8.0 COMPARISON OF ENVIRONMENTAL IMPACT OF LICENSE RENEWAL WITH THE ALTERNATIVES

8.1 DISCUSSION

NRC
"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4 analyzes environmental impacts for Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS) and Chapter 7 analyzes impacts from renewal alternatives. Table 8-1 summarizes environmental impacts of the proposed action (license renewal) and the alternatives, so the reader can compare them. The environmental impacts compared in Table 8-1 are those that are either a Category 2 issue for the proposed action (license renewal) or are issues that the *Generic Environmental Impact Statement* (GEIS) (Ref 8.0-1) identified as major considerations in an alternatives analysis. For example, although the U.S. Nuclear Regulatory Commission (NRC) concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8-1 compares air impacts among the proposed action and the alternatives. Table 8-2 is a more detailed comparison of the alternatives.

In summary, each of the alternatives to PBAPS license renewal has impacts that are similar to, or greater than, the impacts attributable to license renewal. Therefore, Exelon concludes that none of the alternatives is environmentally preferable to PBAPS license renewal.

8.2 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of all cited web pages are available in Exelon files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Exelon have been given for these pages, even though they may not be directly accessible.

Ref. 8.0-1 U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC.

TABLE 8-1
IMPACTS COMPARISON SUMMARY

Impact	Proposed Action (License Renewal)	No-Action Alternative			
		Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	MODERATE	SMALL	MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	SMALL	SMALL
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

TABLE 8-2
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Peach Bottom Atomic Power Station Units 2 and 3 license renewals for 20 years each, followed by decommissioning	Decommissioning following expiration of current Peach Bottom Atomic Power Station Units 2 and 3 licenses. Adopting by reference, as bounding Peach Bottom Atomic Power Station decommissioning, GEIS description (Ref. 8.0-1, Section 7.1)	New construction at a greenfield site, preferably on the shores of Conowingo Pond	New construction at the Peach Bottom Atomic Power Station	Would involve construction of new generation capacity. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.2)
			Use existing switchyard and transmission lines	
		Construct 20 miles of rail spur	Construct 3 miles of gas pipeline in a 150-foot wide corridor	Construct up to 400 miles of transmission lines
		Construct 15 miles of transmission line in a 350-foot wide corridor; construct cooling towers for extreme thermal conditions		
		Four 508-MW tangentially-fired, dry bottom units; capacity factor 0.85	Four 508-MW units; each consisting of two 168-MW combustion turbines and a 172-MW heat recovery boiler; capacity factor 0.85	
		New intake/discharge canal system, preferably on Conowingo Pond	Existing intake/ discharge canal system	
		Pulverized bituminous coal, 12,403 Btu/pound; 10,200 Btu/kWh; 11.9% ash; 2.13% sulfur; 9.7 lb/ton nitrogen oxides; 6,594,715 tons coal/yr	Natural gas, 1,035 Btu/ft^3; 6,928 Btu/kWh; 0.0034 lb sulfur/MMBtu; 0.0128 lb NO_x/MMBtu; 69,790,772,162 ft^3 gas/yr	

TABLE 8-2 (Cont'd)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Low NO_x burners, overfire air (60% NO_x reduction efficiency). Wet scrubber – lime/limestone desulfurization system (95% SO_x removal efficiency); 246,000 tons limestone/yr Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency)	Low NO_x burners, water injection, selective catalytic reduction	
950 workers		300 workers (Section 7.2.2.1)	150 workers (Section 7.2.2.2)	
		Land Use Impacts		
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (Ref. 8.0-1, Section 7.3)	MODERATE – 1,800 acres required for the powerblock and associated facilities and 640 acres for transmission corridor. (Section 7.2.2.1)	SMALL – 110 acres for facility at PBAPS location; 54 acres for pipeline (Section 7.2.2.2)	MODERATE – most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3) Adopting by reference GEIS description of land use impacts from alternate technologies (Ref. 8.0-1, Section 8.2)

TABLE 8-2 (Cont'd)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 3, 5, 6, 7-12). Three Category 2 groundwater issues not applicable (Section 4.5, Issue 33; Section 4.7, Issue 35; and Section 4.8, Issue 39). Evaporative loss from cooling towers would have minimal affect on biological communities (Section 4.1, Issue 13) and aquifer recharge (Section 4.6, Issue 34)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Withdrawal of cooling water from Conowingo Pond would be equivalent to withdrawal for PBAPS operation (Section 7.2.2.1)	SMALL – Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (Ref. 8.0-1, Section 8.2)
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 51). Category 2 issue not applicable (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issue 88)	MODERATE – • 13,344 tons SO_x/yr • 12,794 tons NO_x/yr • 1,649 tons CO/yr • 392 tons TSP/yr • 90 tons PM_{10}/yr (Section 7.2.2.1)	MODERATE – • 123 tons SO_x/yr • 462 tons NO_x/yr • 607 tons CO/yr • 69 tons PM_{10}/yr[a] (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (Ref. 8.0-1, Section 8.2)

TABLE 8-2 (Cont'd)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 15-24, 28-30, 41-48). One Category 2 issue not applicable (Section 4.9, Issue 40). Exelon holds a current NPDES permit, which constitutes compliance with Clean Water Act Section 316(b) (Section 4.2, Issue 25; Section 4.3, Issue 26) and 316(a) (Section 4.4, Issue 27)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 90)	MODERATE – 400 acres of forested land could be required for ash/sludge disposal over 20 year license renewal term. (Section 7.2.2.1)	SMALL – Construction of the pipeline could alter habitat. (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (Ref. 8.0-1, Section 8.2)
Threatened or Endangered Species Impacts				
SMALL – No threatened or endangered species are known at the site or along the transmission corridor (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (Ref. 8.0-1, Section 7.3)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats
Human Health Impacts				
SMALL – Category 1 issues (Table 4-2, Issues 56, 58, 61, 62). Risk from microbiological organisms minimal due to low discharge temperatures (Section 4.12, Issue 57). Risk due to transmission-line induced currents minimal due to conformance with consensus code (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (Ref. 8.0-1, Section 8.3.9)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (Ref. 8.01, Table 8.2)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (Ref. 8.0-1, Section 8.2)

TABLE 8-2 (Cont'd)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 64, 67). Two Category 2 issues not applicable (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Proximity to large metropolitan area, should minimizes potential for housing impacts. (Section 4.14, Issue 63). Plant contribution to county tax base cannot be ascertained at this time, but based on economic base existing in county is expected to be small. Uncertainty applies equally to all alternatives (Section 4.17.2, Issue 69). Capacity of public water supply and transportation infrastructure minimizes potential for related impacts (Section 4.15, Issue 65 and Section 4.18, Issue 70)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 91)	SMALL – Reduction in permanent work force at PBAPS could adversely affect surrounding counties (Section 7.2.2.1).	SMALL – Reduction in permanent work force at PBAPS could adversely affect surrounding counties (Section 7.2.2.2)	SMALL – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (Ref. 8.0-1, Section 8.2)
Waste Management Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 87)	MODERATE – 784,000 tons of coal ash and 728,000 tons of scrubber sludge would require 400 acres over 20-year license renewal term. Industrial waste generated annually (Section 7.2.2.1)	SMALL – Almost no waste generation (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (Ref. 8.0-1, Section 8.2)

TABLE 8-2 (Cont'd)
IMPACTS COMPARISON DETAIL

Proposed Action (License Renewal)	Base (Decommissioning)	No Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Aesthetic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (Ref. 8.0-1, Section 7.3)	MODERATE – The coal-fired power block and the exhaust stack would be visible from Conowingo Pond and from a moderate offsite distance (Section 7.2.2.1)	SMALL – Steam turbines and stacks (approximately 200 feet tall) would create visual impacts comparable to those from existing PBAPS facilities (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (Ref. 8.0-1, Section 8.2)
Cultural Resource Impacts				
SMALL – Lack of resources and SHPO consultation minimizes potential for impact (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (Ref. 8.0-1, Section 7.3)	SMALL – Impacts to cultural resources would be considered during the site selection process (Section 7.2.2.1)	SMALL – Three miles of pipeline construction in eastern Pennsylvania may affect some cultural resources (Section 7.2.2.2)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (Ref. 8.0-1, Section 8.2)

SMALL = Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE - Environmental effects are sufficient to alter noticeably but not to destabilize any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, footnote 3.

Btu = British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (Ref. 8.0-1)
SHPO = State Historic Preservation Officer
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_X = nitrogen oxide
PM_{10} = particulates having diameter less than 10 microns
SO_x = sulfur dioxide
TSP = total suspended particulates
yr = year

a. All TSP for gas-fired alternative is PM_{10}.

9.0 STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 GENERAL

Table 9-1 lists environmental authorizations that Exelon has obtained for current Peach Bottom Atomic Power Station (PBAPS) operations. In this context, Exelon uses "authorizations" to include any permits, licenses, approvals, or other entitlements. Exelon expects to continue renewing these authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license renewal period. Based on the new and significant information identification process described in Chapter 5, Exelon concludes that Peach Bottom Units 2 and 3 are in compliance with applicable environmental standards and requirements.

Table 9-2 lists additional environmental authorizations and consultations related to NRC renewal of the PBAPS licenses to operate. As indicated, Exelon anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 THREATENED OR ENDANGERED SPECIES

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires Federal agencies to ensure that agency action is not likely to jeopardize any species that is listed, proposed for listing as endangered, or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. FWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that

address consultation, and FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by Federal law or NRC regulation, Exelon has chosen to invite comment from Federal and state agencies regarding potential effects that PBAPS license renewal might have. Exelon (as PECO) also corresponded with the Pennsylvania Game Commission and the Maryland Wildlife and Heritage Division regarding potential effects on protected species. Appendix C includes copies of PECO correspondence with FWS, NMFS, and the state agencies.

The NMFS has determined that "the operating license renewal of the PBAPS on Conowingo Pond is likely to have no effect on endangered shortnose sturgeon", and that no further Section 7 consultation under the Endangered Species Act is required of the NRC (letter, Kurkul to Hutton, July 25, 2000; in Appendix C). The FWS stated that "(e)xcept for occasional transient species, no federally listed or proposed threatened or endangered species under our jurisdiction are known to occur in the project area" and no further Section 7 consultation under the Endangered Species Act is required of the NRC (letter, Densmore to Hutton, October 18, 2000; in Appendix C).

Based on the Exelon submittals and other information, as discussed in detail in Section 4.10, the agencies concur with the Exelon conclusion that PBAPS license renewal would not adversely affect threatened or endangered species or critical habitat.

9.1.3 COASTAL ZONE MANAGEMENT PROGRAM COMPLIANCE

The Federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone (Ref. 9.1-1, Attachment 7). PBAPS, located in York County, is not within the Pennsylvania coastal zone (Ref. 9.1-2) and, due to its distance (approximately 50 miles) from the coastal zone, is not expected to affect the Pennsylvania coastal zone. Certification from the Commonwealth coastal zone management program is not necessary. However, the Maryland coastal zone extends to Conowingo Pond. Therefore, Exelon has chosen to prepare a Certification of Compliance with the Maryland Coastal Zone Management Program (Appendix E).

9.1.4 HISTORIC PRESERVATION

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to, prior to issuing the license, take into account the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Council review (35 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, Exelon (as PECO) has chosen to invite comment by the Pennsylvania, Maryland, and Delaware SHPOs. Appendix F includes copies of PECO correspondence with the SHPOs regarding potential effects that PBAPS license renewal might have on historic or cultural resources. Based on the Exelon submittal and other information, the Pennsylvania and Maryland SHPOs concurred with Exelon's conclusion that PBAPS license renewal would not affect known historic or archaeological properties. Delaware SHPO has not officially responded to the Exelon correspondence.

9.1.5 WATER QUALITY (401) CERTIFICATION

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). Exelon is applying to NRC for license renewal to continue PBAPS operations.

In the Commonwealth of Pennsylvania, water quality certifications have been integrated with other required approvals or permits (Ref. 9.1-3). The issuance or denial of water quality certifications is an integral part of the respective approval or permit. The Commonwealth of Pennsylvania has U.S. Environmental Protection Agency authorization to implement the National Pollutant Discharge Elimination System (NPDES) within the Commonwealth for facilities such as PBAPS. Pursuant to Commonwealth authority and the U.S. Environmental Protection Agency authorization, the Pennsylvania Department of Environmental Protection has issued a discharge permit for the PBAPS (Appendix B). Issuance of the NPDES permit constitutes water quality certification by the Commonwealth.

