCA frequency.	A	N/A
91	Improve operator training on ISLOCA coping.	SAMA would decrease ISLOCA effects.	A	N/A
92	Install relief valves in the CC System.	SAMA would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	N/A	N/A
93	Provide leak testing of valves in ISLOCA paths. At Kewaunee Nuclear Power Plant, four MOVs isolating RHR from the RCS were not leak tested.	This SAMA would help reduce ISLOCA frequency.	A	N/A
94	Revise EOPs to improve ISLOCA identification. Salem Nuclear Power Plant had a scenario where an RHR ISLOCA could direct initial leakage back to the pressurizer relief tank, giving indication that the LOCA was inside containment.	Procedure enhancements would ensure LOCA outside containment could be identified as such.	N/A	N/A
95	Ensure all ISLOCA releases are scrubbed.	This SAMA would scrub all ISLOCA releases. One example is to plug drains in the break area so that the break point would cover with water.	A	N/A
96	Add redundant and diverse limit switches to each containment isolation valve.	Enhanced isolation valve position indication could reduce the frequency of containment isolation failure and ISLOCAs.	A	N/A
97	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	SAMA would prevent flood propagation, for a plant where internal flooding from turbine building to safeguards areas is a concern.	N/A	Doors open into turbine building. No flooding scenarios propagating from turbine building to safeguards area (BFN IPE)
98	Improve inspection of rubber expansion joints on main condenser.	SAMA would reduce the frequency of internal flooding, for a plant where internal flooding due to a failure of circulating water system expansion joints is a concern.	None	Phase II SAMA 17

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
99	Implement internal flood prevention and mitigation enhancements.	This SAMA would reduce the consequences of internal flooding.	D	SAMA 128
100	Implement internal flooding improvements such as those implemented at Fort Calhoun.	This SAMA would reduce flooding risk by preventing or mitigating: a rupture in the RCP seal cooler of the component cooling system an ISLOCA in a shutdown cooling line, an AFW flood involving the need to remove a watertight door.	N/A	N/A
101	Install a digital feedwater upgrade.	This SAMA would reduce the chance of a loss of main feedwater following a plant trip.	C	N/A
102	Perform surveillances on manual valves used for back-up AFW pump suction.	This SAMA would improve success probability for providing alternative water supply to the AFW pumps.	N/A	N/A
103	Install manual isolation valves around AFW turbine-driven steam admission valves.	This SAMA would reduce the dual turbine-driven AFW pump maintenance unavailability.	N/A	N/A
104	Install accumulators for turbine-driven AFW pump flow control valves (CVs).	This SAMA would provide control air accumulators for the turbine-driven AFW flow CVs, the motor-driven AFW pressure CVs and SG PORVs. This would eliminate the need for LOCA manual action to align nitrogen bottles for control air during a LOOP.	N/A	N/A
105	Proceduralize intermittent operation of HPCI.	SAMA would allow for extended duration of HPCI availability.	C	If RCIC is available, HPCI used in test mode to control pressure and avoid cycling.
106	Increase the reliability of safety relief valves. (Adding signals to add electrical signal to open automatically).	SAMA reduces the probability of a certain type of medium break LOCA. Hatch evaluates medium LOCA initiated by an MSIV closure transient with a failure of SRVs to open. Reducing the likelihood of the failure for SRVs to open subsequently reduces the occurrence of this medium LOCA.	C	N/A
107	Install motor-driven feedwater pump.	This would increase the availability of injection subsequent to MSIV closure.	E	Cost greater than $10M per unit
108	Procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	SAMA increases availability of required RHR/CS pumps. Reduction in room heat load allows continued operation of required RHR/CS pumps, when room cooling is lost.	None	Phase II SAMA 18

Table IV-1. Initial Screening of Generic SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
109	Increase available NPSH for injection pumps.	SAMA increases the probability that these pumps will be available to inject coolant into the vessel by increasing the available NPSH for the injection pumps.	C	NPSH concerns are not a concern in the dominant BFN sequences. RHR has been demonstrated to operate satisfactorily at less than "minimum" NPSH. Torus water temperature leading to loss of lube oil cooling rather than NPSH, is a limiting concern for HPCI and RCIC
110	Increase the SRV reseat reliability.	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after SLC injection.	None	Phase II SAMA 19
111	Reduce DC dependency between high pressure injection system and ADS.	SAMA would ensure vessel depressurization and high pressure injection upon a DC failure.	None	Phase II SAMA 20
112	Modify RWCU for use as a decay heat removal system and proceduralize use.	SAMA would provide an additional source of decay heat removal.	C	N/A
113	Use of CRD for alternate boron injection.	SAMA provides an additional system to address ATWS with SLC failure or unavailability.	None	Phase II SAMA 21
114	Increase seismic ruggedness of plant components.	SAMA would increase the availability of necessary plant equipment during and after seismic events.	D	SAMA 138
115	Allow cross connection of uninterruptable compressed air supply to opposite unit.	SAMA would increase the ability to depressurize containment using the hardened vent.	N/A	N/A

Note:

N/A indicates that the proposed SAMA is not applicable to BFN or the BWR-4/Mark I design.

A indicates that the proposed SAMA is related to mitigation of an Intersystem LOCA (ISLOCA). ISLOCA contributes little risk for boiling water reactors, because of the lower primary pressures. Because of the low risk contribution due to ISLOCA, this SAMA has not been developed further.

B indicates that the proposed SAMA is related to RCP seal leakage. A review of NUREG-1560 (Reference 13) indicates that although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.

C indicates that the proposed SAMA has already been installed at BFN.

D indicates that similar item is addressed under other proposed SAMAs.

E indicates that SAMA did not pass initial cost screening and was therefore not examined in detail.

F Primary cause of loss of existing, redundant hardware is due to a common cause event, which another string of hardware would not alleviate.

Table IV-2. Initial Screening of Plant Specific SAMAs

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
116	borate torus water	borate torus water to mitigate ATWS upon water injection from the torus.	None	Phase II SAMA 22
117	automate torus cooling	automate torus cooling on high torus temperature to avoid lack of torus cooling due to operator error	None	Phase II SAMA 23
117a	provide torus positive pressure relief valves	provide torus positive pressure relief valves to prevent containment overpressure failure	None	Phase II SAMA 24
117b	reduce DW head bolt pretension	reduce DW head bolt pretension to allow DW to "burp" thereby preventing catastrophic containment overpressure failure	None	Phase II SAMA 24
118	Eliminate operator action to inhibit ADS for ATWS	Mitigate failure to inhibit ADS due to operator error during ATWS conditions.	D	SAMA 116
119	Eliminate fine water level control for ATWS	Mitigate failure to control water level at TAF due to operator error for ATWS conditions.	D	SAMA 116
120	Provide redundancy for SLC	ATWS, Provide redundancy to mitigate failure of SLC due to hardware failure during ATWS conditions.	D	SAMA 116
121	automate SLC initiation	automate SLC initiation to mitigate failure of SLC due to operator error during ATWS conditions	None	Phase II SAMA 25
122	RPV replacement	replace the RPV to reduce probability of Excessive LOCA	E	Cost greater than $10M per unit
122a	RPV inspection	increase the RPV inspection frequency to reduce probability of Excessive LOCA	None	Phase II SAMA 26
123	remove DW high pressure signal from ADS logic	remove DW high pressure signal from ADS logic to mitigate loss of all HP injection coupled with failure to depressurize due to operator error	C	N/A
124	provide independent torus cooling system	mitigate failure of torus cooling due to hardware failure	None	Phase II SAMA 27
125	Eliminate operator action to initiate torus cooling	Mitigate loss of all HP injection due to hardware failure coupled with failure of torus cooling due to operator error	D	SAMA 117
126	Eliminate operator action to depressurize reactor in event of HP injection failure.	Mitigate loss of all HP injection due to operator error coupled with failure to depressurize due to operator error	D	SAMA 123
127	Provide core cooling system outside interfacing system LOCA zone of influence	Mitigate effects of interfacing system LOCA	D	SAMA 133
128	Provide core cooling system outside flood zone of influence	Mitigate effects of internal Flooding	D	SAMA 133
129	Not used	None	N/A	N/A
130	Not used	None	N/A	N/A

Table IV-2. Initial Screening of Plant Specific SAMAs (Continued)

SAMA ID Number	SAMA Title	Description of Potential Enhancement	Screening Criterion*	Reference Paragraph Number
131	Not used	None	N/A	N/A
132	Improve 4kV crosstie capability	Provide 4kV shutdown bus crosstie capability from Unit 1/2 to Unit 3.	None	Phase II SAMA 28
133	Provide HP diesel-driven pump.	Provide capability to inject river water at HP via diesel-driven pump to mitigate Station Blackout	None	Phase II SAMA 29
134	Provide additional LP core cooling system	Mitigate SORV coupled with failure of LP injection due to hardware failure	D	SAMA 133
135	Not used	None	N/A	N/A
136	Not used	None	N/A	N/A
137	Reduce fire risk	Mitigate Fire effects	K	N/A
138	Reduce earthquake risk	Mitigate Earthquake effects	G, H, I	N/A
139	Reduce HFO risk	Mitigate effects of High winds, Floods, Transportation, and Other (HFO) External Events.	J	N/A

Note:

N/A indicates that the proposed SAMA is not applicable to BFN or the BWR-4/Mark I design.

A indicates that the proposed SAMA is related to mitigation of an Intersystem LOCA (ISLOCA). Because of the low risk contribution due to ISLOCA, this SAMA has not been developed further.

B indicates that the proposed SAMA is related to RCP seal leakage. A review of NUREG-1560 (Reference 13) indicates that although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.

C indicates that the proposed SAMA has already been installed at BFN.

D indicates that similar item is addressed under other proposed SAMAs.

E indicates that SAMA did not pass initial cost screening and was therefore not examined in detail.

F Primary cause of loss of existing, redundant hardware is due to a common cause event, which another string of hardware would not alleviate.

G "The outliers identified [in accordance with the Seismic Qualification Utility Group Generic Implementation Procedure criteria] for BFN Unit 3 were resolved during the Cycle 7 refueling outage that completed on March 13, 1997." "TVA considers the commitments regarding USI A-46 and the seismic portion of IPEEE to be complete for BFN Unit 3." Letter from TVA to the USNRC. R08 970411 803 (Reference 14).

H "...TVA has completed the resolution of outliers for BFN Unit 2 identified in accordance with the Seismic Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) criteria." "The outliers identified for BFN Unit 2 were resolved ... during the Cycle 9 refueling outage that completed on October 19. 1997." "TVA considers the commitments regarding USI A-46 and the seismic portion of IPEEE to be complete for BFN Unit 2." Letter from TVA to the USNRC. R08 971118 922 (Reference 15).

I "The staff's review of the licensee's action regarding outliers indicates that identified outliers have been resolved by analysis or corrective actions." "The staff has also concluded that its findings regarding the USI A-46 program do not warrant any further regulatory action under the provisions of 10 CFR 50.54(f)." Letter from the USNRC to TVA dated 3/21/2000 and attached USI A-46 SER (Reference 7).

J "These events were screened out in a manner consistent with the guidance given in NUREG-1407...." Letter from the USNRC to TVA dated 6/22/2000, and attached IPEEE SER (Reference 6).

K "No plant modifications were found to be necessary as a result of the fire IPEEE for BFN Units 2 and 3." Letter from the USNRC to TVA dated 6/22/2000, and attached IPEEE SER (Reference 6).

V. SAMA Analysis Results for BFN

A. Summary of Phase II SAMA Analysis

A summary of Phase II SAMAs is shown in Table V-1.

SAMA hardware implementation costs were first estimated in 2001 dollars and are based on costs of previous modifications judged to be similar in scope to the proposed SAMA (Reference 17). New or revised procedures were estimated to cost $50K per unit. These values were then inflated (at 3%/year) to arrive at Year 2016 estimated costs. This step is necessary to make the costs directly comparable to estimated costs averted.

Figure V-1 presents a sample table of results that summarizes the comparison of the baseline PRA results and the PRA results of each SAMA.

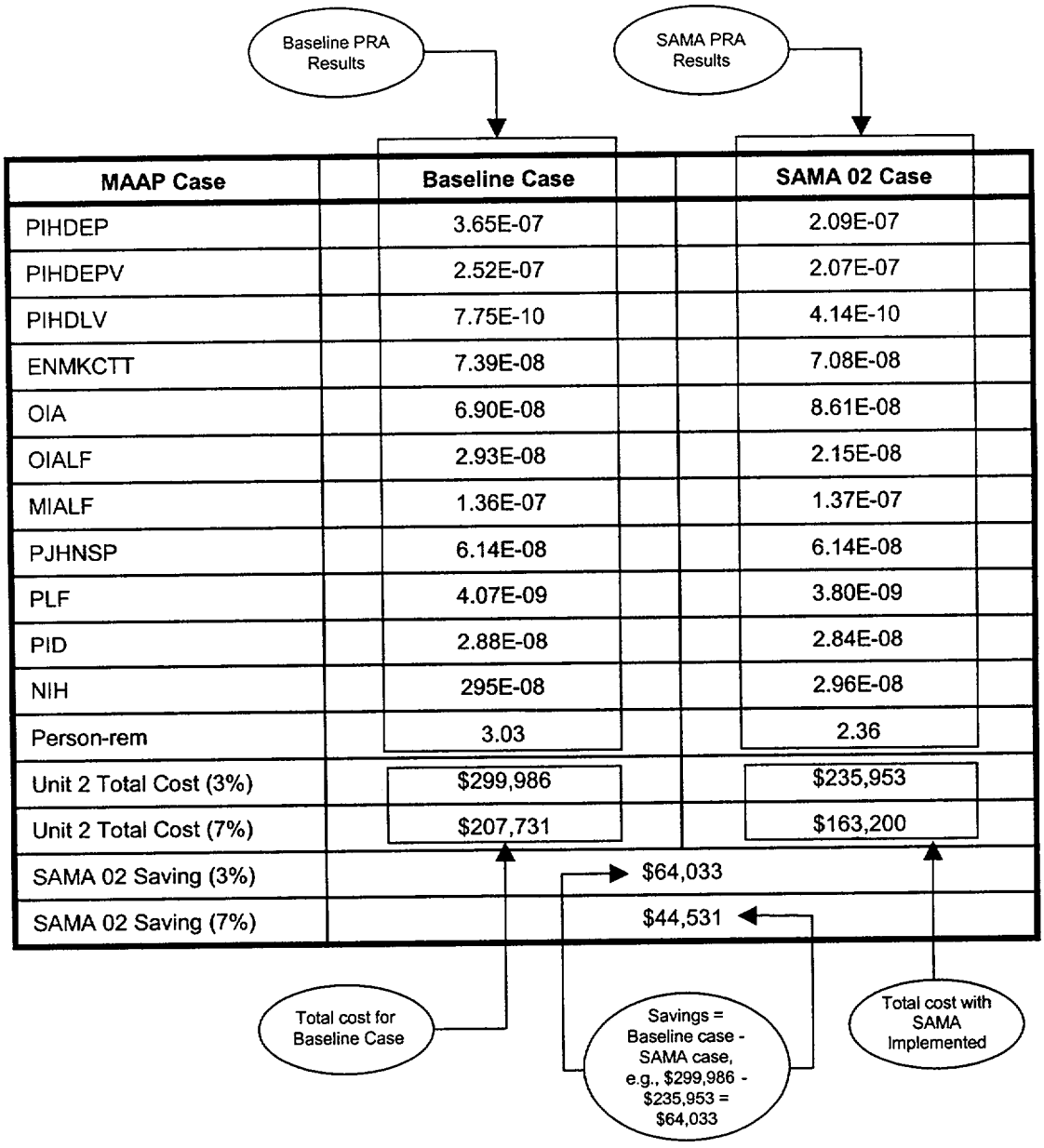

Figure V-1. Sample Table of Results

Table V-1. Summary of Phase II SAMA Analysis

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Result of Potential Enhancement	Estimated Cost (2001)	Estimated Cost (2016)	Phase II Disposition
1	7	Increase CRD pump lube oil capacity.	SAMA would lengthen the time before control rod drive (CRD) pump failure due to lube oil	N/A	N/A	No significant risk decrease. See Section V.B
2	12	Replace ECCS pump motor with air-cooled motors.	SAMA would eliminate ECCS dependency on ERCW.	$6M per unit	$9.3M per unit	See Section V.C
3	17	Implement procedures to stagger CRD pump use after a loss of service water.	SAMA would allow injection with CRD to be extended after a loss of service water.	$50k/unit	$78k/unit	No significant risk decrease. See Section V.D
4	19	Procedural guidance for use of cross-tied component cooling or service water pumps.	SAMA would reduce the frequency of the loss of component cooling water and service water.	$50k/unit	$78k/unit	See Section V.E
5	20	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	SAMA would potentially improve the success rate of operator actions subsequent to support system failures.	$50k/unit	$78k/unit	See Section V.F
6	21	Improved ability to cool the residual heat removal heat exchangers	SAMA would reduce the probability of a loss of decay heat removal by implementing procedure and hardware modifications to allow manual alignment of the fire protection system or by installing a component cooling water crosstie.	$1M/unit	$1.5M/unit	See Section V.G
7	23	Provide a redundant train of ventilation.	SAMA would increase the availability of components dependent on room cooling.	$6M/unit.	$9.3M per unit	See Section V.H
8	25	Add a diesel building switchgear room high temperature alarm.	SAMA would improve diagnosis of a loss of switchgear room HVAC. Option 1: Install high temp alarm Option 2: Redundant louver and thermostat	option 1: $400k per building option 2: $6M per building	Option 1: $623K per building. Option 2: $9.3M per building.	See Section V.I

Table V-1. Summary of Phase II SAMA Analysis (Continued)

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Result of Potential Enhancement	Estimated Cost (2001)	Estimated Cost (2016)	Phase II Disposition
9	34	Install a containment vent large enough to remove ATWS decay heat.	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	$2M/unit	$3.1M/unit	See Section V.J
10	46	Use the fire protection system as a back-up source for the containment spray system.	SAMA would provide redundant containment spray function without the cost of installing a new system.	$500k/unit	$779k/unit	See Section V.K
11	48	Install a passive containment spray system.	SAMA would provide redundant containment spray method.	$6M/unit	$9.3M/unit	See Section V.L
12	57	Provide additional DC battery capacity.	SAMA would ensure longer batter capability during an SBO, reducing the frequency of long-term SBO sequences.	$1M/plant	$1.5M/plant	See Section V.M.
	58	Use fuel cells instead of lead-acid batteries.	SAMA would extend DC power availability in an SBO.	$6M/plant	$9.3M/plant	
	62	Increase/improve DC bus load shedding.	SAMA would extend battery life in an SBO event.	$50k/plant	$78k/plant	
	9	Add redundant DC Control Power for SW pumps	SAMA would increase reliability of SW and decrease core damage frequency due to a loss of SW. Relevant potential concern at BFN is loss of DC-D	$1M/plant	$1.5M/plant	
13	61	Incorporate an alternate battery charging capability.	SAMA would improve DC power reliability by either cross-tying the AC buses, or installing a portable diesel-driven battery charger.	$1M/unit	1.5M/unit	See Section V.N
	63	Replace existing batteries with more reliable ones.	SAMA would improve DC power reliability and thus increase available SBO recovery time.	$6M/plant	$9.3M/plant	

Table V-1. Summary of Phase II SAMA Analysis (Continued)

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Result of Potential Enhancement	Estimated Cost (2001)	Estimated Cost (2016)	Phase II Disposition
14	66	Develop procedures to repair or replace failed 4 kV breakers.	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16kV non-emergency busses from unit station service transformers, leading to loss of emergency AC power.	$50k/unit	$78k/unit	See Section V.O
15	73	Use Fire Protection System as a back-up source for diesel cooling.	This SAMA would provide a redundant and diverse source of cooling for the diesel generators which would contribute to enhanced diesel reliability.	$1M/plant	$1.5M/plant	See Section V.P
16		This reference is reserved.				
17	98	Improve inspection of rubber expansion joints on main condenser.	SAMA would reduce the frequency of internal flooding, for a plant where internal flooding due to a failure of circulating water system expansion joints is a concern.	$100k/unit	$155k/unit	See Section V.R
18	108	Procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	SAMA increases availability of required RHR/CS pumps. Reduction in room heat load allows continued operation of required RHR/CS pumps, when room cooling is lost.	$50k/unit	$78k/unit	See Section V.S
19	110	Increase the SRV reseat reliability.	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after SLC injection.	$700k/unit	$1.09M/unit	See Section V.T
20	111	Reduce DC dependency between high pressure injection system and ADS.	SAMA would ensure vessel depressurization and high pressure injection upon a DC failure.	$500k/unit	$779k/unit	See Section V.U

Table V-1. Summary of Phase II SAMA Analysis (Continued)

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Result of Potential Enhancement	Estimated Cost (2001)	Estimated Cost (2016)	Phase II Disposition
21	113	Use of CRD for alternate boron injection.	SAMA provides an additional system to address ATWS with SLC failure or unavailability.	$2M/unit	$3.1M/unit	See Section V.V
22	116	Borate torus water	Borate torus water to mitigate ATWS upon water injection from the torus.	$6M/unit	$9.3M/unit	See Section V.W
23	117	Automate torus cooling	Automate torus cooling on high torus temperature to avoid lack of torus cooling due to operator error	$400k/unit	$623k/unit	See Section V.X
24	117a	Provide torus positive pressure relief valves	Provide torus positive pressure relief valves to prevent containment overpressure failure	$700k/unit	$1.09M/unit	See Section V.Y
	177b	Reduce DW head bolt pretension	Reduce DW head bolt pretension to allow DW to "burp" thereby preventing catastrophic containment overpressure failure	$50k/unit	$78k/unit	
25	121	Automate SLC initiation	Automate SLC initiation to mitigate failure of SLC due to operator error during ATWS conditions	$400k/unit	$623k/unit	See Section V.Z
26	122a	RPV inspection	Increase the RPV inspection frequency to reduce probability of Excessive LOCA	$100k/unit	$155k/unit	See Section V.AA
27	124	Provide independent torus cooling system	Mitigate failure of torus cooling due to hardware failure	$6M/unit	$9.3M/unit	See Section V.BB
28	132	Improve 4kV crosstie capability	Provide 4kV shutdown bus crosstie capability from Unit 1/2 to Unit 3.	$5M/plant	$7.8M/plant	See Section V.CC
29	133	Provide HP diesel-driven pump.	Provide capability to inject river water at HP via diesel-driven pump to mitigate Station Blackout	$6M/unit	$9.3M/unit	See Section V.DD

B. Phase II SAMA Number 01: Increase CRD Lube Oil Capacity

This SAMA has the potential to increase the time before CRD pump failure due to failure of lube oil. The original SAMA addressed a PWR concern relating to charging pumps. The closest equivalent in BWRs are the CRD pumps.

The risk significance of the CRD pumps in the BFN models is modest. The risk reduction worth impact of the CRD system is approximately 6% and 3% for Unit 2 and Unit 3, respectively. In addition the contribution of lube oil failure to CRD system unavailability (BFN IPE) is approximately 0.2% of the total system unavailability.

It is therefore concluded that there is no significant risk reduction potential associated with this SAMA.

C. Phase II SAMA Number 02: Eliminate ECCS Dependency on EECW

This SAMA would replace ECCS pump motors with passively cooled motors. This would reduce the functional dependency of the RHR and Core Spray pumps on EECW.

To bound the potential impact of this SAMA, the dependency on all RHR and Core Spray pumps on EECW has been eliminated. In addition, the RHR and Core Spray top event models were reviewed. It was determined that failure of the pump coolers contributed approximately 20% to the split fractions representing the RHR pumps and the Core Spray system. All split fractions associated with the RHR pumps and Core Spray system were reduced by 20%. This has the effect of increasing the calculated availability of these pumps.

These changes necessitated changes to be made in the split fraction assignment rules in the low pressure general transient event tree (LPGTET), as well as the large and medium LOCA event trees (LLOCA and MLOCA, respectively). In addition, the split fraction adjustments were made directly to the master frequency file (which is the reference table for the split fractions used in the scenario quantification).

These changes reflect the following bounding assumption: Replacing the pump motors with passively cooled motors completely removes any dependency on EECW.

PSA Model Results

The results from this case indicates about a 18.6% reduction in Unit 2 CDF (CDF_{new}=8.5438E-7). The new end state frequencies are presented in Table V-2. For Unit 3 there is a 11.5% reduction in CDF (CDF_{new}=1.6788E-6) and the new end state frequencies are presented in Table V-3.

Table V-2. Unit 2 SAMA Number 02 Results

MAAP Case	Baseline Case	SAMA 02 Case
PIHDEP	3.65E-07	2.09E-07
PIHDEPV	2.52E-07	2.07E-07
PIHDLV	7.75E-10	4.14E-10
ENMKCTT	7.39E-08	7.08E-08
OIA	6.90E-08	8.61E-08
OIALF	2.93E-08	2.15E-08
MIALF	1.36E-07	1.37E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	3.80E-09
PID	2.88E-08	2.84E-08
NIH	2.95E-08	2.96E-08
Person-rem	3.03	2.36
Unit 2 Total Cost (3%)	$299,986	$235,953
Unit 2 Total Cost (7%)	$207,731	$163,200
SAMA 02 Saving (3%)	$64,033	
SAMA 02 Saving (7%)	$44.531	

Table V-3. Unit 3 SAMA Number 02 Results

MAAP Case	Baseline Case	SAMA 02 Case
PIHDEP	8.59E-07	6.38E-07
PIHDEPV	4.20E-07	3.71E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.42E-07
OIA	1.60E-07	2.27E-07
OIALF	1.11E-08	8.43E-09
MIALF	1.32E-07	1.33E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.94E-08
PID	9.67E-09	9.37E-09
NIH	3.75E-09	3.76E-09
Person-rem	6.28	5.48
Unit 3 Total Cost (3%)	$609,146	$533,518
Unit 3 Total Cost (7%)	$423,366	$370,691
SAMA 02 Saving (3%)	$75,628	
SAMA 02 Saving (7%)	$52,675	

D. Phase II SAMA Number 03: Implement Procedures to Stagger CRD Pump Use After Loss of Service Water

This SAMA originally was originally associated with the PWR concern of loss of high pressure injection following loss of service water. The CRD system at BFN can act as a source of high pressure injection and is dependent on RCW. RCW provides oil bearing cooling and thrust bearing cooling. Staggering CRD pump operation would have little benefit on loss of service water.

E. Phase II SAMA Number 04: Enhance Ability to Crosstie Service Water

Several systems at BFN provide the generic 'service water' systems support function. These systems include RCW, EECW, RHRSW, and RBCCW.

The base case models reflect the capability to realign swing RHRSW pumps to support EECW.

To bound the potential benefit of further enhancing the ability to cross tie service water systems (via hardware and procedural changes), the following assumptions were made:

1. If insufficient EECW flow occurs and the RHRSW swing pumps are available, the actions necessary to align the swing pumps for EECW service are assumed to occur with a probability of 1.

2. RBCCW is assumed to be successful if RCW is available. In other words, it is assumed that RCW is cross-tied to RBCCW.

3. The frequency of the initiator Loss of RBCCW is assumed to be zero.

To reflect these changes, top OEE, alignment of the swing RHRSW to support EECW, is assumed to be successful if the swing pumps are available. Also top RBC representing the availability of the RBCCW system is assumed to be available if RCW is available.

PSA Model Results

The results from this case indicates about a 0.9% reduction in Unit 2 CDF (CDF_{new}=1.0400E-6). The new end state frequencies are presented in Table V-4. Unit 3 there is a 1.6% reduction in CDF (CDF_{new}=1.8675E-6) and the new end state frequencies are presented in Table V-5.

Table V-4. Unit 2 SAMA Number 04 Results

MAAP Case	Baseline Case	SAMA 04 Case
PIHDEP	3.65E-07	3.63E-07
PIHDEPV	2.52E-07	2.49E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.33E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.33E-07
PJHNSP	6.14E-08	6.13E-08
PLF	4.07E-09	3.87E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.79E-08
Person-rem	3.03	3.01
Unit 2 Total Cost (3%)	$299,986	$297,934
Unit 2 Total Cost (7%)	$207,731	$206,328
SAMA 04 Saving (3%)	$2,052	
SAMA 04 Saving (7%)	$1,403	

Table V-5. Unit 3 SAMA Number 04 Results

MAAP Case	Baseline Case	SAMA 04 Case
PIHDEP	8.59E-07	8.43E-07
PIHDEPV	4.20E-07	4.17E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.50E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.26E-07
PJHNSP	1.28E-07	1.27E-07
PLF	2.11E-08	2.00E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.50E-09
Person-rem	6.28	6.19
Unit 3 Total Cost (3%)	$609,146	$600,706
Unit 3 Total Cost (7%)	$423,366	$417,524
SAMA 04 Saving (3%)	$8,440	
SAMA 04 Saving (7%)	$5,842	

F. Phase II SAMA Number 05: Enhanced Recovery of Failed Support Systems

The base case models explicitly consider the recovery of key support systems. Specific recovery actions considered in one or both base case models are:

1. Alignment of RHRSW swing pumps to support EECW operation (top OEE).
2. Restoration of power at a diesel auxiliary board (top ODSB).
3. Restoration of power to support diesel room cooling (top ODSBU3).
4. Restoration of power at a 480V Reactor MOV board (top RMOV).
5. Alignment of spare battery charger (top CPREC).
6. Recovery of power at a 4-kV shutdown board (top SDREC).
7. Alignment of power to a unit board from 161-kV results in a loss of the 500-kV supply (top OUB).
8. Recovery of power at specific unit boards (UBREC).
9. Other electric power recovery actions (top OX).

To estimate a bound for the potential impact of improved procedures, each of the split fractions associated with the above top events were assumed to improve (i.e., be more reliable) by a factor of 3.

The models were then quantified with all of the above operator recovery actions simultaneously improved.

PSA Model Results

The results from this case indicates about a 0.2% reduction in Unit 2 CDF (CDF_{new}=1.0473E-6). The new end state frequencies are presented in Table V-6. For Unit 3 there is a 0.1% reduction in CDF (CDF_{new}=1.8954E-6) and the new end state frequencies are presented in Table V-7.

Table V-6. Unit 2 SAMA Number 05 Results

MAAP Case	Baseline Case	SAMA 05 Case
PIHDEP	3.65E-07	3.63E-07
PIHDEPV	2.52E-07	2.51E-07
PIHDLV	7.75E-10	7.77E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	6.88E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.08E-09
PID	2.88E-08	2.85E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	3.02
Unit 2 Total Cost (3%)	$299,986	$299,202
Unit 2 Total Cost (7%)	$207,731	$207,187
SAMA 05 Saving (3%)	$784	
SAMA 05 Saving (7%)	$544	

Table V-7. Unit 3 SAMA Number 05 Results

MAAP Case	Baseline Case	SAMA 05 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	8.69E-09
NIH	3.75E-09	3.36E-09
Person-rem	6.28	6.28
Unit 3 Total Cost (3%)	$609,146	$608,907
Unit 3 Total Cost (7%)	$423,366	$423,208
SAMA 05 Saving (3%)	$239	
SAMA 05 Saving (7%)	$158	

G. Phase II SAMA Number 06: Fire Water as Backup for RHR Heat Exchanger Cooling

To estimate the potential impact of providing a connection from the fire water system to the RHR heat exchangers, the following assumptions were made:

1. The fire water system was assumed to be capable of providing adequate cooling water flow to all Unit 2 and 3 RHR heat exchangers

2. The fire water system was assumed to have a 100% availability.

3. Any required operator actions associated with aligning the fire water system to provide flow to the RHR heat exchanger was assumed to be successfully completed in a timely manner.

To implement this bounding model, split fractions representing guaranteed success associated with the four RHRSW pumps were used. (In other words, the failure fraction for top events SW2A, SW2C, SW2B, and SW2D were set to zero.)

PSA Model Results

The results from this case indicates about a 2.6% reduction in Unit 2 CDF (CDF_{new}=1.0230E-6). The new end state frequencies are presented in Table V-8. For Unit 3 there is a 9.3% reduction in CDF (CDF_{new}=1.7201E-6) and the new end state frequencies are presented in Table V-9.

Table V-8. Unit 2 SAMA Number 06 Results

MAAP Case	Baseline Case	SAMA 6 Case
PIHDEP	3.65E-07	3.39E-07
PIHDEPV	2.52E-07	2.39E-07
PIHDLV	7.75E-10	8.01E-10
ENMKCTT	7.39E-08	7.53E-08
OIA	6.90E-08	7.81E-08
OIALF	2.93E-08	2.97E-08
MIALF	1.36E-07	1.38E-07
PJHNSP	6.14E-08	6.10E-08
PLF	4.07E-09	3.24E-09
PID	2.88E-08	2.93E-08
NIH	2.95E-08	2.99E-08
Person-rem	3.03	2.93
Unit 2 Total Cost (3%)	$299,986	$290,684
Unit 2 Total Cost (7%)	$207,731	$201,252
SAMA 06 Saving (3%)	$9,302	
SAMA 06 Saving (7%)	$6,479	

Table V-9. Unit 3 SAMA Number 06 Results

MAAP Case	Baseline Case	SAMA 6 Case
PIHDEP	8.59E-07	7.52E-07
PIHDEPV	4.20E-07	3.46E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.53E-07
OIA	1.60E-07	1.63E-07
OIALF	1.11E-08	1.13E-08
MIALF	1.32E-07	1.34E-07
PJHNSP	1.28E-07	1.26E-07
PLF	2.11E-08	2.03E-08
PID	9.67E-09	9.99E-09
NIH	3.75E-09	3.84E-09
Person-rem	6.28	5.68
Unit 3 Total Cost (3%)	$609,146	$551,355
Unit 3 Total Cost (7%)	$423,366	$383,183
SAMA 06 Saving (3%)	$57,791	
SAMA 06 Saving (7%)	$40,183	

H. Phase II SAMA Number 07: Provide a Redundant Train of Ventilation

A limited number of systems are dependent on room or area cooling at BFN. The RHR and Core Spray pumps, as modeled, require fan coolers. In addition, room cooling is required for operation of the diesel generators.

A review of the systems analyses for the RHR and Core Spray systems (BFN IPE) reveals that the contribution (including common cause) to RHR or Core Spray pump unavailability due to fan cooler failure is less than 20%.

To bound the potential impact of a redundant ventilation for the RHR and Core Spray pumps, the split fractions representing these pumps (i.e., RPA, RPB, RPC, RPD and CS) were reduced by 20%.

In addition, the top event representing recovery of diesel generator room cooling was set to guaranteed success.

This bounding modeling approach assumes that the redundant ventilation has an availability of 1.0 (i.e., an unavailability of 0.0) and is independent of any support system such as electric power.

PSA Model Results

The results from this case indicates about a 18.6% reduction in Unit 2 CDF (CDF_{new}=8.5408E-7). The new end state frequencies are presented in Table V-10. For Unit 3 there is a 11.5% reduction in CDF (CDF_{new}=1.6788E-6) and the new end state frequencies are presented in Table V-11.