9.2 ALTERNATIVES

NRC

"The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

The coal, gas, and purchased power alternatives discussed in Section 7.2.1 probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. Exelon notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations.

9.3 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of all cited web pages are available in Exelon files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by Exelon have been given for these pages, even though they may not be directly accessible.

Ref. 9.1-1 U.S. Nuclear Regulatory Commission. 1999. *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues.* NRR Office Letter No. 906, Rev. 2.

Ref. 9.1-2 Pennsylvania Department of Environmental Protection. Undated. Bureau of Watershed Conservation. *The Pennsylvania Coastal Zone Management Program. Fact Sheet 2019.* Available at http://www.dep.state.pa.us/dep/deputate/watermgt/WC/FactSheets/WS/fs2019.html. Accessed March 8, 2000.

Ref. 9.1-3 Pennsylvania Department of Environmental Protection, Office of Water Management. *400.2 Procedure for 401 Water Quality Certification.* Available at http://www.dep.state.pa.us/dep/subject/all_final_technical guidance/bwqm/wqp_pm_29.pdf. Accessed October 30, 2000.

TABLE 9-1
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT PEACH BOTTOM UNITS 2 AND 3 OPERATIONS

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal Requirements to License Renewal					
U. S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	DPR – 44 - Unit 2 DPR – 56 - Unit 3	Issued on 10/25/73 Expires on 08/08/13 (Unit 2) Issued on 07/02/74 Expires on 07/02/14 (Unit 3)	Operation of Units 2 and 3
Pennsylvania Department of Environmental Resources (DER)	Clean Water Act (33 USC Section 1251 et seq.), Pennsylvania Clean Streams Law (35 P.S. Section 691.1 et seq.)	Individual Discharge Permit	PA 0009733	Issued on 11/03/00 Expires on 12/01/05 (Renewal application was submitted 01/05/00)[a]	Contains effluent limits for PBAPS discharges to the Susquehanna River.
U.S. Environmental Protection Agency (EPA), Pennsylvania Department of Environmental Protection (DEP)	Clean Water Act Section 401 (33 USC 1341)	Certification of compliance with state water quality standards	NPDES permit constitutes compliance		Discharges during license renewal term

TABLE 9-1 (Cont'd)
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT PEACH BOTTOM UNITS 2 AND 3 OPERATIONS

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Susquehanna River Basin Commission	Susquehanna River Basin Compact (PL91-575). 18 CFR 803	Approval	Docket 19830506	Issued on 05/12/85; no expiration date	Consumptive use of Conowingo Pond water
EPA, Pennsylvania DEP	Clean Air Act (42 USC 7661 et seq.) Air Pollution Control Act (25 Pa. Code Chapter 127)	Title V Operating Permit	67-05020	Issued on 03/01/99; Expires on 02/29/04	Establishes emissions limits
Pennsylvania DEP	Storage Tank and Spill Prevention Act (Act 32)	Registration	187882	Issued annually; Expires on 06/04/01	Storage Tanks located at PBAPS (gasoline, used oil, hazardous substances, unlisted materials)

TABLE 9-1 (Cont'd)
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT PEACH BOTTOM UNITS 2 AND 3 OPERATIONS

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Pennsylvania DEP	Pennsylvania Dam Safety and Encroachment Act (32 P.S. Section 693.1 et seq.), Clean Stream Law (35 P.S. Section 691.1 et seq.), Flood Plain Management Act (32 P.S. Section 679.101 et seq.)	Permit	E36-693	Issued 09/26/00; Expires 12/31/10	Maintenance dredging of intake area
Pennsylvania DER	Pennsylvania Safe Drinking Water Act (35 P.S. Sections 7.21.1-7.21-17)	Permit	6791502	Issued 03/21/94; no expiration date	Public Water Supply Permit

a. The NPDES permit is issued for five years. Exelon submitted its renewal application in January 2000. The current permit expired in July 2000; however, because Exelon submitted an application to renew 6 months prior to the expiration, the terms and conditions of the expired permit are automatically continued, pending the issuance of a new permit.

CFR - Code of Federal Regulations
DEP - Pennsylvania Department of Environmental Protection
DER - Pennsylvania Department of Environmental Resources
EPA - U.S. Environmental Protection Agency
P.S. - Pennsylvania Statutes

TABLE 9-2
ENVIRONMENTAL AUTHORIZATIONS FOR PEACH BOTTOM UNITS 2 AND 3 LICENSE RENEWAL[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
FWS and NMFS	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires Federal agency issuing a license to consult with FWS and NMFS (Appendix C)
Pennsylvania Department of Environmental Protection	Clean Water Act Section 401 (33 USC 1341)	Certification	
Pennsylvania Historical and Museum Commission, Bureau of Historic Preservation	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires Federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (SHPO). SHPO has concurred that license renewal will not affect any sites listed or eligible for listing (Appendix F)
Maryland Historical Trust	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Appendix F
Delaware Division of Historic and Cultural Affairs, State Historic Preservation Office	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Appendix F
Maryland Department of Natural Resources	Federal Coastal Zone Management Act (16 USC 1451 et seq.)		Requires an applicant to provide certification to the Federal agency issuing the license that license renewal would be consistent with the Federally-approved state coastal zone management program. Based on its review of the proposed activity, the state must concur with or object to the applicant's certification (Appendix E)

FWS = U.S. Fish and Wildlife Service
NMFS = National Marine Fisheries Service
NPDES = National Pollutant Discharge Elimination System
a. No renewal-related requirements identified for local or other agencies.

APPENDIX A

NRC NEPA ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

Exelon has prepared this Environmental Report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act issues for license renewal of nuclear power plants. Table A-1 lists these 92 issues and identifies the section in which Exelon addressed each issue in the Environmental Report. For expediency, Exelon has assigned a number to each issue and uses the issue numbers throughout the Environmental Report.

TABLE A-1
PEACH BOTTOM ATOMIC POWER STATION ENVIRONMENTAL REPORT DISCUSSION OF LICENSE RENEWAL NEPA ISSUES[a]

Issue		Category	Section of this Environmental Report
1.	Impacts of refurbishment on surface water quality	1	4.0
2.	Impacts of refurbishment on surface water use	1	4.0
3.	Altered current patterns at intake and discharge structures	1	4.0
4.	Altered salinity gradients	1	4.0
5.	Altered thermal stratification of lakes	1	4.0
6.	Temperature effects on sediment transport capacity	1	4.0
7.	Scouring caused by discharged cooling water	1	4.0
8.	Eutrophication	1	4.0
9.	Discharge of chlorine or other biocides	1	4.0
10.	Discharge of sanitary wastes and minor chemical spills	1	4.0
11.	Discharge of other metals in waste water	1	4.0
12.	Water use conflicts (plants with once-through cooling systems)	1	4.0
13.	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	4.1
14.	Refurbishment impacts to aquatic resources	1	4.0
15.	Accumulation of contaminants in sediments or biota	1	4.0
16.	Entrainment of phytoplankton and zooplankton	1	4.0
17.	Cold shock	1	4.0
18.	Thermal plume barrier to migrating fish	1	4.0
19.	Distribution of aquatic organisms	1	4.0
20.	Premature emergence of aquatic insects	1	4.0
21.	Gas supersaturation (gas bubble disease)	1	4.0
22.	Low dissolved oxygen in the discharge	1	4.0
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.0
24.	Stimulation of nuisance organisms (e.g., shipworms)	1	4.0
25.	Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	4.2

TABLE A-1 (Cont'd)
PEACH BOTTOM ATOMIC POWER STATION ENVIRONMENTAL REPORT DISCUSSION OF LICENSE RENEWAL NEPA ISSUES[a]

	Issue	Category	Section of this Environmental Report
26.	Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	4.3
27.	Heat shock for plants with once-through and cooling pond heat dissipation systems	2	4.4
28.	Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	4.0
29.	Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	4.0
30.	Heat shock for plants with cooling-tower-based heat dissipation systems	1	4.0
31.	Impacts of refurbishment on groundwater use and quality	1	4.0
32.	Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	4.0
33.	Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	4.5
34.	Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	4.6
35.	Groundwater use conflicts (Ranney wells)	2	4.7
36.	Groundwater quality degradation (Ranney wells)	1	4.0
37.	Groundwater quality degradation (saltwater intrusion)	1	4.0
38.	Groundwater quality degradation (cooling ponds in salt marshes)	1	4.0
39.	Groundwater quality degradation (cooling ponds at inland sites)	2	4.8
40.	Refurbishment impacts to terrestrial resources	2	4.9
41.	Cooling tower impacts on crops and ornamental vegetation	1	4.0
42.	Cooling tower impacts on native plants	1	4.0
43.	Bird collisions with cooling towers	1	4.0
44.	Cooling pond impacts on terrestrial resources	1	4.0
45.	Power line right-of-way management (cutting and herbicide application)	1	4.0

TABLE A-1 (Cont'd)
PEACH BOTTOM ATOMIC POWER STATION ENVIRONMENTAL REPORT DISCUSSION OF LICENSE RENEWAL NEPA ISSUES[a]

	Issue	Category	Section of this Environmental Report
46.	Bird collisions with power lines	1	4.0
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0
48.	Floodplains and wetlands on power line right-of-way	1	4.0
49.	Threatened or endangered species	2	4.10
50.	Air quality during refurbishment (non-attainment and maintenance areas)	2	4.11
51.	Air quality effects of transmission lines	1	4.0
52.	Onsite land use	1	4.0
53.	Power line right-of-way land use impacts	1	4.0
54.	Radiation exposures to the public during refurbishment	1	4.0
55.	Occupational radiation exposures during refurbishment	1	4.0
56.	Microbiological organisms (occupational health)	1	4.0
57.	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.12
58.	Noise	1	4.0
59.	Electromagnetic fields, acute effects (electric shock)	2	4.13
60.	Electromagnetic fields, chronic effects	NA[b]	4.0
61.	Radiation exposures to public (license renewal term)	1	4.0
62.	Occupational radiation exposures (license renewal term)	1	4.0
63.	Housing impacts	2	4.14
64.	Public services: public safety, social services, and tourism and recreation	1	4.0
65.	Public services: public utilities	2	4.15
66.	Public services: education (refurbishment)	2	4.16
67.	Public services: education (license renewal term)	1	4.0
68.	Offsite land use (refurbishment)	2	4.17.1
69.	Offsite land use (license renewal term)	2	4.17.2
70.	Public services: transportation	2	4.18
71.	Historic and archaeological resources	2	4.19
72.	Aesthetic impacts (refurbishment)	1	4.0

TABLE A-1 (Cont'd)
PEACH BOTTOM ATOMIC POWER STATION ENVIRONMENTAL REPORT DISCUSSION OF LICENSE RENEWAL NEPA ISSUES[a]

	Issue	Category	Section of this Environmental Report
73.	Aesthetic impacts (license renewal term)	1	4.0
74.	Aesthetic impacts of transmission lines (license renewal term)	1	4.0
75.	Design basis accidents	1	4.0
76.	Severe accidents	2	4.20
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0
78.	Offsite radiological impacts (collective effects)	1	4.0
79.	Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0
80.	Nonradiological impacts of the uranium fuel cycle	1	4.0
81.	Low-level waste storage and disposal	1	4.0
82.	Mixed waste storage and disposal	1	4.0
83.	Onsite spent fuel	1	4.0
84.	Nonradiological waste	1	4.0
85.	Transportation	1	4.0
86.	Radiation doses (decommissioning)	1	4.0
87.	Waste management (decommissioning)	1	4.0
88.	Air quality (decommissioning)	1	4.0
89.	Water quality (decommissioning)	1	4.0
90.	Ecological resources (decommissioning)	1	4.0
91.	Socioeconomic impacts (decommissioning)	1	4.0
92.	Environmental justice	NA[b]	2.11

a. Source: 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Not applicable. Regulation does not categorize this issue.
NEPA = National Environmental Policy Act.

APPENDIX B

NPDES PERMIT

The NPDES permit for Peach Bottom Atomic Power Station is approximately 35 pages long. Only the cover page, providing the authority to discharge is provided. No other pages are pertinent to any Category 2 issues.

Pennsylvania Department of Environmental Protection
WATER MANAGEMENT PROGRAM

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
NPDES PERMIT NO. PA 0009733

In compliance with the provisions of the Clean Water Act, 33 U.S.C. Section 1251 et seq. (the "Act") and Pennsylvania's Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq.,

PECO Energy Company
Peach Bottom Atomic Power Station
1848 Lay Road
Delta, PA 17314

is hereby authorized to discharge from a facility located in **Peach Bottom Township, York County** to the receiving waters named **Susquehanna River in Watershed 7-I (Kreutz - Muddy Creeks)** in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts A, B, and C hereof.

THIS PERMIT SHALL BECOME EFFECTIVE ON DECEMBER 1, 2000

AND EXPIRE AT MIDNIGHT, DECEMBER 1, 2005

The authority granted by this permit is subject to the following further qualifications:

1. If there is a conflict between the application, its supporting documents and/or amendments and the terms and conditions of this permit, the terms and conditions shall apply.

2. Failure to comply with the terms or conditions of this permit is grounds for enforcement action; for permit termination, revocation and reissuance or modification; or for denial of a permit renewal application.

3. Application for renewal of this permit, or notification of intent to cease discharging by the expiration date, must be submitted to the Department at least 180 days prior to the above expiration date (unless permission has been granted by the Department for submission at a later date), using the appropriate NPDES Permit Application Form. In the event that a timely and complete application for renewal has been submitted and the Department is unable, through no fault of the permittee, to reissue the permit before the above expiration date, the terms and conditions to this permit will be automatically continued and will remain fully effective and enforceable pending the grant or denial of the application for permit renewal.

4. This permit does not constitute authorization to construct or make modifications to wastewater treatment facilities necessary to meet the terms and conditions of this permit.

PERMIT ISSUED: NOV 3 2000

PERMIT AMENDED: _____

BY: _____
Leon M. Oberdick
Program Manager
Southcentral Regional Office

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APPENDIX C

SPECIAL-STATUS SPECIES CORRESPONDENCE

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

June 22, 2000

Mr. Christopher Mantzaris
Asst. Regional Administrator for Protected Resources
National Marine Fisheries Service
Northeast Regional Office
One Blackburn Drive
Gloucester, MA 01930-2298

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
Request for Information on Threatened or Endangered Species

Dear Mr. Mantzaris:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power Station (PBAPS). Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10 CFR 51.53). The NRC will request an informal consultation with your office at a later date under Section 7 of the Endangered Species Act. By contacting you early in the application process, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite the NRC consultation.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached map). Conowingo Pond, created in 1928 by impounding a portion of the lower Susquehanna River for a hydroelectric generating facility, is approximately 14 square miles (9,000 acres) in surface area and ranges from 0.5 to 1.5 miles wide. The Conowingo Dam lies about 9 miles downstream from Peach Bottom Atomic Power Station and about 10 miles upstream of the mouth of the Susquehanna River (the Chesapeake Bay).

Peach Bottom Atomic Power Station, a two-unit nuclear plant with a total rated output of 2,160 MWe (mega-watts electrical), uses a once-through cooling water system that withdraws from and discharges to Conowingo Pond. Five mechanical draft ("helper") cooling towers were built on berms adjacent to the discharge canal to supply additional cooling capacity in summer months, but in recent years these cooling towers have not been used.

In recent years, anadromous fish have become more abundant up- and downstream of Conowingo Dam. The American shad, in particular, has responded to a restoration program that includes stocking young shad in the Susquehanna River and passing spawning shad upstream by means of fishways at Conowingo Dam, Hollwood Dam, and Safe Harbor Dam. In more than 30 years of monitoring fish populations of Conowingo Pond, PECO Energy and its contractors have never collected a fish species listed by the U.S. Fish and Wildlife Service as threatened or endangered. One candidate species, the Atlantic sturgeon (*Acipenser oxyrhynchus*) has been captured by anglers in the lower Susquehanna River below the Conowingo Dam in Maryland, but apparently has not been collected upstream of the Dam in Pennsylvania. In addition, no candidates of Shortnose sturgeon (*Acipenser brevirostrum)* have been captured.

PECO Energy is committed to the conservation of significant natural habitats and protected species, and expects that operation of PBAPS through the license renewal period (an additional 20 years) would not adversely affect any listed aquatic species. PECO Energy has no plans to alter current operations over the license renewal period. Any normal maintenance activities during the license renewal term would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no additional land disturbance outside of the established industrial area is anticipated in support of license renewal. We, therefore, request your concurrence with our determination that license renewal would have no effect on listed or proposed endangered or threatened species and that formal consultation is not necessary.

Please do not hesitate to call Robert Matty at (610) 640-6353 if you have any questions or require any additional information. After your review, we would appreciate receiving your input by December 1, 2000, detailing any concerns you may have about any listed species or critical habitat in the area or confirming PECO Energy's conclusion that operation of PBAPS over the license renewal term would have no effect on any threatened or endangered species under the jurisdiction of the National Marine Fisheries Service. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

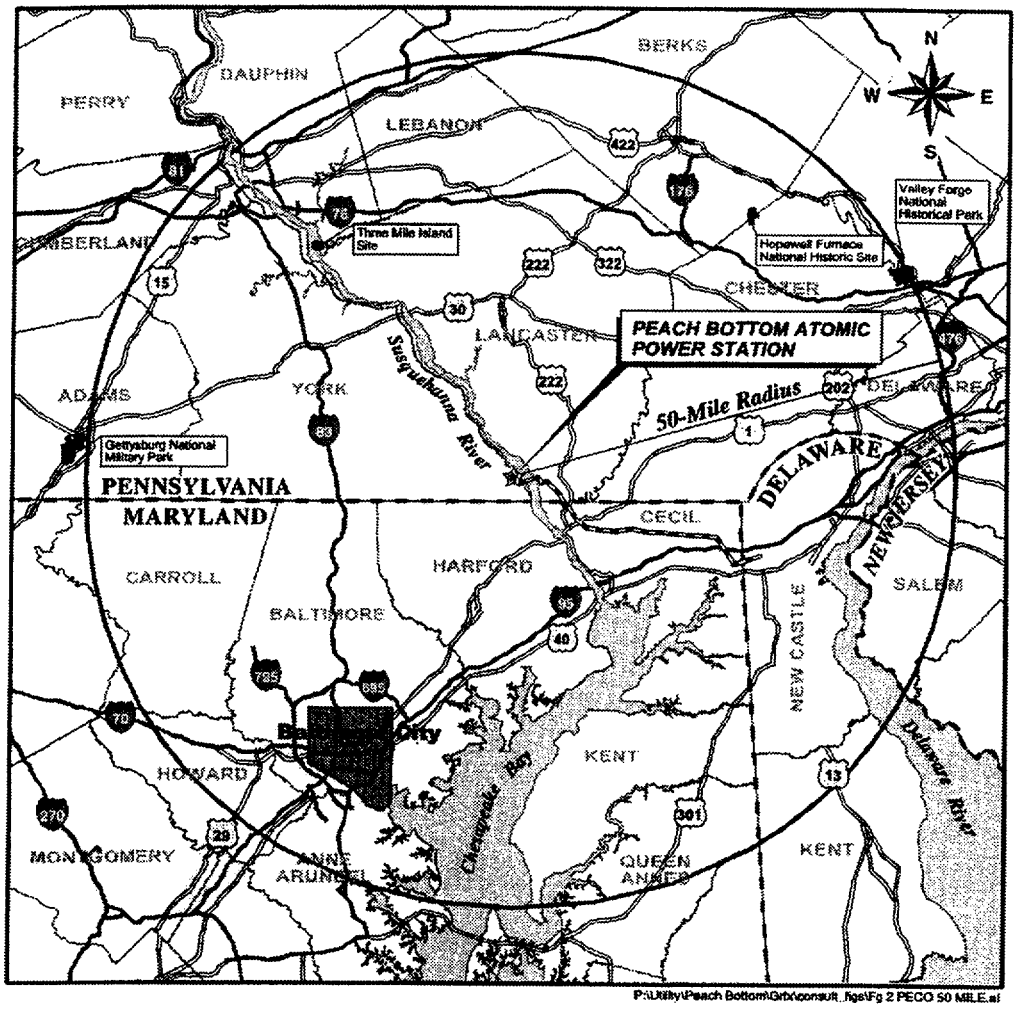
James A. Hutton
Director - Licensing

Enc: Map of PBAPS and vicinity

cc: R. St. Pierre, USFWS
M. McCarthy, USFWS
F. Polaski, PECO Energy
W. Maher, PECO Energy
K. Patterson, TTNUS
H. J. Miller, Administrator, Region I, USNRC
A. C. McMurtray, USNRC Senior Resident Inspector, PBAPS

Request for Information on Threatened or Endangered Species
June 22, 2000
Page 3

bcc: Manager, Financial Controls and Co-Owner Affairs,
Public Service Electric & Gas
R. I. McLean, State of Maryland
A. F. Kirby, III, Delmarva Power & Light Company
R. R. Janati, Commonwealth of Pennsylvania
G. R. Rainey - 63C-3
C. P Lewis - 63C-3
J. J. Hagan - 62C-3
J. W. Langenbach - 62C-3
J. Doering - PB, SMB4-9
G. L. Johnston - PB, A4-1S
P. J. Davison - PB, SMB3-2A
J. P. Grimes - 63B-1
R. W. Boyce - 63C-3
R. A. Kankus - 63C-2
A. A. Winter - PB, A4-5S
J. G. Hufnagel/TRL - 62A-1
PBAPS ISEG - PB, SMB4-6
Commitment Coordinator - 62A-1
Correspondence Control Desk - 61B-5
DAC - 61B-5



LEGEND

- Peach Bottom Atomic Power Station
- Transmission Line

10 0 10 20 Kilometers

10 0 10 20 Miles

FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930

Mr. James A. Hutton
Director, Licensing
PECO Nuclear
PECO Energy Company
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

Dear Mr. Hutton:

This responds to your inquiry received June 29, 2000, requesting information on the presence of any federally listed threatened or endangered species and/or designated critical habitat for listed species in the vicinity of the Peach Bottom Atomic Power Station (PBAPS) on Conowingo Pond on the Susquehanna River, York County, Pennsylvania. The PBAPS, a two-unit nuclear plant with a total rated output of 2,160 mega-watts electrical, uses a once-through cooling water system that withdraws from and discharges to Conowingo Pond. The current operating licenses for the PBAPS expire in 2013 and 2014 and the renewal term would be for an additional 20 years. There are no plans to alter current operations over the license renewal period and no expansion of the existing facilities is planned.

Endangered shortnose sturgeon (*Acipenser brevirostrum*) have been documented in the Chesapeake Bay and in the lower Susquehanna River. During a reward program conducted in the Maryland waters of the Chesapeake Bay from 1996 to 1998, two shortnose sturgeon were captured in the lower Susquehanna River. The Conowingo Dam lies approximately 9 miles downstream from the PBAPS and this dam has been equipped with fishways to pass migrating American shad. While shortnose sturgeon have difficulty using fishways, there is a possibility that sturgeon can migrate upstream of the Conowingo Dam. However, no sturgeon have been captured above the Conowingo Dam to date.

Due to the limited documentation of shortnose sturgeon in the lower Susquehanna River, the presence of the Conowingo Dam and resulting impediment to shortnose sturgeon migration, and the lack of any incidental capture of shortnose sturgeon above the dam, the operating license renewal of the PBAPS on Conowingo Pond is likely to have no effect on endangered shortnose sturgeon. No further consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, is required by the U.S. Nuclear Regulatory Commission, the Federal action agency responsible for Section 7 consultation. Should project plans change or new information become available that changes the basis for this determination, consultation should be reinitiated.

Should you have any questions about these comments, please contact Carrie McDaniel at (978) 281-9388.

Sincerely,

Patricia A. Kurkul
Regional Administrator

File Code: 1514-05 (A), NRC General

PECO NUCLEAR
A Unit of PECO Energy

Nuclear Group Headquarters
200 Exelon Way
Kennett Square, PA 19348

October 11, 2000

Mr. Michael McCarthy
U.S. Fish and Wildlife Service
Pennsylvania Field Office
315 South Allen Street
Suite 322
State College, PA 16801

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal: Request for Information on
Threatened or Endangered Species

Dear Mr. McCarthy:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3. Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10 CFR 51.53). The NRC will also request an informal consultation with your office at a later date under Section 7 of the Endangered Species Act. By contacting you early in the application process, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite the NRC consultation.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached map). Only one new transmission corridor was required to integrate PBAPS into PECO Energy's bulk power system when the facility was constructed. This transmission line, from Peach Bottom to the Keeney Substation in Delaware, is the only transmission line/corridor under review during this license renewal process.