Table V-10. Unit 2 SAMA Number 07 Results

MAAP Case	Baseline Case	SAMA 07 Case
PIHDEP	3.65E-07	2.08E-07
PIHDEPV	2.52E-07	2.07E-07
PIHDLV	7.75E-10	4.14E-10
ENMKCTT	7.39E-08	7.08E-08
OIA	6.90E-08	8.61E-08
OIALF	2.93E-08	2.15E-08
MIALF	1.36E-07	1.37E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	3.80E-09
PID	2.88E-08	2.84E-08
NIH	2.95E-08	2.96E-08
Person-rem	3.03	2.36
Unit 2 Total Cost (3%)	$299,986	$235,850
Unit 2 Total Cost (7%)	$207,731	$163,129
SAMA 07 Saving (3%)	$64,136	
SAMA 07 Saving (7%)	$44,602	

Table V-11. Unit 3 SAMA Number 07 Results

MAAP Case	Baseline Case	SAMA 07 Case
PIHDEP	8.59E-07	6.37E-07
PIHDEPV	4.20E-07	3.71E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.42E-07
OIA	1.60E-07	2.27E-07
OIALF	1.11E-08	8.43E-09
MIALF	1.32E-07	1.33E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.94E-08
PID	9.67E-09	9.38E-09
NIH	3.75E-09	3.76E-09
Person-rem	6.28	5.48
Unit 3 Total Cost (3%)	$609,146	$533,509
Unit 3 Total Cost (7%)	$423,366	$370,685
SAMA 07 Saving (3%)	$75,637	
SAMA 07 Saving (7%)	$52,681	

I. Phase II SAMA Number 08: Improve Diagnostics for Diesel Generator Room HVAC

The base case models include the consideration of recovery of a diesel aux board (top ODSB, Unit 2 and Unit 3 models) and recovery of power associated with diesel C room cooling (top ODSBU3, Unit 3).

To bound the potential impact of improved diagnostics for loss of cooling to diesel generator rooms, top events relating to diesel support recovery (ODSB and ODSBU3) were set to guaranteed success.

PSA Model Results

The results from this case indicates about a 0.03% reduction in Unit 2 CDF (CDF_{new}=1.0495E-6). The new end state frequencies are presented in Table V-12. For Unit 3 there is about a 0.04 reduction in CDF (CDF_{new}=1.8966E-6) and the new end state frequencies are presented in Table V-13.

Table V-12. Unit 2 SAMA Number 08 Results

MAAP Case	Baseline Case	SAMA 08 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	3.03
Unit 2 Total Cost (3%)	$299,986	$299,880
Unit 2 Total Cost (7%)	$207,731	$207,658
SAMA 08 Saving (3%)	$106	
SAMA 08 Saving (7%)	$73	

Table V-13. Unit 3 SAMA Number 08 Results

MAAP Case	Baseline Case	SAMA 08 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	6.28
Unit 3 Total Cost (3%)	$609,146	$608,956
Unit 3 Total Cost (7%)	$423,366	$423,236
SAMA 08 Saving (3%)	$190	
SAMA 08 Saving (7%)	$130	

J. Phase II SAMA Number 09: Install a Containment Vent Large Enough to Remove ATWS Decay Heat

This SAMA would provide redundancy in the ability to remove decay heat and be of sufficient size to successfully handle ATWS decay heat levels.

To estimate the potential effects of this SAMA, the event tree structure (event tree TRANCDBIN) was reviewed along with the logic rules that determine whether a sequence is assigned to core damage or "success." The relevant logic macro (AHEAT) was modified to reflect the vent (top event VNT) as a potential success path.

PSA Model Results

The results from this case indicates about a 0.9% reduction in Unit 2 CDF (CDF_{new}=1.0400E-6). The new end state frequencies are presented in Table V-14. For Unit 3 there is a 4.2% reduction in CDF (CDF_{new}=1.818E-6) and the new end state frequencies are presented in Table V-15.

Table V-14. Unit 2 SAMA Number 09 Results

MAAP Case	Baseline Case	SAMA 09 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	6.41E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	2.97
Unit 2 Total Cost (3%)	$299,986	$295,207
Unit 2 Total Cost (7%)	$207,731	$204,376
SAMA 09 Saving (3%)	$4,779	
SAMA 09Saving (7%)	$3,355	

Table V-15. Unit 3 SAMA Number 09 Results

MAAP Case	Baseline Case	SAMA 09 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	7.30E-08
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	5.84
Unit 3 Total Cost (3%)	$609,146	$570,657
Unit 3 Total Cost (7%)	$423,366	$396,348
SAMA 09 Saving (3%)	$38,489	
SAMA 09 Saving (7%)	$27,018	

K. Phase II SAMA Number 10: Fire Protection System as Backup Source for Containment Spray

This SAMA considers the use of the Fire Protection water as a backup source for Containment Spray.

To bound the potential impact of this SAMA, the analysis performed for Phase II SAMA 11 (the installation of a passive containment spray system) was used.

L. Phase II SAMA Number 11: Installation of a Passive Containment Spray System

This SAMA would result in the installation of a system capable of providing containment spray and be independent of operator actions.

To bound the potential impact of this SAMA, the top event representing the containment spray function (top event DWS) was set to "success."

PSA Model Results

The results from this case indicates about a 0.9% increase in Unit 2 CDF (CDF_{new}=1.0588E-6). The new end state frequencies are presented in Table V-16. For Unit 3 there is a 1.1% increase in CDF (CDF_{new}=1.9177E-6) and the new end state frequencies are presented in Table V-17.

Table V-16. Unit 2 SAMA Number 11 Results

MAAP Case	Baseline Case	SAMA 11 Case
PIHDEP	3.65E-07	3.67E-07
PIHDEPV	2.52E-07	2.53E-07
PIHDLV	7.75E-10	7.52E-10
ENMKCTT	7.39E-08	7.51E-08
OIA	6.90E-08	1.00E-07
OIALF	2.93E-08	3.05E-08
MIALF	1.36E-07	1.65E-07
PJHNSP	6.14E-08	6.16E-08
PLF	4.07E-09	4.14E-09
PID	2.88E-08	0.00E+00
NIH	2.95E-08	1.20E-09
Person-rem	3.03	Not meaningful
Unit 2 Total Cost (3%)	$299,986	Not meaningful
Unit 2 Total Cost (7%)	$207,731	Not meaningful
SAMA 11 Saving (3%)	Not meaningful	
SAMA 11 Saving (7%)	Not meaningful	

Table V-17. Unit 3 SAMA Number 11 Results

MAAP Case	Baseline Case	SAMA 11 Case
PIHDEP	8.59E-07	8.66E-07
PIHDEPV	4.20E-07	4.24E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.55E-07
OIA	1.60E-07	1.73E-07
OIALF	1.11E-08	1.15E-08
MIALF	1.32E-07	1.37E-07
PJHNSP	1.28E-07	1.29E-07
PLF	2.11E-08	2.16E-08
PID	9.67E-09	0.00E+00
NIH	3.75E-09	2.20E-10
Person-rem	6.28	Not meaningful
Unit 3 Total Cost (3%)	$609,146	Not meaningful
Unit 3 Total Cost (7%)	$423,366	Not meaningful
SAMA 11 Saving (3%)	Not meaningful	
SAMA 11 Saving (7%)	Not meaningful	

The core damage frequency for this SAMA should be equal to the base case evaluation. The cost of the different cases does not significantly differ from the baseline costs. The fact that the calculated core damage frequencies are slightly greater than the baseline case is attributed to model resolution limitations.

The primary impact of this SAMA is to shift release categories to more benign releases. From the data presented in Table III-8, the maximum costs averted are bounded by $300k and $610k for Units 2 and 3, respectively.

M. Phase II SAMA Number 12: Provide Additional DC Battery Capacity

This SAMA would provide additional functional battery life and be especially beneficial during a Station Blackout event.

To bound the potential impact of this SAMA, the logic associated with determining whether a sequence involves core damage or is "success" was modified. This was done by adding additional statements in the split fraction logic in the TRANCDBIN event tree (specifically for the split fraction assignment logic associated with top event NCD). Any sequence involving successful scram, no stuck open relief valves and successful operation and control of either HPCI or RCIC was considered to be successfully mitigated.

This approach involved making the bounding assumption concerning the reliability of operation of HPCI and RCIC for 24 hours. For the purposes of providing a bounding assessment of this SAMA, representing the operation of HPCI/RCIC for 24 hours with the top event representing 6 hours of operation is conservative.

PSA Model Results

The results from this case indicates about a 45.1% reduction in Unit 2 CDF (CDF_{new}=5.7609E-7). The new end state frequencies are presented in Table V-18. For Unit 3 there is a 51.1% reduction in CDF (CDF_{new}=9.2730E-7) and the new end state frequencies are presented in Table V-19.

Table V-18. Unit 2 SAMA Number 12 Results

MAAP Case	Baseline Case	SAMA 12 Case
PIHDEP	3.65E-07	2.24E-08
PIHDEPV	2.52E-07	1.68E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	3.67E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	5.92E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.02E-08
NIH	2.95E-08	2.52E-08
Person-rem	3.03	1.44
Unit 2 Total Cost (3%)	$299,986	$145,161
Unit 2 Total Cost (7%)	$207,731	$100,069
SAMA 12 Saving (3%)	$154,825	
SAMA 12 Saving (7%)	$107,662	

Table V-19. Unit 3 SAMA Number 12 Results

MAAP Case	Baseline Case	SAMA 12 Case
PIHDEP	8.59E-07	2.57E-07
PIHDEPV	4.20E-07	1.89E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	4.81E-08
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.07E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	6.54E-09
NIH	3.75E-09	3.57E-09
Person-rem	6.28	3.01
Unit 3 Total Cost (3%)	$609,146	$289,719
Unit 3 Total Cost (7%)	$423,366	$201,195
SAMA 12 Saving (3%)	$319,427	
SAMA 12 Saving (7%)	$222,171	

N. Phase II SAMA Number 13: Improve DC Power Reliability

Two specific Phase I SAMAs focused on improving DC power reliability. Phase I SAMA 61 would incorporate additional/alternate battery charging capacity. Phase I SAMA 63 would replace station batteries with more reliable ones.

It should be noted that the PSA models already take credit for aligning the spare battery charger.

Reanalyzing the PSA models with "improved" failure probabilities assumed for the station batteries bound the potential impact of improving DC reliability. For the purposes of this analysis, it was assumed that it was possible to improve the unavailability of each of the three station batteries by a factor of 10. This is believed to be a conservative assumption.

PSA Model Results

The results from this case indicates about a 12.3% reduction in Unit 2 CDF (CDF_{new}=9.2059E-7). The new end state frequencies are presented in Table V-20. For Unit 3 there is a 3.2% reduction in CDF (CDF_{new}=1.8372E-6) and the new end state frequencies are presented in Table V-21.

Table V-20. Unit 2 SAMA Number 13 Results

MAAP Case	Baseline Case	SAMA 13 Case
PIHDEP	3.65E-07	3.67E-07
PIHDEPV	2.52E-07	1.76E-07
PIHDLV	7.75E-10	4.83E-10
ENMKCTT	7.39E-08	7.43E-08
OIA	6.90E-08	6.62E-08
OIALF	2.93E-08	2.77E-08
MIALF	1.36E-07	1.35E-07
PJHNSP	6.14E-08	6.15E-08
PLF	4.07E-09	2.97E-09
PID	2.88E-08	5.32E-09
NIH	2.95E-08	4.14E-09
Person-rem	3.03	2.78
Unit 2 Total Cost (3%)	$299,986	$273,464
Unit 2 Total Cost (7%)	$207,731	$189,607
SAMA 13 Saving (3%)	$26,522	
SAMA 13 Saving (7%)	$18,124	

Table V-21. Unit 3 SAMA Number 13 Results

MAAP Case	Baseline Case	SAMA 13 Case
PIHDEP	8.59E-07	8.61E-07
PIHDEPV	4.20E-07	3.74E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.48E-07
OIA	1.60E-07	1.58E-07
OIALF	1.11E-08	8.83E-09
MIALF	1.32E-07	1.30E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	5.70E-09
NIH	3.75E-09	2.47E-09
Person-rem	6.28	6.12
Unit 3 Total Cost (3%)	$609,146	$593,311
Unit 3 Total Cost (7%)	$423,366	$412,432
SAMA 13 Saving (3%)	$15,835	
SAMA 13 Saving (7%)	$10,934	

O. Phase II SAMA Number 14: Develop Procedures to Repair or Replace failed 4-kV Breakers

The specific concern addressed by this SAMA centers on the potential for failure to transfer 4-kV non-emergency busses from the unit station service transformers could lead to the loss of emergency AC power.

To bound the potential impact of this SAMA, the models were reanalyzed with the transfer of power at the unit board level assumed to occur without fault.

PSA Model Results

The results from this case indicates about a 0.02 % increase in Unit 2 calculated CDF (CDF_{new}=1.0500E-6). The new end state frequencies are presented in Table V-22. For Unit 3 there is a 0.01% increase in the calculated CDF (CDF_{new}=1.8971E-6) and the new end state frequencies are presented in Table V-23. These changes are due to model resolution limitations. Any costs averted would be very small.

Table V-22. Unit 2 SAMA Number 14 Results

MAAP Case	Baseline Case	SAMA 14 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.76E-10
ENMKCTT	7.39E-08	7.40E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.08E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	Not meaningful
Unit 2 Total Cost (3%)	$299,986	Not meaningful
Unit 2 Total Cost (7%)	$207,731	Not meaningful
SAMA 14 Saving (3%)	Not meaningful	
SAMA 14 Saving (7%)	Not meaningful	

Table V-23. Unit 3 SAMA Number 14 Results

MAAP Case	Baseline Case	SAMA 14 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	Not meaningful
Unit 3 Total Cost (3%)	$609,146	Not meaningful
Unit 3 Total Cost (7%)	$423,366	Not meaningful
SAMA 14 Saving (3%)	Not meaningful	
SAMA 14 Saving (7%)	Not meaningful	

P. Phase II SAMA Number 15: Redundant and Diverse Source of Cooling to the Diesel Generators

This SAMA would provide a redundant and diverse source, such as the fire protection system, of cooling water for the diesel generators.

To bound the potential impact of this SAMA, the "logical loop" linking the operation of the diesel generators and their normal cooling water source (EECW) was broken. Three assumptions were made:

1? It was assumed that the fire protection system has sufficient capacity to service all eight diesel generators.

2? It was further assumed that the fire protection system is aligned for diesel cooling in a timely manner.

3? The fire protection system is assumed to be perfectly available (i.e., its unavailability is zero) and the operators align the system (or a passive alignment scheme has been implemented) without failure.

To accomplish this model change, top OEE in the high pressure general transient event tree (HPGTET) was set to "success". This has the effect of making the generator status macros (e.g., "NOGA" for diesel A) dependent only on the hardware status of the diesel and its associated equipment. In the large LOCA and medium LOCA event trees (LLOCA and MLOCA, respectively), the definition of the generator status macros were modified directly.

PSA Model Results

The results from this case indicates about an 18.9% reduction in Unit 2 CDF (CDF_{new}=8.5117E-7). The new end state frequencies are presented in Table V-24. For Unit 3 there is a14.3% reduction in CDF (CDF_{new}=1.6266E-6) and the new end state frequencies are presented in Table V-25.

Table V-24. Unit 2 SAMA Number 15 Results

MAAP Case	Baseline Case	SAMA 15 Case
PIHDEP	3.65E-07	2.06E-07
PIHDEPV	2.52E-07	2.15E-07
PIHDLV	7.75E-10	4.22E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	6.59E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	2.34
Unit 2 Total Cost (3%)	$299,986	$233,386
Unit 2 Total Cost (7%)	$207,731	$161,384
SAMA 15 Saving (3%)	$66,600	
SAMA 15 Saving (7%)	$46,347	

Table V-25. Unit 3 SAMA Number 15 Results

MAAP Case	Baseline Case	SAMA 15 Case
PIHDEP	8.59E-07	6.52E-07
PIHDEPV	4.20E-07	3.76E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	1.41E-07
OIALF	1.11E-08	1.12E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.72E-09
NIH	3.75E-09	3.72E-09
Person-rem	6.28	5.35
Unit 3 Total Cost (3%)	$609,146	$518,608
Unit 3 Total Cost (7%)	$423,366	$360,367
SAMA 15 Saving (3%)	$90,538	
SAMA 15 Saving (7%)	$62,999	

Q. This Section Not Used

This section is reserved.

Table V-26. This Table Reserved

MAAP Case	Baseline Case	SAMA # Case

Table V-27. This Table Reserved

MAAP Case	Baseline Case	SAMA # Case

R. Phase II SAMA Number 17: Improve Inspection of Rubber Expansion Joints on Main Condenser

This SAMA has the potential to decrease the frequency of internal flooding events impacting the turbine building.

To estimate the potential impact of improved inspection of condenser expansion joints, the basis for the turbine building flood frequencies was reviewed. Plant-specific screening of the generic flood database in support of the BFN IPE determined that 11 events were applicable to BFN. These 11 events formed the basis for the estimate of the turbine building flooding frequency in the IPE. Two of the eleven events involved failure of expansion joints (of all types). This observation supports the assumption that eliminating expansion joint failure would result in an approximate 20% reduction in the turbine building flooding frequency.

To represent the potential impact of the implementation of this SAMA, the models were reanalyzed with the initiating event flooding frequencies reduced from the base case by 20%. The new flooding frequencies for small and large turbine building floods become 1.152×10^{-2} and 1.760×10^{-3} per year, respectively.

PSA Model Results

The results from this case indicates about a 0.7% reduction in Unit 2 CDF (CDF_{new}=1.0423E-6). The new end state frequencies are presented in Table V-28. For Unit 3 there is a 0.6% reduction in CDF (CDF_{new}=1.8858E-6) and the new end state frequencies are presented in Table V-29.

Table V-28. Unit 2 SAMA Number 17 Results

MAAP Case	Baseline Case	SAMA 17 Case
PIHDEP	3.65E-07	3.64E-07
PIHDEPV	2.52E-07	2.50E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.37E-08
OIA	6.90E-08	6.82E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.34E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	3.99E-09
PID	2.88E-08	2.80E-08
NIH	2.95E-08	2.94E-08
Person-rem	3.03	3.01
Unit 2 Total Cost (3%)	$299,986	$298,379
Unit 2 Total Cost (7%)	$207,731	$206,631
SAMA 17 Saving (3%)	$1,607	
SAMA 17 Saving (7%)	$1,100	

Table V-29. Unit 3 SAMA Number 17 Results

MAAP Case	Baseline Case	SAMA 17 Case
PIHDEP	8.59E-07	8.55E-07
PIHDEPV	4.20E-07	4.18E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.51E-07
OIA	1.60E-07	1.59E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.30E-07
PJHNSP	1.28E-07	1.27E-07
PLF	2.11E-08	2.08E-08
PID	9.67E-09	9.42E-09
NIH	3.75E-09	3.73E-09
Person-rem	6.28	6.25
Unit 3 Total Cost (3%)	$609,146	$605,979
Unit 3 Total Cost (7%)	$423,366	$421,176
SAMA 17 Saving (3%)	$3,167	
SAMA 17 Saving (7%)	$2,190	

S. Phase II SAMA Number 18: Procedure to Trip Unneeded RHR/CS Pumps on Loss of Room Ventilation

This SAMA would increase the availability of RHR and/or Core Spray pumps by lessening the heat load on the room when area cooling is lost.

This SAMA has common elements to Phase II SAMAs 2 and 7. To bound the potential benefit of implementing Phase II SAMA 18, all requirements for area cooling were removed for the top events representing the RHR and CS pumps by reducing each corresponding split fraction by 20%. It has been determined earlier (see Phase II SAMAs 2 and 7) that ventilation failure contributed less than 20% to RHR and Core Spray failure.

PSA Model Results

The results from this case indicate about a 3.4% reduction in Unit 2 CDF (CDF_{new} = 1.0144E-6). The new end state frequencies are presented in Table V-30. For Unit 3 there is a 3.6% reduction in CDF (CDF_{new} = 1.8284E-6) and the new end state frequencies are presented in Table V-31.

Table V-30. Unit 2 SAMA Number 18 Results

MAAP Case	Baseline Case	SAMA 18 Case
PIHDEP	3.65E-07	3.58E-07
PIHDEPV	2.52E-07	2.39E-07
PIHDLV	7.75E-10	7.77E-10
ENMKCTT	7.39E-08	7.08E-08
OIA	6.90E-08	6.37E-08
OIALF	2.93E-08	2.15E-08
MIALF	1.36E-07	1.37E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	3.82E-09
PID	2.88E-08	2.84E-08
NIH	2.95E-08	2.96E-08
Person-rem	3.03	2.93
Unit 2 Total Cost (3%)	$299,986	$290,382
Unit 2 Total Cost (7%)	$207,731	$201,092
SAMA 19 Saving (3%)	$9,604	
SAMA 19 Saving (7%)	$6,639	

Table V-31. Unit 3 SAMA Number 18 Results

MAAP Case	Baseline Case	SAMA 18 Case
PIHDEP	8.59E-07	8.35E-07
PIHDEPV	4.20E-07	4.11E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.42E-07
OIA	1.60E-07	1.38E-07
OIALF	1.11E-08	8.43E-08
MIALF	1.32E-07	1.33E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.94E-08
PID	9.67E-09	9.37E-09
NIH	3.75E-09	3.78E-09
Person-rem	6.28	6.05
Unit 3 Total Cost (3%)	$609,146	$586,415
Unit 3 Total Cost (7%)	$423,366	$407,556
SAMA 19 Saving (3%)	$22,731	
SAMA 19 Saving (7%)	$15,810	

T. Phase II SAMA Number 19: Increase the SRV Reseat Reliability

This SAMA would reduce the likelihood that an SRV would fail to reseat following a successful lift.

To bound the potential impact of this SAMA, the PSA models were reanalyzed with the assumption that any valves that lift would successfully reseat. The baseline PSA models associated with initiating events involving the inadvertent lifting of relief valves were not altered in the assessment of this SAMA.

PSA Model Results

The results from this case indicates about a 5.8% reduction in Unit 2 CDF (CDF_{new}=9.8871E-7). The new end state frequencies are presented in Table V-30. For Unit 3 there is a 3.8% reduction in CDF (CDF_{new}=1.8259E-6) and the new end state frequencies are presented in Table V-31.

Table V-32. Unit 2 SAMA Number 19 Results

MAAP Case	Baseline Case	SAMA 19 Case
PIHDEP	3.65E-07	3.69E-07
PIHDEPV	2.52E-07	2.08E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	6.98E-08
OIA	6.90E-08	5.16E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.38E-07
PJHNSP	6.14E-08	6.12E-08
PLF	4.07E-09	4.12E-09
PID	2.88E-08	2.74E-08
NIH	2.95E-08	2.98E-08
Person-rem	3.03	2.84
Unit 2 Total Cost (3%)	$299,986	$281,125
Unit 2 Total Cost (7%)	$207,731	$194,638
SAMA 19 Saving (3%)	$18,861	
SAMA 19 Saving (7%)	$13,093	

Table V-33. Unit 3 SAMA Number 19 Results

MAAP Case	Baseline Case	SAMA 19 Case
PIHDEP	8.59E-07	8.68E-07
PIHDEPV	4.20E-07	3.59E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.46E-07
OIA	1.60E-07	1.45E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.34E-07
PJHNSP	1.28E-07	1.27E-07
PLF	2.11E-08	2.14E-08
PID	9.67E-09	9.54E-09
NIH	3.75E-09	3.79E-09
Person-rem	6.28	6.06
Unit 3 Total Cost (3%)	$609,146	$587,115
Unit 3 Total Cost (7%)	$423,366	$408,073
SAMA 19 Saving (3%)	$22,031	
SAMA 19 Saving (7%)	$15,293	

U. Phase II SAMA Number 20: Reduce the Dependency between the High Pressure Injection System and ADS

This SAMA would reduce the likelihood that failure of the DC power system would significantly impact redundant means of mitigating transients and small LOCAs.

To bound the potential impact of this SAMA, the PSA models were reanalyzed with the DC dependency for HPCI completely removed.

PSA Model Results

The results from this case indicates about a 1% reduction in Unit 2 CDF (CDF_{new}=1.0396E-6). The new end state frequencies are presented in Table V-32. For Unit 3 there is a 2.1% reduction in CDF (CDF_{new}=1.8579E-6) and the new end state frequencies are presented in Table V-33.

Table V-34. Unit 2 SAMA Number 20 Results

MAAP Case	Baseline Case	SAMA 20 Case
PIHDEP	3.65E-07	3.70E-07
PIHDEPV	2.52E-07	2.48E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	1.42E-09
PID	2.88E-08	2.13E-08
NIH	2.95E-08	2.88E-08
Person-rem	3.03	3.03
Unit 2 Total Cost (3%)	$299,986	$299,709
Unit 2 Total Cost (7%)	$207,731	$207,601
SAMA 20 Saving (3%)	$277	
SAMA 20 Saving (7%)	$130	

Table V-35. Unit 3 SAMA Number 20 Results

MAAP Case	Baseline Case	SAMA 20 Case
PIHDEP	8.59E-07	8.66E-07
PIHDEPV	4.20E-07	3.84E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.93E-08
PID	9.67E-09	2.46E-09
NIH	3.75E-09	2.96E-09
Person-rem	6.28	6.20
Unit 3 Total Cost (3%)	$609,146	$600,209
Unit 3 Total Cost (7%)	$423,366	$417,232
SAMA 20 Saving (3%)	$8,937	
SAMA 20 Saving (7%)	$6,134	

V. Phase II SAMA Number 21: Use of CRD for Alternate Boron Injection

The intent of this SAMA is to provide a second means of injecting a boron solution into the vessel in the event of an ATWS and failure of the SLC System.

The potential benefit of this SAMA was bounded by crediting operation of the CRD hydraulic system as a redundant backup to the SLC system. This was accomplished by modifying the split fraction logic rules that select the value used for top event NCD in the event tree TRANCDBIN. The top event NCD determines whether a sequence involves core damage or is successfully mitigated.

Three assumptions were made:

1. It was assumed that success of top event OSLC (the operator actions associated with initiating the SLC system) was necessary for success of the CRD system in delivering the boron solution to the reactor. Actions by the operator are assumed to be necessary to initiate boron injection via the CRD system. This assumption completely couples those actions with the actions associated with initiating the SLC system. The implication of this assumption is that the CRD system would provide redundancy for hardware failures of the SLC system.

2. It was assumed that any additional operator actions associated with initiating the CRD are represented by top event OSLC.

3. It was also assumed that any additional failure modes of the CRD system over those analyzed in the base case PSA were not significant contributors to CRD system unavailability in its postulated function of delivering boron solution to the reactor.

PSA Model Results

The results from this case indicates about a 1.5% reduction in Unit 2 CDF (CDF_{new}=1.0336E-6). The new end state frequencies are presented in Table V-34. For Unit 3 there is a 0.9% reduction in CDF (CDF_{new}=1.8811E-6) and the new end state frequencies are presented in Table V-35.

Table V-36. Unit 2 SAMA Number 21 Results

MAAP Case	Baseline Case	SAMA 21 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	5.77E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	2.94
Unit 2 Total Cost (3%)	$299,986	$292,089
Unit 2 Total Cost (7%)	$207,731	$202,187
SAMA 21 Saving (3%)	$7,897	
SAMA 21 Saving (7%)	$5,544	

Table V-37. Unit 3 SAMA Number 21 Results

MAAP Case	Baseline Case	SAMA 21 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.36E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	6.19
Unit 3 Total Cost (3%)	$609,146	$601,425
Unit 3 Total Cost (7%)	$423,366	$417,948
SAMA 21 Saving (3%)	$7,721	
SAMA 21 Saving (7%)	$5,428	

W. Phase II SAMA Number 22: Borate Torus Water

The intent of this SAMA is to provide additional reactivity control by replacing the water in the torus with borated water.

No specialized model was created to provide a bounding assessment of the potential impact of this SAMA. The base case PSA models map all ATWS core damage sequences to a single endstate: ENMKCTT. To bound the potential impact of this SAMA, the frequency of this endstate was set to zero. This has the same effect as assuming that all ATWS scenarios are successfully mitigated.

This analysis does not consider any detrimental effects on plant availability and associated costs that would result with the introduction of borated water into the vessel not in response to an ATWS.

PSA Model Results

The results from this case indicates about a 7.0% reduction in Unit 2 CDF (CDF_{new}=9.7584E-7). The new end state frequencies are presented in Table V-36. For Unit 3 there is a 8.0% reduction in CDF (CDF_{new}=1.7457E-6) and the new end state frequencies are presented in Table V-37.

Table V-38. Unit 2 SAMA Number 22 Results

MAAP Case	Baseline Case	SAMA 22 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	0.00E-00	0.00E+00
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	2.62
Unit 2 Total Cost (3%)	$299,986	$263,961
Unit 2 Total Cost (7%)	$207,731	$182,440
SAMA 22 Saving (3%)	$36,025	
SAMA 22 Saving (7%)	$25,291	

Table V-39. Unit 3 SAMA Number 22 Results

MAAP Case	Baseline Case	SAMA 22 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	7.75E-10
ENMKCTT	0.00E+00	0.00E+00
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	5.44
Unit 3 Total Cost (3%)	$609,146	$535,250
Unit 3 Total Cost (7%)	$423,366	$371,488
SAMA 22 Saving (3%)	$73,896	
SAMA 22 Saving (7%)	$51,878	

X. Phase II SAMA Number 23: Automate Torus Cooling

The purpose of this SAMA is to eliminate the possibility of failing to initiate torus cooling because of operator error.

To represent the potential impact of this SAMA, the operator action associated with the initiation of torus cooling was set to "guaranteed success."

This change was implemented in the low pressure transient event tree (LPGTET), the large LOCA event tree (LLOCA) and the medium LOCA event tree (MLOCA) by setting the value (failure probability) of top event OSP (operator initiates torus cooling) to 0.

The model adopted assumes that the contribution to failure of any necessary sensors, monitors or other actuation devices does not significantly contribute to the likelihood of actuation failure.

PSA Model Results

The results from this case indicates about a 6.4% reduction in Unit 2 CDF (CDF_{new}=9.8217E-7). The new end state frequencies are presented in Table V-38. For Unit 3 there is a 9.0% reduction in CDF (CDF_{new}=1.7264E-6) and the new end state frequencies are presented in Table V-39.

Table V-40. Unit 2 SAMA Number 23 Results

MAAP Case	Baseline Case	SAMA 23 Case
PIHDEP	3.65E-07	3.51E-07
PIHDEPV	2.52E-07	1.99E-07
PIHDLV	7.75E-10	7.70E-10
ENMKCTT	7.39E-08	7.42E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	2.76E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.94E-08
Person-rem	3.03	2.82
Unit 2 Total Cost (3%)	$299,986	$279,786
Unit 2 Total Cost (7%)	$207,731	$193,723
SAMA 23 Saving (3%)	$20,200	
SAMA 23 Saving (7%)	$14,008	

Table V-41. Unit 3 SAMA Number 23 Results

MAAP Case	Baseline Case	SAMA 23 Case
PIHDEP	8.59E-07	7.86E-07
PIHDEPV	4.20E-07	3.33E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.48E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.54E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.68E-09
Person-rem	6.28	5.73
Unit 3 Total Cost (3%)	$609,146	$555,650
Unit 3 Total Cost (7%)	$423,366	$386,214
SAMA 23 Saving (3%)	$53,496	
SAMA 23 Saving (7%)	$37,152	

Y. Phase II SAMA Number 24: Containment Overpressure Protection

This Phase II SAMA represents the potential impact of two specific Phase I SAMAs: 117a (Provide Torus Positive Pressure Relief Valves); and, 117b (Reduce Drywell Head Bolt Pretension).

Without the consideration of additional recovery actions, this SAMA would not alter the calculated core damage frequency, but instead changes the core damage endstate for selected sequences. The current models only consider a limited number of plant damage endstates. The only "containment failed late" endstate is "PLF." All sequences mapped to PLF were instead mapped to success; thus, bounding the potential benefit of the SAMA.

PSA Model Results

As analyzed, results from this case indicates negligible (less than 0.4%) change in the calculated Unit 2 CDF (CDF_{new} = 1.0460-06). The new end state frequencies are presented in Table V-40. For Unit 3 there is also a negligible (less than 1.1%) change in the calculated CDF (CDF_{new} = 1.8766-06) and the new end state frequencies are presented in Table V-41.

Table V-42. Unit 2 SAMA Number 24 Results

MAAP Case	Baseline Case	SAMA 24 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	0
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	3.03
Unit 2 Total Cost (3%)	$299,986	$299,775
Unit 2 Total Cost (7%)	$207,731	$207,605
SAMA 24 Saving (3%)	$211	
SAMA 24 Saving (7%)	$126	

Table V-43. Unit 3 SAMA Number 24 Results

MAAP Case	Baseline Case	SAMA 24 Case
PIHDEP	8.59E-07	8.59E-7
PIHDEPV	4.20E-07	4.20E-7
PIHDLV	0.00+00	0.00+00
ENMKCTT	1.52E-07	1.52E-7
OIA	1.60E-07	1.60E-7
OIALF	1.11E-08	1.11E-8
MIALF	1.32E-07	1.32E-7
PJHNSP	1.28E-07	1.28E-7
PLF	2.11E-08	0.00E-0
PID	9.67E-09	9.67E-9
NIH	3.75E-09	3.75E-9
Person-rem	6.28	6.27
Unit 3 Total Cost (3%)	$609,146	$607,672
Unit 3 Total Cost (7%)	$423,366	$422,449
SAMA 24 Saving (3%)	$1,474	
SAMA 24 Saving (7%)	$917	

Z. Phase II SAMA Number 25: Automate SLC Initiation

This SAMA would eliminate the failure of the SLC system to inject boron solution to the vessel due to operator error.

To represent the potential impact of this SAMA, the operator action associated with the initiation of the SLC system was set to "guaranteed success."

This change was implemented in the high pressure transient event tree (HPGTET) by setting the value (failure probability) of top event OSLC (operator initiates SLC injection) to 0.

The model adopted assumes that the contribution to failure of any necessary sensors, monitors or other actuation devices does not significantly contribute to the likelihood of actuation failure.

PSA Model Results

The results from this case indicates about a 2.3% reduction in Unit 2 CDF (CDF_{new}=1.0258E-6). The new end state frequencies are presented in Table V-42. For Unit 3 there is a 1.2% reduction in CDF (CDF_{new}=1.8746E-6) and the new end state frequencies are presented in Table V-43.

Table V-44. Unit 2 SAMA Number 25 Results

MAAP Case	Baseline Case	SAMA 25 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	5.00E-08
OIA	6.90E-08	6.90E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	2.89
Unit 2 Total Cost (3%)	$299,986	$288,300
Unit 2 Total Cost (7%)	$207,731	$199,527
SAMA 25 Saving (3%)	$11,686	
SAMA 25 Saving (7%)	$8,204	

Table V-45. Unit 3 SAMA Number 25 Results

MAAP Case	Baseline Case	SAMA 25 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.30E-07
OIA	1.60E-07	1.60E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	6.16
Unit 3 Total Cost (3%)	$609,146	$598,263
Unit 3 Total Cost (7%)	$423,366	$415,729
SAMA 25 Saving (3%)	$10,883	
SAMA 25 Saving (7%)	$7,637	

AA. Phase II SAMA Number 26: Decrease Frequency of Excessive LOCA

This Phase II SAMA addressed Phase I SAMA 122a (Increase the Inspection Frequency of the Reactor Vessel).

To bound the potential impact of this SAMA, the models were reanalyzed with the initiating event frequency of "Excessive LOCA" set to 0.

PSA Model Results

The results from this case indicates about a 0.9% reduction in Unit 2 CDF (CDF_{new}=1.0404E-6). The new end state frequencies are presented in Table V-44. For Unit 3 there is about a 0.5% reduction in CDF (CDF_{new}=1.8872E-6) and the new end state frequencies are presented in Table V-45.