The *Final Environmental Statement related to operation of Peach Bottom Atomic Power Station Units 2 and 3* (FES) prepared in 1973 by the U.S. Atomic Energy Commission stated that three Federally-listed species occurred historically in the general vicinity of the Peach Bottom site, but suggested that one of these species, the Delmarva Peninsula fox squirrel, had been extirpated locally:

> "The American peregrine falcon, southern bald eagle, and Delmarva Peninsula fox squirrel (a sub-species are on the Endangered Species List of the Department of Interior and were once found throughout the site area. Isolated occurrences may still be a possibility, although the Delmarva Peninsula fox squirrel is thought to be...extinct in Pennsylvania and the breeding sites of the peregrine falcon in eastern Pennsylvania have apparently not been in use since 1959."

The FES also contained a letter from the Department of Interior (dated December 1, 1972) suggesting that the bog turtle should be added to the list of threatened and endangered species potentially occurring on the site.

As you know, the peregrine falcon was de-listed in August 1999 (Federal Register/Vol. 64, No. 164/August 25, 1999). It is our understanding that the Delmarva Peninsula fox squirrel (exclusive of some translocated and experimental populations) is found only on the Eastern Shore of Maryland. Based on our preliminary review of PECO Energy documents and the U.S. Fish and Wildlife Service web site (http://endangered.fws.gov/wildlife.html), we believe that two listed species, the threatened bald eagle (*Haliaeetus leucocephalus*) and the threatened (northern) bog turtle (*Clemmys muhlenbergii*), could occur in the vicinity of the Peach Bottom site or its associated transmission line.

Habitat suitable to the bog turtle does not occur on the Station site, however, the transmission line does cross streams and low areas. To determine if any of the habitat along the transmission corridor was suitable for bog turtles, PECO Energy conducted a survey of the corridor using the Fish and Wildlife Service Guideline for Bog Turtle Surveys, dated August 30, 2000 as guidance. The purpose of this survey was to determine whether or not the wetland(s) are potential bog turtle habitat. The survey determined that streams along the transmission corridor traverse upland habitats and lack wetlands adjacent to them. With a single exception, there are no swamps, bogs, marshes, marshy meadows, springs, or seeps within the corridor. The single exception is a small marshy area that is dominated by the exotic mile-a-minute weed (*Polygonum perfoliatum*). Hydrology and vegetation suitable for bog turtle habitat does not exist in this area. In addition, hydrology, soils, and vegetation suitable as bog turtle habitat do not exist at any location within the Keeney corridor.

PECO Energy is committed to the conservation of significant natural habitats and protected species, and expects that operation of PBAPS, including maintenance of the identified transmission line, through the license renewal period (an additional 20 years) would not adversely affect any listed species. PECO Energy has no plans to alter current operations over the license renewal period. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is anticipated in support of license renewal.

Please do not hesitate to call Robert Matty at (610) 765-5514 if you have any questions or require any additional information. After your review, we would appreciate receiving your input by December 1, 2000, detailing any concerns you may have about any listed species or critical habitat in the area or confirming PECO Energy's conclusion that operation of

License Renewal: Request for Information on
Threatened or Endangered Species
October 11, 2000
Page 3

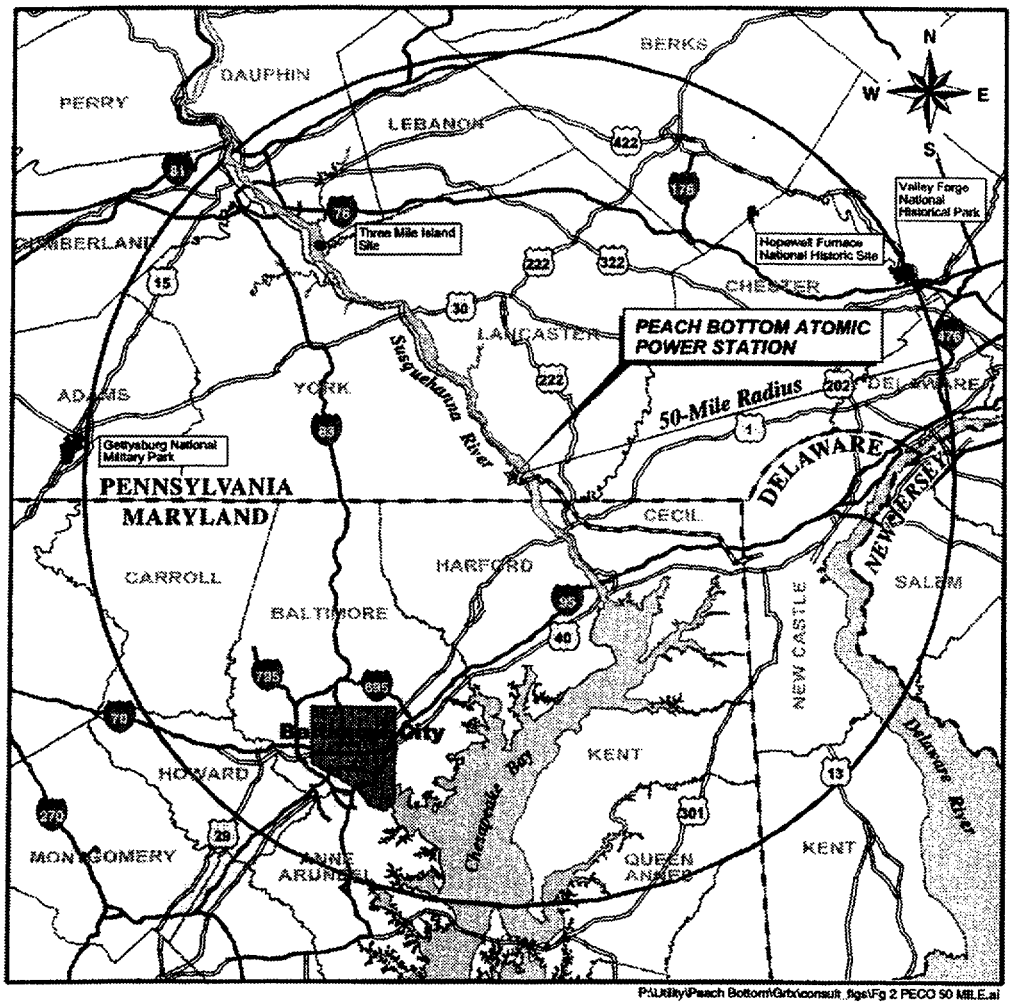
PBAPS over the license renewal term would have no effect on any threatened or endangered species. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

James A. Hutton
Director - Licensing

Enc: Map of PBAPS and vicinity.
Holtwood, Wakefield, Conowingo, Rising Sun, Bay View, Elkton, Newark West Quadrangle Maps with Keeney transmission corridor highlighted

cc K. Patterson, Tetra Tech NUS
F. Polaski, PECO Energy
W. Maher, PECO Energy



LEGEND

- Peach Bottom Atomic Power Station
- Transmission Line

10 0 10 20 Kilometers

10 0 10 20 Miles

FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

October 18, 2000

JAMES A. HUTTON
LICENSING SECTION
OCT 25 2000
REFER TO: 1

James A. Hutton
Director - Licensing
Peco Energy Company
Nuclear Group Headquarters
200 Exelon Way
Kennett Square, PA 19348

Dear Mr. Hutton:

This responds to your letter of October 11, 2000, requesting information about federally listed and proposed endangered and threatened species within the area affected by the proposed license renewal for the Peach Bottom Atomic Power Station (Units 2 and 3) located in Peach Bottom Township, York County, Pennsylvania. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

Except for occasional transient species, no federally listed or proposed threatened or endangered species under our jurisdiction are known to occur within the project impact area. Therefore, no Biological Assessment or further Section 7 consultation under the Endangered Species Act will be required with the Fish and Wildlife Service. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered. A compilation of certain federal status species in Pennsylvania is enclosed for your information.

This response relates only to endangered or threatened species under our jurisdiction based on an office review of the proposed project's location. No field inspection of the project area has been conducted by this office. Consequently, this letter is not to be construed as addressing potential Service concerns under the Fish and Wildlife Coordination Act or other authorities.

Requests for information regarding State-listed endangered or threatened species should be directed to the Pennsylvania Game Commission (birds and mammals), the Pennsylvania Fish and Boat Commission (fish, reptiles, amphibians and aquatic invertebrates), and the Pennsylvania Department of Conservation and Natural Resources (plants).

Please contact Michael McCarthy of my staff at 814-234-4090 if you have any questions or require further assistance.

Sincerely,

David Densmore
Supervisor

Enclosure

2

FEDERALLY LISTED AND PROPOSED SPECIES THAT NO LONGER OCCUR IN PENNSYLVANIA

COMMON NAME	SCIENTIFIC NAME	STATUS**	FORMER DISTRIBUTION
MAMMALS			
Canada lynx	*Lynx canadensis*	PT	north-central PA (Tioga Co.)
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	E	mature forests of southeastern PA (Delaware and Chester Co.)
Eastern cougar	*Felis concolor couguar*	E	state-wide
Grey wolf	*Canis lupus*	E	state-wide
MOLLUSKS			
Dwarf wedge mussel*	*Alasmidonta heterodon*	E	Delaware River drainage
Fanshell*	*Cyprogenia stegaria*	E	Ohio River drainage
Orange pimpleback*	*Plethobasus striatus*	E	Ohio River drainage
Pink mucket pearly mussel*	*Lampsilis abrupta*	E	Ohio River drainage
Ring pink mussel*	*Obovaria retusa*	E	Ohio River drainage
Rough pigtoe*	*Pleurobema plenum*	E	Ohio River drainage
INSECTS			
American burying beetle	*Nicrophorus americanus*	E	state-wide
Karner blue butterfly	*Lycaeides melissa samuelis*	E	pine barrens, oak savannas (wild lupine habitat) (Wayne Co.)
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	T	along large rivers in southeastern PA
PLANTS			
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	wet prairies, bogs (Crawford Co.)
Sensitive joint-vetch	*Aeschynomene virginica*	T	freshwater tidal marshes of Delaware river (Delaware and Philadelphia Co.)
Virginia spiraea*	*Spiraea virginiana*	T	along Youghiogheny River (Fayette Co.)
Smooth coneflower	*Echinacea laevigata*	E	serpentine barrens (Lancaster Co.)

Revised 11/18/99

* *It is possible that remnant populations of some of these species (indicated with an *) may still occur in Pennsylvania, however, there have been no confirmed sightings of these species for over 70 years.*

** *E = Endangered, T = Threatened, PT = Proposed Threatened*

The following is a partial list of additional species that no longer occur in Pennsylvania: moose, bison, wolverine, passenger pigeon, Bachman's sparrow, greater prairie-chicken, olive-sided flycatcher, Bewick's wren, eastern tiger salamander, blue pike, butterfly mussel, Diana fritillary butterfly, precious underwing moth, deertoe mussel, marbled underwing moth, cobblestone tiger beetle, mountain clubmoss, crested yellow orchid, red milkweed, American barberry, small white lady's-slipper, etc, etc.