Table V-46. Unit 2 SAMA Number 26 Results

MAAP Case	Baseline Case	SAMA 26 Case
PIHDEP	3.65E-07	3.65E-07
PIHDEPV	2.52E-07	2.52E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	5.96E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.07E-09
PID	2.88E-08	2.88E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	3.00
Unit 2 Total Cost (3%)	$299,986	$297,089
Unit 2 Total Cost (7%)	$207,731	$205,720
SAMA 26 Saving (3%)	$2,897	
SAMA 26 Saving (7%)	$2,011	

Table V-47. Unit 3 SAMA Number 26 Results

MAAP Case	Baseline Case	SAMA 26 Case
PIHDEP	8.59E-07	8.59E-07
PIHDEPV	4.20E-07	4.20E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.52E-07
OIA	1.60E-07	1.51E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	2.11E-08
PID	9.67E-09	9.67E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	6.25
Unit 3 Total Cost (3%)	$609,146	$606,075
Unit 3 Total Cost (7%)	$423,366	$421,236
SAMA 26 Saving (3%)	$3,071	
SAMA 26 Saving (7%)	$2,130	

BB. Phase II SAMA Number 27: Provide an Independent Torus Cooling System

This SAMA would mitigate the failure of torus cooling due to hardware failures.

The base case models already include consideration of the possibility of recovery of torus cooling, if failure was due to hardware unavailability. To bound the potential impact of this SAMA, the top event in the low pressure transient event tree (LPGTET), the large LOCA event tree (LLOCA) and the medium LOCA event tree (MLOCA) which represents recovery of suppression pool cooling (top SPR) was set to 'guaranteed success".

The results of the reanalysis with SPR set to guaranteed success are shown below in Tables V-46 and V-47.

PSA Model Results

The results from this case indicates a 2.9% reduction in Unit 2 CDF (CDF_{new} = 1.0196-06). The new end state frequencies are presented in Table V-46. For Unit 3 there is about a 16.0% reduction in CDF (CDF_{new} = 1.5929-06) and the new end state frequencies are presented in Table V-47.

Table V-48. Unit 2 SAMA Number 27 Results

MAAP Case	Baseline Case	SAMA 27 Case
PIHDEP	3.65E-07	3.49E-07
PIHDEPV	2.52E-07	2.49E-07
PIHDLV	7.75E-10	7.36E-10
ENMKCTT	7.39E-08	7.40E-08
OIA	6.90E-08	5.92E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.37E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	1.44E-09
PID	2.88E-08	2.87E-08
NIH	2.95E-08	2.96E-08
Person-rem	3.03	2.93
Unit 2 Total Cost (3%)	$299,986	$290,682
Unit 2 Total Cost (7%)	$207,731	$201,272
SAMA 27 Saving (3%)	$9,304	
SAMA 27 Saving (7%)	$6,459	

Table V-49. Unit 3 SAMA Number 27 Results

MAAP Case	Baseline Case	SAMA 27 Case
PIHDEP	8.59E-07	6.22E-07
PIHDEPV	4.20E-07	3.77E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.59E-07
OIA	1.60E-07	1.49E-07
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.23E-09
PID	9.67E-09	9.66E-09
NIH	3.75E-09	3.75E-09
Person-rem	6.28	5.30
Unit 3 Total Cost (3%)	$609,146	$513,069
Unit 3 Total Cost (7%)	$423,366	$356,625
SAMA 27 Saving (3%)	$96,077	
SAMA 27 Saving (7%)	$66,741	

CC. Phase II SAMA Number 28: Improve 4-kV Crosstie Capability

This SAMA seeks to improve the ability to crosstie emergency boards from Units 1 and 2 to Unit 3. This would be accomplished using the shutdown busses. Likewise, the ability to crosstie Unit 3 boards to support Unit 2 was considered. It is noted that the base case model already includes limited support of Unit 2 emergency busses from Unit 3.

To bound the potential impact of this SAMA, individual split fraction rules and macro-logic associated with AC power support of RHR, Core Spray, and long term operation of HPCI and RCIC were modified. It was assumed that any Unit 3 diesel could feed any Unit 1 or 2 4-kV shutdown board, and that any Units 1 or 2 diesel could feed any Unit 3 4-kV shutdown board. It was further assumed that any necessary operator actions to accomplish required breaker manipulations would be done without fail and that breaker and bus failures would not significantly contribute to failure.

PSA Model Results

The results from this case indicates about a 4.2% reduction in Unit 2 CDF (CDF_{new}=1.0053E-6). The new end state frequencies are presented in Table V-48. For Unit 3 there is a 29.3% reduction in CDF (CDF_{new}=1.3417E-6) and the new end state frequencies are presented in Table V-49.

Table V-50. Unit 2 SAMA Number 28 Results

MAAP Case	Baseline Case	SAMA 28 Case
PIHDEP	3.65E-07	3.09E-07
PIHDEPV	2.52E-07	2.33E-07
PIHDLV	7.75E-10	7.75E-10
ENMKCTT	7.39E-08	7.39E-08
OIA	6.90E-08	9.95E-08
OIALF	2.93E-08	2.93E-08
MIALF	1.36E-07	1.36E-07
PJHNSP	6.14E-08	6.14E-08
PLF	4.07E-09	4.82E-09
PID	2.88E-08	2.83E-08
NIH	2.95E-08	2.95E-08
Person-rem	3.03	2.86
Unit 2 Total Cost (3%)	$299,986	$284,458
Unit 2 Total Cost (7%)	$207,731	$196,914
SAMA 28 Saving (3%)	$15,528	
SAMA 28 Saving (7%)	$10,817	

Table V-51. Unit 3 SAMA Number 28 Results

MAAP Case	Baseline Case	SAMA 28 Case
PIHDEP	8.59E-07	5.35E-07
PIHDEPV	4.20E-07	2.55E-07
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.51E-07
OIA	1.60E-07	9.80E-08
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.32E-07
PJHNSP	1.28E-07	1.28E-07
PLF	2.11E-08	1.92E-08
PID	9.67E-09	8.43E-09
NIH	3.75E-09	3.67E-09
Person-rem	6.28	4.44
Unit 3 Total Cost (3%)	$609,146	$428,814
Unit 3 Total Cost (7%)	$423,366	$297,993
SAMA 28 Saving (3%)	$180,332	
SAMA 28 Saving (7%)	$125,373	

DD. Phase II SAMA Number 29: Provide High Pressure Diesel-Driven Pump

This SAMA would provide an additional means of mitigating a station blackout event by allowing river water to be injected into the vessel via a high pressure, diesel-driven pump.

To bound the potential impact of this SAMA, a variant of the model developed to consider Phase II SAMA 12 was used. To estimate the effect of an independent diesel driven high pressure injection source, two changes were made to the base case models. First a new logic rule was added to the TRANCDBIN event tree for top event NCD. Top event NCD determines whether a sequence is assigned to a core damage state or represents successful mitigation of the event. This new "success" rule states that if RPS is successful and if HPCI and operator control are successful, then core damage is averted. Next, the split fractions, including the one representing "guaranteed failure" of short term HPCI operation were modified. It was estimated that the unavailability of a diesel driven injection system, including start, 24-hour operation and maintenance would be on the order of 0.1. Therefore the HPCI split fractions were reduced by one order of magnitude.

PSA Model Results

The results from this case indicates about a 74.1% reduction in Unit 2 CDF (CDF_{new}=2.7173E-7). The new end state frequencies are presented in Table V-50. For Unit 3 there is a 82% reduction in CDF (CDF_{new}=3.4154E-7) and the new end state frequencies are presented in Table V-51.

Table V-52. Unit 2 SAMA Number 29 Results

MAAP Case	Baseline Case	SAMA 29 Case
PIHDEP	3.65E-07	0.00E+00
PIHDEPV	2.52E-07	5.69E-08
PIHDLV	7.75E-10	7.71E-10
ENMKCTT	7.39E-08	7.41E-08
OIA	6.90E-08	1.24E-08
OIALF	2.93E-08	2.82E-08
MIALF	1.36E-07	1.41E-08
PJHNSP	6.14E-08	6.09E-08
PLF	4.07E-09	1.75E-10
PID	2.88E-08	2.67E-09
NIH	2.95E-08	2.15E-08
Person-rem	3.03	0.92
Unit 2 Total Cost (3%)	$299,986	$86,794
Unit 2 Total Cost (7%)	$207,731	$60,314
SAMA 29 Saving (3%)	$213,192	
SAMA 29 Saving (7%)	$147,417	

Table V-53. Unit 3 SAMA Number 29 Results

MAAP Case	Baseline Case	SAMA 29 Case
PIHDEP	8.59E-07	0.00E+00
PIHDEPV	4.20E-07	5.13E-08
PIHDLV	0.00+00	0.00E+00
ENMKCTT	1.52E-07	1.56E-07
OIA	1.60E-07	1.83E-08
OIALF	1.11E-08	1.11E-08
MIALF	1.32E-07	1.38E-08
PJHNSP	1.28E-07	8.74E-08
PLF	2.11E-08	1.35E-09
PID	9.67E-09	7.40E-10
NIH	3.75E-09	1.79E-09
Person-rem	6.28	1.48
Unit 3 Total Cost (3%)	$609,146	$134,133
Unit 3 Total Cost (7%)	$423,366	$93,730
SAMA 29 Saving (3%)	$475,013	
SAMA 29 Saving (7%)	$329,636	

EE. Verification of the Model

Two RISKMAN® models were received from BFN for use in the SAMA analysis. Model U2011701 represents the base case for the operation of Unit 2 while model U3011701 represents the base case for the operation of Unit 3.

Because multiple computers were used to perform the required analyses, it was first necessary to verify that these computers would reproduce the results of the base cases. For each computer used in the SAMA analysis, models U2011701 and U3011701 were reanalyzed and the results compared to the original base case results. In all cases, the base case results were reproduced exactly.

FF. Reassignment of Core Damage Scenario End States

Models U2011701 and U3011701 characterized core damage scenarios as either 'LERF' or 'NLERF'. These characterizations are referred to as "end states". LERF scenarios are those core damage sequences that result in a "large early release" of radioactive material. The sum of the frequencies of these scenarios is the "large early release frequency." In a similar manner, core damage scenarios that do not involve a "large early release" were assigned to the 'NLERF' (no 'LERF') end state.

The LERF and NLERF end states do not sufficiently differentiate the core damage sequences to enable linkage to the conditional offsite consequence analyses. The offsite consequence analyses, and supporting MAAP analyses, utilized the end state definitions developed for the BFN Unit 2 IPE. It was therefore necessary to reassign the core damage scenarios used in the base case models to the set of end states consistent with the Level 2 (MAAP) and Level 3 (MACCS2) analyses.

The base case models with the IPE endstate binning were named U2PDSB and U3PDSB corresponding to Unit 2 and Unit 3, respectively.

Since only the assignments of end states were changed, the total calculated core damage frequency for either unit did not change.

GG. Investigation of the Impact of "Truncation Frequency" Chosen

Since the models are so large and take a significant amount of time to run, an analysis was performed to verify that the "truncation frequency" used in the U2011701 and U3011701 models would yield reasonable results. To accomplish this, several computer runs were completed. These runs included a baseline run for each unit with additional computer runs for both units with the resolved sequence frequencies truncated at 1E-13, 1E-14, and 1E-15. For Unit 2 an additional run was completed with the frequency truncated at 1E-16. The results of these runs are presented in Figures V-2 and V-3.

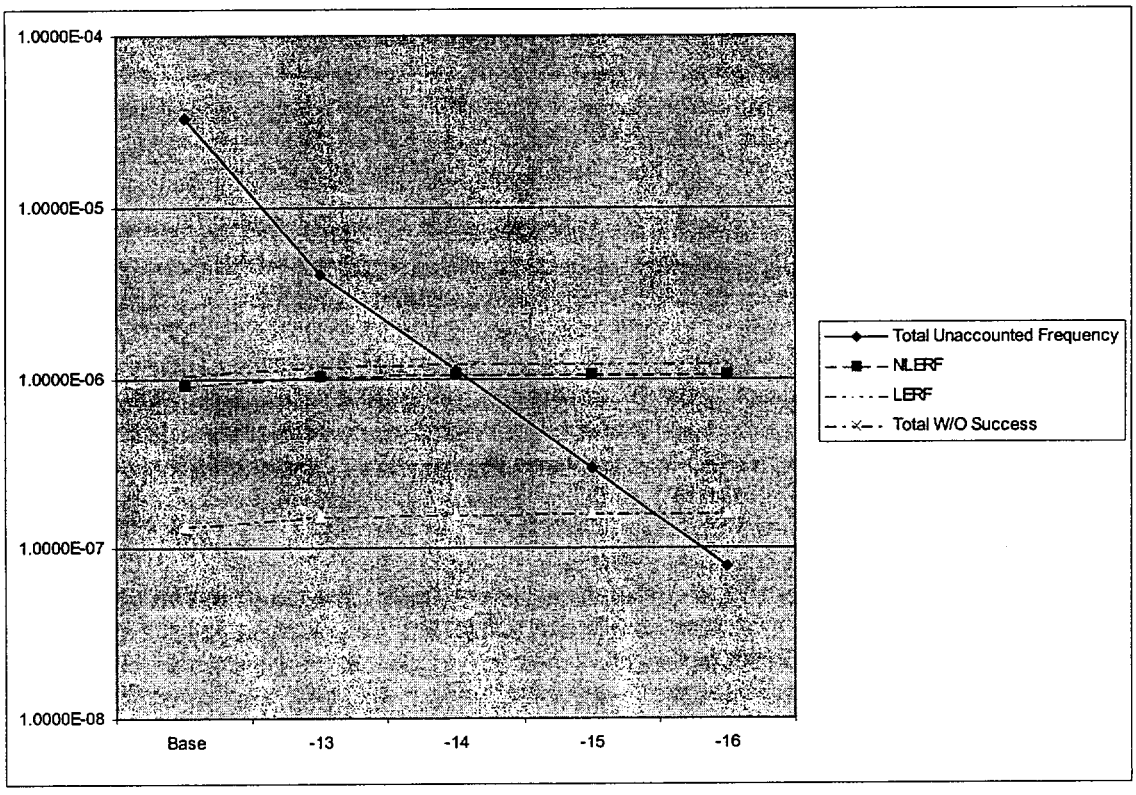

Figure V-2. Results of the Truncation Frequency Verification for Unit 2

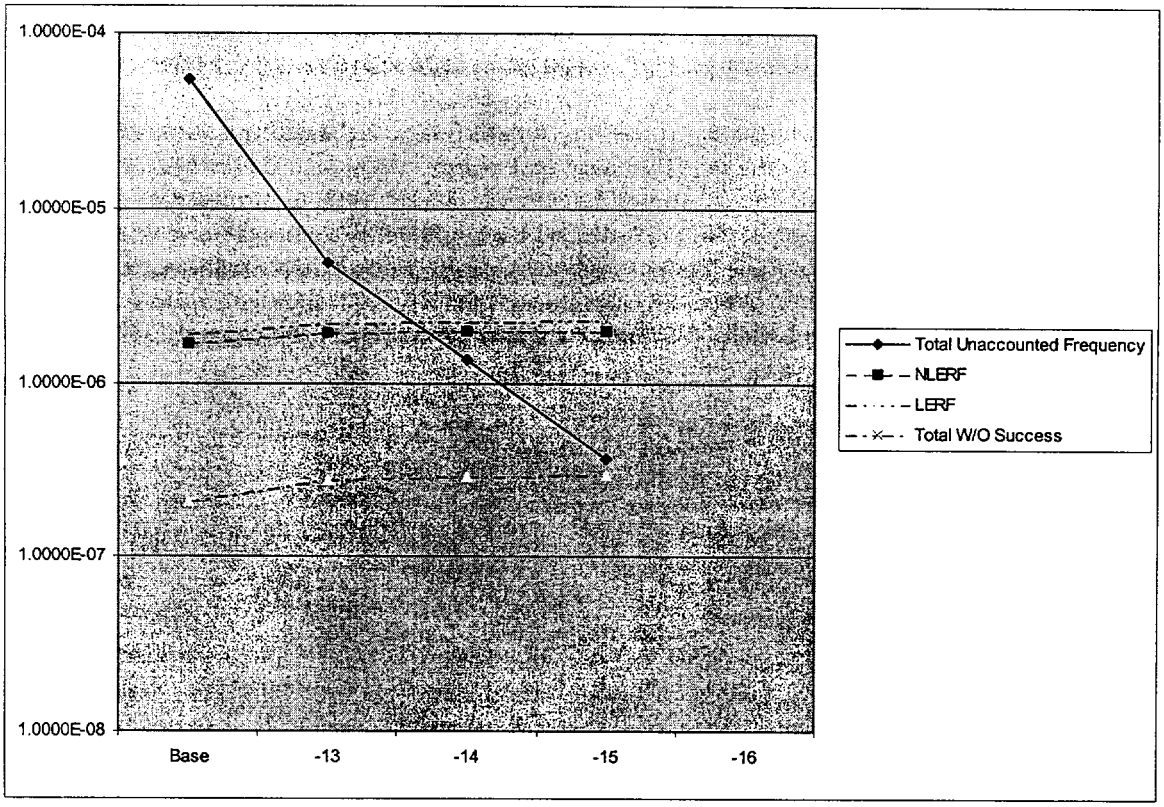

Figure V-3. Results of the Truncation Frequency Verification for Unit 3

As can be seen in Figures V-2 and V-3, there is very little change of the values for LERF and NLERF at truncation frequencies below 1E-13. Based on these results the SAMA computer runs were truncated at 1E-13.

HH. Extrapolation to Operation of All Three Units Operating at EPV Power Level

Browns Ferry Nuclear plant is comprised of three individual units that share certain systems and buildings. In the consideration of the cost/benefit measures of potential SAMAs, therefore, it is important to consider how multiple unit events may impact the evaluation.

As discussed in the BFN Multi Unit PRA, selected initiators, have the potential to result in core damage in both Unit 2 and Unit 3. SBO is an example of a class of scenarios

with this potential. The cost of such scenarios, in the unlikely event that they were to occur, would likely be equal to or less than the cost associated with two independent core damage events. It is therefore concluded that considering post accident costs as the sum of Unit 2 and Unit 3 costs unit basis is appropriate and conservative for such initiators.

Implementation costs are considered on a per plant basis for specific SAMAs. One example would be replacement of the station batteries. The cost/benefits comparison for these specific SAMAs are then made on a plant basis.

Up to this point the detailed evaluations of the individual SAMAs have utilized the PSAs that are current and available. These PSAs address the operation of Units 2 and 3 operating at 105% of their original licensed power level. Both PSAs assume that Unit 1 is in extended layup and not operating.

The analysis now addresses how the conclusions of the SAMA cost/benefit analysis are potentially impacted if operation of all three units under EPUP conditions is considered.

The operation of unit 1 would increase the calculated core damage frequency of Units 2 and 3. The units share certain equipment (e.g., diesel generators, RHR Service Water and Emergency Equipment Cooling Water) resulting, in selected scenarios, in decreased availability of equipment to a particular unit. Success criteria for selected systems are also impacted.

The Multiple Unit PSA (reference 18) performed in 1995 provides some insight into the potential affect of multiple unit operation. That study provides a basis for the comparison of the core damage frequency of Unit 2 with both other units operating with the IPE results. The IPE assumed that only Unit 2 was operational. The observation is made in the Multiple Unit PSA that the mean core damage frequency of Unit 2 is a factor of 4 greater with all three units operating compared to only Unit 2 operating. For the purpose of the SAMA screening analysis, it is assumed that the baseline core damage frequencies for Unit 1 and Unit 2 are equal with a mean value 4 times the currently calculated Unit 2 core damage frequency mean. This is felt to be a conservative assumption.

Because Unit 1 is more closely associated with Unit 2 than it is with Unit 3, it is expected that the return to service will have a larger impact on Unit 2 that it will on Unit 3. Units 1 and 2 share the electrical system in a more intimate manner than do Units 1 and 3. In addition, RHR System interunit cross connections are possible between Units 1 and 2, as well as Units 2 and 3, but not directly between Units 1 and 3. It is assumed that the maximum impact on the calculated core damage frequency of Unit 3 will be a factor of 2 over the currently calculated value.

If we further assume that the potential economic savings of the individual SAMAs scale by the same factor as the baseline PSA core damage frequency results, then the preceding analyses can be revisited to identify individual SAMAs that warrant further attention. This assumption is felt to be conservative since ATWS scenarios (which have relatively severe offsite impacts) would be "increased" in frequency in the scaled model but, in fact, not appreciably increased in frequency due to the restart of Unit 1.

II. Uncertainty

An important consideration in any PSA involves the evaluation of uncertainty and its potential impact on the information provided to support management decisions. The uncertainty in the total core damage frequency was calculated for both base case models. The results are shown in Table V-52.

Table V-54. Core Damage Uncertainty

	Unit 2	Unit 3
Mean value	1.0498E-6	1.9866E-6
5th percentile	2.4458E-7	3.1794E-7
50th percentile	7.2170E-7	1.1919E-6
95th percentile	2.8152E-6	5.6597E-6

Note that the ratio of the 95th percentile to the mean is 2.7 and 2.8 for Units 2 and 3, respectively. The values in Table V-52 reflect the uncertainty in the data distributions used in the analysis. Each of the Phase II SAMA evaluations were reviewed to determine if a factor of 3 would alter the decision to screen any of them

VI. SAMA Analysis Results

A. SAMA Analysis Results for BFNP

A summary comparison of estimate costs and costs averted is shown in Table VI-1 for the Phase II SAMAs.

It should be noted that additional engineering analyses is warranted to further consider those SAMAs identified as cost effective via this analysis. The analysis documented here is bounding in nature. In addition, as noted in the text, potential negative impacts associated with the SAMAs were not considered.

B. SAMA Analysis Results from Previous Submittals

A review of previously approved and submitted SAMA analyses was performed to determine the potential scope of changes that would reasonably be expected to be applicable to this analysis. The following paragraphs are quoted from the conclusion of each referenced SAMA analysis.

Calvert Cliffs (approved) – "BGE identified and committed to pursue one enhancement in accordance with the CCNPP modification process. This involves the installation of a watertight door between the service water pump room and the adjacent fan room to reduce the likelihood of core damage from internal flooding events. BGE also committed to further evaluate the adequacy of CCNPP procedures regarding response to internal floods following resolution of the hardware flooding enhancement. BGE concluded that no additional mitigation alternatives are cost-beneficial and warrant implementation at CCNPP."

Oconee (approved) – "Because the environmental impacts of potential severe accidents are of small significance and because additional measures to reduce such impacts would not be justified from a public risk perspective, Duke concludes that no additional severe accident mitigation alternative measures beyond those already implemented during the current term license would be warranted for Oconee."

Hatch (in review by the USNRC) – "None of the SAMAs analyzed would be being[sic] justified on a cost-benefit basis."

Arkansas Nuclear One Unit 1 (approved by the USNRC) – "As a result of this reassessment, the "marginally" cost-beneficial SAMA 129 became more cost-beneficial. All other SAMA candidates retained negative net values. SAMA 129 involves improvements in training and awareness associated with operator actions required to swapover from the injection phase to low-pressure recirculation during a large LOCA. This SAMA does not relate to adequately managing the effects of aging during the period of extended operation and based on further information provided by Entergy, appears to be adequately addressed within the current operations training cycle. Therefore, no further action is necessary as part of license renewal pursuant to 10 CFR Part 54."

Table VI-1. Evaluation of Phase II SAMAs

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Estimated Cost (2016)	Maximum Cost Avoidance (Base Case)	Screening Cost Avoidance for Impact of Uncertainty	Screening Cost Avoidance for Impact of Three-Unit Operation	Screening Cost Avoidance for Impact of both Uncertainty and Three-Unit Operation	Cost Effective?
1	7	Increase CRD pump lube oil capacity.	N/A	N/A	N/A	N/A	N/A	N
2	12	Replace ECCS pump motor with air-cooled motors.	$9.3M/unit	$76k/unit	$228k/unit	$256k/plant	$768k/unit	N
3	17	Implement procedures to stagger CRD pump use after a loss of service water.	$78k/unit	N/A	N/A	N/A	N/A	N
4	19	Procedural guidance for use of cross-tied component cooling or service water pumps.	$78k/unit	$8k/unit	$24k/unit	$17k/unit	$51k/unit	N
5	20	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	$78k/unit	$1k/unit	$3k/unit	$3k/unit	$9k/unit	N
6	21	Improved ability to cool the residual heat removal heat exchangers	$1.5M/unit	$58k/unit	$174k/unit	$115k/unit	$347k/unit	N
7	23	Provide a redundant train of ventilation.	$9.3M/unit	$75k/unit	$225k/unit	$256k/unit	$770k/unit	N
8	25	Add a diesel building switchgear room high temperature alarm.	Option 1: $623k per building Option 2: $9.3M per building	$0.2k/unit	$0.6/unit	$0.4/unit	$1k/unit	N
9	34	Install a containment vent large enough to remove ATWS decay heat.	$3.1M/unit	$38k/unit	$114k/unit	$77k/unit	$231k/unit	N

Table VI-2. Evaluation of Phase II SAMAs

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Estimated Cost (2016)	Maximum Cost Avoidance (Base Case)	Screening Cost Avoidance for Impact of Uncertainty	Screening Cost Avoidance for Impact of Three-Unit Operation	Screening Cost Avoidance for Impact of both Uncertainty and Three-Unit Operation	Cost Effective?
10	46	Use the fire protection system as a back-up source for the containment spray system.	$779k/unit	N/A	N/A	N/A	N/A	N
11	48	Install a passive containment spray system.	$9.3M/unit	N/A	N/A	N/A	N/A	N
12	57	Provide additional DC battery capacity.	$1.5M/plant	$474k/plant	$1.4M/plant	$1.9M/plant	$5.6M/plant	*Y(1)
	58	Use fuel cells instead of lead-acid batteries.	$9.3M/plant					N
	62	Increase/improve DC bus load shedding.	$78k/plant					Y
13	61	Incorporate an alternate battery charging capability.	1.5M/unit	$27k/unit	$81k/unit	$106k/unit	$318k/unit	N
	63	Replace existing batteries with more reliable ones.	$9.3M/plant	aa				N
14	66	Develop procedures to repair or replace failed 4 kV breakers.	$78k/unit	N/A	N/A	N/A	N/A	N
15	73	Use Fire Protection System as a back-up source for diesel cooling.	$1.5M/plant	$157k/plant	$471k/plant	$713k/plant	$2.1M/plant	*Y(2)

** Note:* *Y(1) Potentially cost-beneficial for three-unit operation.*
Y(2) Potentially cost-beneficial for three-unit operation when uncertainty is considered.

Table VI-3. Evaluation of Phase II SAMAs

Phase II SAMA ID No.	Phase I SAMA ID No.	SAMA Title	Estimated Cost (2016)	Maximum Cost Avoidance (Base Case)	Screening Cost Avoidance for Impact of Uncertainty	Screening Cost Avoidance for Impact of Three-Unit Operation	Screening Cost Avoidance for Impact of both Uncertainty and Three-Unit Operation	Cost Effective?
17	98	Improve inspection of rubber expansion joints on main condenser.	$155k/unit	$3k/unit	$9k/unit	6.4k/unit	$19k/unit	N
18	108	Procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	$78k/unit	$23k/unit	$69k/unit	$45k/unit	$136k/unit	*Y(2)
19	110	Increase the SRV reseat reliability.	$1.09M/unit	$22k/unit	$66k/unit	$75k/unit	$226k/unit	N
20	111	Reduce DC dependency between high pressure injection system and ADS.	$779k/unit	$9k/unit	$27k/unit	$18k/unit	$54k/unit	N
21	113	Use of CRD for alternate boron injection.	$3.1M/unit	$8k/unit	$24k/unit	$32k/unit	$95k/unit	N
22	116	borate torus water	$9.3M/unit	$74k/unit	$222k/unit	$148k/unit	$443k/unit	N
23	117	automate torus cooling	$623k/unit	$53k/unit	$159k/unit	$107k/unit	$321k/unit	N
24	117a	provide torus positive pressure relief valves	$1.09M/unit	$1k/unit	$3k/unit	$3k/unit	$9k/unit	N
	117b	reduce DW head bolt pretension	$78k/unit					N
25	121	automate SLC initiation	$623k/unit	$12k/unit	$36k/unit	$46k/unit	$140k/unit	N
26	122a	RPV inspection	$155k/unit	$3k/unit	$9k/unit	$12k/unit	$35k/unit	N
27	124	provide independent torus cooling system	$9.3M/unit	$96k/unit	$288k/unit	$192k/unit	$576k/unit	N
28	132	Improve 4kV crosstie capability	$7.8M/plant	$196k/plant	$588k/plant	$484k/plant	$1.4M/plant	N
29	133	provide HP diesel-driven pump.	$9.3M/unit	$475k/unit	$1.4M/unit	$950k/unit	$2.9M/unit	N

* *Note: Y(1) Potentially cost-beneficial for three-unit operation.*
Y(2) Potentially cost-beneficial for three-unit operation when unit uncertainty is considered.

VII. References

1. Reserved.

2. Browns Ferry Nuclear Plant Probabilistic Safety Assessment, Unit 2 Summary Report, R0.

3. Browns Ferry Nuclear Plant Probabilistic Safety Assessment, Unit 3 Summary Report, R0.

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5. Letter from TVA to the USNRC, Browns Ferry Nuclear Plant (BFN) – Units 1, 2, and 3 – Final Response to Request for Additional Information Regarding Browns Ferry Nuclear Plant Individual Plant Examination for External Events (IPEEE) (TAC Nos. M83595, M83596, M83597). RIMS R08 990129 770.

6. Letter from the USNRC to TVA, Browns Ferry Units 1, 2, and 3, Individual Plant Examination of External Events (IPEEE) and Related Generic Safety Issues. Issuance of Staff Evaluation (TAC Nos. M83595, M83596, M83597). 6/22/2000.

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8. Edwin I. Hatch Nuclear Plant, Application for License Renewal, Environmental Report, Appendix D, Attachment F. February 2000.

9. TVA calculation CN-BFN-MEB-MDN0-999-2001-0011, R0.

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12. Browns Ferry Nuclear Plant, Unit 2 Probabilistic Risk Assessment Individual Plant Examination, September 1992.

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14. Letter from TVA to USNRC, RO8 970411 803.

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18. PLG, "Browns Ferry Multi-Unit Probabilistic Risk Assessment," prepared for Tennessee Valley Authority, PLG-1045, January 1995.

APPENDIX B

AGENCY CORRESPONDENCE

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499
February 16, 2001

Dear

INTERGOVERNMENTAL REVIEW - TENNESSEE VALLEY AUTHORITY - PREPARATION OF SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR RENEWAL OF BROWNS FERRY NUCLEAR PLANT OPERATING LICENSES

The Tennessee Valley Authority (TVA) will prepare a supplemental Environmental Impact Statement (SEIS) to address the environmental impacts associated with obtaining license extensions for the Browns Ferry Nuclear Plant (BFN) located in Limestone County, Alabama. Enclosed is a copy of the Notice of Intent for the SEIS published in the *Federal Register* on February 15, 2001. Action alternatives TVA is currently considering include license extensions for Units 2 and 3 to continue power operation for an additional 20 years, and the possible return to service of Unit 1 with a 20-year license extension. TVA will also consider a "no action" alternative which would be a decision by the TVA Board of Directors to not pursue license renewal. Under the no action alternative the plant would cease to produce power and TVA would choose one of the decommissioning options. Under this alternative, the power no longer being produced by BFN may or may not be generated or obtained by other means.

On March 6, 2001, TVA will conduct a public meeting on the scope of the SEIS in Limestone County, Alabama. The meeting will be held at the Aerospace Technology Building Auditorium on the campus of Calhoun State Community College on Highway 31 North. Registration for the meeting will be from 6:00 p.m. to 6:30 p.m. At this early stage, we would appreciate your comments regarding issues and alternatives. To receive further information or to provide comments, please contact Bruce Yeager at (865) 632-8051; direct mail to WT 8C, 400 West Summit Hill Drive, Knoxville, Tennessee, 37902; or e-mail to blyeager@tva.gov. Please send comments on alternatives and issues to the above address by March 23, 2001.

Sincerely,

Jon M. Loney
Manager, NEPA Administration
Environmental Policy & Planning

Enclosure

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BFN - Intergov-LoneyLetter

The attached letter was sent to the following people:

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January 18, 2002

ER 01/1073

Mr. Jon M. Loney
Manager, NEPA Administration
Environmental Policy and Planning
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

RE: Draft SEIS for Operating License Renewal of the Browns Ferry Nuclear Plant, Athens, AL

Dear Mr. Loney:

The Department of the Interior has reviewed the Draft SEIS for the referenced document. We have no comments at this time. Thank you for the opportunity to review this document.

Sincerely,

Gregory L. Hogue
Acting Regional Environmental Officer

cc:
FWS, Atlanta
OEPC, WASO

Cavat 626454S

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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January 25, 2002

Mr. Bruce L. Yeager
Senior NEPA Specialist
Tennessee Valley Authority
400 W. Summit Hill Drive
Mail Stop WT 8C
Knoxville, TN 37902-1499

SUBJ: EPA NEPA Comments on the TVA DSEIS for "Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama"; Limestone County, AL; CEQ No. 010519

Dear Mr. Yeager:

The U.S. Environmental Protection Agency (EPA) has reviewed the referenced Tennessee Valley Authority (TVA) Draft Supplemental Environmental Impact Statement (DSEIS) in accordance with EPA's responsibilities under Section 309 of the Clean Air Act and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The proposed action is to relicense Browns Ferry Nuclear Plant (BFN) with the Nuclear Regulatory Commission (NRC) for an additional 20 years. Existing 40-year licenses would expire in 2013 (Unit 1), 2014 (Unit 2) and 2016 (Unit 3). This TVA SEIS supplements the original EIS of 1972 approved by TVA and the former Atomic Energy Commission (AEC).

For this relicensing, TVA proposes to continue operations for Units 2 and 3, and potentially recover and restart Unit 1 (inoperative for 15 yrs). In addition, it is proposed to add a dry cast storage facility for spent nuclear fuel, construct additional or replacement cooling towers, and construct additional office buildings. Operation for all units would be uprated (i.e., Extended Power Uprate: EPU) at 120 % of the originally licensed level of power generation. BFN is one of three nuclear facilities (five units) currently operated by TVA (BFN, Sequoyah and Watts Bar).

In general, EPA encourages maximizing the use of existing facilities as opposed to environmentally disrupting new (greenfield) sites, unless there is environmental reason not to do so (e.g., societal issues such as Environmental Justice (EJ) impacts or cumulative impacts associated with expansions). Therefore, EPA supports the proposed relicensing of the existing operational facilities (Units 2 & 3) and the recovery and restart of Unit 1 since it maximizes an existing facility.

Our support of the BFN relicensing assumes that operation would be in compliance with all federal, state and local laws and regulations, which in particular include NRC compliance,

approval and periodic inspection. We note the referenced (pg. 2-28) history of problems and shutdowns of all BFN units at various times and assume that all of these problems have been resolved to the satisfaction of both TVA and NRC (the Final SEIS [FSEIS] should specify). EPA therefore defers to the NRC in regard to the final approval, conditioning, or denial of the proposed license renewal and overall compliance with radiological standards during relicensing and life of the project.

EPA offers the following comments on the DSEIS that should be considered for incorporation in the TVA FSEIS:

▸ **NEPA Process**

* *TVA Cooperating Agency* - We note that the NRC is not listed as a cooperating agency for the DSEIS. The FSEIS should discuss the relationship of this SEIS to NRC's review of the relicensing and if the NRC would need, for the purposes of NEPA, to adopt the SEIS for its licensing action. We note that the NRC typically prepares EISs for the relicensing of commercial (i.e., non-federal) nuclear plants. If NRC were a cooperating agency, its adoption of the EIS would be streamlined.

* *NEPA Coverage for Unit 1* - EPA agrees with the TVA approach to include NEPA coverage in the DSEIS for the potential restart of Unit 1, even if this alternative (2) is not selected. Should Alternative 2 not be selected but becomes viable within a relatively short time frame (5 yrs), NEPA requirements for construction and operation would already be completed (as opposed to possible additional NEPA supplementation, assuming no substantive project/site modifications had occurred since the TVA Record of Decision (ROD) and if the ongoing NRC relicensing process could still be modified to include Unit 1 recovery and restart.

* *Connected Action* - We also agree with the inclusion of the construction of dry cast spent fuel storage as a NEPA "connected action" to the relicensing. This is related to the fact that the size of the storage facility would differ if Unit 1 was restarted or not (even though additional storage capacity would be needed before the current NRC license would expire for Units 2 and 3) and dry cast storage would replace the current pool storage. Such onsite storage would not preclude use of a proposed permanent DOE storage site.

* *Lengthy Term of NRC Renewed License* - The existing license (40 yrs) and the proposed relicensing (20 yrs) are long termed. Accordingly, the importance of a quality SEIS for license renewal and a thorough NEPA public review becomes magnified. However, it may be noted that other plant operational permits such as the National Pollutant Discharge Elimination Discharge (NPDES) administered by the State of Alabama with EPA oversight, are shorter termed (5 yrs) to allow for modifications in operation if needed. We also assume that all permits and licenses required for BFN can also be reopened for cause before term completion.

* *Original 1972 TVA EIS* - We agree that relevant analyses of the original 1972 TVA EIS need not be repeated in the present SEIS and can be incorporated by reference. However, given the age and probable lack of public availability of the original EIS, we recommend that the FSEIS provide brief summaries of incorporated analyses, findings and rationales wherever appropriate. Similarly, we also recommend that a summary table be include in Section 1.5.2 (pg. 1-17) that summarizes the primary changes between the original EIS and the present SEIS.

* *Need for Site-Specific NEPA Documentation* - Although clearly intended as a Programmatic EIS (PEIS), certain predictions within the TVA *Energy Vision 2020* PEIS have already been greatly exceeded (e.g., projections for Tennessee Valley power needs: pg. 1-13). As such, the importance of providing site-specific NEPA documentation such as the present SEIS (which not only supplements the original EIS but also tiers from the *Energy Vision 2020* PEIS) is exemplified.

▸ **Alternatives**

* *DSEIS Alternatives* - Two alternatives are offered by TVA in the DSEIS. Alternative 1 (*Relicensing of Units 2 and 3*) would continue the operation of Units 2 and 3, although at an EPU power level, and upgrade/add some facilities. Alternative 2 (*Refurbishment and Restart of Unit 1 with Relicensing of all Units*) would be an extension of Alternative 1 by adding the recovery and restart of Unit 1, also at EPU. Subalternatives for Alternative 2 involve various designs, additions or replacements of cooling towers since additional tower cooling and cooling water flow would be required for EPU and the restart of Unit 1. Three subalternatives are offered by TVA: 2A (addition of 2 new linear mechanical draft cooling towers similar to the existing 6, such that 8 towers would be available); 2B (addition of 2 cooling towers of different design from the existing towers, such that 8 towers would be available); and 2C (replacement of 4 of the existing original towers, retention of 1 replaced tower constructed after the original tower was burned down and construction of 5 new larger linear mechanical draft cooling towers, such that 6 larger towers would be available).

* *Current TVA Preferred Alternative* - TVA currently prefers Alternative 2 (pg. 2-52) at the DSEIS stage. The recovery and restart of Unit 1 is being contemplated since TVA's cost analysis and benefits comparison indicates "...that recovering Unit 1 for extended operation (with license renewal) is financially viable" (pg. 2-51). TVA should provide a firm preferred alternative in the FSEIS and its selected alternative in the TVA ROD once a financial decision on the restart of Unit 1 is made.

* *Current EPA Preferred Alternative* - Because of EPA's policy to maximize existing corridors and facilities unless there is environmental reason not to do so, EPA favors Alternative 2 over 1. In regard to the subalternatives for Alternative 2, we recommend that the TVA selection be based on design efficiency and the amount of additional waste heat load that would need to be dissipated in order to remain in NPDES permit compliance, given the uprating of all units and restart of Unit 1. We note that costs of each subalternative are similar (pg. 2-51). EPA offers no

preference for the presented subalternatives as long as thermal discharges remain in compliance with the thermal limits of the NPDES operational permit, which is expected by TVA for all subalternatives. Generically, however, EPA prefers the most efficient design that best minimizes the level of thermal discharge and tower noise, drift, diesel emissions and public visibility. This includes removal and proper re-disposal of existing spoil piles to the extent that they deflect wind flow needed for efficient functioning of the existing towers.

* *Disclosure of Additional MW Levels by Alternative* - Page 1-10 states that "the current project at BFN will add approximately 250 MWs..." It is unclear, however, if this is for implementation of Alternative 1 or 2 (i.e., with or without Unit 1 restart). The FSEIS should document the projected additional power generation for each BFN unit and action alternative compared to the No-Action. Specifically, the FSEIS should quantify the additional MWs that would be generated for each unit at the proposed EPU power level and the total additional MWs generated at the BFN facility as a whole if Unit 1 was restarted versus remain shutdown, and the total additional MWs that would be generated at BFN if all three units would be operational and uprated. The nominal MW generation level for BNF as a whole should also be provided for each alternative and compared to the existing level.

* *Status of Thermal Discharge Modeling* - Page 2-18 indicates that Computational Fluid Dynamics (CFD) modeling on thermal discharges and reservoir receiving waters is being conducted to determine the level of additional cooling needed for Alternative 1 and 2 due to EPU and the potential restart of Unit 1. A reduced amount of additional cooling is being contemplated by TVA that would still be in compliance with temperature requirements of the existing NPDES permit. Although preliminary modeling results are generally discussed, final modeling will not be available until the FSEIS and "...certainly would be available during the NPDES review process." Such modeling should have already been completed at the DSEIS stage since the draft stage is the primary time for public review. Modeling results are important to the alternative analysis since various subalternatives exist for Alternative 2 that involve three cooling tower designs that affect effluent temperature.

▸ **Water Quality**

* *NPDES Permit Compliance* - We are pleased to note that despite the additional waste heat load associated with EPU (Alternatives 1 & 2) and the restart of Unit 1 (Alternative 2), the DSEIS indicates (pg. 2-39) that thermal discharges are expected to stay within compliance of the temperature limits of the current NPDES permit due to the proposed additional cooling towers. Compliance with NPDES permitting is a primary EPA concern and would be required for continued operation for whichever relicensing action is selected by TVA.

* *Additional Waste Heat Load* - Although the relicensed BNF is expected to stay in compliance with its operational NPDES permit, the heat waste load is expected to increase for both Alternative 1 and 2 (pg. 2-37). The DSEIS discusses potential impacts to the Wheeler Reservoir aquatic resources associated with such incremental increases. It was indicated

(pg. 1-19) that fish in the area are mobile enough to avoid thermal discharges (or be attracted to thermal plumes in winter for refuge or concentrated prey), that sessile benthic assemblages would not be affected due to discharge diffuser design and the fact that warm water rises within the water column, and that preliminary modeling predicts that the thermal plume would not extend across the Reservoir and therefore would not provide a thermal blockage. We acknowledge these preliminary modeling results or published studies.

Although not a requirement as long as compliance with NPDES permitting is maintained, the following additional potential impacts of elevating effluent temperatures should be considered in the FSEIS:

+ Droughts - Even though Wheeler Reservoir pool levels are controlled by TVA, will the receiving waters be at a lower pool during drought periods (which appear to be more common now than historically) such that there would be less volume available for thermal mixing, resulting in higher temperatures in the receiving waters?

+ Consumptive Use - Similar to drought effects, will consumptive water use continue to increase in the Tennessee Valley (much as power needs are projected to increase) such that reservoir water levels would be further lowered, resulting in even less volume of receiving water available for thermal mixing?

+ Global Warming - Will overall Reservoir water temperatures measurably increase due to global warming effects (which may be manifested over the lengthy 20-year license renewal term) such that ambient temperatures of receiving waters and the thermal plume become warmer on average than currently?

+ Sublethal Effects - Although lethal thermal effects on fish species may be avoidable due to their mobility, will increased discharge and plume temperatures illicit sublethal thermal effects expressed in behavior, reproduction, predator-prey relationships, etc. Will effects on juvenile fish or fish eggs and larvae differ from adults?

+ NPDES Temperature Limits - In the event that temperature limits for BFN effluent were to be lowered as part of permit renewals every five years, would any or all of the cooling tower subalternatives have the flexibility for additional cooling capacity in order to stay in compliance with such new limits rather than result in non-compliance or reduced (derated) power generation?

+ Thermal Tolerances - The temperature limits of the NPDES permit will be well below the thermal tolerance levels of reservoir aquatic species. However, to gain a perspective, we recommend that the FSEIS provide discussion on how close local aquatic species live near their thermal maximum compared to the ambient temperatures of Wheeler Reservoir. This would particularly be significant for important sport, commercial and ecological species to the extent that such species-specific thermal tolerance bioassay data are available. Also, do ambient temperatures upstream (i.e., before thermal addition) of BFN receiving waters ever naturally already equal or exceed regulatory NPDES permit temperature limits?

+ Nuisance Species - Page ES-12 indicates that Asiatic clams and zebra mussels exist within the Wheeler Reservoir system. Would the proposed additional thermal addition exacerbate these populations and in turn expedite the clogging of BFN intake systems? Would other aquatic nuisance species such as milfoil weed be enhanced by greater thermal addition? Would conditions

be created that make Reservoir eutrophication more likely?

+ 303(d) Reach - Would the additional waste heat load exacerbate the condition of the 303(d) listed, 10-mile reach between Wheeler Dam and the Elk River, particularly given that the 303(d) parameters for this reach already include temperature/thermal modifications from industrial effluent?

+ Fog Generation - Would hotter effluent discharges create additional fog at the surface of receiving waters during fall, winter and possibly cool early summer mornings? Would such fog impact local Reservoir navigation?

If these potential impacts have not already been considered as part of the SEIS process and on-site aquatic research, TVA should consider them during its selection of a cooling tower subalternative and document the findings in the FSEIS. While NPDES compliance remains the main concern and is expected to be satisfied by TVA, we recommend that the selected cooling tower system emphasize efficiency rather than the discharge of an allowable but greater waste heat load into the aquatic environment.

* *Fish Impingement & Entrainment* - The DSEIS (pg. 2-39) states that the 21% increase in BFN intake flows needed for Unit 1 operation under Alternative 2 "...may increase impingement of adult fish and entrainment of fish eggs and larvae." Given the TVA-assessed good health of Wheeler Reservoir fisheries (pg. ES-12), this TVA impact evaluation (i.e., *may* increase) appears to be understated. We believe that a significant increase in intake flow from a healthy natural water source can be expected to result in greater fish impingement and entrainment, unless some fish avoidance mechanism is added. Editorially, we also note that page ES-23 states that "...increased CCW [Condenser Circulating (i.e., cooling)Water] intake volume would increase impingement of adult fish and entrainment of fish eggs and larvae," which we believe is a more realistic assessment (i.e., *would* increase). The FSEIS should reconsider the effects of the increased intake flows and insure consistency within the document.

It is also noted that "[o]perational monitoring of impingement and entrainment during the first year of operation of Unit 1 would be used to confirm the extent of effects on various species" (pg. ES-23). While EPA strongly agrees with a well conceived monitoring program and an adaptive management approach to resolve any observed problems, it should be noted that avoidance of fish impingement and egg and larval entrainment are even more important. Are any fish avoidance mechanisms being employed or planned by TVA at the intake for BNF? What adaptive management methods could be applied if corrective actions are needed? What guidance will be used to determine if the level of impingement and entrainment is significant versus acceptable? We suggest coordination with the U.S. Fish and Wildlife Service (FWS) and its State of Alabama counterparts and disclosure in the FSEIS.

* *Wetlands* - We are pleased to note that the DSEIS indicates (pg. ES-23) that the project area does not contain wetlands. We note that this includes the three designated alternate areas for the disposal of spoil from the berm that would be reduced for new cooling tower construction or to reduce wind resistance for more efficient function of new or replaced cooling towers. These

alternate areas are all located outside the 100-year floodplain.

▸ **Radiological Impacts** - Given the uprating of Units 2 and 3 for Alternative 1 and the restart of Unit 1 and the uprating of all units for Alternative 2, it is clear that more source material will be required onsite. We offer the following:

* *Spent Fuel Storage* - EPA agrees with the addition of more dry cask storage, as has been done at many other nuclear power plants. We assume that Congress and DOE will provide High-Level Waste storage/disposal by 2010 or shortly thereafter.

* *Radiological Impacts* - Radiological impacts are stated to increase by "no more than 1.8 times...recently reported values after restart of Unit 1." The actual doses to the public [mrem/yr EDE] should be included in the FSEIS discussion in Section 4.3.21.2, although the limits established by EPA's 40 CFR 190, *Environmental Standards for Nuclear Power Operations*, will be easily met as before. Page 3-54 indicates that for 1999, liquid and gaseous releases were 1.2% and 0.3% of the action limits, which are 1/8 and 1/5 of the actual EPA limits, respectively.

* *Emergency Preparedness* - In Appendix A, we note that *Severe Accident Mitigation* is discussed for the alternatives. After the events of September 11, 2001, new emphasis and discussion is needed regarding potential terrorist scenarios and how they may affect BFN's preparedness, as well as future radiological emergency exercises with the Federal Emergency Management Agency (FEMA) and other federal and state agencies. In the FSEIS, the public should be assured that the contingencies to prepare for such attacks and other emergencies have been discussed, planned, and exercised for TVA Browns Ferry.

▸ **Air Quality** - A distinct environmental advantage of nuclear power plants compared to fossil-fired power plants is that they do not produce CO_2, NOx, SOx and other emissions to generate power. However, some of these emissions are generated through support facilities and plant deliveries such as diesel generators, auxiliary steam boilers, vehicular/construction traffic, and cooling tower drift losses. Emissions include CO, CO_2, PM, NOx, SOx and VOCs. It is unclear as to why CO_2 was not referenced (e.g., pg. 4-29) given that most combustion (e.g., diesel and gasoline engines) would emit more CO_2 than CO if properly tuned.

We note that page 4-8 references emission analyses in Section 2.5 (Vol. 1) of the original 1972 EIS. While we agree with a reasonable incorporation by reference, the results for the level of emissions previously calculated should be adopted from the 1972 EIS and presented in a FSEIS table by emission source and by alternative. Calculated data apparently include emissions for diesel generators and cooling tower drift losses. Other additional emission sources should also be reasonably inventoried, and listed with their emissions qualified in terms of the level of emissions (substantive, minor, intermittent, etc.), purpose (cooling tower, pumping, vehicular, etc.) and time/season of operations (daily, summer only, etc.) for each alternative. No additional calculations are requested unless updates are needed or substantive cumulative emissions for

any air quality parameter are expected.

Also related to air quality, page ES-25 indicates that traffic on access roads to BFN (Shaw Road, Nuclear Plant Road and Browns Ferry Road) would increase from 1,600 to 2,900 vehicles per day during construction and temporarily be at a lower Level of Service (LOS). The FSEIS should reference the predicted LOS (should not be less than LOS C for safety, air quality & flow and the approximate time span for this decreased LOS.

Since construction would be a relatively important source of emissions, we are pleased to note (pg. 2-29) that the time frame for the restart of Unit 1 was disclosed (5.5 years). However, we note that construction impacts would be rather long termed as opposed to *temporary* as indicated in the DSEIS. We assume that the 5.5-year period would also incorporate other construction such as uprating of Units 2 & 3 and construction of additional buildings. The FSEIS should verify this.

▸ **Noise** - Cooling tower construction and Unit 1 refurbishment would generate noise, as would general operation of the plant and cooling towers. We note the following:

* *Construction* - Assuming that at least some form of on-site construction would last for 5.5 years, we do not agree, as suggested above, that construction noise would be "...for a relatively short time" (pg. 2-42). TVA may wish to distinguish in the FSEIS between general cooling tower and building construction versus Unit 1 refurbishment in terms of their longevity. We appreciate that a range of noise levels for basic construction equipment at 50 feet was provided (pg. 4-54).

We do not totally agree with the assumption (pg. 4-54) that construction noise should be insignificant because "[p]eople understand that construction projects use heavy equipment and that the equipment produces noise, and they understand that the construction has an end point" and that "[f]requently, people like to watch the equipment work and the noise is part of the experience." We suggest that the other reasons listed on page 4-54 be emphasized such as noise generally being limited to daytime and a normal business week. Moreover, the FSEIS should commit to such noise abatement rather than just indicating that "noise effects can be addressed or ameliorated in several ways if necessary." Considering the long-termed nature of construction in this case (5.5 yrs), this becomes important.

* *Operation* - Noise from general plant operation and support would be increased during operation of the fan motors of the cooling towers. Cooling towers, however, would apparently only operate 17-27 days per year. During operation, noise levels at the nearest residences (Paradise Shores S/D) would be elevated +3 to +7 dBA Leq(24) and +5 to +9 dBA DNL, depending on the fan vendor selected. Given ambient levels of 47 dBA Leq(24) and 52 dBA DNL, respectively, these increases may or may not be significant per the Federal Interagency Committee on Noise (FICON). The FSEIS should verify. However, we do note that given the short time of cooling tower use per year, the annualized levels are reduced to +3 dBA DNL for

both the 17 and 27 days of operation. This level of increase would not be considered significant per FICON at the ambient level of 50 dBA DNL. Nevertheless, because operational periods would likely noise-impact Paradise Shores S/D, we suggest that source reduction methods (low-noise fan motors: pg. 4-66) be achieve through careful selection of the fan vendor. We also note that "TVA is not committing to use such fans at this time" but, we believe, should consider such in the FSEIS. EPA further suggests that towers closest to the residences (3 & 4), be the last of the 6-8 towers to be operated and first to be shutdown in order to minimize noise (i.e., Leq(24) is reduced by 6 dBA: pg. 4-66). The FSEIS should further discuss this and consider a commitment to implement this protocol.

▸ **Ground Water** - We note that ground water will not be used for BFN cooling. The FSEIS should indicate, however, if the on-site waste lagoons would affect ground water (i.e., are the lagoons lined and is the leachate monitored?). Also, what wastes would be contained in the lagoons?

▸ **Geology** - Page ES-8 states that "[t]he BFN is located in an area far removed from any centers of significant seismic activity in historic time." It is noted, however, that an earthquake registering 3 or more on the Richter Scale recently occurred in December 2000 in the general vicinity (near Scottsboro, AL). What structural or other effects, if any, did this have on BFN (and parenthetically, the unfinished TVA Bellefonte Nuclear Plant near Scottsboro) and what additional seismic activity, if any, can be expected in the vicinity of BFN in the future?

▸ **Editorial Comments**

* *Figure 1.2-1* - We suggest that Figure 1.2-1 (pg. 1-3) be improved by labeling or including and labeling water-related features such as the Tennessee and Elk Rivers, Wheeler Dam, and the 303(d) reach between the Dam and the Elk River.

* *NRC GEIS* - The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS: NUREG-1437) was referenced on page 1-18. The FSEIS should provide a publication date for the GEIS and perhaps include it in the references on page 1-22.

* *Original EIS* - The original EIS is sometimes referred to as an *Environmental Statement* (pg. ES-8, ES-19, 1-17) as opposed to an *Environmental Impact Statement* or *EIS,* and should be corrected and made consistent in the FSEIS.

* *Cooling Towers* - We suggest that the cooling towers be labeled when shown on figures in Chapter 2 (e.g., Fig. 2.0-1 and 2.2-1). Similarly, the three units should also be identified.

* *Noise Documentation* - Table 3.19-2 (pg. 3-45) should clarify the time frame of the data presented for "Background Leq" (9 hr or 15 hr?) and the "Total Leq" (24 hrs?). Also, data in the table do not always agree with the text.

▸ **Summary** - EPA supports the proposed relicensing of the existing operational BFN facilities (Units 2 & 3), the potential recovery and restart of Unit 1, and the uprating of all units. However, EPA defers to the NRC in regard to the final approval, conditioning, or denial of the proposed license renewal and overall compliance with radiological standards during the relicensing and

operation throughout the life of the project.

Due to the proposed unit upratings and potential addition of Unit 1, EPA is concerned about potential fish impingement and entrainment effects given the proposed 21% increase in intake water volume, as well as the probable discharge of thermal effluent at a higher temperature. While NPDES compliance remains the main concern and is expected to be satisfied by TVA, we recommend that the selected cooling tower system emphasize efficiency rather than the discharge of an allowable but greater waste heat load into the aquatic environment.

▸ **EPA DSEIS Rating** - EPA supports the proposed BFN relicensing and operation if compliant with NRC and other federal, state and local laws and regulations. However, based on the above potential impacts and concerns about past nuclear problems at BFN, EPA rates this DSEIS an "EC-2" (i.e., EPA has environmental concerns and requests additional information).

EPA appreciates the opportunity to review the DSEIS. Should you have questions about these comments, feel free to contact Chris Hoberg of my staff at 404/562-9619.

Sincerely,

Heinz Mueller

Heinz J. Mueller, Chief
Office of Environmental Assessment
Environmental Accountability Division

cc: Barry Zalcman - Senior Program Manager, NRC: Washington, DC

APPENDIX C

SCOPING MEETING REPORT

DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Browns Ferry Nuclear Plant
Operating License Renewal
Athens, Alabama

Scoping Report

TENNESSEE VALLEY AUTHORITY
March 2001

Introduction

TVA proposes to submit an application to the Nuclear Regulatory Commission (NRC) requesting renewal of the operating licenses for Units 2 and 3 of the Browns Ferry Nuclear Plant (BFN), located in Limestone County, Alabama. In additional to requesting continued operation of Units 2 and 3 for an additional 20 years, consideration is being given to relicensing and recovery of Unit 1 which has been non-operational for 15 years; addition of a spent fuel storage facility; and a few new office buildings. This Supplemental EIS (SEIS) is being prepared to provide the public and TVA decision-makers an assessment of the environmental impacts of relicensing as well as the additional proposals.

In *Energy Vision 2020*, TVA's load forecast indicates that future electricity needs in the TVA Power Service Area will exceed TVA's current generating capacity by the year 2020. The proposal to renew the operating license for BFN and to restart Unit 1 are consistent with TVA's plans to continue to make maximum use of existing power production facilities at the BFN site into the foreseeable future in order to meet projected annual growth rate of two to three percent over the next 20 years.

An important activity in EIS preparation is the description of what topics the environmental review will cover, known as the **scope**. The EIS scope is based on the nature of the proposed action and the issues to be evaluated. During the scoping process, the general public, potentially affected parties, TVA experts, and other government agencies are asked to help identify the issues to be evaluated and to help define the alternative actions to be considered in the EIS. This report describes the scoping process used by TVA to determine the issues to be evaluated and the scope of the EIS based on public input.

The Scoping Process

TVA invited comments from the public to help determine the scope of this EIS by publishing a Notice of Intent (NOI) in the *Federal Register* (65 FR 47817) on February 15, 2001. The NOI provided background information on the reason for the EIS, a discussion of the alternatives being considered, and a description of the scoping process. A copy of the NOI is provided in Appendix E of the SEIS.

A public meeting was held on March 6, 2001 in Decatur, Alabama on the campus of Calhoun Community College. The public was notified about the meeting by paid newspaper announcements in the March 4, 2001 Sunday edition of the *Decatur Daily, The Athens News-Courier, The Huntsville Times,* and *the Florence Times Daily* and the March 6, 2001 edition of the *The Athens News-Courier.* A news release about the project and upcoming meeting was provided to the local media on March 4 and 6, 2001. Articles about the project and the public scoping meeting were carried in Sunday editions of *The Athens News-Courier* on February 25, 2001 and *The Decatur Daily* on March 4, 2001. *The Florence Times Daily* carried a

similar article on March 5, 2001. In addition to the paid announcement and press release, on February 22, 2001 TVA mailed a letter of invitation to the public meeting to 99 U. S. and State Representatives, area Mayors, County Commissioners, Judges, and other local officials.

The paid announcements included a map illustrating the location of Browns Ferry Nuclear Plant as well as the location of the public meeting. The announcements and the press release both stated that the meeting was being held to obtain public input on TVA's proposed plan to apply for renewal of the operating licenses for Units 1,2, and 3 at BFN. They further stated that written comments on the project would be received through March 23, 2001. Copies of the paid announcements and news releases are in Appendix E.

Approximately 60 members of the public along with 15 College officials attended the public meeting on March 6, including representatives from the following newspapers: *The Huntsville times, The Birmingham News, The Knoxville News-Sentinel, The Athens News-Courier, The Decatur Daily*, and *The Florence Times Daily*. Representatives from WVNN/WZYP radio and WVNN-TV, both from Athens, Alabama, were also present.

The meeting was facilitated by Dr. Dena Stephenson of Calhoun Community College. It began with began with a brief presentation by Karl Singer, Senior Vice President of Nuclear Operations. Mr. Singer explained the environmental review process, the purpose of scoping and the proposed BFN License Renewal Project. Following the presentation, the attendees were divided into four small groups facilitated by Calhoun State College and TVA staff. In the small groups, participants were invited to list **issues and concerns** (Question 1) they might have concerning the potential environmental impacts that might result from the proposed actions and alternatives to the proposed action (Question 2) that should be addressed in the SEIS.

Comments received during the public meeting were noted and later reviewed to help identify environmental issues that should be addressed in the SEIS as well as those minor issues which do not warrant detailed evaluation. In addition to the providing verbal input at a public meeting, the public and other government agencies were invited to provide written comments at the meeting, by mail, or by e-mail. One e-mail and two letters were received and are included in this scoping report.

Major Themes in Public Comments

Several recurring themes representing diverse points of view were present in the oral and written comments concerning this EIS project. Many commenters shared the following concerns or opinions regarding nuclear power and the relicensing of BFN:

- **Nuclear Waste** - People were concerned about how much high and low level waste would be generated, and how and where it would be stored. The cost of storage was also mentioned. One commenter, however, stated that the storage issue is a political scare.

- **Emergency Management/Safety** - People were concerned that there be adequate plans for evacuation to ensure the safety of those who live near the plant. The need to ensure worker safety and concerns about the age of Unit 1 as it relates to prospects for safe operation were also mentioned.

- **Water Quality** - Concerns were expressed about thermal impacts on water as well as run off from construction.

- **Cost of Restarting Unit 1** - People were concerned about the impact of completing Unit 1 on TVA's debt load.

- **Relationship to Plans for Bellefonte Nuclear Plant** - Several people questioned how plans for BFN would impact plans for nearby, incomplete Bellefonte Nuclear Plant and vice versa.

- **Alternatives to Relicensing and or Restarting Unit 1** - Of the many alternative power sources mentioned, the primary alternatives to additional nuclear power cited were coal, natural gas, energy conservation, and "green" energy sources. Fact-based clarification of TVA's future power needs was sought.

- **Proponents of Increased Nuclear Power** - Many participants favored nuclear power as the source of choice for the future, citing reduction of air pollution, sunk costs, safety, and environmental preference as reasons. Power shortages in California were cited as an example of the result of poor or weak power planning.

Table 1 includes a paraphrased list of all issues raised during public scoping for the Browns Ferry Nuclear Plant Relicensing project, by topic. A copy of the flip chart notes and letters received are part of the public record of this project.

Table 1 Topical List of Issues Raised During Public Scoping for Browns Ferry Nuclear Plant Relicensing Project

Topic	Sub Issues
1. Nuclear Waste/spent fuel	• dangers of transporting nuclear waste • cost of storing both low level and high level waste • disposition/management of spent fuel • amount of additional waste to be generated by Unit 1 • amount of low and high level waste to be generated (2)* • location of low and high level waste storage (3) • plans for on-site waste storage • safety precautions for on-site storage of high level waste • plans for further waste reduction • will TVA rent waste storage space on the Goshutes Indian Reservation • advocates national funding for technology to study hazard waste clean up and effects of nuclear energy use • nuclear waste storage is a political scare—not as big a problem as public perceives
2. Emergency management/Safety	• use of iodine capsules in case of disaster • proximity of nearest resident to plant • possibility of train tracks crossing the emergency route • adequacy of evacuation routes for traffic • range of evacuation plan • adequacy of safety monitoring (supervisors should live within 5-10 mile radius) • process for reporting safety problems for Unit 1 start-up • concerns about NRC becoming lax with aging reactors pushed beyond design limitations • implications of increasing dependence on aging, less reliable reactors • status of cracked shroud and implications for restart • amount of curies released into air/water • exposure of workers to ionizing radiation • responsibility for exposed workers

Topic	Sub Issues
3. Water Quality	• increased heat load; temperature • potential impact of thermal plume on aquatic organisms (e.g. rough tiptoe musel) • construction runoff • more water screening at construction/demolition landfill • extent of use of cooling towers • meeting meet new EPA requirements on water intake and thermal discharge
4. Environment	• need more personnel and resources allocated to the environment (2) • what will be the net environmental impact of start-up
5. Environmental justice	• potential impact on low-income or minority population to plant
6. Public notification	• process for informing public about meeting • when will Unit 1 go on-line
7. Nuclear power, general	• public needs more education to clear misconception; improve understanding of nuclear technology (how clean and safe it is) • public needs more education about BFNP safety record • Decatur needs a visitor area to show the public a nuclear plant • encourage and educate young people about nuclear power operations/ environmental tracking
8. Costs of Unit 1 restart	• use cost/benefit analysis to choose best option • How was $1B cost estimated (look at minimum costs to possible costs)? • Cost analysis of limited lifespan, considering plant is 15 years old • impact on TVA debt of bringing Unit 1 online—already $25 billion (2) • cost comparison of starting Unit 1 Bellefonte vs. Unit 1 BFNP
9. Other Unit 1 startup issues	• how will TVA compensate for parts taken from Unit 1 • how does restart fit with plans for river management and hydro generation • potential impact of TVA loosing integrated river management system • effects of deregulation of BFNP Unit 1 startup • potential length of service for units under the re-licensing extension (TVA could ask NRC to extend licenses to account for years each unit was off line) • impact of Calpine, a proposed private merchant plant proposed for nearby location.

Topic	Sub Issues
10. Alternate uses of Unit 1	• gas-powered plant (cost, impact of pipeline, environmental impact of plant)2) • look at cost/efficiency/ impact of coal plant • explore cost/competitiveness of natural gas • explore cost/competitiveness of using other sources • close Unit 1; build new nuclear plant elsewhere • consider the socioeconomic impacts of decommissioning BFNP
11. Other considerations for meeting new power needs	• consider TVA's debt level • increase conservation; don't waste energy • is TVA expecting more use of its coal fired plants • control end-user demand (3) • energy efficiency initiatives (2) • population growth projections (anticipated growth/decline in demand) • need a balanced national energy policy—mix of sources • power supply planning is important and as are alternative power sources • deregulation will probably not benefit the public • improve efficiency of transmission to minimize power loss • improve building codes to require energy conservation • discuss TVA 's power mix in next 40 years • explore the long term implications of TVA's forecast of becoming more dependant on natural gas • alternative power source being considered if BFNP is decommissioned • decommission BFNP Units 1&2; use restart money for clean development of clean energy technologies like fuel cells, distributed generation • purchase power off-system • evaluate the possible sale of assets and service area to other utilities • explore relationship of increasing TVA nuclear power and reducing air pollution from fossil fuel • consider building new nuclear power plants (2) • nuclear power is most desirable long-term energy source (energy crisis is due to restrictions on fossil fueled energy sources have driven up price of natural gas) work aggressively to increase nuclear production (TVA and U.S.)(3)
12. Relationship to Bellefonte	• does Bellefonte require a separate EIS • has there been any decision about whether or not to bring Bellefonte online • licensing status of Bellefonte/ relationship to Browns Ferry Nuclear Plant (2)

* Numbers in parentheses following comments indicate the number of times that or a similar comment was noted

APPENDIX D

ANNOUNCEMENTS, NOTICES, AND NEWS RELEASES

NEWS RELEASE

TVA Seeks Public Comment on Draft Environmental Impact Statement

ATHENS, Ala. -- TVA is seeking public comment on a draft supplemental environmental impact statement that examines environmental impacts of a proposal to extend the operation of Units 2 and 3 and, potentially, of Unit 1 at Browns Ferry Nuclear Plant.

TVA will conduct a public meeting on Jan. 17 at the Aerospace Technology Training Center on the campus of Calhoun Community College near Decatur to provide an opportunity to comment on the draft SEIS. Registration begins at 6 p.m.

TVA has made copies of the draft environmental impact statement available to the public and other government agencies for review and comment and will accept comments until January 30. Copies of the draft SEIS were mailed to federal agencies and people who requested them following a public meeting to help determine the scope of the review in March 2001. A notice of availability of the SEIS appeared in the Federal Register on Dec. 14.

TVA proposes to submit an application to the Nuclear Regulatory Commission to extend the operating licenses of Browns Ferry Nuclear Plant. Renewal of the licenses would permit TVA to continue operating the units an additional 20 years past the current 40-year operating license terms, which expire in 2014 and 2016 for Units 2 and 3, respectively.

The Unit 1 operating license expires in 2013. Unit 1 has not operated for 15 years. The SEIS examines the potential environmental impacts of restarting the unit and increasing the power output by up to 20 percent.

If TVA decides to seek license extensions, the three units would be able to continue to supply a firm, round-the-clock power supply to the TVA electric system to meet growing power demands.

Information from the environmental review process and other evaluations will be used to decide whether to pursue restarting Browns Ferry Unit 1 and whether to seek license extensions for all three units.

Anyone may request a copy of the SEIS or a summary of the document from Donald W. Snodgrass at TVA, CEB 4C, Muscle Shoals, Alabama 35662-1010, or by e-mail at dwsnodgrass@tva.gov. Written comments may be submitted to Bruce L. Yeager, Senior Specialist, National Environmental Policy Act, TVA, WT 8C-K, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499. Comments also may be e-mailed to blyeager@tva.gov.

TVA is the nation's largest public power producer, and its power system is self financed. TVA provides power to large industries and 158 power distributors that serve 8.3 million consumers in seven southeastern states.

PAPER: ATHENS NEWS COURIER

CITY: ATHENS, AL

DATE: 1-10-02 PAGE A3

NOTICE

PUBLIC MEETING TO DISCUSS DRAFT ENVIRONMENTAL IMPACT STATEMENT ON BROWNS FERRY NUCLEAR PLANT

TVA has prepared a Draft Supplemental Environmental Impact Statement addressing the potential environmental impacts of a proposal to extend the operating licenses of Browns Ferry Nuclear Plant for an additional 20 years and addressing spent fuel storage. License renewal is one option TVA is considering to supply base load generation to its power system to meet growing power demands.

TVA will conduct a public meeting on Thursday, January 17, 2002 at the Aerospace Technology Training Center at Calhoun Community College on U.S. 31 North, near Decatur, Alabama to obtain public comment on the Draft SEIS. Registration begins at 6 p.m. and the meeting at 6:30.

Persons who would like a copy or summary of the draft SEIS or would like to send in comments should contact Bruce L. Yeager, Tennessee Valley Authority, WT 8C-K, 400 West Summit Hill Drive, Knoxville, TN 37902-1499 or to: blyeager@tva.gov

TVA will accept comments through January 30, 2002.

TVA

December 6, 2001

U.S. Environmental Protection Agency
Office of Federal Activities
NEPA Compliance Division
EIS Filing Section
Ariel Rios Building (South Oval Lobby)
Mail Code 2252-A, Room 7241
1200 Pennsylvania Avenue, NW
Washington, DC 20044

Dear Sir or Madam:

TENNESSEE VALLEY AUTHORITY - DRAFT ENVIRONMENTAL IMPACT STATEMENT: BROWNS FERRY NUCLEAR PLANT OPERATING LICENSE RENEWAL, ATHENS, ALABAMA

Enclosed are five copies of the Draft Supplemental Environmental Impact Statement (SEIS): *Browns Ferry Nuclear Plant Operating License Renewal, Athens, Alabama.* This document is concurrently being distributed to commenting agencies and to the public.