U.S. FISH AND WILDLIFE SERVICE

FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES (in Pennsylvania)

COMMON NAME	SCIENTIFIC NAME	STATUS*	DISTRIBUTION
FISHES			
Shortnose sturgeon**	*Acipenser brevirostrum*	E	Delaware River & other Atlantic coastal waters
REPTILES & AMPHIBIANS			
Bog turtle	*Clemmys muhlenbergii*	T	Current - Adams, Berks, Bucks, Chester, Cumberland, Delaware, Franklin, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton and York Counties. Historic - Crawford, Mercer and Philadelphia Counties
Eastern massasauga rattlesnake	*Sistrurus catenatus catenatus*	C	Current - Butler, Crawford, Mercer and Venango Counties. Historic - Allegheny and Lawrence Counties.
BIRDS			
Bald eagle	*Haliaeetus leucocephalus*	T	Suitable habitats across the state. Recent nesting in Butler, Centre, Chester, Crawford, Dauphin, Erie, Forest, Huntingdon, Lancaster, Mercer, Northumberland, Pike, Tioga, Venango, Warren and York Co. Wintering concentrations occur near ice-free sections of rivers, lakes and reservoirs, including the Delaware River.
Piping plover	*Charadrius melodus*	E	Presque Isle (Erie County). Migratory. No nesting in Pennsylvania since mid-1950s.
MAMMALS			
Indiana bat	*Myotis sodalis*	E	Winter hibernacula: Armstrong, Blair, Lawrence, Luzerne, Mifflin and Somerset Co.
MOLLUSKS			
Dwarf wedgemussel	*Alasmidonta heteradon*	E	Current - Delaware River watershed; Wayne County. Historic - Delaware River watershed; Bucks, Carbon, and Philadelphia Counties; Susquehanna River watershed; Lancaster County
Clubshell mussel	*Pleurobema clava*	E	French Creek and Allegheny River watersheds; Clarion, Crawford, Erie, Forest, Mercer, Venango and Warren Counties
Northern riffleshell	*Epioblasma torulosa rangiana*	E	French Creek and Allegheny River watersheds; Clarion, Crawford, Erie, Forest, Mercer, Venango and Warren Counties
PLANTS			
Northeastern bulrush	*Scirpus ancistrochaetus*	E	Current - Adams, Bedford, Blair, Carbon, Centre, Clinton, Cumberland, Dauphin, Franklin, Huntingdon, Lackawanna, Lehigh, Lycoming, Mifflin, Monroe, Perry, Snyder and Union Counties. Historic - Northampton County
Small-whorled pogonia	*Isotria medeoloides*	T	Current - Centre and Venango Counties. Historic - Berks, Chester, Greene, Monroe, Montgomery and Philadelphia Counties

E = Endangered, T = Threatened, PE = Proposed Endangered, PT = Proposed Threatened, C = Candidate *Revised 7/27/00*

** Shortnose sturgeon is under the jurisdiction of the National Marine Fisheries Service*

U.S. FISH AND WILDLIFE SERVICE
315 SOUTH ALLEN ST., SUITE 322, STATE COLLEGE, PA 16801

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
200 Exelon Way
Kennett Square, PA 19348

August 9, 2000

Mr. Gary Camus
Wildlife Impact Review Coordinator
Pennsylvania Game Commission
2001 Elmerton Avenue
Harrisburg, PA 17110-9797

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal: Request for Information on State-Listed Species and Important Habitats

Dear Mr. Camus:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power (PBAPS) Units 2 and 3. Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10 CFR 51.53). The NRC will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service under Section 7 of the Endangered Species Act and may also seek your assistance in the identification of important species and habitats. By contacting your office now, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite your evaluation of the impact of the continued operation of PBAPS on threatened or endangered species.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached map). Only one new transmission corridor was required to integrate PBAPS into PECO Energy's bulk power system when the facility was constructed. This transmission line, from Peach Bottom to the Keeney Substation in Delaware is the only transmission line/corridor under review during this license renewal process.

PECO Energy is committed to the conservation of significant natural habitats and protected species, and believes that operation of PBAPS since 1974 has had no adverse impact on any threatened or endangered species. Any maintenance

activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is currently anticipated in support of license renewal. As a consequence, we believe that operation of PBAPS, including maintenance of the identified transmission line, over the license renewal period (an additional 20 years) would not adversely affect any threatened or endangered species. Accordingly, we request your concurrence with our determination that a renewed license would have no effect on listed or proposed endangered or threatened species and that formal consultation is not necessary.

Please do not hesitate to call Robert Matty at (610) 765-5514 if you have any questions or require any additional information. After your review, we would appreciate receiving your input by December 1, 2000, detailing concerns, if any, you may have about any state-listed species or ecologically-significant habitats in the vicinity of PBAPS or in the associated transmission corridor (right-of-way), or concurring with PECO Energy's conclusions that continued operation of PBAPS and the associated transmission line would not affect any threatened or endangered species. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

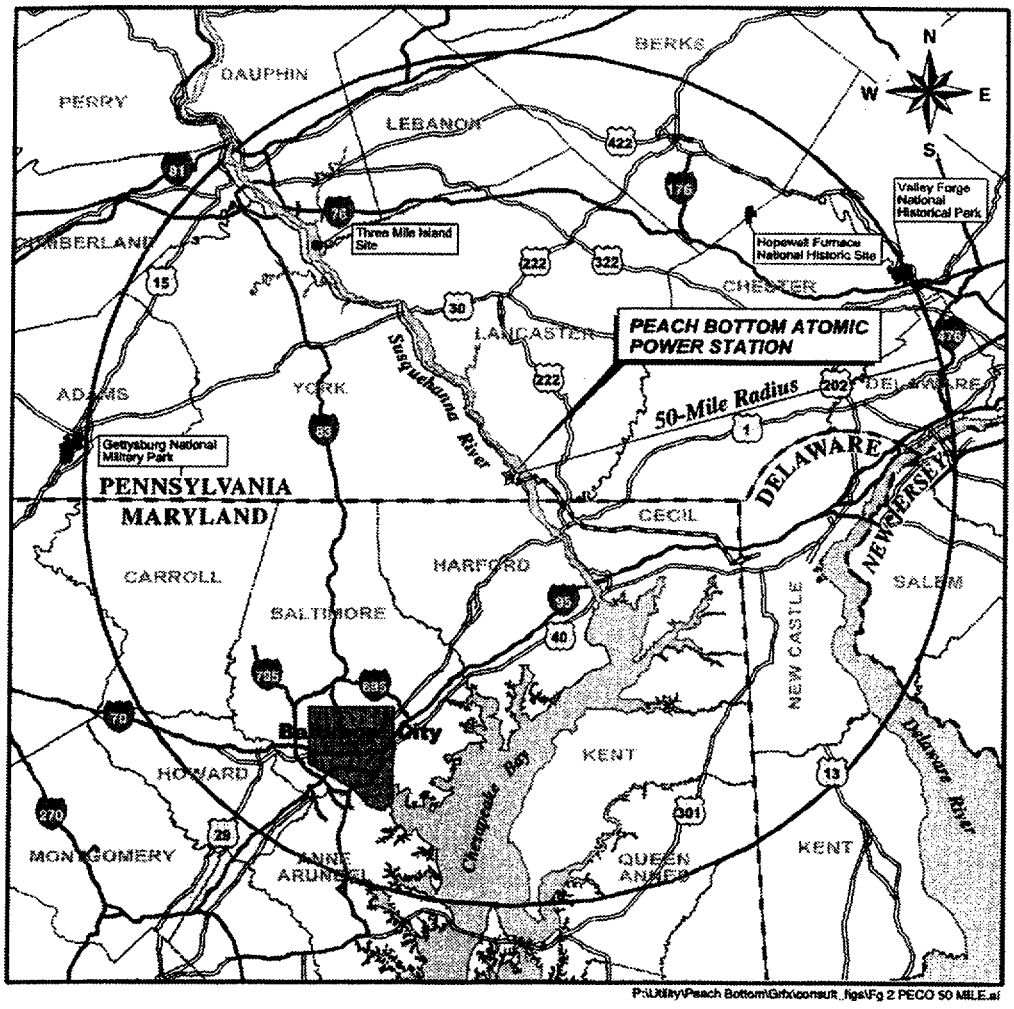
James A. Hutton
Director - Licensing

Enc: Maps of PBAPS and vicinity
Holtwood, Wakefield, and Conowingo Quadrangle Maps with Keeney transmission corridor highlighted

cc K. Patterson, Tetra Tech NUS
F. Polaski, PECO Energy
W. Maher, PECO Energy

Request for Information on State-Listed
Species and Important Habitats
August 9, 2000
Page 3

bcc: PSE&G, Financial Controls and Co-Owner Affairs
R. I. McLean, State of Maryland
A. F. Kirby, III, Delmarva Power & Light Company
R. R. Janati, Commonwealth of Pennsylvania
G. R. Rainey - 63C-3
C. P Lewis - 63C-3
J. J. Hagan - 62C-3
J. W. Langenbach - 62C-3
J. Doering - PB, SMB4-9
G. L. Johnston - PB, A4-1S
P. J. Davison - PB, SMB3-2A
J. P. Grimes - 63B-1
R. W. Boyce - 63C-3
R. A. Kankus - 63C-2
A. A. Winter - PB, A4-5S
J. G. Hufnagel/TRL - 62A-1
PBAPS ISEG - PB, SMB4-6
Commitment Coordinator - 62A-1
Correspondence Control Desk - 61B-5
DAC - 61B-5



LEGEND

- Peach Bottom Atomic Power Station
- Transmission Line

10 0 10 20 Kilometers

10 0 10 20 Miles

FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
2001 ELMERTON AVENUE
HARRISBURG, PA 17110-9797

ADMINISTRATIVE BUREAUS:
ADMINISTRATION 717-787-5670
AUTOMOTIVE AND PROCUREMENT DIVISION ... 717-787-6594
LICENSE DIVISION 717-787-2084
PERSONNEL DIVISION 717-787-7836
WILDLIFE MANAGEMENT 717-787-5529
INFORMATION & EDUCATION ... 717-787-6286
LAW ENFORCEMENT 717-787-5740
LAND MANAGEMENT 717-787-6816
REAL ESTATE DIVISION 717-787-6568
MANAGEMENT INFORMATION SYSTEMS 717-787-4076

September 26, 2000

JAMES A. HUTTON
LICENSING SECTION
OCT 0 2 2000
REFER TO:

Mr. James A. Hutton
Director - Licensing
PECO Energy Company
200 Exelon Way
Kennett Square, PA 19348

In re: Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal: Request for Information on State-Listed Species and Important Habitats

Dear Mr. Hutton:

This is in response to your letter requesting information concerning endangered and threatened species of birds and mammals as related to the above project.

We have completed an office review of the proposed project and determined that except for occasional transient individuals, this project should not affect any endangered or threatened species of birds and mammals recognized by the Pennsylvania Game Commission.

This response is related only to endangered species, it does not address other concerns of the Game Commission. If, in the normal review process, it is determined that the project may impact critical or unique habitats such as wetlands, wintering areas, or nesting cover, etc., you may be requested to conduct additional studies.

If you have any questions, please contact me directly at (717) 783-1728.

Very truly yours,

Gary R. Camus
Game Land Officer Manager
Section Oil/Gas and Mineral Development
Bureau of Land Management

cc: File
GRC
Kepler

An Equal Opportunity Employer

PECO NUCLEAR
A Unit of PECO Energy

Nuclear Group Headquarters
200 Exelon Way
Kennett Square, PA 19348

September 22, 2000

Ms. Lori Byrne
Wildlife & Heritage Division
Tawes Office Building E-1
580 Taylor Avenue
Annapolis, MD 21401

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal: Request for Information on State-Listed Species and Important Habitats

Dear Ms. Byrne:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power (PBAPS) Units 2 and 3. Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10 CFR 51.53). The NRC will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service under Section 7 of the Endangered Species Act and may also seek your assistance in the identification of important species and habitats. By contacting your office now, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite your evaluation of the impact of the continued operation of PBAPS on threatened or endangered species.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached map). Only one new transmission corridor was required to integrate PBAPS into PECO Energy's bulk power system when the facility was constructed. This transmission line, from Peach Bottom to the Keeney Substation in Delaware is the only transmission line/corridor under review during this license renewal process.

The Keeney line, which is approximately 34 miles long, runs eastward from PBAPS to the Keeney Substation in northwestern Delaware (see attached map). For approximately 24 miles of its length, the Keeney line passes through the northeastern corner of (Cecil County) Maryland. As you know, PECO Energy allowed the Maryland Department of Natural Resources to conduct a rare plant survey on this transmission line corridor in 1998. The results of that survey, published in December 1998, indicate that two ecologically-significant areas (Richardsmere Powerline Protection Area and Rock Springs Barren Protection Area) are crossed by the Keeney line.

To date, the effect of vegetation management along the Keeney corridor has been positive. A 0.8 mile segment of the Keeney transmission corridor is part of the Rock Springs Barren

Protection Area (also known as Rock Springs Powerline Natural Area), which is managed for rare plant species including the serpentine aster (*Aster depauperatus*; state-listed in Maryland) and the reticulated nutrush (*Scleria reticularis*; state-listed in Pennsylvania and "rare" in Maryland). Regular mowing in the transmission corridor prevents development of woody vegetation (shrubs and trees) and maintains open, glade-like conditions that favor a number of rare herbaceous species. In the absence of PECO Energy's vegetation management, these (Keeney line) plant populations would almost certainly be eliminated, shaded out by trees and shrubs.

PECO Energy is committed to the conservation of significant natural habitats and protected species, and believes that operation of PBAPS since 1974 has had no adverse impact on any threatened or endangered species. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is currently anticipated in support of license renewal. As a consequence, we believe that operation of PBAPS, including maintenance of the identified transmission line, over the license renewal period (an additional 20 years) would not adversely affect any threatened or endangered species. Accordingly, we request your concurrence with our determination that a renewed license would have no effect on listed or proposed endangered or threatened species and that formal consultation is not necessary.

Please do not hesitate to call Robert Matty at (610) 765-5514 if you have any questions or require any additional information. After your review, we would appreciate receiving your input by December 1, 2000, detailing concerns, if any, you may have about any state-listed species or ecologically-significant habitats in the vicinity of PBAPS or in the associated transmission corridor (right-of-way), or concurring with PECO Energy's conclusions that continued operation of PBAPS and the associated transmission line would not affect any threatened or endangered species. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

James A. Hutton
Director - Licensing

Enc: Maps of PBAPS and vicinity
Conowingo, Rising Sun, Bay View, Newark West, and Elkton Quadrangle
Maps with Keeney transmission corridor highlighted

cc K. Patterson, Tetra Tech NUS
F. Polaski, PECO Energy
W. Maher, PECO Energy

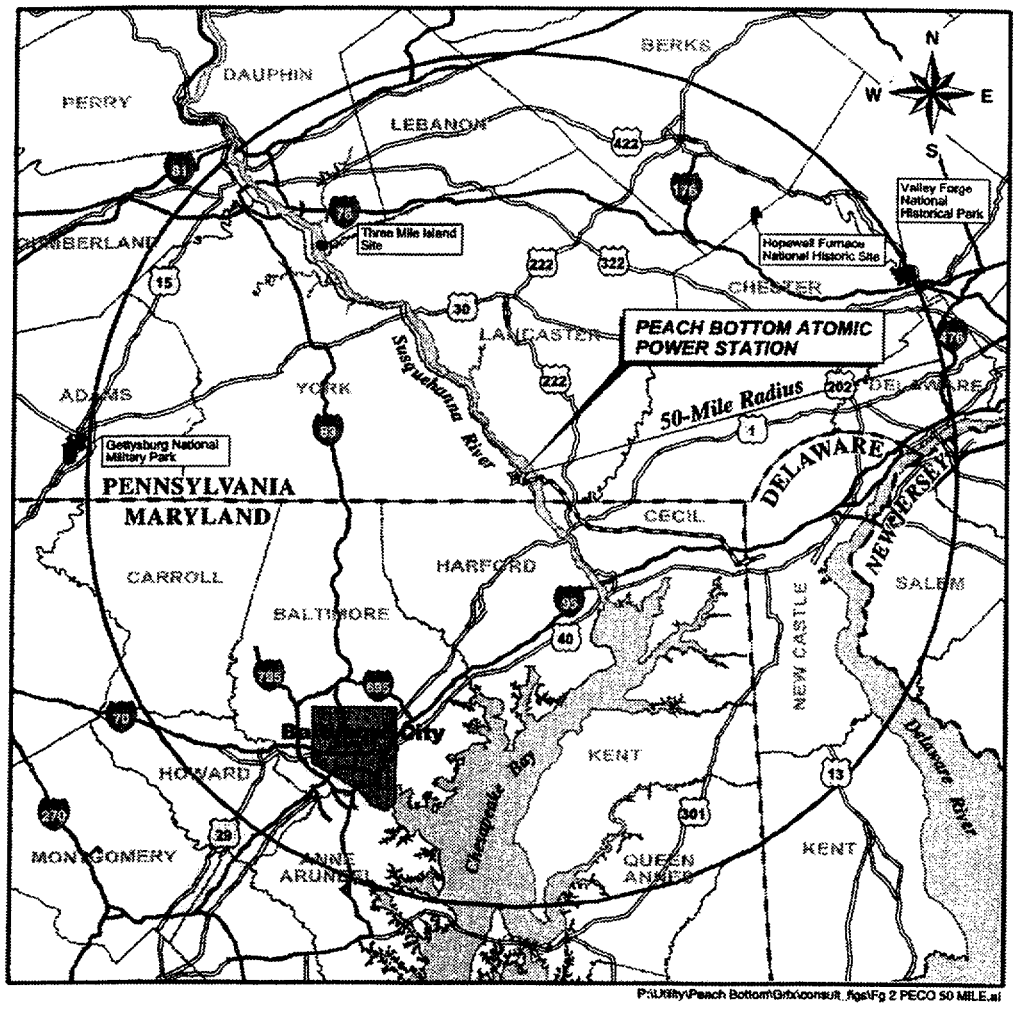


FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

Parris N. Glendening
Governor

Kathleen Kennedy Townsend
Lt. Governor

Maryland Department of Natural Resources
Forest, Wildlife and Heritage Service
Tawes State Office Building
Annapolis, Maryland 21401

Sarah J. Taylor-Rogers, Ph. D.
Secretary

Stanley K. Arthur
Deputy Secretary

December 22, 2000

Mr. James A. Hutton
PECO Nuclear
200 Exelon Way
Kennett Square, PA 19348

RE: **Environmental Review for Peach Bottom Atomic Power Station, Units 2 & 3, License Renewal, Transmission Line from Peach Bottom in PA to Keeney Substation in DE, Cecil County, Maryland.**

Dear Mr. Hutton:

The Wildlife and Heritage Division's Natural Heritage database indicates that there are records for rare, threatened and endangered species of plants and animals on or near the project site. These are listed below, organized by USGS 7.5 minute quadrangle. Please note that locations for these records are provided where feasible and include recent as well as historical records, unless specifically noted. Furthermore, the review includes species recorded at or in close proximity to the project site as well as species located within the vicinity (usually within 1.5 miles) of the site. Any species found within the vicinity of the site could potentially occur on the project site in areas of appropriate habitat.

Conowingo Dam Quad

The following records for species of concern are known to occur on or immediately adjacent to the project site:

1. Along a tributary to Conowingo Creek and Old Mill Road, there are recent records for state threatened Canada Burnet (*Sanguisorba canadensis*), state rare Reticulated Nutrush (*Scleria reticularis*), and a large population of state endangered Serpentine Aster (*Aster depauperatus*), all of which could be directly impacted by this project, and are associated with serpentine soils.

2. State endangered Whorled Mountain-mint (*Pycnanthemum verticillatum*) is known to occur along a powerline corridor south of Richardsmere and continuing onto Octoraro Creek.

Telephone: (410) 260-8540
DNR TTY for the Deaf: 410-974-3683

The project site is within the vicinity of the following species:

3. The drainage area for a known population of federally and state threatened Bog Turtle (*Clemmys muhlenbergii*) includes tributaries to Octoraro Creek in the US Route 1 area. There are also locations of Bog Turtle drainages that fall within the vicinity of the project site in other areas.

4. In the area of Old Mill Road and a tributary to Conowingo Creek are recent or historical records for the following species of concern:

Scientific Name	Common Name	State Status
Buchnera americana	Blue-hearts	Endangered Extirpated
Gentianopsis crinita	Fringed gentian	Endangered
Solidago rigida	Hard-leaved goldenrod	Endangered Extirpated

5. Recent or historical records for species of concern are known to occur along the slopes of Octoraro Creek and its tributaries are:

Scientific Name	Common Name	State Status
Aster concinnus	Steele's aster	Endangered Extirpated
Carex hitchcockiana	Hitchcock's sedge	Endangered
Clematis occidentalis	Purple clematis	Endangered
Gentiana andrewsii	Fringe-tip closed gentian	Threatened
Scutellaria nervosa	Veined skullcap	Endangered
Carex mesochorea	Midland sedge	Endangered

6. For the area of US Route 1 at Mary Knoll Lane there is a record for state endangered Long-awned Diplachne (*Leptochloa fascicualris*).

7. In the Richardsmere / Octoraro Creek area there is a record for state endangered Darlington's Spurge (*Euphorbia purpurea*).

8. For the Kilby Corner area there are records for state threatened Leonard's Skullcap (*Scutellaria leonardii*) and state endangered Regal Fritillary (*Speyeria idalia*).

9. There is another record for state endangered Darlington's Spurge (*Euphorbia purpurea*) known to occur near Johnson Road.

10. In the Rock Springs area are recent or historical records for the following species of concern:

Scientific Name	Common Name	State Status
Agrimonia microcarpa	Small-fruited agrimony	Endangered
Desmodium rigidum	Rigid tick-trefoil	Endangered
Euphorbia purpurea	Darlington's spurge	Endangered
Helianthemum bicknellii	Hoary frostweed	Endangered Extirpated
Solidago speciosa	Showy goldenrod	Endangered

11. Records for the following species of concern are known to occur along the powerline running from Fulton County, Pennsylvania to MD Route 222:

Scientific Name	Common Name	State Status
Carex hystericina	Porcupine sedge	Endangered
Deschampsia cespitosa	Tufted hairgrass	Endangered
Salix tristis	Dwarf prairie willow	Highly Rare
Scleria reticularis	Reticulated nutrush	Rare

12. State threatened Fameflower (*Talinum teretifolium*) is known to occur along Red Hill Road.

13. The following records for species of concern are associated with serpentine soils in the Pilottown area along Conowingo Creek:

Scientific Name	Common Name	State Status
Aster depauperatus	Serpentine aster	Endangered
Apocynum sibiricum	Clasping-leaved dogbane	Endangered Extirpated
Bromus latiglumis	Broad-glumed brome	Endangered
Campanula rotundifolia	Harebell	Rare
Panicum oligosanthes	Few-flowered panicgrass	Endangered
Pycnanthemum virginianum	Virginia mountain-mint	Rare
Scutellaria leonardii	Leonard's skullcap	Threatened
Sporobolus heterolepis	Northern dropseed	Endangered
Stenanthium gramineum	Featherbells	Threatened
Talinum teretifolium	Fameflower	Threatened

Rising Sun Quad

The following records for species of concern are known to occur on or immediately adjacent to the project site:

14. The federally and state threatened Bog Turtle (*Clemmys muhlenbergii*) is known to occur in the Basin Run drainage near the town of Colora. Bog turtles are found primarily in palustrine emergent wetlands, often with a scrub-shrub wetland component. Any proposed activities that would impact the hydrologic and/or vegetative character of wetlands matching these descriptions should be avoided. A minimum 100 foot vegetated buffer should be established or maintained. Appropriate sediment and erosion control measures should be taken to minimize impact to these wetlands.

The project site is within the vicinity of the following species:

15. Other populations of Bog Turtles (*Clemmys muhlenbergii*) are known for two areas: the Basin Run drainage in the West Nottingham area, and the Principio Creek drainage around Harrington and Post roads. In addition, there may be historical locations of Bog Turtle drainages that fall within the vicinity of the project site.

16. Recent records for state threatened Goldenseal (*Hydrastis canadensis*) and state endangered Hitchcock's Sedge (*Carex hitchcockiana*) are known to occur along the slopes of Octoraro Creek.

17. Near MD Route 273 and a tributary to Octoraro Creek, there is a record for state endangered Midland Sedge (*Carex mesochorea*).

Bay View Quad

The following records for species of concern are known to occur on or immediately adjacent to the project site:

18. The federally and state threatened Bog Turtle (*Clemmys muhlenbergii*) is known to occur in the West Branch drainage near Wheatley Road. Bog turtles are found primarily in palustrine emergent wetlands, often with a scrub-shrub wetland component. Any proposed activities that would impact the hydrologic and/or vegetative character of wetlands matching these descriptions should be avoided. A minimum 100 foot vegetated buffer should be established or maintained. Appropriate sediment and erosion control measures should be taken to minimize impact to these wetlands.

The project site is within the vicinity of the following species:

19. Another population of Bog Turtles (*Clemmys muhlenbergii*) is found in tributaries to Northeast Creek in the area of MD Route 272. In addition, there may be historical locations of Bog Turtle drainages that fall within the vicinity of the project site.

20. State threatened Buxbaum's Sedge (*Carex buxbaumii*) is known to occur in the Pleasant Hill area.

Elkton Quad

21. State endangered Grass-like Beakrush (*Rhynchospora globularis*) is known to occur on or immediately adjacent to the project site. This record is known for the portion of the powerline corridor that runs between Muddy Lane on the Elkton Quad and the Delaware state line.

22. State highly rare Dwarf Prairie Willow (*Salix tristis*) is known for the Gray's Hill area within the vicinity of the project site.

Newark West Quad

23. The project site is within the vicinity of the drainage for a known population of federally and state threatened Bog Turtles (*Clemmys muhlenbergii*).