Please publish a Notice of Availability of this DEIS in the Federal Register. To confirm publication date, or should you have any questions, please contact Bruce L. Yeager at (865) 632-8051.

Sincerely,

Original signed by

Kathryn J. Jackson

BLY:TMH
Enclosures (5)
cc (Enclosure)
Mr. Heinz J. Mueller
Chief, Office of Environmental Assessment
U.S. Environmental Protection Agency, Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303-3104

cc: A. S. Bhatnagar, POB 2C-BFN
J. B. Brellenthin, PEC 1D-BFN
J. R. Rupert, LP 6A-C
J. A. Scalice, LP 6A-C
J. W. Shipp, Jr., MR 2T-C
G. R. Signer, ET 11A-K
K. W. Singer, LP 6A-C
C. L. Wilson, BR 4X-C
Files, EP&P, CST 17B-C

Prepared by Bruce L. Yeager; reviewed by Jon M. Loney; approved by John W. Shipp, Jr.

budgets in accordance with the needs of the program and the availability of funds. Awards made will be subject to periodic reporting and evaluation requirements.

Notification

Final awards cannot be made until funds have been appropriated by Congress, allocated and committed through internal ECA procedures.

Dated: February 9, 2001.

Helena Kane Finn,

Acting Assistant Secretary for Educational and Cultural Affairs, U.S. Department of State.

[FR Doc. 01–3879 Filed 2–14–01; 8:45 am]

BILLING CODE 4710–05–P

TENNESSEE VALLEY AUTHORITY

Supplemental Environmental Impact Statement: Browns Ferry Nuclear Plant Operating License Renewal

AGENCY: Tennessee Valley Authority.

ACTION: Notice of intent.

SUMMARY: This notice is provided in accordance with the Council on Environmental Quality's regulations (40 CFR parts 1500–1508) and TVA's procedures for implementing the National Environmental Policy Act. The Tennessee Valley Authority (TVA) will prepare a supplemental environmental impact statement (SEIS) to address the environmental impacts associated with obtaining license extensions for the Browns Ferry Nuclear Plant (BFN) located in Limestone County, Alabama. Renewal of the operating licenses will allow the plant to continue to operate for an additional 20 years beyond the expiration dates of the current operating licenses. The regulations of the Nuclear Regulatory Commission (NRC) in 10 CFR part 54 set forth the applicable license extension requirements. This SEIS will also consider the impacts of the possible restart of Unit 1, which has been in a non-operational status since 1985, with an extended operating license. At this early stage, TVA contemplates that the action alternatives in the EIS could include a combination of license renewal and restart of Unit 1. The no-action alternative considered is a decision by TVA to not seek renewal of the operating licenses for the BFN units. Public comment is invited concerning both the scope of alternatives and environmental issues that should be addressed as part of the SEIS.

DATES: Comments on the scope of the SEIS must be postmarked or e-mailed no later than March 23, 2001 to ensure consideration.

ADDRESSES: Written comments or e-mails on the scope of issues to be addressed in the SEIS should be sent to Bruce L. Yeager, Senior Specialist, National Environmental Policy Act, Environmental Policy and Planning, Tennessee Valley Authority, 400 West Summit Hill Drive, Mail Stop WT 8C–K, Knoxville, Tennessee 37902 (e-mail: blyeager@tva.gov).

FOR FURTHER INFORMATION CONTACT: Charles L. Wilson, Nuclear Licensing Staff, Tennessee Valley Authority, 1101 Market Street, Mail Stop BR 4X–C, Chattanooga, Tennessee, 37402 (e-mail: clwilson@tva.gov), Roy V. Carter, Tennessee Valley Authority, Mail Stop CEB 4C–M, Muscle Shoals, Alabama, 35662 (e-mail: rvcarter@tva.gov) or Bruce Yeager, Tennessee Valley Authority, 400 West Summit Hill Drive, Mail Stop WT 8C–K, Knoxville, Tennessee 37902 (e-mail: blyeager@tva.gov).

SUPPLEMENTARY INFORMATION:

Background

The proposal to renew the operating licenses for the Browns Ferry Nuclear Plant (BFN) was part of a system-wide evaluation of future power needs. A range of options to meet those needs was evaluated in TVA's Integrated Resource Plan and Environmental Impact Statement, *Energy Vision 2020,* released on December 21, 1995.

The Final Environmental Statement for BFN was published in 1972. BFN was TVA's first nuclear power plant. The facility is located on an 840-acre tract adjacent to Wheeler Reservoir in Limestone County, Alabama, 10 miles southwest of Athens, Alabama. BFN has three General Electric boiling water reactors and associated turbine-generators that can produce more than 3,000 megawatts (MW) of power. Unit 1 began commercial operation in August 1974, Unit 2 in 1975 and Unit 3 in 1977. An extended shutdown of all units at Browns Ferry began in 1985 to review the TVA nuclear power program. Unit 2 returned to service in May 1991 and Unit 3 in November 1995. Unit 1 has been idled since 1985, and changes would be necessary prior to restarting the unit. The current operating characteristics of Units 2 and 3 are considered representative of future operations at Browns Ferry because of the changes in personnel, procedures, and equipment that occurred during and following the extended regulatory outage which began in 1985. For example, since return to service from the regulatory outage, Units 2 and 3 have performed well with consistently higher levels of availability and generating capacity than before the outage.

Proposed Action

TVA proposes to submit an application to the Nuclear Regulatory Commission (NRC) requesting renewal of BFN operating licenses. Renewal of the current operating licenses would permit operation for an additional twenty years past the current (original) 40-year operating license terms which expire in 2014 and 2016 for Units 2 and 3, respectively. The Unit 1 operating license expires in 2013. License renewal of the operating BFN facilities does not involve new major construction or modifications beyond normal maintenance and minor refurbishment.

The SEIS will also examine the impacts associated with the possible recovery and restart of Unit 1, which has been in a non-operational status for 15 years. Among the impacts to be examined in this SEIS are those resulting from thermal (heat) discharges to Wheeler Reservoir associated with three-unit operation. The cooling capaicity necessary to mitigate thermal impacts under the various alternatives would also be examined in the SEIS. Other aspects of the actions under consideration include the impacts associated with a spent fuel storage facility and a few new office buildings.

Independent of the matters considered in the SEIS, TVA is considering a project which would uprate the maximum operating power level of Units 2 and 3 to 120 percent of their originally licensed power levels. If this project is approved, the various alternatives in the SEIS will be modified as appropriate to reflect the higher operating levels. If Unit 1 is returned to service, it is currently contemplated that it would also be operated at 120 percent of its originally licensed power level. Additional information about the uprate project is available from the contacts listed above.

Range of Alternatives

As required by Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14), TVA will evaluate a reasonable range of alternatives in this SEIS. Action alternatives TVA is currently considering include license extensions for Units 2 and 3 to continue power operation for an additional 20 years, and the possible return to service of Unit 1 with a 20-year license extension. TVA will also consider a "no action" alternative which would be a decision by the TVA Board of Directors to not

pursue license renewal. Under the no action alternative the plant would cease to produce power and TVA would choose one of the decommissioning options. Under this alternative, the power no longer being produced by Browns Ferry may or may not be generated or obtained by other means.

Preliminary Identification of Environmental Issues

This SEIS will discuss the need to continue to operate the plant and will describe the existing environmental, cultural, recreational, and socioeconomic resources. The SEIS will consider the potential environmental impacts resulting from refurbishment, operation and maintenance of the existing facilities, as well as any additional impacts from returning Unit 1 to service. TVA's evaluation of environmental impacts to resources will include, but not necessarily be limited to, the potential impacts on air quality, surface and ground water quality and resources, vegetation, wildlife, aquatic ecology, endangered and threatened species, floodplains, wetlands and wetland wildlife, aesthetics and visual resources, land use, cultural and historic resources, light, noise, socioeconomics, transportation, spent fuel management, and radiological impacts. These concerns and other important issues identified during the scoping process will be addressed as appropriate in the SEIS.

Additionally, TVA will review the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG–1437, in which the U.S. Nuclear Regulatory Commission (NRC) considered the environmental effects of renewing nuclear power plant operating licenses for a 20-year period (results are codified in 10 CFR Part 51). The GEIS identifies 92 environmental issues and reaches generic conclusions on environmental impacts for 69 of those issues that apply to all plants or to plants with specific design or site characteristics. It is expected that the generic assessment in NRC's EIS would be relevant to the assessment of impacts of the proposed actions at the Browns Ferry Plant. Information from NRC's EIS that is relevant to the current assessment would be incorporated by reference following the procedures described in 40 CFR 1502.21. Alternatively, TVA may choose to tier off this EIS after first adopting this EIS in accordance with 40 CFR 1506.3. Additional plant-specific review would likely be necessary for the remaining issues, which are encompassed by the range of resource issue areas identified above.

Public Participation

This Supplemental Environmental Impact Statement (SEIS) is being prepared to provide the public an opportunity to provide input to TVA's assessment of the environmental impacts of the suite of proposals at BFN including the request for license renewal and the possible return to service of Unit 1. The SEIS will also serve to inform the public and the decision-makers of the reasonable alternatives that would minimize adverse impacts.

The scoping process will include both interagency and public scoping. The agencies expected to participate in interagency scoping include the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, various State of Alabama agencies including the Department of Environmental Management, and other federal, state and local agencies as appropriate.

The public is invited to submit written comments or e-mail comments on the scope of this SEIS no later than the date given under the **DATES** section of this notice.

Comments may also be provided in an oral or written format at the public scoping meeting. TVA will conduct a public meeting on the scope of the SEIS in Limestone County, Alabama, on Tuesday, March 6, 2001. The meeting will be held at the Aerospace Technology Building Auditorium on the campus of Calhoun State Community College on Highway 31 North. Registration for the meeting will be from 6 to 6:30 p.m. There will be visual displays and information handouts available during the registration period. The meeting will begin with brief presentations by TVA staff explaining the SEIS process and the proposed license renewal project. Following these presentations there will be group discussions facilitated by staff of TVA and Calhoun State Community College to record the issues and concerns that the public believes should be considered in the SEIS.

Upon consideration of the scoping comments, TVA will develop alternatives and identify important environmental issues to be addressed in the SEIS. Following analysis of the environmental consequences of each alternative, TVA will prepare a draft SEIS for public review and comment. Notice of availability of the draft SEIS will be published in the **Federal Register**. TVA will solicit written comments on the draft SEIS through this **Federal Register** notice. Any meetings that are scheduled to comment on the draft SEIS will be announced by TVA. TVA expects to release a final SEIS by January 2002.

Dated: February 9, 2001.

Kathryn J. Jackson,

Executive Vice President, River System Operations & Environment.

[FR Doc. 01–3823 Filed 2–14–01; 8:45 am]

BILLING CODE 8120–08–U

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Notice of Intent To Request From the Office of Management and Budget (OMB) of Six Current Public Collections of Information

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice.

SUMMARY: In compliance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*), the FAA invites public comment on six currently approved public information collections which will be submitted to OMB for renewal.

DATES: Comments must be received on or before April 16, 2001.

ADDRESSES: Comments may be mailed or delivered to the FAA at the following address: Ms. Judy Street, Room 613, Federal Aviation Administration, Standards and Information Division, APF–100, 800 Independence Ave., SW., Washington, DC 20591.

FOR FURTHER INFORMATION CONTACT: Ms. Judy Street at the above address or on (202) 267–9895.

SUPPLEMENTARY INFORMATION: the FAA solicits comments on the following six current collections of information in order to evaluate the necessity of the collection, the accuracy of the agency's estimate of the burden, the quality, utility, and clarity of the information to be collected, and possible ways to minimize the burden of the collection. Following are short synopses of the information collection activities which will be submitted to OMB for review and request for renewal:

1. 2120–0001, Notice of Proposed Construction or Alteration and Notice of Actual Construction or Alteration, and Project Status Request. Federal regulations require all persons to report proposed or actual construction/alteration of structures affecting air safety. The reporting requirements as prescribed in 14 CFR Part 77 affects any persons or business planning to construct or alter a structure that may affect air safety. The information is used to ensure the safe and efficient use of the navigable airspace by aircraft. The

[Federal Register: December 14, 2001 (Volume 66, Number 241)]
[Notices]
[Page 64818-64819]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr14de01-44]

ENVIRONMENTAL PROTECTION AGENCY

[ER-FRL-6624-5]

Environmental Impact Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564-7167 or www.epa.gov/oeca/ofa.
Weekly receipt of Environmental Impact Statements
Filed December 03, 2001 Through December 07, 2001
Pursuant to 40 CFR 1506.9.
EIS No. 010506, DRAFT EIS, AFS, UT, Quitchupah Creek Road Project, Construct a Public Road, To Provide Public Access from SR-10 to the Acord Lakes Road, Application for Right-of-Way, Fishlake National, Forest, Sevier County Special Services District (SSD), Sevier and Emery Counties, UT, Comment Period Ends: February 15, 2002, Contact: Linda Jackson (435) 896-9233.
EIS No. 010507, FINAL EIS, COE, ND, Maple River Dam and Reservoir, Construction and Operation, Flood Control, Cass County Joint Water Resource District, Cass County, ND, Wait Period Ends: January 14, 2002, Contact: Robert Nebel (402) 221-4621.
EIS No. 010508, DRAFT EIS, FHW, WV, US-340 Transportation Corridor Improvement Study, Implementation, Proposal to Improve US 340 from the four-lane Section of the Charles-Town Bypass, Jefferson County, WV, Comment Period Ends: February 08, 2002, Contact: Thomas Smith (304) 347-5928.
EIS No. 010509, DRAFT EIS, COE, AR, Greers Ferry Lake Shoreline Management Plan (SMP), Implementing Revision to Replace the 1994 Shore Management Plan, Revision include Zoning of Limited Development Areas, Vegetation Modification Provisions for Grandfathered Docks and Restrictions on Boats, Van Buren, Cleburne, Searcy, Stone, White, Independence and Pope Counties, AR, Comment Period Ends: January 28, 2002, Contact: Patricia Anslow (501) 324-5028.
EIS No. 010510, FINAL EIS, AFS, MT, Tobacco Root Vegetation Management Plan, Restore and Maintain a Mix of Vegetation, Beaverhead-Deer Lodge National Forest, Madison Ranger District, Madison County, MT , Wait Period Ends: January 14, 2002, Contact: Jan M. Bowey (406) 842-5432.
EIS No. 010511, FINAL EIS, APH, Fruit Fly Cooperative Control Program, Eradication Program, Implementation, Wait Period Ends: January 14, 2002, Contact: Harold T. Smith (301) 734-6742. This document is available on the Internet at: http:www.aphis.usda.gov/ppd/es/ppq/ffeis.pdf
EIS No. 010512, FINAL SUPPLEMENT, COE, CA, Prado Dam Water Conversion Plan, Implementation, New Information Concerning New Modified Flood Protection Features, Remaining Features of the Santa Ana River Project (SARP) and Stabilization of the Bluff Toe at Norco Bluffs, Riverside, Orange and San Bernardino Counties, CA, Wait Period Ends: January 14, 2002, Contact: Ms. Hayle Lovan (213) 452-3863.
EIS No. 010513, DRAFT EIS, FHW, OR, Lincoln Bypass Construction, South of Industrial Boulevard to North of Riosa Road, Funding and U.S. Army COE Section 404 Permit Issuance, Placer County, CA, Comment Period Ends: January 28, 2002, Contact: Maiser Khaled (916) 498-5020.
EIS No. 010514, FINAL EIS, USN, ME, South Weymouth Naval Air Station, Disposal and Reuse, Norfolk and Plymouth Counties, MA, Wait Period

Ends: February 11, 2002, Contact: Robert K. Ostermueller (610) 595-0759.
EIS No. 010515, FINAL EIS, HUD, CA, North Hollywood Arts and Entertainment District Project, Construction and Operation, North Hollywood Redevelopment Project, City of Los Angeles, and Los Angeles County, CA, Wait Period Ends: January 14, 2002, Contact: Mr. Tony Kochinas (213) 847-4307.
EIS No. 010516, DRAFT EIS, FHW, OR, South Medford Interchange Project, Interchange Project, Relocation on I-5 south of its current location at Barnett Road, Funding, Jackson County, OR, Comment Period Ends: January 14, 2002, Contact: John Gernhauser (503) 399-5749. Due to an Administrative Error by the FHWA the above DEIS was not properly filed with the USEPA. FHWA has confirmed that distribution of the DEIS was made available to federal agencies and interested parties for a 45-Day Comment Period Ending on 12/03/2001. FHWA has Extended the Comment Period for 30-Days Ending 01/14/2002. For further information contact Mr. Greg Holthoff at 503-986-3504.
EIS No. 010517, DRAFT EIS, FRC, WA, Georgia Strait Crossing Pipeline (LP) Project, Construction and Operation, To Transport Natural Gas from the Canadian Border near Sumas, WA to US/Canada Border at Boundary Pass in the Strait of Georgia, Docket Nos. CP01-176-000 and CP01-179-000, Whatcom and San Juan Counties, WA, Comment Period Ends: February 04, 2002, Contact: Linwood A. Watson (202) 208-0400.
EIS No. 010518, FINAL EIS, IBR, WA, Potholes Reservoir Resource Management Plan, Implementation, COE Section 404 and NPDES Permits, Moses Lake, Grant County, WA, Wait Period Ends: January 14, 2002, Contact: Jim Blanchard (509) 754-0226.
EIS No. 010519, DRAFT EIS, TVA, TN, KY, MS, AL, GA, NC, Browns Ferry Nuclear Plant, Operating License Renewal, To Extend Operation of Units 2 and 3, and Potentially Unit 1, Athens, Limestone County, AL, Comment Period Ends: January 30, 2002, Contact: Bruce L. Yeager (865) 632-8051.
EIS No. 010520, FINAL SUPPLEMENT, NPS, AZ, Organ Pipe Cactus National Monument General Management Plan and Development Concept Plan Implementation, Portion of the Sonoran Desert, Pima County, AZ , Wait Period Ends: January 14, 2002, Contact: William E. Wellman (520) 387-7661.
EIS No. 010521, FINAL EIS, AFS, MT, Gold/Boulder/Sullivan (GBS), Implementation of Timber Harvest and Associated Activities Prescribed Burning, Kootenai National Forest, Rexford Ranger District, Lincoln County, MT , Wait Period Ends: January 14, 2002, Contact: Ron Komac (406) 296-2536.
EIS No. 010522, FINAL EIS, COE, OH, Ashtabula River and Harbor Dredging and Disposal Project, Design, Construction, Operation and Maintenance, Ashtabula River Partnership (ARP), Ashtabula County, OH , Wait Period Ends: January 14,

[[Page 64819]]

2002, Contact: John Mahan (440) 964-0277.

Amended Notices

EIS No. 010305, DRAFT SUPPLEMENT, FAA, MN, Flying Cloud Airport, Substantive Changes to Alternatives and New Information, Extension of the Runways 9R/27L and 9L/27R, Long-Term Comprehensive Development, In the City of Eden Prairie, Hennepin County, MN, Comment Period Ends: December 07, 2001, Contact: Glen Orcutt (612) 713-4354. Revision of FR Notice Published on 08/24/2001: CEQ. Comment Period Ending on 12/07/2001 has been Extended to 01/31/2002.
EIS No. 010401, DRAFT SUPPLEMENT, FHW, MI, US-31 Petoskey Area Improvement Study, To Reduce Congestion on US-31 in the City of Petoskey and Resort and Bear Creek Townships, COE Section 404 Permit, Emmet County, MI, Comment Period Ends: December 17, 2001, Contact:

James A. Kirschensteiner (517) 702-1835. Revision of FR Notice Published on 11/02/2001: CEQ. Comment Period Ending 12/17/2001 has been extended to 01/15/2002.
EIS No. 010500, DRAFT SUPPLEMENT, BIA, NV, Moapa Paiute Energy Center/ Associated Facilities Construction, Operation and Maintenance of a 760 Megawatt (MW) Baseload Natural Gas-Fired Combined Cycle Power Plant, New Information concerning Structural, Route and Substation Location Changes, Moapa River Indian Reservation and Bureau of Land Management Lands, Clark County, NV, Comment Period Ends: January 14, 2002, Contact: Amy L. Heuslien (602) 379-6750. Revision of FR notice published on 11/30/2001: CEQ Comment Period Ending 01/04/2002 has been Corrected to 01/14/2002.

Dated: December 11, 2001.
Joseph C. Montgomery,
Director, NEPA Compliance Division, Office of Federal Activities.
[FR Doc. 01-30932 Filed 12-13-01; 8:45 am]
BILLING CODE 6560-50-P

Letter and a copy of the DSEIS sent to the attached list

December 6, 2001

Dear:

TENNESSEE VALLEY AUTHORITY DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR OPERATING LICENSE RENEWAL OF THE BROWNS FERRY NUCLEAR PLANT IN ATHENS, ALABAMA

The Tennessee Valley Authority (TVA) proposes to extend operation of Units 2 and 3, and potentially Unit 1, of its Browns Ferry Nuclear Plant (BFN) located in Limestone County, Alabama. This would require obtaining a renewal of the units' operating licenses from the Nuclear Regulatory Commission (NRC). Renewal of the licenses would permit operation for an additional twenty years past the current (original) 40-year operating license terms, which expire in 2013, 2014, and 2016 for Units 1, 2, and 3, respectively.

A Draft Supplemental Environmental Impact Statement (DSEIS) assessing a number of alternatives has been prepared for this project in accordance with the National Environmental Policy Act (NEPA) and the NEPA regulations specified in Title 40 of the Code of Federal Regulations, Parts 1500-1508. In preparing the DSEIS, TVA has considered comments received by mail and comments presented in a public meeting conducted on March 6, 2001, regarding this proposal.

Enclosed for your review is a copy of the DSEIS. If you have any comments or questions regarding the project, please send them by mail or email to:

Bruce L. Yeager, Senior NEPA Specialist
Tennessee Valley Authority
400 W. Summit Hill Drive, Mail Stop WT 8C-K
Knoxville, Tennessee 37902-1499
Telephone: (865) 632-8051
E-mail: blyeager@tva.gov

For further information, please contact:

Charles L. Wilson, Project Manager
Tennessee Valley Authority
1101 Market Street, Mail Stop BR 4X-C
Chattanooga, Tennessee 37402-2801
Telephone: (423) 751-6153
E-mail: clwilson@tva.gov

Comet 6264374

December 6, 2001

TVA will host a second public meeting during the upcoming 45-day public review period. The purpose of this meeting is to provide to any interested party the opportunity to comment on the DSEIS. The date, time, and location of this meeting is as follows:

Thursday, January 17, 2002
6:30 p.m. CST (registration begins at 6:00 p.m.)
Aerospace Technology Building
Calhoun Community College
Highway 31, North
Decatur, Alabama

Comments on the DSEIS must be received by January 30, 2002, to ensure that they are considered in preparing the Final SEIS which is scheduled for publication in March 2002. If you have any questions about the DSEIS, please call Mr. Yeager at the number listed above. We appreciate your interest in the project.

Sincerely,

John A. Scalice

DWS:BLT
cc (Enclosure):
A. S. Bhatnagar, POB 2C-BFN
J. B. Brellenthin, PEC 1D-BFN
K. J. Jackson, WT 11A-K
J. M. Loney, WT 8C-K
D. C. Olcsvary, LP 6A-C
J. R. Rupert, LP 6A-C
J. W. Shipp, Jr., MR 2T-C
G. R. Signer, ET 11A-K
K. W. Singer, LP 6A-C
C. L. Wilson, BR 4C-C
Files, ER&TA, CEB 1B-C

F/DWSnodgrass/BFN DEIS ltr cclist 12601

BF DEIS mailing list 12/6/01

Title1	FirstName	LastName	JobTitle	Address	City	State1	State2	Zip
	Kem	Carr	Decatur Utilities	P. O. Box 2232	Decatur,	AL	Alabama	35609
Mr.	Richard C.	Crawford	TVPPA	811 Broad Street	Chattanooga,	TN	Tennessee	37402
Mr.	George M.	Grabryan, Jr.	Florence-Lauderdale EMA	110 W. College Street, Room B-25	Florence,	AL	Alabama	35630
Mr.	Sam	Gueweca	AL Emergency Mgt. Agency	5858 County Road 41 P. O. Box Drawer 2160	Clanton,	AL	Alabama	35046
Mr.	Jack	Hilliard	Florence Utilities	P. O. Box 2818 Cypress Mill Road	Florence,	AL	Alabama	35631
Mr.	J. Wayne	McCain	Athens State University	300 N. Beaty Street	Athens,	AL	Alabama	35611
Mr.	Bryan	Mitchell	Knoxville News-Sentinel	838 W. Hill Avenue #2	Knoxville,	TN	Tennessee	37902
Ms.	Tanjie	Nash	The News Courier	410 W. Green Street	Athens,	AL	Alabama	35611
Mr.	Roy	Priest	Congressman Bud Cramer's Office	403 Franklin Street	Huntsville,	AL	Alabama	35801
Mr.	Anthony C.	Reding		18026 Circle Drive	Athens,	AL	Alabama	35613
Mr.	Woody	Saylor	Calpine	700 Milam Street	Houston,	TX	Alabama	77002
Mr.	Dennis	Sherer	Times Daily	P. O. Box 797	Florence,	AL	Alabama	35633
Mr.	Stephen	Smith	Southern Alliance for Clean Energy	2743 Winpdle Avenue	Knoxville,	TN	Tennessee	37914

Decatur Daily, Jan. 18, 2002

DAILY Photo by Corey Wilson

Joe Valente, Tim Abney, Bill Crouch and J.D. Wilcott listen during a public information session conducted Thursday by the Tennessee Valley Authority at the Aerospace Training Center at Calhoun Community College.

TVA hears 3 people speak in favor of Unit 1 restart

By Holly Hollman
DAILY Staff Writer
hhollman@decaturdaily.com

Should the Tennessee Valley Authority meet growing power demand by restarting the idled Browns Ferry Unit 1 reactor, or should the federal utility let licenses expire and explore other energy sources?

TVA sought public input in a hearing on the plant's environmental impact statement. Issues include whether to restart the unit, which has been shut down for 15 years, and whether the plant, which has two functioning reactors, should remain on line.

The three people who spoke Thursday night at the hearing at Calhoun Community College — two representing employee unions and the general manager of Decatur's Holiday Inn — said Unit 1 should be restarted.

Several groups opposing nuclear

Please see **TVA**, page **A7**

TVA

Continued from page A1

power have written the Nuclear Regulatory Commission asking that TVA not be allowed to restart Browns Ferry's Unit 1 reactor.

If TVA's three-member board of directors decide not to renew licenses for the plant's units, the alternative is to close it.

TVA and Limestone County officials who attended the hearing said the county would lose less than 1 percent of its work force if the plant closed.

The plant employs 900 to 1,000 people in the Tennessee Valley.

But, TVA officials at the meeting seemed to favor restarting Unit 1 and renewing the licenses of all three units. TVA estimates that it would take five years and from $1.3 billion to $1.5 billion to restart Unit 1.

The three people who spoke at the said their organizations wanted TVA to restart Unit 1.

"We back the project 100 percent," said Rick Humphries of the Holiday Inn. "We're excited about the economic impact."

The board will have to consider the aging effects on the units and the environmental impact before submitting an application to the Nuclear Regulatory Commission for license renewals.

Unit 1's defueled status has gone on 15 years. Its license expires in 2013. Unit 2's license expires in 2014 and Unit 3's in 2016. The renewals would extend those licenses 20 years. The units' original licenses were for 40 years.

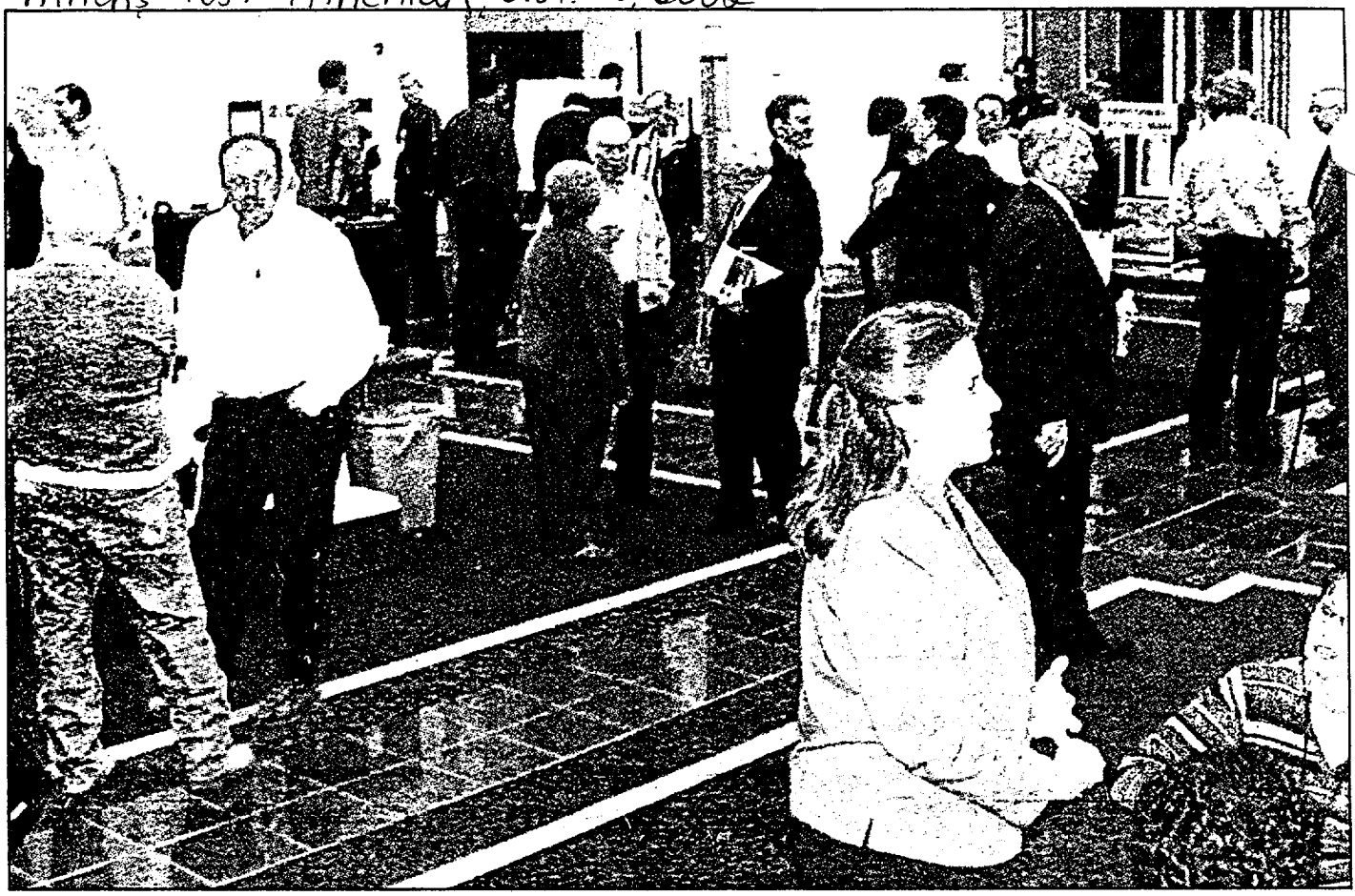
"There is about a 3-percent growth each year in the Tennessee Valley, and to keep providing adequate and reliable power, we need to add more to our baseline," said Browns Ferry spokesman Craig Beasley.

Residents have until Jan. 30 to send TVA comments about these alternatives.

The comments should be sent to Bruce L. Yeager, Senior NEPA specialist, Tennessee Valley Authority, 400 W. Summit Hill Drive, Mail Stop WT 8C, Knoxville, TN 37902-1499.

TVA will complete its final environmental impact study in March. It expects the board to reach its decision by April.

Athens Post Athenian, Jan. 18, 2002



News-Courier/Tanjie Nas'

About 90 people attended a public hearing Thursday night regarding license renewal for Browns Ferry Nuclear Plant operations Experts were on hand in 10 different categories to answer questions on potential environmental impact and other concerns related to continued operations at Browns Ferry, which is located about 10 miles west of Athens near the Ripley community.

TVA seeks input on Browns Ferry future

BY TANJIE NASH
News-Courier Reporter

The second of two Tennessee Valley Authority hearings designed to solicit public input on extension of operating licenses at Browns Ferry Nuclear Plant drew about 90 people Thursday night, with half of those representing TVA, Browns Ferry and other entities associated with the facility's operation.

A similar hearing last March attracted about 75 people. At that hearing area residents were asked to submit questions and comments to be considered in the preparation of an Environmental Impact Statement (SEIS) to serve as a supplement to the original environmental statement prepared in 1972.

Chuck Wilson, project manager for the SEIS said such comments have only trickled in over the last year.

"They've started coming in now," Wilson said Thursday night. "But up until a few days ago we only had about a half dozen or so. As of yesterday we had about 20, all totaled."

Thursday's meeting was held to address any concerns that may have arisen as a result of the SEIS, a draft version of which was

See Browns Ferry, Page 2A

Browns Ferry

Continued from Page 1A

completed in December.

The SEIS draft, made up of eight chapters with seven appendices, addresses what impact license extension would have on the area surrounding the nuclear plant. Such topics as hazardous waste management, aquatic and terrestrial life and noise levels are considered.

An introductory page of the 1.5-inch thick volume indicates the SEIS is designed to "provide the public and TVA decision-makers an assessment of the environmental impacts of extending unit operation."

Browns Ferry is located about 10 miles west of Athens near the Ripley community in Limestone County.

License renewal would allow operation for an additional 20 years past the original 40-year licensure. Current licenses for reactor Units 1, 2 and 3 are set to expire in 2013, 2014 and 2016, respectively.

The federal Nuclear Regulatory Commission oversees licensure of the nuclear power industry.

Browns Ferry Vice President Ashok Bhatnagar said TVA is considering three options. Those options are requesting license extensions for Units 2 and 3 only;

Unit 1, the first of the three Browns Ferry reactors to go online, began commercial operation in 1974. Units 2 and 3 began operations in 1975 and 1977, respectively.

In 1985 all three units were shut down during a review of the TVA nuclear program. Unit 1 was never returned to service, while Unit 2 resumed power production in 1991 and Unit 3 was put back online in 1995.

Tim Abney, licensing manager at Browns Ferry, said bringing Unit 1 back online would take roughly five years.

"To bring it back would be a tremendous amount of work," Abney said. "The thing is that it's exactly what we did on (Units) 2 and 3, so we know what it takes to get there."

Those with questions or concerns over the possibility of license renewal for the Browns Ferry Nuclear Plant have until Jan. 30 to submit those concerns to Tennessee Valley Authority officials.

Written comments may be submitted to Bruce L. Yeager, National Environmental Policy Act, TVA, WT 8C-K, 400 West Summit Hill Drive, Knoxville, Tenn., 37902-499. Comments also maybe e-mail led to blyeager@tva.gov.

Wilson said all comments will ›e taken into consideration and ddressed in the final SEIS, slated or completion in March.

TVA NEWS CLIPS

Compiled by Media Relations 865-632-4788 Distributed 1-18-02

PAPER FLORENCE TIMES DAILY

CITY FLORENCE, AL

DATE 1-18-02 PAGE A1

Committee recommends Unit 1 restart

Labor leaders say Browns Ferry reactor could be boost for area

By Dennis Sherer
STAFF WRITER

DECATUR – Members of a TVA committee studying the environmental impact of restarting a reactor at Browns Ferry Nuclear Power Plant have found no reason to nix the project.