24. State endangered Woodland Agrimony (*Agrimonia striata*) is known to occur in the Childs area in the vicinity of the project site.

Overall Project Site

For the entire area of the proejct site, the forested area on or adjacent to the project site contains Forest Interior Dwelling Bird habitat. Populations of many Forest Interior Dwelling Bird species (FIDS) are declining in Maryland and throughout the eastern United States. The conservation of this habitat is strongly encouraged by the Department of Natural Resources. The following guidelines will help minimize the project's impacts on FIDS and other native forest plants and wildlife:

1. Avoid placement of new corridors or related construction in the forest interior. If forest loss or disturbance is absolutely unavoidable, restrict development to the perimeter of the forest (i.e., within 300 feet of the exisiting forest edge), and avoid corridor placement in areas of high quality FIDS habitat (e.g., old-growth forest). Maximize the amount of remaining contiguous forested habitat.

2. Do not remove or disturb forest habitat during May-August, the breeding season for most FIDS. This seasonal restriction may be expanded to February-August if certain early nesting FIDS (e.g., Barred Owl) are present.

December 22, 2000
Page 5

3. Maintain forest habitat as close as possible to the corridor, and maintain canopy closure where possible.

4. Maintain grass height at least 10" during the breeding season (May-August).

Please contact David Brinker, Central Regional Ecologist for the Wildlife and Heritage Division, for technical assistance regarding potential impacts to rare species, the need for surveys, or appropriate conservation measures, especially for Bog Turtle consultation and for species found on or immediately adjacent to the project site. He can be reached at (410) 744-8939, or at 1200 Frederick Road, Catonsville, MD 21228.

Sincerely,

Lori A. Byrne

Lori A. Byrne,
Environmental Review Specialist,
Wildlife & Heritage Division

ER# 2000.1873.ce
cc: D. Brinker
R. McLean

Telephone: (410) 260-8540
DNR TTY for the Deaf: 410-974-3683

APPENDIX D

MICROBIOLOGICAL ORGANISMS CORRESPONDENCE

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

June 2, 2000

Mrs. Karen Bassett
Assistant Regional Director
Bureau of Water Supply Management
Pennsylvania Department of Environmental Protection
909 Elmerton Avenue
Harrisburg, PA 17110-8200

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
Request for Information on Thermophilic Microorganisms

Dear Mrs. Bassett:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power (PBAPS), Units 2 and 3. Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. This two-unit nuclear plant uses a once-through cooling water system that withdraws from and discharges to Conowingo Pond. Five mechanical draft ("helper") cooling towers were built on berms adjacent to the discharge canal to supply additional cooling capacity in summer months, but in recent years these cooling towers have not been used.

PECO Energy is preparing a license renewal application in accordance with NRC regulatory requirements. The NRC requires license applicants to provide "...an assessment of the impact of the proposed action {license renewal} on public health from thermophilic organisms in the affected water." The NRC regulations state that "these organisms are not expected to be a problem at most operating plants" but state further that "without site-specific data, it is not possible to predict the effects generically."

The NRC requires this assessment because certain microorganisms associated with cooling towers and thermal discharges are known to have deleterious impacts on human health. These microorganisms include the enteric pathogens *Salmonella* sp. and *Shigella* sp. as well as the *Pseudomonas aeruginosa* bacterium. Other less-common aquatic microorganisms that sometimes occur in heated waters include the Legionnaire's disease bacteria (*Legionella* sp.) and free-living amoeba of the genus *Naegleria* (esp. *Naegleria fowleri*). NRC guidance directs license applicants to consult with the state agency responsible for environmental health to determine if there is a concern about the presence of *Naegleria fowleri* in plant receiving waters. Attached is an excerpt from an NRC document on this topic.

PECO Energy believes that PBAPS discharge temperatures, which do not exceed 110^{0}F (in late summer 1999, daily average temperatures in the discharge canal ranged from 67 to 106.5^{0}F), are below those known to be conducive to growth and survival of thermophilic pathogens. Further, disinfection of the PBAPS sewage treatment plant effluent and NPDES-required monitoring of fecal coliforms in the same effluent reduce the likelihood that a seed source or inoculant would be introduced to the station's heated discharge or Conowingo Pond.

Discharge limits and monitoring requirements for PBAPS are set forth in NPDES Permit 0009733, which was issued by the Pennsylvania Department of Environmental Protection's (PADEP) Water Management Program on July 7, 1995 and amended on January 20, 1998. The NPDES permit states that "the permittee shall provide for effective disinfection of this discharge to control disease-producing organisms during the swimming season (May 1 through September 30) to achieve a fecal coliform concentration not greater than 200/100 ml geometric average, and not greater than 1,000/100 ml in more than 10% of the samples tested" [Part C(I)(E)].

PECO Energy does not expect PBAPS operations and cooling systems to change significantly over the license renewal term, and there is no reason to believe that discharge temperatures will increase or that disinfection would cease. However, we are requesting any information that the PADEP may have compiled on the presence of thermophilic microorganisms in Conowingo Pond in the vicinity of PBAPS, including results of any monitoring or special studies that might have been conducted by PADEP or its subcontractors. We also request your concurrence with the PECO Energy's conclusion that there is no significant threat to the public from thermophilic microorganisms attributable to PBAPS operations.

Please feel free to call Robert Matty at (610) 640-6353 if you have any questions or require any additional information. After your review, we would appreciate receiving your input by December 1, 2000, detailing concerns, if any, you may have on the presence of thermophilic microorganisms in Conowingo Pond in the vicinity of PBAPS, including results of any monitoring or special studies that might have been conducted by PDEP or its subcontractors, or concurring with PECO's conclusions that continued operation of PBAPS would not affect the presence of thermophilic microorganisms in Conowingo Pond in the vicinity of PBAPS. This will enable us to meet our application preparation schedule. PECO will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

James A. Hutton
Director - Licensing

Enc. (1) Map of PBAPS and vicinity
(2) Cover page and Section 4.3.6 of the Generic Environmental Impact Statement for License Renewal of Nuclear Plants

cc: H. J. Miller, Administrator, Region I, USNRC
A. C. McMurtray, USNRC Senior Resident Inspector, PBAPS

Request for Information on Thermophilic Microorganisms
June 2, 2000
Page 2

bcc: Manager, Financial Controls and Co-Owner Affairs,
Public Service Electric & Gas
R. I. McLean, State of Maryland
A. F. Kirby, III, Delmarva Power & Light Company
R. R. Janati, Commonwealth of Pennsylvania
G. R. Rainey - 63C-3
C. P Lewis - 63C-3
J. J. Hagan - 62C-3
J. W. Langenbach - 62C-3
J. Doering - PB, SMB4-9
M. E. Warner - PB, A4-1S
G. L. Johnston - PB, SMB3-2A
J. P. Grimes - 63B-1
R. W. Boyce - 63C-3
R. A. Kankus - 63C-2
A. A. Winter - PB, A4-5S
J. G. Hufnagel/TRL - 62A-1
PBAPS ISEG - PB, SMB4-6
Commitment Coordinator - 62A-1
Correspondence Control Desk - 61B-5
DAC - 61B-5
K. Patterson, Tetra Tech NUS
F. Polaski - 63A-3
W. Maher- 63A-3

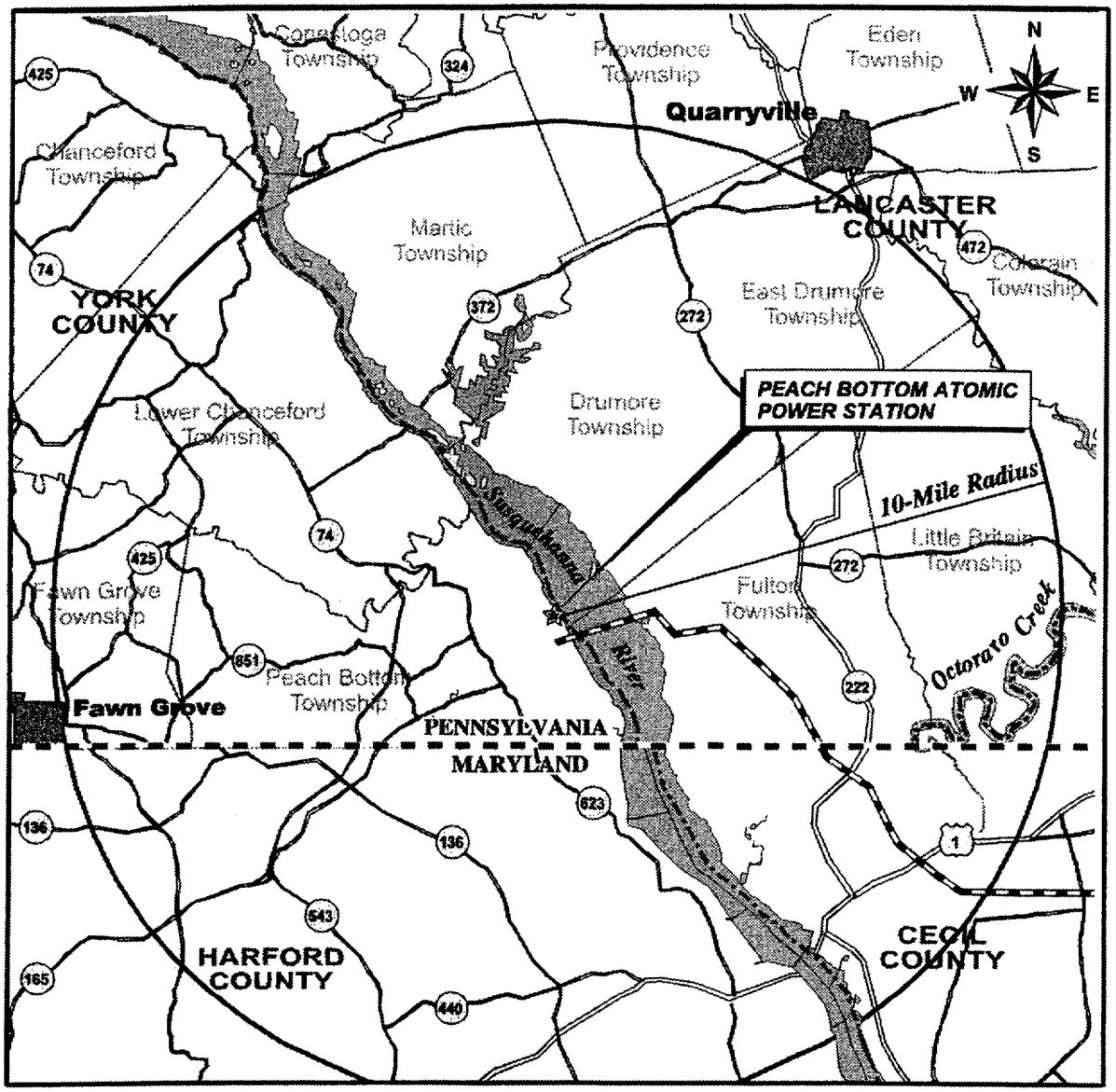


FIGURE 1. Peach Bottom Atomic Power Station 10-Mile Vicinity Map.

Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437 Vol. 1)

4.3.6 Human Health

Some microorganisms associated with cooling towers and thermal discharges can have deleterious impacts on human health. Their presence can be enhanced by thermal additions. These microorganisms include the enteric pathogens *Salmonella* sp. and *Shigella* sp. as well as *Pseudomonas aeruginosa* and the thermophilic fungi (Appendix D). Tests for these pathogens are well established, and factors germane to their presence in aquatic environs are known and in some cases controllable. Other aquatic microorganisms normally present in surface waters have only recently been recognized as pathogenic for humans. Among these are Legionnaires' disease bacteria (*Legionella* sp.) and free-living amoebae of the genera *Naegleria* and *Acanthamoeba*, the causative agents of various, although rare, human infections. Factors affecting the distribution of *Legionella* sp. and pathogenic free-living amoebae are not well understood. Simple, rapid tests for their detection and procedures for their control are not yet available. The impacts of nuclear plant cooling towers and thermal discharges are considered of small significance if they do not enhance the presence of microorganisms that are detrimental to water and public health.

Potential adverse health effects on workers due to enhancement of microorganisms are an issue for steam-electric plants that use cooling towers. Potential adverse health effects on the public from thermally enhanced microorganisms is an issue for the nuclear plants that use cooling ponds, lakes, or canals and that discharge to small rivers. These plants are all combined in the category of small river (average flow less than 2830 m^3/s (100,000 ft^3/s) in Tables 5.18 and 5.19. These issues were evaluated by reviewing what is known about the organisms that are potentially enhanced by operation of the steam-electric plants.