The committee is expected to recommend later this year to Tennessee Valley Authority directors to extend the life of the idle Unit 1 reactor at Browns Ferry.

Bhatnagar

People who gathered Thursday night at Calhoun Community voiced overwhelming support for restarting the unit, which would add 20 years of life to the plant.

"Restarting Unit 1 will provide a lot of good jobs for craftspeople during the construction phase and in the operation and maintenance. It would be a big boost for the Shoals," said Gene Tackett, president of the Shoals Area Central Labor Council. "We have the highest unemployment rate in the state and could use the jobs. The country could use the additional power. It would be just a win-win for everybody."

More than 2,500 temporary jobs for skilled craftspeople could be created during the restart, officials said. The construction phase would last about five years.

Tackett was among a crowd of 35 who attended the meeting, which was part of TVA's process for developing an environmental impact statement for Browns Ferry.

TVA will need the impact statement if it asks the Nuclear Regulatory Commission to extend the operating license for the Browns Ferry reactors for 20 years.

A committee that prepared the report found the plan is not expected to have any significant environmental impacts, said Ashok Bhatnagar, who is TVA's site vice president at Browns Ferry.

Committee members have determined seeking a license

renewal for all three units and placing Unit 1 back in operation is the best of the three options being considered, he said.

The other options are allowing the licenses to expire or extending the licenses but continuing to operate only Units 2 and 3.

The operating license for Unit 2 is scheduled to expire in 2014, with the Unit 3 license ending in 2016.

The license for Unit 1 expires in 2013. The unit was shut down in 1985 because of safety concerns.

The original operating licenses for all three units are for 40 years.

As part of the licensing process, TVA will have to prove it will be able to safely operate the Browns Ferry reactor during the extended license period. It must also prove it has evaluated all potential environmental impacts during that period.

The committee's recommendation for TVA board members to seek the license extension and restart the idle reactor would be made after the final version of the environmental impact statement is completed in March, said Browns Ferry spokesman Craig Beasley.

The committee's recommendation will be only one of many things the board will consider before deciding the fate of Unit 1, Beasley said.

The board will also consider the cost of the restart, which is estimated at about $1.4 billion, and the expected demand for power.

Support was strong Thursday for the restart, but some environmental organizations have expressed opposition in the past.

Stephen Smith, executive director of the Knoxville, Tenn.-based Southern Alliance for Clean Energy, has said TVA could save its ratepayers money by promoting conservation of electricity rather than restarting the reactor. If enough residents conserved power, the reactor would not be needed.

Smith did not attend Thursday's meeting. He has previously expressed concern about the plan to operate the reactors beyond their original life expectancy. Beasley said TVA is only one of many utilities seeking to extend the operating license for their nuclear plants. TVA officials said engineers and scientists have learned that nuclear plants can be operated safely much longer than originally expected.

U.S. Sens. Jeff Sessions and Richard Shelby, both R-Ala., and U.S. Rep. Bud Cramer, D-Ala., have urged TVA to restart the reactor.

No time frame has been set for the TVA board to make a decision on Unit 1.

PAPER: HUNTSVILLE TIMES
CITY: HUNTSVILLE, AL
DATE 1-18-02 PAGE: B3

Most at hearing favor relicensing nuclear reactors

TVA considers option of restarting Browns Ferry Unit 1

By CHRISTOPHER BELL
Times Staff Writer
chrisb@htimes.com

DECATUR — Nuclear power advocates voiced support Thursday night for extending operating licenses for all three reactors at the Browns Ferry Nuclear Plant, including the idle Unit 1.

TVA held a public meeting at Calhoun Community College to hear comments on proposals to allow another 20 years of operation for the reactors. Few negative comments were made.

TVA spokesman Craig Beasley said Unit 1, shut down for 17 years for safety reasons, could be operating within five years.

TVA has argued relicensing restarting Unit 1 at Browns Ferry is its least expensive route to more nuclear power generation. But critics have questioned the wisdom of spending more than $1 billion on a reactor that is nearly 30 years old, especially when TVA's debt exceeds $25 billion.

Originally, the Nuclear Regulatory Commission issued 40-year permits for all three reactors.

Unit 1 was issued a license on June 26, 1973, but was shut down for on March 19, 1985, and remains idle. An extension would allow it to operate until 2033.TVA estimates it would cost $1.5 billion to modify the reactor to return it to service.

Unit 2 was licensed on June 28, 1974, but was shut down on March 9, 1985, for almost seven years. An extension would extend its operation until 2034.

Unit 3 was licensed on July 2, 1976, but was shut down on March 9, 1985, for almost 10 years. An extension would allow it to operate until 2036.

Beasley said if the TVA board decides to restart Unit 1, an additional administration building would have to be built and the plant's cooling towers would have to be expanded.

Decatur Mayor Lynn Fowler said he supports extending the licenses because of Browns Ferry's economic impact on the area. Rick Humphreys, manager of the Holiday Inn here, said Browns Ferry means lower power rates.

Written comments may be sent to Bruce L. Yeager, senior specialist, National Environmental Act, TVA, WT BC-K, 400 West Summit Hill Drive, Knoxville TN, 37902-1499. Comments may be e-mailed to blyeager@tva.gov.

PAPER DECATUR DAILY
CITY DECATUR, AL
DATE 1-20-02 PAGE: A10
Editorial

Nuclear power making comeback with public

Proponents of nuclear power have to be pleased with the turnout at last week's public environmental comments meeting at Calhoun Community College on the future of Browns Ferry Nuclear Plant.

The well-publicized meeting with Tennessee Valley Authority officials drew only three responses — all in support of restarting Unit 1. Many others sent statements in support directly to TVA headquarters. In times past, opponents would have filled the room.

The lack of opposition may be an indication that nuclear power is making a comeback. There are reasons why:

▶The industry is proving to be reliable and safe, after the Three Mile Island disaster of 1979.

▶People are tired of OPEC nations dictating the energy flow in the United States.

▶Some people are still recovering from the doubling of natural gas prices last winter.

U.S. Sen. Richard Shelby was in the Tennessee Valley last week urging TVA to restart Unit 1 and the abandoned Bellefonte Nuclear Plant in Jackson County.

He said nuclear energy "is the best way to go."

Actually, the senator's colleague, Jeff Sessions, has been urging TVA to expand its nuclear program for some time.

TVA officials would like to do that. Chairman Glenn L. McCullough says the agency must do something about its "non performing asset," meaning the idled nuclear plants.

The problem is more cost than safety. Restarting Unit 1 will cost more than $1 billion. Upgrading, or extending the life of the other two units, and the two at the Sequoyah site, will cost at least an additional $157 million.

Then there is the cost of finishing Bellefonte.

Our concern is that TVA will get saddled with more debt that would raise industrial and residential rates if the agency undertakes a building program.

Maybe the senators could convince the federal government to help. Energy is a national security issue. TVA already serves in seven states, and could export energy if it had all its nuclear plants running and modernized.

Congress should help pay that cost to keep the nation out of an energy crisis.

PAPER ATHENS NEWS COURIER

CITY ATHENS, AL

DATE 1-22-02 PAGE A1

TVA still seeking input from public

BY TANJIE NASH
News-Courier Reporter

While Tennessee Valley Authority officials may not have been inundated with comments and concerns regarding license extensions for reactors at Browns Ferry Nuclear Plant the recently compiled draft Supplemental Environmental Impact Statement (SEIS) addresses what are likely common concerns of area residents.

The SEIS is made up of eight chapters and seven appendices and covers such topics as spent-fuel management, terrestrial and aquatic ecology, environmental noise and socioeconomic impacts.

TVA officials are considering making application to the Nuclear Regulatory Commission for a 20-year extension past the original 40-year licensure. Current licenses for reactor Units 1, 2 and 3 are set to expire in 2013, 2014 and 2016, respectively.

At a recent public hearing regarding license extension Browns Ferry Vice President Ashok Bhatnagar said should the extension be granted some construction work would likely be necessary at the facility.

"Additional cooling tower capacity may be needed for power uprates," Bhatnagar said. "And storage capacity will be needed by 2005 even if we don't opt for the extended license"

Bhatnagar also said one potential archaeological site had been identified in preparing the SEIS draft

"That area will be avoided both during construction and operation"

The construction of an additional cooling tower may also cause increased noise levels.

Jay McFeters, a specialist on environmental noise, said those who would be most affected by a new cooling tower would probably be the residents of nearby Paradise Shores.

"It's approximately 1500 feet from the tip of cooling tower number three into the property (of Paradise Shores) there," he said. "The increase would be one or two extra decibels into that area."

McFeters said one decibel is not normally detectable to the human ear

"But with two decibels it might be detectable in these levels," he said.

McFeters said noise from the cooling tower is primarily cause by fan motors and falling water

He said cooling towers are used only in the summer months and then use averages 17 to 20 days each year

TVA is considering three options, according to Bhatnagar. Those options are requesting license extensions for Units 2 and 3 only; recovery of the currently idle Unit 1 along with license extension for all three units; or not seeking license extension and ceasing operation of power production upon license expiration

Those with questions or concerns over the possibility of license renewal for the Browns Ferry Nuclear Plant have until Jan 30 to submit those concerns to Tennessee Valley Authority officials

Written comments may be submitted to Bruce L. Yeager, National Environmental Policy Act, TVA, WT 8C-K, 400 West Summit Hill Drive, Knoxville, Tenn., 37902-1499 Comments also maybe e-mailed to blyeager@tva.gov

TVA NEWS CLIPS

Compiled by Media Relations 865 632-4788 Distributed 1-23 02

PAPER. FLORENCE TIMES DAILY

CITY FLORENCE, AL

DATE 1-23-02 PAGE B1

TVA nears decision on Unit 1

By Dennis Shorer
STAFF WRITER

MUSCLE SHOALS – A decision on whether to restart the idle Unit 1 reactor at Browns Ferry Nuclear Plant could be made by midyear, TVA officials said Tuesday

Tennessee Valley Authority Chairman Glenn McCullough Jr. said several studies exploring the feasibility of restarting the unit are nearing completion, and board members should have the issue presented to them for a vote soon after.

McCullough

"We could be ready to make a decision by mid-'02," McCullough said in response to a question asked during a news conference after the board's meeting Tuesday at the TVA Reservation in Muscle Shoals.

Studies have explored the environmental impacts, demand for electricity in the region and cost of restarting the reactor, which has not produced electricity for more than 15 years.

TVA is also reviewing ways for the agency to pay for the project, which carries an estimated cost of $1.4 billion.

McCullough said TVA will explore several options, including forming a public-private partnership. Several investors have proposed loaning the money to TVA in exchange for reaping a share of the profits earned by selling electricity produced by the reactor.

McCullough said a decision about how to pay for the project won't be necessary until the board determines whether to restart the unit. "We don't have anything to finance today," he said.

TVA voluntarily shut down the reactor in March 1985 because of safety concerns.

Units 2 and 3 at Browns Ferry were also shut down in 1985 but were restarted in 1991 and 1995, respectively, after major renovations.

Stephen Smith, executive director of the Southern Alliance for Clean Energy in Knoxville, Tenn., contends restarting the reactor could cause TVA to raise power rates in order to pay for the project.

Smith said the additional electricity would not be needed if TVA would promote energy conservation.

Numerous federal and local elected officials in north Alabama have contacted TVA board members recommending the project because of the jobs it would create.

More than 2,500 workers could be needed to prepare the reactor for restart.

The construction process will take about five years.

TVA has not determined how many permanent jobs would be created by the restart, but officials say about 200 more workers would be needed.

Harris

Elected officials also contend the restart is needed to ensure TVA has enough power for expected growth in the Tennessee Valley.

When operating at capacity, the reactor can produce enough electricity to supply 200,000 homes.

Proponents of the restart also argue that the it would reduce TVA's dependence on its coal-burning plants that are under attack by environmental groups.

Board member Skila Harris said the board will consider the role Unit 1 would play in TVA's mix of power sources before a decision is made.

A TVA committee studying the issue is expected to recommend this spring that the board ask the Nuclear Regulatory Commission to extend Browns Ferry's operating license for 20 years and allow the Unit 1 restart.

The operating license for Unit 1 is scheduled to expire in 2013, with Unit 2's ending in 2014 and Unit 3's expiring in 2016.

The original operating licenses are for 40 years.

A committee studying the impact of extending the life of the nuclear plant reported that preliminary analysis shows the restart is in TVA's best interests.

The committee has also considered allowing the licenses to expire and closing the plant or extending the life of Units 2 and 3 by 20 years while leaving Unit 1 idle.

The environmental impact study should be completed in March, officials said. They say its results will play a key role in making a decision on the restart.

McCullough said Tuesday that board members will base their decision on sound business principals.

In other business, the board:

- awarded a contract to Smooth Cut Lawn Care of Lenoir City, Tenn., for grounds maintenance and herbicide services at several TVA properties, including John Sevier, Bull Run and Kingston fossil plants in Tennessee.
- approved raising the ceiling on a contract with Framatome ANP for engineering, testing and support services required to implement tritium production at Sequoyah Nuclear Plant by $3.25 million to a total of $8 billion. The Department of Energy, which is a partner with TVA on the project, will pay the additional cost.
- honored Russell Patterson of Whitwell, Tenn., as TVA's Engineer of the Year for developing innovative ways to protect TVA's transmission system.

DANIEL GILES/TimesDaily

Several studies into restarting Unit 1 at Browns Ferry Nuclear Plant are under way.

Associated Press 1-23-02

TVA nears decision on Browns Ferry nuclear plant
Eds: Similar story moved in previous cycle; This version corrects McCullough's title to 'chairman' sted 'director' 2nd graf
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MUSCLE SHOALS, Ala. (AP) - The Tennessee Valley Authority may decide whether to restart an idle Browns Ferry nuclear reactor by midyear, officials said Tuesday.

TVA studies of the project to fire up the idle Unit 1 reactor are nearing completion, and board members would vote on it soon afterward, TVA Chairman Glenn McCullough Jr. said.

"We could be ready to make a decision by mid-'02," McCullough told the TimesDaily of Florence after the TVA board's meeting in Muscle Shoals.

The TVA is evaluating environmental impacts, demand for power in the region and costs before holding a vote.

The Unit 1 reactor hasn't produced electricity for more than 15 years, and it would need an estimated $1.4 billion to become fully operational.

TVA could enter into a public-private partnership with investors to raise money, McCullough said. Investors have proposed loaning money to TVA in exchange for later profits from reactor electricity sales.

But money worries won't become serious unless the TVA board approves the project, McCullough said.

"We don't have anything to finance today," he said.

TVA voluntarily shut down the reactor in March 1985 because of safety concerns. Units 2 and 3 at Browns Ferry also stopped in 1985 but were restarted in 1991 and 1995 after major renovations.

Critics say TVA would have to raise power rates in order to pay for the project.

The North Alabama and lower Tennessee region wouldn't need another nuclear plant if TVA did a better job of promoting energy conservation, said Stephen Smith, executive director of the Southern Alliance for Clean Energy in Knoxville, Tenn.

But others say restarting the reactor could create more than 2,500 jobs over five years. Officials say about 200 workers would be retained full time if the plant became operational.

TVA wants to ensure the region has enough power for expected growth. The Unit 1 reactor could provide enough electricity for 200,000 homes when running at capacity

An environmental impact study should be completed in March, officials said.

TVA, the nation's largest public power producer, provides electricity to about 8.3 million people in Tennessee, Georgia, Kentucky, North Carolina, Virginia, Alabama and Mississippi.

APPENDIX E

INDIVIDUALS AND AGENCIES PROVIDING COMMENTS

APPENDIX E

Individuals and Agencies Providing Comments

APPENDIX F

RESPONSES TO PUBLIC COMMENTS

Comment ID	1
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	6.3
Comment	We note that the NRC is not listed as a cooperating agency for the DSEIS. The FSEIS should discuss the relationship of this SEIS to NRC's review of the relicensing and if the NRC would need, for the purposes of NEPA, to adopt the SEIS for its licensing action. We note that the NRC typically prepares EISs for the relicensing of commercial (i.e., non-federal) nuclear plants. If NRC were a cooperating agency, its adoption of the EIS would be streamlined.
Response	TVA agrees that NRC should be a cooperating agency on the SEIS under the regulations promulgated by the Council on Environmental Quality. *See* 40 C.F.R. § 1501.6. As noted in this comment, NRC routinely prepares EISs for the relicensing of non-federal nuclear plants, and NEPA does not distinguish between federal and private nuclear plants for purposes of review. NRC's predecessor, the Atomic Energy Commission cooperated on the original EIS that TVA prepared for the plant. Cooperating now would save paperwork and better integrate the environmental reviews of TVA and NRC. In the past, TVA has approached NRC about the desirability of cooperating on environmental reviews. However, NRC takes the position that cooperating with TVA, the licensee in this situation, could be perceived as potentially biasing its review processes and NRC has refused to do this.

Comment ID	2
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	1.1
Comment	EPA agrees with the TVA approach to include NEPA coverage in the DSEIS for the potential restart of Unit 1, even if this alternative (2) is not selected. Should Alternative 2 not be selected but becomes viable within a relatively short time frame (5 yrs), NEPA requirements for construction and operation would already be completed (as opposed to possible additional NEPA supplementation, assuming no substantive project/site modifications had occurred since the TVA Record of Decision (ROD) and if the ongoing NRC relicensing process could still be modified to include Unit 1 recovery and restart.
Response	This comment does not require a response.

Comment ID	3
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	1.1
Comment	We also agree with the inclusion of the construction of dry cast [cask] spent fuel storage as a NEPA "connected action" to the relicensing. This is related to the fact that the size of the storage facility would differ if Unit 1 was restarted or not (even though additional storage capacity would be needed before the current NRC license would expire for Units 2 and 3) and dry cast storage would replace the current pool storage. Such onsite storage would not preclude use of a proposed permanent DOE storage site.
Response	This comment does not require a response.

Comment ID	4
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Sections	1.1 and 5.2.2
Comment	The existing license (40 yrs) and the proposed relicensing (20 yrs) are long termed. Accordingly, the importance of a quality SEIS for license renewal and a thorough NEPA public review becomes magnified. However, it may be noted that other plant operational permits such as the National Pollutant Discharge Elimination Discharge (NPDES) administered by the State of Alabama with EPA oversight, are shorter termed (5 yrs) to allow for modifications in operation if needed. We also assume that all permits and licenses required for BFN can also be reopened for cause before term completion.
Response	This comment does not require a response.

Comment ID	5
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	1.5.2
Comment	We agree that relevant analyses of the original 1972 TVA EIS need not be repeated in the present SEIS and can be incorporated by reference. However, given the age and probable lack of public availability of the original EIS, we recommend that the FSEIS provide brief summaries of incorporated analyses,

	findings and rationales wherever appropriate. Similarly, we also recommend that a summary table be include in Section 1.5.2 (pg. 1-17) that summarizes the primary changes between the original EIS and the present SEIS.
Response	These are helpful suggestions and ones which TVA will consider in future documents. No electronic version of the original 1972 Browns Ferry EIS exists. TVA has instead elected to offer a hard copy of the 1972 EIS free of charge to anyone who requests it. This offer is also made on the Abstract page. The present FSEIS, however, is publicly available on the internet as explained on the Abstract page. The completed FSEIS in its entirety is itself a compilation of the differences from the original 1972 EIS; as such, the Executive Summary at the beginning of the FSEIS constitutes an abbreviated compilation of those primary changes. In those cases where relevant analyses in the 1972 EIS were incorporated by reference, the text of the FSEIS describes what has been incorporated. No specific comments were received on the Draft SEIS relative to any particular analyses incorporated by reference from the original 1972 EIS.

Comment ID	6
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	1.4.4
Comment	Although clearly intended as a Programmatic EIS (PEIS), certain predictions within the TVA *Energy Vision 2020* PEIS have already been greatly exceeded (e.g., projections for Tennessee Valley power needs: pg. 1-13). As such, the importance of providing site-specific NEPA documentation such as the present SEIS (which not only supplements the original EIS but also tiers from the *Energy Vision 2020* PEIS) is exemplified.
Response	This comment does not require a response.

Comment ID	7
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Sections	2.2.1; 2.2.2, and 2.2.3
Comment	Two alternatives are offered by TVA in the DSEIS. Alternative 1 (*Relicensing of Units 2 and 3*) would continue the operation of Units 2 and 3, although at an EPU power level, and upgrade/add some facilities. Alternative 2 (*Refurbishment and Restart of Unit 1 with Relicensing of all Units*) would be an extension of

	Alternative 1 by adding the recovery and restart of Unit 1, also at EPU. Subalternatives for Alternative 2 involve various designs, additions or replacements of cooling towers since additional tower cooling and cooling water flow would be required for EPU and the restart of Unit 1. Three subalternatives are offered by TVA: 2A (addition of 2 new linear mechanical draft cooling towers similar to the existing 6, such that 8 towers would be available); 2B (addition of 2 cooling towers of different design from the existing towers, such that 8 towers would be available); and 2C (replacement of 4 of the existing original towers, retention of 1 replaced tower constructed after the original tower was burned down and construction of 5 new larger linear mechanical draft cooling towers, such that 6 larger towers would be available).
Response	This comment does not require a response.

Comment ID	8
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.8
Comment	TVA currently prefers Alternative 2 (pg. 2-52) at the DSEIS stage. The recovery and restart of Unit 1 is being contemplated since TVA's cost analysis and benefits comparison indicates "...that recovering Unit 1 for extended operation (with license renewal) is financially viable" (pg. 2-51). TVA should provide a firm preferred alternative in the FSEIS and its selected alternative in the TVA ROD once a financial decision on the restart of Unit 1 is made.
Response	Appropriate text in Section 2.8 has been changed.

Comment ID	9
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.7 and 2.8
Comment	Because of EPA's policy to maximize existing corridors and facilities unless there is environmental reason not to do so, EPA favors Alternative 2 over 1. In regard to the subalternatives for Alternative 2, we recommend that the TVA selection be based on design efficiency and the amount of additional waste heat load that would need to be dissipated in order to remain in NPDES permit compliance, given the uprating of all units and restart of Unit 1. We note that costs of each subalternative are similar (pg. 2-51). EPA offers no preference for the presented subalternatives as long as thermal discharges remain in compliance with the thermal limits of the NPDES operational permit, which is expected by TVA for all subalternatives. Generically, however, EPA prefers the most efficient design that best minimizes the level of thermal discharge and tower noise, drift, diesel emissions and public

visibility. This includes removal and proper re-disposal of existing spoil piles to the extent that they deflect wind flow needed for efficient functioning of the existing towers.

Response

As explained in Sections 2.7 (Comparison of Costs Between Alternatives) and 2.8 (The Preferred Alternative), the preferred cooling tower capacity addition sub-alternative is Alternative 2D. Alternative 2D is to construct a single new linear 20 cell mechanical draft cooling tower which is 25 percent larger than the existing 16 cell cooling towers. The tower would utilize current technology thereby maximizing its thermal efficiency. TVA has performed analyses which demonstrate that the plant with this cooling tower configuration can operate with its thermal discharges remaining in compliance with the thermal limits of the NPDES operational permit. This alternative has been demonstrated to have the best financial advantage but yet still maintains the ability to operate the three units in an uprated condition.

This tower would reside on the location of a vacant cooling tower basin with the 25 percent extension to the tower in the eastern direction away from the residential areas near the plant. This configuration would minimize the impact of increased tower noise, plume drift, and public visibility. The tower would utilize electric fans powered from in-house sources and thus would not produce any diesel emissions. This alternative would not involve removal or re-disposal of existing spoil piles. Figure 2.2-10 shows the approximate location and footprint of the enlarged cooling tower for Alternative 2D.

Appropriate changes have been made to the text of Section 2.2.3, Associated Cooling Tower Impacts and Alternatives, to describe cooling tower capacity addition Alternative 2D.

Comment ID 10

Name Heinz J. Mueller

Affiliation U.S. Environmental Protection Agency, Region 4

DEIS Section 1.4.3

Comment

Page 1-10 states that "the current project at BFN will add approximately 250 MWs..." It is unclear, however, if this is for implementation of Alternative 1 or 2 (i.e., with or without Unit 1 restart). The FSEIS should document the projected additional power generation for each BFN unit and action alternative compared to the No-Action. Specifically, the FSEIS should quantify the additional MWs that would be generated for each unit at the proposed EPU power level and the total additional MWs generated at the BFN facility as a whole if Unit 1 was restarted versus remain shutdown, and the total additional MWs that would be generated at BFN if all three units would be operational and uprated. The nominal MW generation level for BNF as a whole should also be provided for each alternative and compared to the existing level.

Response

Appropriate text additions, including a new table summarizing changes in power levels have been added to section 2.2.1, Proposed Action Alternatives for this SEIS.

Comment ID	11
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.2.3
Comment	Page 2-18 indicates that Computational Fluid Dynamics (CFD) modeling on thermal discharges and reservoir receiving waters is being conducted to determine the level of additional cooling needed for Alternative 1 and 2 due to EPU and the potential restart of Unit 1. A reduced amount of additional cooling is being contemplated by TVA that would still be in compliance with temperature requirements of the existing NPDES permit. Although preliminary modeling results are generally discussed, final modeling will not be available until the FSEIS and "...certainly would be available during the NPDES review process." Such modeling should have already been completed at the DSEIS stage since the draft stage is the primary time for public review. Modeling results are important to the alternative analysis since various subalternatives exist for Alternative 2 that involve three cooling tower designs that affect effluent temperature.
Response	Appropriate changes have been to the text of Section 2.2.3, Associated Cooling Tower Impacts and Alternatives.

Comment ID	12
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	We are pleased to note that despite the additional waste heat load associated with EPU (Alternatives 1 & 2) and the restart of Unit 1 (Alternative 2), the DSEIS indicates (pg. 2-39) that thermal discharges are expected to stay within compliance of the temperature limits of the current NPDES permit due to the proposed additional cooling towers. Compliance with NPDES permitting is a primary EPA concern and would be required for continued operation for whichever relicensing action is selected by TVA.
Response	This comment does not require a response.

Comment ID	13
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Sections	2.2.3 and 2.6.1
Comment	Although the relicensed BNF is expected to stay in compliance with its operational NPDES permit, the heat waste load is expected to increase for both Alternative 1 and 2 (pg. 2-37). The DSEIS discusses potential impacts to the Wheeler Reservoir aquatic resources associated with such incremental increases. It was indicated (pg. 1-19 [2-19]) that fish in the area are mobile enough to avoid thermal discharges (or be attracted to thermal plumes in winter for refuge or concentrated prey), that sessile benthic assemblages would not be affected due to discharge diffuser design and the fact that warm water rises within the water column, and that preliminary modeling predicts that the thermal plume would not extend across the Reservoir and therefore would not provide a thermal blockage. We acknowledge these preliminary modeling results or published studies.
Response	The text in Sections 2.2.3, Associated Cooling Tower Impacts and Alternatives; 2.6.1, Comparison by Resource; and elsewhere addressing the subjects of Surface Water Resources and Aquatic Ecology, has been revised to reflect final analyses.

Comment ID	14
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Even though Wheeler Reservoir pool levels are controlled by TVA, will the receiving waters be at a lower pool during drought periods (which appear to be more common now than historically) such that there would be less volume available for thermal mixing, resulting in higher temperatures in the receiving waters?
Response	Drought conditions in the Tennessee Valley affect flow through Wheeler Reservoir to a much greater extent than elevations. Each spring, TVA allows Wheeler Reservoir to begin filling in mid March, with targeted summer levels to be reached by April 15. Local inflow is used to fill the reservoir (i.e. inflow from the unregulated area between Guntersville and Wheeler Dam) if there is insufficient inflows coming into Wheeler from upstream projects, as would be the case during drought conditions. TVA does not lower tributary pool elevations just to allow main river reservoirs, such as Wheeler, to fill on schedule. An examination of the 31 years of historical data from 1971 to 2001 indicates that the latest that Wheeler reached its normal summer operating zone (555 - 556) was late May, which occurred in 1986. In all other years, the normal summer operating range was reached no later than the end of April.

Once summer levels have been reached, droughts have little effect on the Wheeler elevations for the remainder of the year. Any minimum flow requirements needed downstream are supplied by withdrawals from the tributary reservoirs as well as planned (normal) drawdowns on the main river projects.

Comment ID	15
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Similar to drought effects, will consumptive water use continue to increase in the Tennessee Valley (much as power needs are projected to increase) such that reservoir water levels would be further lowered, resulting in even less volume of receiving water available for thermal mixing?
Response	As stated in the Final Environmental Impact Statement for the Tennessee River and Reservoir System Operation and Planning Review, dated December 1990, the minimum flow requirements past Browns Ferry Nuclear Plant are 10,000 cfs daily average in the months of July through September; 8,000 cfs daily average in the months of December through February; and 5,000 cfs otherwise. The increase in consumptive use (withdrawals from the Tennessee River system less returns to the system) for the year 2030 over present levels has been estimated to be 294 cfs for the Tennessee River system above Wheeler Dam. This represents about 3 percent of the present minimum daily average flow past BFN during the months of July through September, about 4 percent of the present minimum daily average flow during the months of December through February and about six percent of the minimum daily average flow during the rest of the year. Such increases will reduce the volume of water for thermal mixing. However, the percent change in flow is small compared to the overall entrainment and dilution of the thermal plume. As a result, related changes in the 24-hour average mixed temperature are expected to be insignificant. Also, the 24-hour average river flow at BFN drops below 10,000 cfs, on the average, only 2.7% of the time. Thus, the corresponding frequency of low flows where the impact of consumptive use would be the largest (i.e., below 10,000 cfs) is expected to be small.

Comment ID	16
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Will overall Reservoir water temperatures measurably increase due to global warming effects (which may be manifested over the lengthy 20-year license

	renewal term) such that ambient temperatures of receiving waters and the thermal plume become warmer on average than currently?
Response	Whether or not water temperatures will measurably increase depends on the expected magnitude of global warming, which at this time cannot be reliably predicted. Climate variations summarized in Section 3.1.1 of the SEIS are considered to be natural, without any detectable affects of man-made global warming. However, in recognition of concerns about global warming, TVA has performed studies to examine the sensitivity of the river and power systems to extreme meteorology and climate variations (Miller et al., 1993). In terms of water temperature, the studies evaluated the response of three typical types of reservoirs found in the river system—a deep tributary reservoir, a transitional tributary reservoir, and a mainstream reservoir. Wheeler Reservoir is a mainstream reservoir. Based solely on changes in air temperature, average (April through October) water temperatures in the mainstream reservoir showed an increase of between 0.3 F° and 0.5 F° for each 1 F° increase in air temperature. Thus, if the air temperature at BFN were to increase by an amount of 1 F° or more, measurable increases in the average temperature of the ambient water and thermal plume would be expected. Global warming, if it occurs, will undoubtedly increase the challenge facing TVA in managing the river and power systems to maintain water temperatures within limits specified in plant NPDES permits and plant technical specifications. References: Miller, B.A., V. Alavian, M.D. Bender, D.J. Benton, L.L. Cole, L.K. Ewing, P. Ostrowski, Jr., N.A. Nielsen, J.A. Parsley, W.B. Proctor, H.M. Samples, M.C. Shiao, and R.A. Shane, "Sensitivity of the TVA Reservoir and Power Supply Systems to Extreme Meteorology,", Tennessee Valley Authority, Resource Group, Engineering Services, Hydraulic Engineering, Report No. WR28-1-680-111, June 1993.

Comment ID	17
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Although lethal thermal effects on fish species may be avoidable due to their mobility, will increased discharge and plume temperatures illicit [elicit] sublethal thermal effects expressed in behavior, reproduction, predator-prey relationships, etc. Will effects on juvenile fish or fish eggs and larvae differ from adults?
Response	Appropriate text has been added to Section 4.2.10.1 of the FSEIS

Comment ID	18
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	In the event that temperature limits for BFN effluent were to be lowered as part of permit renewals every five years, would any or all of the cooling tower subalternatives have the flexibility for additional cooling capacity in order to stay in compliance with such new limits rather than result in non-compliance or reduced (derated) power generation?
Response	As explained in Section 2.2.3, Associated Cooling Tower Impacts and Alternatives, Alternatives 2A, 2B and 2C are bounding in that they provide the maximum anticipated change in terms of the number and size of additional cooling towers needed to avoid derates during almost all hot weather extremes. As such, these sub-alternatives would provide a conservatively large amount of additional cooling tower capacity and therefore would provide some inherent margin to absorb future changes without significant derates. Alternative 2D does not provide as large an initial increase in cooling tower capacity as that of Alternatives 2A, 2B and 2C but it has a great deal of flexibility to permit future increases in cooling tower capacity if the need should arise. Despite this margin, lowering BFN thermal limits would likely increase the amount of de-rates experienced in the future.

Comment ID	19
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	The temperature limits of the NPDES permit will be well below the thermal tolerance levels of reservoir aquatic species. However, to gain a perspective, we recommend that the FSEIS provide discussion on how close local aquatic species live near their thermal maximum compared to the ambient temperatures of Wheeler Reservoir. This would particularly be significant for important sport, commercial and ecological species to the extent that such species-specific thermal tolerance bioassay data are available. Also, do ambient temperatures upstream (i.e., before thermal addition) of BFN receiving waters ever naturally already equal or exceed regulatory NPDES permit temperature limits?
Response	Appropriate text has been added to Section 4.2.10.1 of the FSEIS.

Comment ID	20
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Page ES-12 indicates that Asiatic clams and zebra mussels exist within the Wheeler Reservoir system. Would the proposed additional thermal addition exacerbate these populations and in turn expedite the clogging of BFN intake systems? Would other aquatic nuisance species such as milfoil weed be enhanced by greater thermal addition? Would conditions be created that make Reservoir eutrophication more likely?
Response	Appropriate text has been added to Section 4.2.10.3 of the FSEIS. The 10 percent increase in cooling intake water as described under alternative 2, would increase the potential for clogging of the Brown's Ferry intakes with aquatic plants. Some problems with clogging have occurred at the current levels of operation. The severity of the problem is expected to vary from year to year and be dependent on the abundance of aquatic plants upstream of the Brown's Ferry intakes. The most significant problems are anticipated during the late summer and fall months when the plants begin to "breakup" and form floating mats, during high flow events, and when there are strong winds from the south. Relatively high eutrophic conditions were recorded (TVA, 1980) in Wheeler Reservoir during the late 1970's, but phytoplankton productivity was usually consistent both above and below BFN. Previous data show eutrophic conditions have been recorded in most of Wheeler Reservoir even during periods of no plant operation. Therefore, additional thermal input from this proposal should not affect enough of the reservoir area to significantly increase eutrophication.

Comment ID	21
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Would the additional waste heat load exacerbate the condition of the 303(d) listed, 10-mile reach between Wheeler Dam and the Elk River, particularly given that the 303(d) parameters for this reach already include temperature/thermal modifications from industrial effluent?
Response	As indicated in the DSEIS (Section 4.3.6.3), modeling analyses were conducted to assess the potential thermal effects under current NPDES permit conditions. A two-dimensional model examined potential effects to the reservoir (and 303 (d) reach), under extreme conditions (i.e., without the use of cooling towers and during the hot and dry conditions experienced in 1988). The results indicated a slight

increase (0.4 °F) in reservoir water temperatures in the 303 (d) listed reach of Wheeler Reservoir for the proposed three-unit operations relative to the originally approved three-unit operations (Table 4.3.6-2, Reservoir Forebay). As indicated in the DSEIS, temperature effects are expected to be less than shown in Table 4.3.6.2 with the use of cooling towers and plant de-rates, if necessary, and in years of more typical hydrology and meteorology.

Comment ID	22
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	Would hotter effluent discharges create additional fog at the surface of receiving waters during fall, winter and possibly cool early summer mornings? Would such fog impact local Reservoir navigation?
Response	During periods when the surface of Wheeler Reservoir is warm and overlain by cool ambient air, hotter effluent discharges from BFN will increase the rate of evaporation from the water surface. This, in turn, will increase the amount of moisture in the air for the production of steam fog. Compared to three-unit operation of BFN at the original power levels, TVA estimates that for three-unit extended power uprate, the rate of evaporation during such events will increase approximately 2 percent on average, and on rare occasions might increase as much as much as 7 percent. The original analyses for the impact of fog on local water transportation estimated that river traffic could be affected roughly 147 hours per year by diffuser-related operation at BFN (TVA, 1972). Assuming that fogging would increase in direct proportion to the rate of evaporation, this period would increase, at most, to about 158 hours per year. This increase is small and is not expected to significantly exacerbate any existing diffuser-related fog impairments to navigation in the vicinity of BFN. References: TVA, "Environmental Statement, Browns Ferry Nuclear Plant, Units 1, 2, and 3," Volume 1, Section 8.2-11.(3), Tennessee Valley Authority, September, 1972.

Comment ID	23
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	The DSEIS (pg. 2-39) states that the 21% increase in BFN intake flows needed for Unit 1 operation under Alternative 2 "...may increase impingement of adult fish and entrainment of fish eggs and larvae." Given the TVA-assessed good health of Wheeler Reservoir fisheries (pg. ES-12), this TVA impact evaluation (i.e., *may*

	increase) appears to be understated. We believe that a significant increase in intake flow from a healthy natural water source can be expected to result in greater fish impingement and entrainment, unless some fish avoidance mechanism is added. Editorially, we also note that page ES-23 states that "...increased CCW [Condenser Circulating (i.e., cooling) Water] intake volume would increase impingement of adult fish and entrainment of fish eggs and larvae," which we believe is a more realistic assessment (i.e., *would* increase). The FSEIS should reconsider the effects of the increased intake flows and insure consistency within the document. It is also noted that "[o]perational monitoring of impingement and entrainment during the first year of operation of Unit 1 would be used to confirm the extent of effects on various species" (pg. ES-23). While EPA strongly agrees with a well conceived monitoring program and an adaptive management approach to resolve any observed problems, it should be noted that avoidance of fish impingement and egg and larval entrainment are even more important. Are any fish avoidance mechanisms being employed or planned by TVA at the intake for BNF? What adaptive management methods could be applied if corrective actions are needed? What guidance will be used to determine if the level of impingement and entrainment is significant versus acceptable? We suggest coordination with the U.S. Fish and Wildlife Service (FWS) and its State of Alabama counterparts and disclosure in the FSEIS.
Response	Appropriate text has been added to Section 4.3.10.4 of the FSEIS.

Comment ID	24
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.6.1
Comment	We are pleased to note that the DSEIS indicates (pg. ES-23) that the project area does not contain wetlands. We note that this includes the three designated alternate areas for the disposal of spoil from the berm that would be reduced for new cooling tower construction or to reduce wind resistance for more efficient function of new or replaced cooling towers. These alternate areas are all located outside the 100-year floodplain.
Response	This comment does not require a response.

Comment ID	25
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	2.3.2

Comment	EPA agrees with the addition of more dry cask storage, as has been done at many other nuclear power plants. We assume that Congress and DOE will provide High-Level Waste storage/disposal by 2010 or shortly thereafter.
Response	This comment does not require a response.

Comment ID	26
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	3.21.1.2
Comment	Radiological impacts are stated to increase by "no more than 1.8 times...recently reported values after restart of Unit 1." The actual doses to the public [mrem/yr EDE] should be included in the FSEIS discussion in Section 4.3.21.2, although the limits established by EPA's 40 CFR 190, *Environmental Standards for Nuclear Power Operations*, will be easily met as before. Page 3-54 indicates that for 1999, liquid and gaseous releases were 1.2% and 0.3% of the action limits, which are 1/8 and 1/5 of the actual EPA limits, respectively.
Response	Appropriate additions have been made to Section 3.21.1.2, Public [Radiological Impacts Baseline During Normal Operations].

Comment ID	27
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	Appendix A
Comment	In Appendix A, we note that *Severe Accident Mitigation* is discussed for the alternatives. After the events of September 11, 2001, new emphasis and discussion is needed regarding potential terrorist scenarios and how they may affect BFN's preparedness, as well as future radiological emergency exercises with the Federal Emergency Management Agency (FEMA) and other federal and state agencies. In the FSEIS, the public should be assured that the contingencies to prepare for such attacks and other emergencies have been discussed, planned, and exercised for TVA Browns Ferry.
Response	TVA believes that the possibility of a terrorist attack affecting BFN operations is remote. Moreover, we do not believe that a potential terrorist attack creates the type of impact that can reasonably be considered to have been caused by, or be a likely or probable consequence of, TVA's proposed action in this instance. Notwithstanding the above, since the events of September 11, 2001, TVA has increased its level of security readiness and its security arrangements with local and Federal law enforcement agencies in response to safeguards advisories issued by the Nuclear Regulatory Commission (NRC). TVA's nuclear plants remain on the

highest level of security alert. Recently, the NRC issued an order to nuclear plant licensees, including TVA, requiring additional compensatory measures to address the ongoing generalized potential threat environment. TVA will continue to follow the requirements of the order pending notification from the NRC that a change in the threat environment has occurred, or until NRC determines that other compensatory measures are needed. In addition, NRC is performing a comprehensive re-evaluation of its security regulations. TVA will implement any additional requirements that result from this effort. The actions taken by TVA and NRC have reduced the potential for terrorist attacks on TVA's nuclear plants and have increased the capability to defend the nuclear plants from potential threats and attacks.

In addition, TVA has also taken measures to increase the level of cooperation and coordination between various Federal, State, and local agencies responsible for law enforcement and homeland security. TVA has specific agreements with the Governor's offices for the States of Alabama and Tennessee to provide a coordinated response to any future attack or emergency, including the use of National Guard and State Police resources, as necessary. The actions taken by TVA and Federal, State, and local agencies have also reduced the potential for terrorist attacks on TVA's nuclear plants and have increased the capability to defend the nuclear plants from potential threats and attacks.

Finally, at the national level, the government has taken additional measures to strengthen homeland security. These actions include the various measures taken to improve airline security and safety as it relates to potential terrorist threats. These actions have further reduced the potential for terrorist attacks on TVA's nuclear plants.

Comment ID	28
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	4.3.1.4
Comment	A distinct environmental advantage of nuclear power plants compared to fossil-fired power plants is that they do not produce CO_2, NO_x, SO_x and other emissions to generate power. However, some of these emissions are generated through support facilities and plant deliveries such as diesel generators, auxiliary steam boilers, vehicular/construction traffic, and cooling tower drift losses. Emissions include CO, CO_2, PM, NO_x, SO_x and VOCs. It is unclear as to why CO_2 was not referenced (e.g., pg. 4-29) given that most combustion (e.g., diesel and gasoline engines) would emit more CO_2 than CO if properly tuned.
Response	Although CO_2 generation at a nuclear plant is very minor compared to that produced at a fossil-fueled plant, identification of CO_2 as an emission has been added in the text of the FSEIS in Sections 3.1.3, 4.2.1.4, and 4.3.1.4. Other than relatively short-term and intermittent emissions associated with construction activities and increased work force traffic, CO_2 emissions from operation of the three units would not be increased beyond those already experienced to date.

Comment ID	29
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	4.2.1.2
Comment	We note that page 4-8 references emission analyses in Section 2.5 (Vol. 1) of the original 1972 EIS. While we agree with a reasonable incorporation by reference, the results for the level of emissions previously calculated should be adopted from the 1972 EIS and presented in a FSEIS table by emission source and by alternative. Calculated data apparently include emissions for diesel generators and cooling tower drift losses. Other additional emission sources should also be reasonably inventoried, and listed with their emissions qualified in terms of the level of emissions (substantive, minor, intermittent, etc.), purpose (cooling tower, pumping, vehicular, etc.) and time/season of operations (daily, summer only, etc.) for each alternative. No additional calculations are requested unless updates are needed or substantive cumulative emissions for any air quality parameter are expected.
Response	Tables of 1) emissions calculation data from the 1972 EIS and 2) other additional emission sources have been added to Section 4.2 of the FSEIS.

Comment ID	30
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	4.3.14.1
Comment	Also related to air quality, page ES-25 indicates that traffic on access roads to BFN (Shaw Road, Nuclear Plant Road and Browns Ferry Road) would increase from 1,600 to 2,900 vehicles per day during construction and temporarily be at a lower Level of Service (LOS). The FSEIS should reference the predicted LOS (should not be less than LOS C for safety, air quality & flow) and the approximate time span for this decreased LOS.
Response	The methodology in the Highway Capacity Manual (Transportation Research Board, 1994) was used to determine levels of service as provided to the roadway user. The manual provides a qualitative method to measure the operational conditions within a traffic stream, and their perception by motorists. The sum of the estimated existing traffic and the projected additional peak traffic was compared with that volume of traffic which is acceptable for a level of service D. Level of service D represents high-density, but stable flow. Tolerable average operating speeds are maintained but are subject to considerable and sudden variation. Although most drivers would consider this service level undesirable, unstable flow has not yet been reached and the roadway condition can be tolerated for short periods of time (i.e., during plant shift changes).

Appropriate changes have been made to the Executive Summary Section S.4 on Environmental Consequences for Transportation during Unit 1 recovery (Alternative 2).

Comment ID	31
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	
Comment	Since construction would be a relatively important source of emissions, we are pleased to note (pg. 2-29) that the time frame for the restart of Unit 1 was disclosed (5.5 years). However, we note that construction impacts would be rather long termed as opposed to *temporary* as indicated in the DSEIS. We assume that the 5.5-year period would also incorporate other construction such as uprating of Units 2 & 3 and construction of additional buildings. The FSEIS should verify this.
Response	As stated in Section 2.4.2.1, Restart of Unit 1, Unit 1 recovery involves a large amount of analytical work as well as a large number of modifications and equipment changes internal to the plant; accordingly, the impact on the air, land, and water environment surrounding the facility is expected to be negligible. The projected external construction tasks, either individually or cumulatively, are relatively limited in terms of duration or environmental impacts and would not be characterized as being a significant source of emissions. This is particularly true since the most likely cooling tower subalternatives do not involve major spoils relocation or new site preparation. It should also be noted that, as shown in Figure 2.4-2, the heavy majority of the craft work for Unit 1 recovery does not take place until well into the second half of the schedule. In contrast, as stated in Sections 2.3.3 and 2.4.2.2, construction of the new Modifications/Fabrication and Administration buildings would begin almost immediately after a favorable decision on Unit 1. The majority of the work on the initial phases of the Dry Cask Storage Facility for spent fuel would be completed before 2005 (as stated in Section 2.3.2), which is after the new Mod/Fab and Admin buildings but well before most of the Unit 1 construction work. Extended Power Uprate (EPU) work for Units 2 and 3 was addressed in a separate Environmental Assessment (EA) and is, accordingly, not addressed in this SEIS as a proposed action. However, as stated in the EPU EA, the only construction issue of any environmental significance is the additional cooling tower capacity required, which has been factored into the discussions of this topic in this SEIS as a cumulative impact. The additional cooling tower capacity required would most likely be constructed in parallel with the Dry Cask Storage Facility concrete work.

Comment ID	32
Name	Heinz J. Mueller

Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Sections	2.6.1 and 4.3.19.1
Comment	Assuming that at least some form of on-site construction would last for 5.5 years, we do not agree, as suggested above, that construction noise would be "...for a relatively short time" (pg. 2-42). TVA may wish to distinguish in the FSEIS between general cooling tower and building construction versus Unit 1 refurbishment in terms of their longevity. We appreciate that a range of noise levels for basic construction equipment at 50 feet was provided (pg. 4-54).
Response	Appropriate changes have been made to the Environmental Noise portion of Section 2.6.1, Comparison by Resource.

Comment ID	33
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	4.3.19.1
Comment	We do not totally agree with the assumption (pg. 4-54) that construction noise should be insignificant because "[p]eople understand that construction projects use heavy equipment and that the equipment produces noise, and they understand that the construction has an end point" and that "[f]requently, people like to watch the equipment work and the noise is part of the experience." We suggest that the other reasons listed on page 4-54 be emphasized such as noise generally being limited to daytime and a normal business week. Moreover, the FSEIS should commit to such noise abatement rather than just indicating that "noise effects can be addressed or ameliorated in several ways if necessary." Considering the long-termed nature of construction in this case (5.5 yrs), this becomes important.
Response	Appropriate changes to section 4.3.19.1, Construction Noise, have been made.

Comment ID	34
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	4.4.19
Comment	Noise from general plant operation and support would be increased during operation of the fan motors of the cooling towers. Cooling towers, however, would apparently only operate 17-27 days per year. During operation, noise levels at the nearest residences (Paradise Shores S/D) would be elevated +3 to +7 dBA Leq(24) and +5 to +9 dBA DNL, depending on the fan vendor selected. Given ambient levels of 47 dBA Leq(24) and 52 dBA DNL, respectively, these increases may or may not be significant per the Federal Interagency Committee on Noise (FICON).

The FSEIS should verify. However, we do note that given the short time of cooling tower use per year, the annualized levels are reduced to +3 dBA DNL for both the 17 and 27 days of operation. This level of increase would not be considered significant per FICON at the ambient level of 50 dBA DNL. Nevertheless, because operational periods would likely noise-impact Paradise Shores S/D, we suggest that source reduction methods (low-noise fan motors: pg. 4-66) be achieve[d] through careful selection of the fan vendor. We also note that "TVA is not committing to use such fans at this time" but, we believe, should consider such in the FSEIS. EPA further suggests that towers closest to the residences (3 & 4), be the last of the 6-8 towers to be operated and first to be shutdown in order to minimize noise (i.e., Leq(24) is reduced by 6 dBA: pg. 4-66). The FSEIS should further discuss this and consider a commitment to implement this protocol.

Response

The Leq(24) at Paradise Shores is estimated to increase 3 to 7 dBA for Alternative 2C as noted in this comment. Alternatives 2A and 2B have 0 (zero) and 1 dBA increases, respectively, in the Leq(24). The incremental increase in operational noise from the cooling tower for the TVA preferred alternative Alternative 2D is about a 1 dBA increase over current operational noise. With regard to the potential impacts of the 24-hr. DNLs from Alternative 2C, with vendors 1 and 2 having 9 and 5 dBA increases, respectively, appropriate text changes have been made in Section 4.3.19.3.1. TVA would further analyze several options for mitigating the potential noise increase at Paradise Shores prior to accepting the final design for the cooling towers from the selected vendor. Some of the options include, but are not limited to: using low noise fans on all cooling towers for Alternative 2C; using low noise fans only on towers 3 and 4; instituting operating instructions to minimize the use of towers 3 and 4; and soliciting other noise reduction options from the cooling tower vendor.

For Alternative 2D, the new tower would reside on the location of a vacant cooling tower basin with the 25 percent extension to the tower in the eastern direction away from the residential areas near the plant. This configuration would minimize the impact of increased noise. Further, low noise fans would be considered as part of the procurement process; TVA would consider the available technologies, relative costs and noise reduction efficiencies in making its decision at that time. However, because under this alternative they would be the most efficient, towers 3 and 4 would probably be operated first and shutdown last in order to maximize heat removal efficiency.

Comment ID	35
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Sections	4.2.7 and 4.3.7
Comment	We note that ground water will not be used for BFN cooling. The FSEIS should indicate, however, if the on-site waste lagoons would affect ground water (i.e., are the lagoons lined and is the leachate monitored?). Also, what wastes would be contained in the lagoons?
Response	Appropriate changes have been made to text in sections 3.7.1, 4.2.7.1, and 4.3.7.1 of the FSEIS.

Comment ID	36
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	3.2.3
Comment	Page ES-8 states that "[t]he BFN is located in an area far removed from any centers of significant seismic activity in historic time." It is noted, however, that an earthquake registering 3 or more on the Richter Scale recently occurred in December 2000 in the general vicinity (near Scottsboro, AL). What structural or other effects, if any, did this have on BFN (and parenthetically, the unfinished TVA Bellefonte Nuclear Plant near Scottsboro) and what additional seismic activity, if any, can be expected in the vicinity of BFN in the future?
Response	Appropriate changes have been made to the text in section 3.2.3 of the FSEIS.

Comment ID	37
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	1.2
Comment	We suggest that Figure 1.2-1 (pg. 1-3) be improved by labeling or including and labeling water-related features such as the Tennessee and Elk Rivers, Wheeler Dam, and the 303(d) reach between the Dam and the Elk River.
Response	A new figure has been included which indicates the suggested additions.

Comment ID	38
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	1.5.3.1.1
Comment	The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS: NUREG-1437) was referenced on page 1-18. The FSEIS should provide a publication date for the GEIS and perhaps include it in the references on page 1-22.
Response	The original two volumes of NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, are identified as both the Main Report and the Final Report and are dated as being published in May 1996. Various Supplements and Addenda have since been issued. The year of publication has been added to the text, and the document has been included in the references for Chapter 1.

Comment ID	39
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	N/A
Comment	The original EIS is sometimes referred to as an *Environmental Statement* (pg. ES-8, ES-19, 1-17) as opposed to an *Environmental Impact Statement* or *EIS,* and should be corrected and made consistent in the FSEIS.
Response	The 1972 comprehensive environmental analysis of the construction and operation of the Browns Ferry Nuclear Plant was titled as an Environmental Statement since it predated the commonly used present-day title of Environmental Impact Statement (EIS). Since the correct 1972 title is an **Environmental Statement** but it actually is an **EIS** in current terminology, the former is used wherever the complete title is needed and the latter is used wherever the abbreviation for the type of document is sufficient.

Comment ID	40
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	N/A
Comment	We suggest that the cooling towers be labeled when shown on figures in Chapter 2 (e.g., Fig. 2.0-1 and 2.2-1). Similarly, the three units should also be identified.
Response	The appropriate figures in Chapter 2 have been updated to identify the cooling towers and the reactor units.

Comment ID	41
Name	Heinz J. Mueller
Affiliation	U.S. Environmental Protection Agency, Region 4
DEIS Section	3.19.5
Comment	Table 3.19-2 (pg. 3-45) should clarify the time frame of the data presented for "Background Leq" (9 hr or 15 hr?) and the "Total Leq" (24 hrs?). Also, data in the table do not always agree with the text.
Response	Appropriate changes have been made to Section 3.19, Potential Effects of Environmental Noise.

Comment ID	42
Name	Gregory L. Hogue
Affiliation	U.S. Department of the Interior, Acting Regional Environmental Officer
DEIS Section	N/A
Comment	The Department of the Interior has reviewed the Draft SEIS for the referenced document. We have no comments at this time. Thank you for the opportunity to review this document.
Response	This comment does not require a response.

Comment ID	43
Name	Jack M. Hilliard
Affiliation	City of Florence Utilities, General Manager
DEIS Section	N/A
Comment	Thank you for the TVA Draft Supplemental Environmental Impact Statement for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama. This letter will advise you that I support the twenty-year extension of the license from the Nuclear Regulatory Commission (NRC) for operation of Units 1, 2 and 3, of the Browns Ferry Nuclear Plant (BFN) located in Limestone County, Alabama. With the ever-increasing need for power generation in the Valley and the need for a balanced energy supply in the Valley and our nations, nuclear energy can provide for that need and balance.
Response	This comment does not require a response.

Comment ID	44
Name	Marie Watkins
Affiliation	
DEIS Section	N/A
Comment	I am a Senior Citizen living alone within a ten mile radius of Browns ferry Nuclear Plant. I live in constant horror and fear of any kind of accident happening there. I can't understand why we continue to build or restart nuclear plants when one bad accident could take thousands of lives. With today's research and technology, I'm sure there are already alternate sources of power. I'm wandering [sic] how many people who are for nuclear energy live within a ten mile radius of a plant?
Response	Severe accidents are addressed in the FSEIS in Sections on Radiological Impacts (3.21, 4.2.21 and 4.3.21). Security readiness for September 11, 2001 types of events is addressed above in the response to Comment 27. Alternative sources of power are addressed in Section 1.4, Projecting TVA's Needs for Generating Capacity. TVA has not taken a poll of individuals residing within 10 miles of BFN, but it can be noted that more than twice as many favorable comments have been received than negative comments.

Comment ID	45
Name	Barrett Shelton
Affiliation	The Decatur Daily, Publisher
DEIS Section	N/A
Comment	Unit one at Browns Ferry Nuclear plant should be restarted. Certainly you and TVA know of many reasons why, possibly the most important being the uncertainty of future power sources. Early in the days of nuclear power it was considered a bridge to the next source of power, but that new source isn't here now nor does it seem close. Thus nuclear, including unit one, may have to carry us longer than ever expected.
Response	This comment does not require a response.

Comment ID	46
Name	Dan Williams
Affiliation	The City of Athens, Alabama, Mayor
DEIS Section	N/A
Comment	The City of Athens and Athens Utilities supports TVA in its efforts to re-license Browns Ferry Nuclear Plant and would like to encourage the TVA Board of Directors to give every consideration to restarting Unit 1 at Browns Ferry. We believe that a reliable, low-cost supply of electricity is essential for continued economic development in the Tennessee Valley and that Browns Ferry Nuclear Plant is a valuable asset in achieving this objective.
Response	This comment does not require a response.

Comment ID	47
Name	Lynn Fowler
Affiliation	The City of Decatur, Alabama, Mayor
DEIS Section	N/A
Comment	I very much support the restart of Unit 1 and the extension of licenses for 1, 2, and 3.
Response	This comment does not require a response.

Comment ID	48
Name	Anonymous response from Public Meeting
Affiliation	
DEIS Section	N/A
Comment	I'm very much in favor of re-starting Unit 1 as the benefits far out-weigh any of the negatives.
Response	This comment does not require a response.

Comment ID	49
Name	Rick Humphreys
Affiliation	Decatur/Morgan County Lodging Association, President
DEIS Section	N/A
Comment	As the General Manager of The Holiday Inn Hotel & Suites in Decatur, and as the president of the Decatur/Morgan County Lodging Association, it is my privilege to fully endorse this project. We are excited about the economic impact that it will bring to our area. Thank you very much
Response	This comment does not require a response.

Comment ID	50
Name	Ellis B. Chenault
Affiliation	Decatur – Morgan County Convention and Visitors Bureau, President
DEIS Section	N/A
Comment	RESOLUTION WHEREAS, the Decatur-Morgan County Convention and Visitors Bureau is organized to achieve the objective of stimulating the economic and cultural environment of Decatur and Morgan County through the promotion of its attractions, events, recreational and meeting facilities and to increase the number of visitors to the City/County for business or pleasure; and WHEREAS, TVA seeks public comment on a draft supplemental environmental impact statement that examines the potential impacts of a proposal to extend the operation of Units 2 and 3 and potentially the restart of Unit 1 at Browns Ferry Nuclear Plant; and

WHEREAS, extension of the operating licenses for Browns Ferry Nuclear Plant would generate jobs, income tax revenues, and sales tax revenues for Decatur/Morgan County, the North Alabama region, and the State of Alabama; and

WHEREAS, the hospitality industry relies heavily on the corporate business traveler and would benefit directly from increased occupancy; and

WHEREAS, the results would be an increase in the lodging taxes collected for the State of Alabama and Decatur/Morgan County; and

THEREFORE, BE IT RESOLVED that the Decatur-Morgan County Convention and Visitors Bureau hereby adopts this resolution in support of the proposed extension of operating licenses for Unit 2 and 3 and the restart of Unit 1 at Browns Ferry Nuclear Plant.

Response: This comment does not require a response.

Comment ID: 51

Name: Teddy Taylor

Affiliation: Received e-mail

DEIS Section: N/A

Comment: My name is Teddy Taylor from Jamestown TN. I believe we need to go with unit 1 @ browns ferry for sure. We need all the power we can produce here @ home!!

Response: This comment does not require a response.

Comment ID: 52

Name: Lee Coker

Affiliation: Received e-mail

DEIS Section: N/A

Comment: Hello.
I will not be able to attend your public comment night for the Brown Ferry Nuclear Plant but would like to make a comment for the EIS. I feel that nuclear power is neither safe nor sustainable and am shocked and disappointed that TVA would seek to further the use of one of the least safe nuclear plants in the country. I feel that the lives and land of the great state of Alabama are beginning put in danger by your Browns Ferry Plant and am outraged at your audicity [sic] to try to reopen a plant that has had one of the most dangerous accidents at any nuclear plant in the country. Nuclear energy is no where near as effecient [sic] as solar, wind, or conservation measures. I would love to see you guys reuse your waste heat at any steam generation plants in the future.
Sincerely,

Lee Coker

Response

As explained in Section 1.5, TVA has significantly improved the performance of BFN to the point where it is now considered to be among the top performing plants in the country. Severe accidents are addressed in the FSEIS in Sections on Radiological Impacts (3.21, 4.2.21 and 4.3.21). Security readiness for September 11, 2001 types of events is addressed above in the response to Comment 27. Alternative sources of power are addressed in Section 1.4, Projecting TVA's Needs for Generating Capacity. Re-use of waste heat continues to be considered by TVA but is outside the scope of this EIS.

Comment ID

53

Name

Rick Jobe

Affiliation

DEIS Section

N/A

Comment

I live in Huntsville and attend Athens State University as an adult student, therefore have standing and an acute interest in the environmental, economic and social issues in the area surrounding Browns Ferry Nuclear Power Plant. I have studied many public documents and followed the operation of the plant as a concerned citizen and sometimes intervener in the licensing process at Browns Ferry, off and on since the fire in 1976.

As a middle aged man with a family I am aware that our options regarding energy demand are complex and get more difficult every year. Even though I have sometimes been at odds with T.V.A.'s plans concerning nuclear (such as opposition to incineration of waste) I am sympathetic and sometimes proud of T.V.A.'s record as an agency that has been willing to be out front on alternative energy options.

I'ye also lived long enough to know that the citizens and the agency are much more effective as partners in the production of energy and the careful stewardship of our resources.

That being said, I would like to raise a voice of concern regarding plans to extend the life of one the nation's oldest nuclear power plants (Browns Ferry) and to restart Unit 1. I don't think either is a good idea.

Even though Browns Ferry has vastly improved its safety record in recent years there are still unresolved problems regarding permanent waste storage and safety. The threat of tornado is not one to be overlooked regarding storage facilities, cooling towers and reactor building.

Most importantly, our world has changed dramatically since September 11. It's time for us to realize that nuclear power poses an unacceptable risk to the valley and to the nation as a result of a growing willingness on the part of international terrorists to commit suicide while destroying sensitive facilities and causing great, long term havoc.

It doesn't strike me as anywhere near impossible to conceive of a determined terrorist obtaining access to an airplane, large or small and crashing it into the reactor building. We all know that if a candle can bring Brown's Ferry to the brink of a disastrous melt-down with the potential to contaminate the Tennessee River and perhaps the whole valley, that it could surely be done by a large vehicle falling from the sky. The amount of time it would take a terrorist to get an airplane from Huntsville airport to Brown's Ferry by simply following the river combined with the ease of identifying the power plant and reactor buildings is a frightening thought.

The long term effects of this kind of accident are well documented in the former Soviet Union and would result in the contamination of our precious land and water for well beyond all our lifetimes.

We owe it to our children to phase out nuclear power and to wake up to the need for conservation, solar, cleaner coal plants, hydro etc. A terrorist act on any of these facilities might be a temporary and large problem but the scale of destruction for the long term pales in comparison to what might result from an attack on a nuclear facility.

Times have changed and so must we.

Please read this letter at the public meeting January 17th at Calhoun Jr. College which I cannot attend due to prior commitment at Athens State College if this is at all possible.

I would also like to be informed of any future hearings on these and related matters. I would prefer any responses or forwarded documents to be electronic whenever possible. I don't want to have or to waste the paper.

Thank You Sincerely;
Rick Jobe

Response

Spent fuel storage activities are discussed in the FSEIS in Sections 2.2.4, Spent Fuel Storage Options; and 2.3.2, Dry Cask Storage Facility. Tornado resistance and other safety considerations are addressed in the BFN Final Safety Analysis Report. Severe accidents are addressed in the FSEIS in Sections on Radiological Impacts (3.21, 4.2.21 and 4.3.21). Security readiness for September 11, 2001 types of events is addressed above in the response to Comment 27. Alternative sources of power are addressed in Section 1.4, Projecting TVA's Needs for Generating Capacity.

Comment ID 54

Name Lorraine Smith

Affiliation

DEIS Section N/A

Comment In regards to extending the operating license for Browns Ferry Nuclear Power Plant, we generally are opposed to nuclear plants. The reason for this is the

	increased activity of terrorists in today's world. Until true security can be accomplished at nuclear plants we feel uncomfortable with the extension.
Response	Security readiness for September 11, 2001 types of events is addressed above in the response to Comment 27.

Comment ID	55
Name	Frank Powell
Affiliation	
DEIS Section	N/A
Comment	Gentlemen: I strongly favor renewal/extension of the Browns Ferry nuclear facility license. I am also concerned that "anti-nuclear" elements are vigorously pursuing ways to halt all nuclear power production at a time when are electrical energy needs are approaching present production capabilities. The near energy crisis in California should serve as a warning. I am also concerned that environmentalist attacks on coal-fired energy could hasten the time when our needs exceed capacity. Entrenched forces within government bureaucracies seem determined to halt all coal-fired plant construction and eventually close all such existing plants. Their contentions that wind and solar facilities can some day supply our electrical energy needs are pipe dreams. I oppose TVA's wind and solar programs since they have been proven to be cost inefficient. TVA's "green power" project, I feel, is an expensive concession to the militant environmentalists, and the voluntary $4.00 surcharge will not cover the expense of construction and maintenance. I also strongly urge returning Unit 3 reactor to service at Browns Ferry as soon as possible. Thank you for this opportunity to comment.
Response	This comment does not require a response.

Comment ID	56
Name	Thomas Hruby
Affiliation	
DEIS Section	N/A
Comment	It seems to me to be imperative to continue the operation of Browns Ferry as a power source. In fact, all units should be operating as much as possible. I believe our country will be in serious problems if we do not expand the use of nuclear power sources.

	Whatever it takes to keep the operation going is imperative. I do believe some of the safety requirements need revisiting to make them reasonable.
Response	This comment does not require a response.

Comment ID	57
Name	Joan Jackson
Affiliation	
DEIS Section	N/A
Comment	This is to register my opinion on the operating extension for units 2 and 3, and the possible re-start of unit 1 at Browns Ferry Nuclear Power Plant. I live in Huntsville and have resided here for over 40 years. In the past, we hoped that any accidental emissions from the nuclear plant would be small and probably would not affect this area. However, since September 11, 2001, our concern has deepened. Because of the close proximity of Huntsville International Airport, there would be no time to intercept a hijacked plane with Browns Ferry as the intended target. Although the possibility of this happening is small, it still remains a possibility with an outcome beyond our ability to control. In view of the current terror threat in this country and taking into account the age of the units, it is my opinion that TVA would be negligent to put a large civilian population (or Redstone Arsenal's military population) in harm's way. It is my hope that TVA will shut down its nuclear plant at Browns Ferry and begin clean up of stored spent fuel at that site.
Response	Security readiness for September 11, 2001 types of events is addressed above in the response to Comment 27. The effects of equipment aging are addressed in Section 2.4, Description of Actions Specific to Associated Alternatives.

Comment ID	58
Name	John Hatfield
Affiliation	Morgan County Economic Development Association
DEIS Section	N/A
Comment	As President/CEO of the Morgan Co. Economic Development Association, I want to thank you for exploring the issue of starting the third reactor at Browns Ferry. Obviously, not only would it provide more reliable power for manufacturers in the area, it itself would create many jobs. I encourage TVA to continue this endeavor.
Response	This comment does not require a response.

Comment ID	59
Name	Tom Wright
Affiliation	
DEIS Section	N/A
Comment	We need Browns Ferry Unit 1 up and going and the life of Units 2 & 3 extended. I've lived in Decatur 23 years and the plant is part of who we are. As long as TVA maintains quality controls and watches costs, Browns Ferry is a tremendous asset.
Response	This comment does not require a response.

Comment ID	60
Name	Jack Fite
Affiliation	The Decatur-Morgan County Chamber of Commerce, Chairman
DEIS Section	N/A
Comment	The Decatur-Morgan County Chamber of Commerce supports the re-start of Unit I and looks forward to playing an active role in helping new and existing businesses participate.
Response	This comment does not require a response.

Comment ID	61
Name	John Diehl
Affiliation	
DEIS Section	N/A
Comment	Dear Sir, What's happening with the Unit One restart proposal? Is anything happening with Bellefonte? (I am a native Huntsville, but work as a Health Physicist at the South Texas Project, hence my interest in Bellefonte). I would point out that of the seven operational B&W units, four have been re-licensed and the remaining three are likely to see license renewals, thus Bellefonte has enormous long term economic potential. Analysis of the cost of restarting BF1 (1100 MW?) should be balanced against the cost of starting Bellefonte 1 and 2 (1600 - 1800 MW combined). The issuance of a new license could make other stranded investments become viable

	(Watts Bar 2) and ultimately lower the regulatory hurdles facing BF1. Please let me know of TVA's progress on these fronts. Sincerely John Diehl
Response	The planned milestones for BFN operating license renewal, which include potential recovery of Unit 1, are listed in the Executive Summary. Bellefonte and Watts Bar are outside the scope of this SEIS, but the status of these projects are frequently reported in area newspapers.

GLOSSARY

A-weighted decibel (dBA) - A unit of weighted sound pressure level, measured by the use of a metering characteristic and the "A" weighting specified by American National Standard Institute S1.4-1971(R176). (See decibel).

Absorbed dose - The energy deposited per unit mass by ionizing radiation. The unit of absorbed dose is the rad.

Accident - One or more unplanned events involving materials that have the potential to endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent adverse health effects.

Accident sequence - With regard to nuclear facilities, an initiating event followed by system failures or operator errors, which can result in significant core damage, confinement system failure, and/or radionuclide releases.

Actinide - Any of a series of chemically similar, mostly synthetic, radioactive elements with atomic numbers ranging from actinium at 89 through lawrencium at 103.

Activation products - Nuclei, usually radioactive, formed by the bombardment and absorption of material with neutrons, protons, or other nuclear particles.

Acute exposure - The exposure incurred during and shortly after a radiological release. Generally, the period of acute exposure ends when long-term interdiction is established, as necessary. The period of acute exposure is generally assumed to end 1 week after the inception of a radiological accident.

Alpha particle - A positively charged particle consisting of two protons and two neutrons that is emitted from the nucleus of certain nuclides during radioactive decay. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

Alpha activity - The emission of alpha particles by radioactive materials.

Alpha particle - A positively charged particle, consisting of two protons and two neutrons, that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

Alpha radiation - The least penetrating of the four common types of radiation (alpha, beta, gamma, and neutron). It consists of a positively charged particle with two protons and two neutrons that is emitted from the nucleus of certain nuclides during decay.

Alpha wastes - Wastes containing radioactive isotopes that decay by producing alpha particles.

Ambient air - The surrounding atmosphere as it exists around people, plants, and structures. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

Archaeological sites (resources) - Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

Artifact - An object produced or shaped by human workmanship of archaeological or historical interest.

As Low as Reasonably Achievable (ALARA) - A concept applied to ensure the quantity of radioactivity released to the environment and the radiation exposure of onsite workers in routine operations, including "anticipated operational occurrences," is maintained as low as reasonably achievable. It takes into account the state of technology, economics of improvements in relation to benefits to public health and safety, and other societal and economic considerations in relation to the use of nuclear energy in the public interest.

Atomic Energy Act of 1954, as amended - The statute that established U.S. requirements with respect to nuclear energy and nuclear materials. This Act, as amended, provides the statutory framework for government control of the possession, use, and production of atomic energy, special nuclear material, and other radioactive material, whether owned by the government or others.

Average daily traffic (ADT) - The number of vehicles that pass a defined point on a defined roadway over a 24-hour period.

AXAIRQ - A computer model that analyzes doses from airborne radionuclide releases.

Background radiation - Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerably with location.

Badged worker - A worker who has the potential to be exposed to radiation and is equipped with a dosimeter to measure his/her dose.

Barrier - Any material or structure that prevents or substantially delays movement of radionuclides toward the accessible environment.

Baseline - A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and progress of a project can be measured. For this environmental impact statement, the environmental baseline is the site environmental conditions as they exist or have been estimated to exist in the absence of the proposed action.

Baseload - The minimum amount of electric power or natural gas delivered or required over a given period of time at a steady rate. The minimum continuous load or demand in a power system over a given period of time usually not temperature sensitive.

Baseload capacity - The generating equipment normally operated to serve loads on an around-the-clock basis.

Benthic - Plants and animals dwelling at the bottom of oceans, lakes, rivers, and other surface waters.

Best Management Practices (BMP) - A practice or combination or practices that is determined by a state (or other planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with air or water quality goals.

Beta particle - A charged particle emitted from the nucleus of an atom during radioactive decay. A negatively charged beta particle is identical to an electron; a positively charged beta particle is called a "positron."

Beta radiation - Consists of an elementary particle emitted from a nucleus during radioactive decay; it is negatively charged, is identical to an electron, and is easily stopped by a thin sheet of metal.

Biodiversity - The diversity of life in all its forms and all its levels of organization. Also termed "biological diversity."

Block groups - U.S. Bureau of the Census term describing a cluster of blocks generally selected to include 250 to 550 housing units.

Blowdown - A maintenance procedure to remove sediment in power plant components.

Boiling water reactor - A type of nuclear reactor that uses fission heat to generate steam in the reactor core or vessel to drive turbines and generate electricity.

Boron-10 - An isotope of the element boron that has a high-capture cross-section for neutrons. It is used in reactor absorber rods for reactor control.

Bounding accident - An accident whose calculated consequences encompass all other possible accident consequences for that facility. For example, a bounding accident for the release of hazardous material from a storage tank would postulate the release of the entire tank contents. The consequences from this accident would be greater than the consequences of all other tank release accidents.

Burnable absorber - A material, such as boron or lithium, which captures neutrons and transmutes or changes to another isotope.

Burnable poison rod - A nuclear reactor rod used to capture or absorb neutrons created in the core by the fission reactions during the early core life.

Burnup - The total energy released through fission by a given amount of nuclear fuel; generally measured in megawatt-days.

Cancer - The name given to a group of diseases characterized by uncontrolled cellular growth with cells having invasive characteristics such that the disease can transfer from one organ to another.

Canister - A stainless-steel container in which nuclear material is sealed.

Capable geology - Describes a geological fault that has moved at or near the ground surface within the past 35,000 years.

Capacity factor - A power production performance measure that compares the amount of power actually produced per year to the maximum power output possible. This measure is typically expressed as a fraction or percentage of the megawatt hours (MWh) produced relative to the possible MWh that would have been produced had the unit or system operated every hour of the year.

Carcinogenic - Capable of inducing cancer.

Cesium - A silver-white alkali metal. A radioactive isotope of cesium, cesium-137, is a common fission product.

Chain reaction - A reaction that initiates its own repetition. In a fission chain reaction, a fissionable nucleus absorbs a neutron and fissions spontaneously, releasing additional neutrons. These, in turn, can be absorbed by other fissionable nuclei, releasing still more neutrons. A fission chain reaction is self-sustaining when the number of neutrons is constant or increases over a period of time.

Chemical oxygen demand - A measure of the quantity of chemically oxidizable components present in water.

Chronic exposure - Low-level radiation exposure incurred over a long time period due to residual contamination.

Cladding - The metal tube that forms the outer jacket of a nuclear fuel rod or burnable absorber rod. It prevents the release of radioactive material into the coolant. Stainless steel and zirconium alloys *are* common cladding materials.

Capacity factor - The ratio of the annual average power production of a power plant to its rated capacity.

Cold standby - Maintenance of a protected reactor condition in which the fuel is removed, the moderator is stored in tanks, and equipment and system lay-up is performed to prevent deterioration, such that future refueling and restart are possible.

Collective committed effective dose equivalent - The committed effective dose equivalent of radiation for a population.

Committed effective dose equivalent - The sum of the committed dose equivalents to various tissues in the body multiplied by their appropriate tissue weighting factor. Equivalent in effect to a uniform external dose of the same value.

Consumptive water use - The difference in the volume of water withdrawn from a body of water and the amount released back into the body of water.

Container - With regard to radioactive wastes, the metal envelope in the waste package that provides the primary containment function of the waste package and is designed to meet the containment requirements of 10 CFR 60.

Containment design-basis - For a nuclear reactor, those bounding conditions for the design of the containment, including temperature, pressure, and leakage rate. Because the containment is provided as an additional barrier to mitigate the consequences of accidents involving the release of radioactive materials, the containment design-basis may include an additional specified margin above those conditions expected to result from the plant design-basis accidents to ensure that the containment design can mitigate unlikely or unforeseen events.

Control rod - A rod containing material such as boron that is used to control the power of a nuclear reactor. By absorbing excess neutrons, a control rod prevents the neutrons from causing further fissions; i.e., increasing power.

Cooling water - Water pumped into a nuclear reactor or accelerator to cool components and prevents damage from the intense heat generated when the reactor or accelerator is operating.

Credible accident - An accident that has a probability of occurrence greater than or equal to one in a million years.

Criticality - A reactor state in which a self-sustaining nuclear chain reaction is achieved.

Crop - A process that cuts off or otherwise removes the hardware on the fuel assemblies, leaving primarily the active fuel for subsequent processes.

Cultural resources - Archaeological sites, historical sites, architectural features, traditional use areas, and Native American sacred sites.

Cumulative impacts - In an environmental impact statement, the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or nonfederal), private industry, or individual(s) undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7*)*.

Curie (Ci) - A unit of radioactivity equal to 37 billion disintegrations per second; also a quantity of any nuclide or mixture of nuclides having I Curie radioactivity.

Daughter - A nuclide formed by the radioactive decay of another nuclide, which is the "parent."

Day-night average sound level - The 24-hour A-weighted equivalent sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance due to noise during nighttime hours.

Decay heat (radioactivity) - The heat produced by the decay of certain radionuclides.

Decay (radioactive) - The decrease in the amount of any radioactive material with the passage of time due to the spontaneous transformation of an unstable nuclide into a different nuclide or into a different energy state of the same nuclide; the emission of nuclear radiation (alpha, beta, or gamma radiation) is part of the process.

Decibel (dB) - A logarithmic unit of sound measurement which describes the magnitude of a particular quantity of sound pressure power with respect to a standard reference value, in general, a sound doubles in loudness for every increase of 10 decibels.

Decibel, A-weighted (dBA) - A unit of frequency weighted sound pressure level, measured by the use of a metering characteristic and the "A" weighting specified by the American National Standards institution ANSI Si .4-1983 (RI 594), that accounts for the frequency response of the human ear.

Decommissioning - The removal from service of facilities such as processing plants, waste tanks, and burial grounds, and the reduction or stabilization of radioactive contamination. Decommissioning includes decontamination, dismantling, and return of the area to original condition without restrictions or partial decontamination, isolation of remaining residues, and continuation of surveillance and restrictions.

Decontamination - The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

Decoupler - That part of an accelerator between the high-energy neutron source and the moderating blanket that contains feedstock material that will absorb low-energy neutrons and help protect the neutron source.

Demographic - Related to the statistical study of human populations, including size, density, distribution, and such vital statistics as age, gender, and ethnicity.

Depleted uranium - A mixture of uranium isotopes where uranium-235 represents less than 0.7 percent of the uranium by mass.

De-rate – Reduction in operating power production level.

Derived Concentration Guide (DCG) - The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 mrem (0.1 rem = 1 mSv [milliSievert]).

Design-basis accident - For nuclear facilities, information that identifies the specific functions to be performed by a structure, system, or component and the specific values (or ranges of values) chosen for controlling parameters for reference bounds for design. These values may be: (1) restraints derived from generally accepted state-of-the-art practices for achieving functional goals; (2) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which a structure, system, or

component must meet its functional goals; or (3) requirements derived from Federal safety objectives, principles, goals, or requirements.

Design-basis events - Postulated disturbances in process variables that can potentially lead to design-basis accidents.

Deuterium - A nonradioactive isotope of the element hydrogen with one neutron and one proton in the atomic nucleus.

Distribution (electrical) - The system of lines, transformers, and switches that connect between the transmission network and customer load. The transport of electricity to ultimate use points such as homes and businesses. The portion of an electric system that is dedicated to delivering electric energy to an end user at relatively low voltages.

Dose - The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

Dose commitment - The dose an organ or tissue would receive during a specified period of time (e.g., *50* to 100 years) *as* a result of intake (by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time.

Dose conversion factor - Factor used to calculate the dose received from exposure to radiation.

Dose equivalent - The product of absorbed dose in rad (or Gray) and a quality factor, which quantifies the effect of this type of radiation in fissue. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert.

Dose rate - The radiation dose delivered per unit time (e.g., rem per year).

Dosimeter - A small device (instrument) carried by a radiation worker that measures cumulative radiation dose (e.g., film badge or ionization chamber).

Drift - Effluent mist or spray carried into the atmosphere from cooling towers.

Drinking water standards - The level of constituents or characteristics in a drinking water supply specified in regulations under the Safe Drinking Water Act as the maximum permissible.

Effective dose equivalent - The sum of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk to the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides, and the effective dose equivalent due to penetrating radiation from sources external to the body. Effective dose equivalent is expressed in units of rem or Sievert.

Effluent - A gas or fluid discharged into the environment.

Effluent monitoring - The collection and analysis of samples or measurements of liquid and gaseous effluents to characterize and quantify contaminants, assess radiation exposure to members of the public, and demonstrate compliance with applicable standards; occurs at the point of discharge, such as an air stack or drainage pipe.

Electromagnetic fields - Two types of energy fields which are emitted from any device that generates, transmits, or uses electricity.

Electron - An elementary particle with a mass of 9.107×10^{-28} gram (or 1/1837 of a proton) and a negative charge. Electrons surround the positively charged nucleus and determine the chemical properties of the atom.

Element - One of the 109 known chemical substances that cannot be divided into simpler substances by chemical means. All isotopes of an element have the same atomic number (number of protons) but have different numbers of neutrons.

Emergency Response Planning Guideline (ERPG) Values - These values, which are specific for each chemical, are established for three general severity levels: exposure to concentrations greater than ERPG-1 values for a period of time greater than 1 hour results in an unacceptable likelihood that a person would experience mild transient adverse health effects, or perception of a clearly objectionable odor; exposure to concentrations greater than ERPG-2 values for a period of time greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects, or symptoms that could impair one's ability to take protective action; exposure to concentrations greater than ERPG-3 values for a period of time greater than 1 hour results in an unacceptable likelihood that a person would experience or develop life-threatening health effects.

Emission standards - Legally enforceable limits on the quantities and/or kinds of air contaminants that may be emitted into the atmosphere.

Endangered species - Any species which is in danger of extinction throughout all or significant portions of its range. The Endangered Species Act of 1973, as amended, establishes procedures for placing species on the Federal lists of endangered or threatened species.

Endangered Species Act of 1973 - The Act requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions likely will not jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Engineered safety features - For a nuclear facility, features that prevent, limit, or mitigate the release of radioactive material from its primary containment.

Enriched uranium - Uranium in which the abundance of the isotope uranium-235 is increased above the normal (naturally occurring) level of 0.711 weight percent.

Enrichment - A process in which the fraction of the uranium-235 isotopes has been artificially increased above the natural abundance level of 0.72 percent.

Entrainment - The involuntary capture and inclusion of organisms in Streams of flowing water; a term often applied to the cooling water systems of power plants/reactors. The organisms involved may include phyto-and zooplankton, fish eggs and larvae (ichthyoplankton), shellfish larvae, and other forms of aquatic life.

Environment - The sum of all external conditions and influences affecting the life, development, and ultimately the survival of an organism.

Environment, safety, and health program - In the context of the U.S. Department of Energy (DOE), encompasses those DOE requirements, activities, and functions in the conduct of all DOE and DOE-controlled operations that are concerned with: impacts to the biosphere; compliance with environmental laws, regulations, and standards controlling air, water, and soil pollution; limiting the risks to the well-being of both the operating personnel and the general public; and protecting property against accidental loss or damage. Typical activities and functions related to this program include, but are not limited to, environmental protection, occupational safety, fire protection, industrial hygiene, health physics, occupational medicine, process and facilities safety, nuclear safety, emergency preparedness, quality assurance, and radioactive and hazardous waste management.

Environmental justice - The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic influence.

Epidemiology - The science concerned with the study of events that determine and influence the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population.

Equivalent sound (pressure) level - The equivalent steady sound level that, if continuous during a specified time period, would contain the same total energy as the actual time varying sound. For example, L_{eq}(1-h) and L_{eq} (24-h) are the 1-hour and 24-hour equivalent sound levels, respectively.

Exposure limit - The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

(1) Reference dose is the chronic exposure dose (milligrams or kilograms per day) for a given hazardous chemical at which or below which adverse human noncancer health effects are not expected to occur.

(2) Reference concentration is the chronic exposure concentration (milligrams per cubic meter) for a given hazardous chemical at which or below which adverse human non cancer health effects are not expected to occur.

Exposure to radiation - The incidence of radiation on living or inanimate material by accident or intent. Background exposure is the exposure to natural background ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs at a person's workplace. Population exposure is the exposure to a number of persons who inhabit an area.

Exposure pathway - The course a chemical or physical agent takes from the source to the exposed organism. The pathway describes a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from the site. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium (e.g., air) is included.

Fertile - Describing radionuclides that can be converted into fissile material (e.g., thorium-232 and uranium-238 can be converted through neutron capture to uranium-233 and plutonium-239, respectively).

Fissile materials - Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning, namely, any material fissionable by thermal (slow) neutrons. The three primary fissile materials are uranium-233, uranium-235, and plutonium-239.

Fission (fissioning) - The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

Fission chain reaction - Nuclear reaction in which atomic nuclei in reactor fuel respond to collisions with neutrons by splitting into two or three major fragments and additional neutrons accompanied by the emission of gamma radiation.

Fission fragments - The parts into which atomic nuclei in reactor fuel split during a fission chain reaction.

Fission products - Nuclei formed by the fission of heavy elements (primary fission products); also, the nuclei formed by the decay of the primary fission products, many of which are radioactive.

Fissionable material - Material that could undergo fission by fast neutrons.

Floodplain - The lowlands adjoining inland and coastal waters and relatively flat areas.

Fluvial - Deposits produced by the action of a stream/river.

Flux - Rate of flow through a unit area; in reactor operation, the apparent flow of neutrons in a defined energy range (see neutron flux).

Fuel assembly - A cluster of fuel rods (or plates). Also called a fuel element. Approximately 200 fuel assemblies make up a reactor core.

Fuel rod - Nuclear reactor component that includes the fissile material.

Fugitive emissions - Emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, piles of stored material, and exposed soil.

Gamma rays - High-energy, short-wavelength, electromagnetic radiation accompanying fission and either emitted from the nucleus of an atom or emitted by some radionuclide or fission product. Gamma rays are very penetrating and can be stopped only by dense materials (such as lead) or a thick layer of shielding materials.

Global warming - The theory that increasing concentrations of certain gases such as carbon dioxide, methane, and chlorofluorocarbons in the Earth's atmosphere are effectively reducing radioative cooling, thus elevating the Earth's ambient temperatures.

Greater-than-Class-C waste - Radioactive waste that contains long-lived radionuclides and requires special disposal considerations.

Grid - A transmission and distribution system for electric power.

Groundshine - The radiation dose received from an area on the ground where radioactivity has been deposited by a radioactive plume or cloud.

Habitat - The environment occupied by individuals of a particular species, population, or community.

Half-life - The time in which half the atoms of a radioactive isotope decay to another nuclear form. Half-lives vary from millionths of a second to billions of years.

Hazardous material - A material, including a hazardous substance, as defined by 49 CFR 171.8, which poses a risk to health, safety, and property when transported or handled.

Hazardous substance - Any substance that when released to the environment in an uncontrolled fashion could be harmful to the biota or human health and when released in an unpermitted fashion becomes subject to the reporting and possible response provisions of the Clean Water Act and the Comprehensive Environmental Response, Compensation, and Liability Act.

Hazardous/toxic air pollutants - Air pollutants known or suspected to cause serious health problems such *as* cancer, poisoning, or sickness, and may have immunological, neurological, reproductive, developmental, or respiratory effects.

Hazardous/toxic waste - Any solid waste (can also be semisolid or liquid, or contain gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the Resource Conservation and Recovery Act and identified or listed in 40 CPR 261 or by the Toxic Substances Control Act.

Heat exchanger - A device that transfers heat from one fluid (liquid or gas) to another.

High Efficiency Particulate Air Filter (HEPA) - A filter used to remove very small particulates from dry gaseous effluent streams.

High-level waste - The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

High(ly) enriched uranium - Uranium that is equal to or greater than 20 percent uranium-235 weight. Many of the fuels discussed in this EIS are based primarily on highly enriched uranium.

High-level radioactive waste - Highly radioactive material from the reprocessing of spent nuclear fuel that contains a combination of transuranic waste and fission products in concentration that require permanent isolation. It includes both liquid waste produced by reprocessing and solid waste derived from that liquid.

Historic resources - Archaeological sites, architectural structures, and objects produced after the advent of written history dating to the time of the first Euro-American contact in an area.

Icthyoplankton - The early life stages of fish (eggs and larvae) that spend part of their life cycle as free-floating plankton.

Impingement - The process by which aquatic organisms too large to pass through the screens of a water intake structure become caught on the screens and are unable to escape.

Induced economic effects - The spending of households resulting from direct and indirect economic effects. Increases in output from a new economic activity lead to an increase in household spending throughout the economy as firms increase their labor inputs.

Interium storage - Safe and secure storage for spent nuclear fuel and radioactive wastes until the materials are dispositioned (treatment and/or disposal).

Internal initiators - Events that normally originate in and around the facility but are always a result of facility operations (equipment or structural failures, human errors, internal flooding). In accident scenarios, initiators start the events that culminate in a release of hazardous or radioactive materials.

Ion - An atom that has too many or too few electrons, causing it to be electrically charged; an electron that is not associated (in orbit) with a nucleus.

Ion exchange - A unit physiochemical process that removes anions and cations, including radionuclides, from liquid streams (usually water) for the purpose of purification or decontamination.

Ion-exchange medium - A substance (see resin) that preferentially removes certain ions from a solution.

Ionizing radiation - Alpha particles, beta particles, gamma rays, neutrons, high-speed electrons, high-speed protons, and other particles or electromagnetic radiation that can displace electrons from atoms or molecules, thereby producing ions.

Irradiation - Exposure to radiation.

Isotope - An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons, but different numbers of neutrons and different atomic masses. Isotopes are identified by the name of the element and the total number of protons and neutrons in the nucleus. For example, plutonium-239 is a plutonium atom with 239 protons and neutrons.

Isotope dilution - Mixing a less-enriched radioisotope with a highly enriched radioisotope to yield an isotope with lower nuclear enrichment.

Joule - A metric unit of energy, work, or heat, equivalent to 1 watt-second, 0.737 foot-pound, or 0.239 calories.

Latent cancer fatalities - Fatalities associated with acute and chronic environmental exposures to chemical or radiation that occur within 30 years of exposure.

Laydown - Area of construction site used to sort and store construction materials.

Licensee amendment - Changes to an existing reactor's operating license that are approved by the U.S. Nuclear Regulatory Commission.

Light water - The common form of water (a molecule with two hydrogen atoms and one oxygen atom, H_20) in which the hydrogen atom consists completely of the normal hydrogen isotope (one proton).

Light water reactor - A nuclear reactor in which circulating light water is used to cool the reactor core and to moderate (reduce the energy of) the neutrons created in the core by the fission reactions.

Loss-of-coolant accident - An accident that results from the loss of reactor coolant because of a break in the reactor coolant system.

Low-enriched uranium (LEU) - Uranium with uranium-235 enriched above the natural concentration (0.72 percent) but below 20 percent; highly enriched uranium (HEU) is enriched 20 percent or higher.

Low-level waste - Waste that contains radioactivity, but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or by-product material as defined by Section lie (2) of the Atomic Energy Act of 1954, as amended. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because of the nature of the generating process and/or constituents, because the waste would tell too much about the process.

Makeup water - Replacement for water lost through drift, blowdown, or evaporation (as in a cooling tower).

MAXIGASP - A computer program used to calculate doses of airborne releases of radioactivity to the maximally exposed member of the public.

Maximum Contaminant Levels (MCLs) - The maximum permissible level of a contaminant in water delivered to any user of a public drinking water system. Maximum contaminant levels are enforceable standards under the Safe Drinking Water Act.

Maximally exposed off site individual - A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.

Megawatt (MW) - A unit of power equal to 1 million watts. "Megawatt-thermal" is commonly used to define heat produced, while "megawatt-electric" defines electricity produced.

Millirem - One thousandth of a rem. (See rem)

Minority communities - A population classified by the Bureau of the Census as Black, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other nonwhite persons, the composition of which is at least equal to or greater than the state minority average of a defined area of jurisdiction.

Mixed waste - Waste that contains both "nonradioactive hazardous waste" and "radioactive waste" as defined in this glossary.

National Ambient Air Quality Standards (NAAQS) - Uniform, national air quality standards established by the Environmental Protection Agency under the authority of the Clean Air Act that restrict ambient levels of criteria pollutants to protect public health (primary standards) or public welfare (secondary standards), including plant and animal life, visibility, and materials. Standards have been set for ozone, carbon monoxide, particulates, sulfur dioxide, nitrogen dioxide, and lead.

National Emission Standards for Hazardous Air Pollutants - A set of national emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources.

National Historic Preservation Act - This Act provides that property resources with significant national historic value be placed on the national Register of Historic Places. It does not require any permits, but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES) - Federal permitting system required for water pollution effluents under the Clean Water Act, as amended.

National Register of Historic Places - A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance under Section 2(b) of the Historic Sites Act of 1935(16 U.S.C. 462) and Section 101(a) (1) (A) of the National Historic Preservation Act of 1966, as amended.

Natural phenomena initiators - Natural occurrences that are independent of facility operations and events at nearby facilities or operations (earthquakes, high winds, floods, lightning, snow). Although these initiators are independent of external facilities, they can affect such facilities and compound the progression of the accident.

National radiation or natural radioactivity - Background radiation. Radiation arising from cosmic and terrestrial naturally-occurring radionuclide sources.

Neutron - An uncharged elementary particle with a mass slightly greater than that of the proton, found in the nucleus of every atom heavier than hydrogen-1. A free neutron is unstable and decays with a half-life of about 13 minutes into an electron and a proton; used in the fission process.

Neutron flux - The product of neutron number density and velocity (energy), giving an apparent number of neutrons flowing through a unit area per unit time.

Neutron poison - A chemical solution (e.g., a boron or component sheet or a burnable absorber rod) inserted into a nuclear reactor or spent fuel pool to absorb neutrons and end criticality. Any material with a strong affinity for absorbing neutrons without generating new neutrons that can be used to control the nuclear chain reaction.

Nuclear grade - Material of a quality adequate for use in a nuclear application.

Nuclear material - Composite term applied to: (1) special nuclear material; (2) source material such as uranium, thorium, or ores containing uranium or thorium; and (3) by-product material, which is any radioactive material that is made radioactive by exposure to a radiation incident or to the process of producing or using special nuclear material.

Nuclear radiation - Particles (alpha, beta, neutrons) or photons (gamma) emitted from the nucleus of unstable radioactive atoms as a result of radioactive decay.

Nuclear reaction - A reaction in which an atomic nucleus is transformed into another isotope of that respective nuclide, or into another element altogether; it is always accompanied by the liberation of either particles or energy.

Nuclear reactor - A device that sustains a controlled nuclear fission chain reaction that releases energy in the form of heat.

Nuclear Regulatory Commission (NRC) - The Federal agency that regulates the civilian nuclear power industry in the United States.

Nuclide - A species of atom characterized by the constitution of its nucleus and, hence, by the number of protons, the number of neutrons, and the energy content.

Occupational Safety and Health Administration - Oversees and regulates workplace health and safety, created by the Occupational Safety and Health Act of 1970.

Off-normal event - An unexplained event that exceeds the range of normal operating parameters, but that usually does not have a significant impact (inside or beyond the SRS boundary).

Outfall - The discharge point of a drain, sewer, or pipe as it empties into a body of water.

Peaking capacity - The capacity of facilities or equipment normally used to supply incremental gas or electricity under extreme demand conditions. Peaking capacity is generally available for a limited number of days at a maximum rate.

Peak load - The maximum load consumed or produced by a unit or group of units in a stated period of time.

Pellets - One configuration of the reactive material in a target rod.

Permeator - A device that selectively allows the passage of hydrogen atoms and prevents the passage of other elements. Used to separate hydrogen and tritium from helium.

Person-rem - The unit of collective radiation dose to a given population; the sum of the individual doses received by a population segment.

Plume - A flowing, often somewhat conical, trail of emissions from a continuous point source.

Plume immersion - With regard to radiation, the situation in which an individual is enveloped by a cloud of radiation gaseous effluent and receives an external radiation dose.

Plutonium (Pu) - A heavy, radioactive, metallic element with the atomic number 94. It is produced artificially in a reactor by bombardment of uranium with neutrons and is used in the production of nuclear weapons.

Poison - A material that has an affinity for absorbing neutrons. Poisons are added to nuclear materials with a potential critically concern to lessen the likelihood of an uncontrolled nuclear reaction.

Pressurized water reactor - A light water reactor in which heat is transferred from the core to an exchanger by water kept under pressure in the primary system. Steam is generated in a secondary circuit. Many reactors producing electric power are pressurized water reactors.

Primary system - With regard to nuclear reactors, the system that circulates a coolant (e.g., water) through the reactor core to remove the heat of reaction.

Prime farmland - Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oil-seed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (Farmland Protection Act of 1981, 7 CPR 7, paragraph *658).*

Probabilistic risk assessment - A comprehensive, logical, and structured methodology to identify and quantitatively evaluate significant accident sequences and their consequences.

Probable maximum flood - The hypothetical flood (peak discharge, volume, and hydrograph shape) that is considered to be the most severe reasonably possible, based on comprehensive hydrometeorological application of Probable Maximum Precipitation, and other hydrologic factors favorable for maximum flood runoff, such as sequential storms and snowmelt. (Reference: FSAR)

Probable Maximum Precipitation - The theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. (Reference: American Meteorological Society, 1959)

Processing (of spent nuclear fuel) - Applying a chemical or physical process designed to alter the characteristics of the spent fuel matrix.

Proton - An elementary nuclear particle with a positive charge equal in magnitude to the negative charge of the electron; it is a constituent of all atomic nuclei, and the atomic number of an element indicates the number of protons in the nucleus of each atom of that element.

Pyrophoric - The tendency to spontaneously ignite in air. Some uranium and thorium metal fuels may be pyrophoric.

Quality factor - The principal modifying factor that is employed to derive dose equivalent from absorbed dose.

Radiation - The emitted particles or photons from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.

Radiation Absorbed Dose (rad) - The basic unit of absorbed dose equal to the absorption of 0.01 Joule per kilogram of absorbing material.

Radiation shielding - Radiation-absorbing material that is interposed between a source of radiation and organisms that would be harmed by the radiation (e.g., people).

Radioactive waste - Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

Radioactivity - The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

Radioisotopes - Radioactive nuclides of the same element (same number of protons in their nuclei) that differ in the number of neutrons.

Radiological - Related to radiology, the science that deals with the use of ionizing radiation to diagnose and treat disease.

Radiolysis - Decomposition of a material by ionizing radiation.

Radionuclide - A radioactive element characterized according to its atomic mass and atomic number which can be man-made or naturally occurring.

Radon - Gaseous, radioactive element with the atomic number 86 resulting from the radioactive decay or radium. Radon occurs naturally in the environment, and can collect in unventilated enclosed areas, such as basements. Large concentrations of radon can cause lung cancer in humans.

RADTRAN - A computer code that combines user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive material.

Reactor - A device or apparatus in which a chain reactor of fissionable material is initiated and controlled; a nuclear reactor.

Reactor accident - See "design basis accident; severe accident."

Reactor coolant system - The system used to transfer energy from the reactor core either directly or indirectly to the heat rejection system.

Reactor core - In a heavy water reactor: the fuel assemblies including the fuel and target rods, control assemblies, blanket assemblies, safety rods, and coolant/moderator. In a light water reactor: the fuel assemblies including the fuel and target rods, control rods, and coolant/moderator. In a modular high-temperature gas-cooled reactor: the graphite elements including the fuel and target elements, control rods, and other reactor shutdown mechanisms, and the graphite reflectors.

Reactor facility - Unless it is modified by words such as containment, vessel, or core, the term reactor facility includes the housing, equipment, and associated areas devoted to the operation and maintenance of one or more reactor cones. Any apparatus that is designed or used to sustain nuclear chain reactions in a controlled manner, including critical and pulsed assemblies and research, tests, and power reactors, is defined as a reactor. All assemblies designed to perform subcritical experiments that could potentially reach criticality are also to be considered reactors.

Record of Decision (ROD) - A document prepared in accordance with the requirements of the Council on Environmental Quality and National Environmental Policy Act regulations 40 CFR 1505.2, that provides a concise public record of the decision on a proposed Federal action for which an environmental impact statement was prepared. A Record of Decision identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not.

Refueling outage - The period of time that a reactor is shut down for refueling operations. A refueling outage usually lasts four to eight weeks.

Repository - A place for the disposal of immobilized high-level waste and spent nuclear fuel in isolation from the environment.

Reprocessing (of spent nuclear fuel) - Processing of reactor-irradiated nuclear material (primarily spent nuclear fuel) to recover fissile and fertile material, in order to recycle such materials primarily for defense programs or generation of electricity. Historically, reprocessing has involved aqueous chemical separations of elements (typically uranium or plutonium) from undesired elements in the fuel.

Resin - An ion-exchange medium; organic polymer used for the preferential removal of certain ions from a solution.

Risk - In accident analysis, the probability-weighted consequence of an accident, defined as the accident frequently per year multiplied by the dose. The term "risk" also is used commonly in other applications to describe the probability of an event occurring.

Risk assessment (chemical or radiological) - The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

Roentgen - A unit of exposure to ionizing X or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equal to 1 rad.

Roentgen Equivalent Man (rem) - A measure of radiation dose (i.e., the average background radiation dose is 0.3 rem per year). The unit of biological dose equal to the product of the absorbed dose in rads; a quality factor, which accounts for the variation in biological effectiveness of different types of radiation; and other modifying factors.

Runoff - The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

Safety analysis report - A safety document that provides a complete description and safety analysis of a reactor design, normal and emergency operations, hypothetical accidents and their predicted consequences, and the means proposed to prevent such accidents or mitigate their consequences.

Safety evaluation report - A document prepared by the U.S. Nuclear Regulatory Commission that evaluates documentation (i.e., technical specifications, safety analysis reports, and special safety reviews and studies) submitted by a reactor licensee for its approval. This ensures that all of the safety aspects of part or all of the activities conducted at a reactor are formally and thoroughly analyzed, evaluated, and recorded.

Scoping - The solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an environmental impact statement.

Secondary system - The system that circulates a coolant (water) through a heat exchanger to remove heat from the primary system.

Seismicity - The tendency for earthquakes to occur.

Seismic zone - An area defined by the Uniform Building Code (1991), designating the amount of damage to be expected as the result of earthquakes. The United States is divided into six zones: (1) Zone 0: no damage; (2) Zone 1: minor damage, corresponds to intensities V and VI of the modified Mercalli intensity scale; (3) Zone 2A: moderate damage, corresponds to intensity VII of the modified Mercalli intensity scale (eastern U.S.); (4) Zone 2B: slightly more damage than 2A (western U.S.); (5) Zone 3: major damage, corresponds to intensity VII and higher of the modified Mercalli intensity scale; (6) Zone 4: areas within Zone 3 determined by proximity to certain major fault systems.

Severe accident - An accident with a frequency rate of less than 10^6 per year that would have more severe consequences than a design-basis accident, in terms of damage to the facility, off site consequences, or both. Also called "beyond design-basis reactor accidents" for this environmental impact statement.

Shielding - With regard to radiation, any material of obstruction (bulkheads, walls, or other construction) that absorbs radiation in order to protect personnel or equipment.

Short-lived activation products - An element formed from neutron interaction that has a relatively short half-life and which is not produced from the fission reaction (e.g., a cobalt isotope formed from impurities in the metal of the reactor piping).

Short-lived nuclides - Radioactive isotopes with half-lives no greater than about 30 years (e.g., cesium-137 and strontium-90).

Shutdown - For a U.S. Department of Energy (DOE) reactor, that condition in which the reactor has ceased operation and DOE has declared officially that it does not intend to operate it further (see DOE Order 5480.6, - Safely of Department of Energy-Owned Nuclear Reactors).

Source term - The estimated quantities of radionuclides or chemical pollutants released to the environment.

Special nuclear materials - As defined in Section 11 of the Atomic Energy Act of *1954,* special nuclear A material means: (1) plutonium, uranium enriched in the isotope 233 or in the isotope *235,* and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material; or (2) any material artificially enriched by any of the above. Tritium is NOT a special nuclear material.

Spent nuclear fuel - Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not be separated.

Stabilization - The action of making a nuclear material more chemically or physically stable by converting its physical or chemical form or placing it in a more stable environment.

Standby (cold standby) - Condition under which a facility is maintained in a protected condition to prevent deterioration such that it can be brought back into operation.

Strontium - Naturally occurring element with 38 protons in its nucleus. Some manmade isotopes of strontium are radioactive (e.g., strontium-89, strontium-90).

Technical specifications - With regard to U.S. Nuclear Regulatory Commission (NRC) regulations, part of A an NRC license authorizing the operation of a nuclear reactor facility. A technical specification establishes requirements for items such as safety limits, limiting safety system settings, limiting control settings limiting conditions for operation, surveillance requirements, design features, and administrative controls.

Thermophilic - Related to plants and animals that thrive in heated water.

Threatened species - Any species designated under the Endangered Species Act as likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Threshold limit values - The recommended highest concentrations of contaminants to which workers may be exposed according to the American Conference of Governmental Industrial Hygienists.

Tier - To link to another in a hierarchical chain. An upper-tier document might be programmatic to the entire DOE complex of sites; a lower-tier document might be specific to one site or process.

Tritium - A radioactive isotope of the element hydrogen with two neutrons and one proton. Common symbols for the isotope are "H-3" and "T." Tritium has a half-life of 12.3 years.

Uranium - A heavy, silvery-white metallic element (atomic number 92) with several radioactive isotopes that is used as fuel in nuclear reactors.

Vault - A reinforced concrete structure for storing strategic nuclear materials used in national defense or other programmatic purposes or for disposing of radioactive or hazardous waste.

Wetlands - Land or areas exhibiting the following: hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions; also, areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Whole-body dose - With regard to radiation, the dose resulting from the uniform exposure of all organs and tissues in a human body. (Also see effective dose equivalent.)

X/Q (Chi/Q) - The relative calculated air concentration due to a specific air release and atmospheric dispersion; units are (seconds per cubic meter). For example (Curies per cubic meter)/(Curies per second)= (seconds per cubic meter) or (grams per cubic meter)/(grams per second) = (seconds per cubic meter).

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