Because of the reported cases of fatal *Naegleria* infections associated with cooling towers, the distribution of these two pathogens in the power plant environs was studied in some detail (Tyndall et al. 1983; see also Appendix D). In response to these various studies (Appendix D), many electric utilities require respiratory protection for workers when cleaning cooling towers and condensers. However, no Occupational Safety and Health Administration (OSHA) or other legal standards for exposure to microorganisms exist at present. Also, for worker protection, one plant with high concentrations of *Naegleria fowleri* in the circulating water successfully controlled the pathogen through chlorination before its yearly downtime operation (Tyndall et al. 1983).

Changes in the microbial population and in the use of bodies of water may occur after the operating license is issued and the application for license renewal is filed. Ancillary factors may also change, including average temperature of water resulting from climatic conditions. Finally, the long-term presence of a power plant may change the natural dynamics of harmful microorganisms within a body of water by raising the level of *N. fowleri*, which are indigenous to the soils. Increased populations of *N. fowleri* may have significant adverse impacts. On entry into the nasal passage of a susceptible individual, *N. fowleri* will penetrate the nasal mucosa. The ensuing infection results in a rapidly fatal form of encephalitis. Fortunately, humans in general are resistant to infection with *N. fowleri*. Hallenbeck and Brenniman (1989) have estimated individual annual risks for

primary amebic meningoencephalitis caused by the free living *N. fowleri* to swimmers in fresh water, to be approximately 4×10^{-6}. Heavily used lakes and other fresh bodies of water may merit special attention and possibly routine monitoring for *N. fowleri*.

Thermophilic organisms may or may not be influenced by the operation of nuclear power plants. The issue is largely unstudied. However, NRC recognizes a potential health problem stemming from heated effluents. Occupational health questions are currently resolved using proven industrial hygiene principles to minimize worker exposures to these organisms in mists of cooling towers. NRC anticipates that all plants will continue to employ proven industrial hygiene principles so that adverse occupational health effects associated with microorganisms will be of small significance at all sites, and no mitigation measures beyond those implemented during the current term license would be warranted. Aside from continued application of accepted industrial hygiene procedures, no additional mitigation measures are expected to be warranted as a result of license renewal. This is a Category 1 issue.

Public health questions require additional consideration for the 25 plants using cooling ponds, lakes, canals, or small rivers (all under the small river category in Tables 5.18 and 5.19) because the operation of these plants may significantly enhance the presence of thermophilic organisms. The data for these sites are not now at hand and it is impossible to predict the level of thermophilic organism enhancement at any given site with current knowledge. Thus the impacts are not known and are site-specific. Therefore, the magnitude of the potential public health impacts associated with thermal enhancement of *N. fowleri* cannot be determined generically. This is a Category 2 issue.

Pennsylvania Department of Environmental Protection

909 Elmerton Avenue
Harrisburg, Pennsylvania 17110-8200

January 3, 2001

JAMES A. HUTTON
LICENSING SECTION
JAN 0 5 2001

REFER TO:

Southcentral Regional Office

717-705-4707
FAX 717-705-4760

Mr. James A. Hutton
PECO Energy Company
200 Exelon Way
Kennett Square, PA 19348

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
Request for Information on Thermophilic Microorganisms

Dear Mr. Hutton:

I have reviewed your June 2, 2000 letter to Karen Bassett in which you requested information concerning monitoring studies for thermophilic bacteria in the Conowingo Pond in the vicinity of your Peach Bottom Atomic Power Station (PBAPS). Although water sampling of the Susquehanna River is routinely conducted by the Pennsylvania Department of Environmental Protection and the Susquehanna River Basin Commission for various inorganic parameters, neither agency has conducted sampling for thermophilic microorganisms. I have also been in contact with Mr. Dennis Wilson, Environmental Health Administrator with the PA Department of Health. He has basically stated that his agency has not been involved with such studies either. If you should need to contact Mr. Wilson his number is (717) 783-4790.

If you should have any questions please feel free to contact me at (717) 705-4764.

Sincerely yours,

Robert J. Schott
Senior Aquatic Biologist

cc: Karen Bassett
Dennis Wilson, PA Dept. of Health

APPENDIX E

COASTAL ZONE MANAGEMENT CONSISTENCY CERTIFICATION

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
200 Exelon Way
Kennett Square, PA 19348

September 8, 2000

Mr. Elder Ghigiarelli
Maryland Department of Environment
Water Management Administration
2500 Broening Highway
Annapolis, MD 21224

Subject: Peach Bottom Atomic Power Station, Units 2 and 3
Draft Federal Consistency Certification for Federal Permit and License Applicants, Peach Bottom Atomic Power Station License Renewal

Dear Mr. Ghigiarelli:

I have enclosed a draft federal consistency certification for Peach Bottom Atomic Power Station (PBAPS) license renewal. Consistent with your discussions with our representative, Bill Maher, I am providing you with this draft to afford you the opportunity to comment prior to receiving the formal certification.

Summer 2001, PECO Energy intends to submit to the U. S. Nuclear Regulatory Commission (NRC) an application to renew the PBAPS licenses to operate. PBAPS is located in southeastern Pennsylvania on the western bank of Conowingo Pond on the Susquehanna River. While not located in Maryland, PBAPS withdraws water from and discharges water to Conowingo Pond. The Conowingo Dam and a portion of the pond are located within Maryland and the Maryland coastal zone. The plant's location, therefore, gives rise to the possibility of affecting the Maryland coastal zone and, as such, is subject to the provisions of the federal Coastal Zone Management Act (16 USC 1451 et seq.). In accordance with the Act, PECO Energy will include in the PBAPS application, certification that license renewal would be consistent with the state coastal zone management program. Also in accordance with the Act, PECO Energy will provide your office with a copy of the certification. The Act requires the state, at the earliest practicable time, but in no case longer than six months, to notify the federal agency (i.e., NRC) and the applicant (i.e., PECO Energy), whether the state concurs or objects to the consistency certification.

Draft Federal Consistency Certification for
Federal Permit and License Applicants
September 8, 2000
Page 2

As you may know, PECO Energy and Unicom are merging. The new company will be called Exelon. The NRC recently approved the transfer of the PBAPS operating licenses to Exelon Generation Company.

Please let Bill Maher know whether you have any comments or suggestions regarding the draft certification by December 1, 2000. You can reach Bill Maher by telephone at (610) 765-5939 or by electronic mail at wmaher@peco-energy.com.

Respectfully,

James A. Hutton
Director - Licensing

Enclosure: *Draft Federal Consistency Certification for Federal Permit and License Applicants*

cc K. Patterson, Tetra Tech NUS
F. W. Polaski, PECO Energy
W. D. Maher, PECO Energy
H. D. Honan, PECO Energy

DRAFT
FEDERAL CONSISTENCY CERTIFICATION FOR
FEDERAL PERMIT AND LICENSE APPLICANTS[1]
PEACH BOTTOM ATOMIC POWER STATION LICENSE RENEWAL

The Federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on an applicant for a Federal license to conduct an activity that could affect a state's coastal zone. The Act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program. The Act also requires the applicant to provide to the state a copy of the certification statement and requires the state, at the earliest practicable time, to notify the federal agency and the applicant whether the state concurs or objects to the consistency certification [See USC 1456(c)(3)(A)].

The National Oceanic and Atmospheric Administration has promulgated implementing regulations that indicate that the certification requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The State of Maryland has a federally-approved coastal zone management program (Reference 1), described below. PECO Energy (PECO) is applying to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the operating licenses for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3. PBAPS is located in southeastern Pennsylvania on the western bank of Conowingo Pond on the Susquehanna River. The Maryland coastal zone extends to the state's northern border, and includes the southern third of Conowingo Pond. Therefore, PECO has chosen to prepare a Certification of Compliance with the Maryland Coastal Zone Management Program (CZMP).

CONSISTENCY CERTIFICATION

PECO has determined that NRC renewal of the PBAPS licenses to operate would be consistent with the federally-approved Maryland CZMP. PECO expects PBAPS operations during the license renewal term to be a continuation of current operations as described below, with no changes that would affect Maryland's coastal zone.

Proposed Activity

PECO operates PBAPS Units 2 and 3 in accordance with NRC licenses DPR-44 and DPR-56, respectively. The Unit 2 license will expire on August 8, 2013 and the Unit 3 license on July 2, 2014. PECO is applying to NRC for renewal of both licenses, which would enable 20 additional years of operation (i.e., until August 8, 2033 for Unit 2 and on July 2, 2034 for Unit 3).

PBAPS is located on 620 acres in Peach Bottom Township, York County, Pennsylvania, on the west side of Conowingo Pond on the Susquehanna River, approximately 18 miles upstream from the point where the river enters the Chesapeake Bay. While not located in Maryland, PBAPS withdraws water from and discharges water to Conowingo Pond. The Conowingo Dam and a portion of the pond are located within Maryland and the Maryland coastal zone. The plant's location, therefore, gives rise to the possibility of it affecting the Maryland coastal zone.

Because PBAPS is located in Pennsylvania, it abides by Commonwealth of Pennsylvania regulations. However, the Commonwealth cooperates with the State of Maryland on matters related to coastal zone management through its participation in the Chesapeake Bay Commission and the Chesapeake Bay

[1] This certification is patterned after the draft model certification included as Attachment 6 of Reference 2.

Program partnership. The Chesapeake Bay Commission is a tri-state legislative commission that advises the members of the General Assemblies of Maryland, Virginia, and Pennsylvania on matters of Bay-wide concern. The Pennsylvania Department of Environmental Protection shares its information on water quality, fish blockages, air deposition and zoning and land use with other Chesapeake Bay Program partners through the Chesapeake Information Management System.

In addition to the two nuclear reactors, the PBAPS site includes two switchyards, an independent spent fuel storage installation, and the retired PBAPS Unit 1 (a prototype high-temperature, gas-cooled reactor). A 500-kilovolt (kV) transmission line runs approximately 34 miles eastward from PBAPS to the Keeney substation in New Castle County, Delaware. The Keeney transmission line crosses Conowingo Pond, and traverses Lancaster County, Pennsylvania and Cecil County, Maryland. Figures 2-1 and 2-2 show the 50-mile region around PBAPS and the site layout, respectively, and Figure 3-2 locates the Keeney transmission line corridor.

PBAPS uses uranium dioxide fuel in two nuclear reactors to produce steam in turbines that generate approximately 1,065 megawatts of electricity each for offsite use. The NRC has licensed both PBAPS reactors to operate on a 24-month refueling cycle, with a fuel burnup of 60,000 megawatt-days per metric ton of uranium. PECO stores PBAPS spent fuel onsite in a spent fuel pool and in an independent spent fuel storage installation.

Until 1996, PBAPS used forced draft cooling towers to cool the condenser cooling water. In 1998, the Pennsylvania Department of Environmental Protection issued a National Pollutant Discharge Elimination System (NPDES) permit amendment that allowed PBAPS to operate without cooling towers. Since then, PBAPS has used a once-through heat dissipation system. When both units are operating, PBAPS withdraws approximately 1.5 million gallons per minute of water through an intake structure that lies on the west bank of the reservoir. PBAPS discharges the heated effluent to the reservoir via a cooling basin and a discharge canal. The highest observed temperature in the discharge canal during a comprehensive three-year study was 106.5°F. PECO holds an NPDES permit for this and other plant and stormwater discharges. In accordance with the permit conditions, PECO monitors discharge characteristics and reports results to the Pennsylvania Department of Environmental Protection.

PECO employs approximately 700 permanent and 275 contract employees at PBAPS. Approximately 66 percent of the employees live in York or Lancaster Counties, Pennsylvania; the remaining 34 percent live in other locations. Once a year, the site workforce increases by approximately 800 temporary workers during refueling outages (30 to 40 days). In compliance with NRC regulations, PECO has identified activities needed for PBAPS to operate an additional 20 years. PECO conservatively assumes that renewal of the PBAPS licenses would require the addition of no more than 60 permanent workers during the period of extended operations.

Environmental Impacts

The NRC has prepared a generic environmental impact statement (GEIS) on impacts that nuclear power plant operations can have on the environment (Reference 3) and it has codified its findings (10 CFR 51, Subpart A, Appendix B, Table B-1). The codification identifies 92 potential environmental issues, 69 of which NRC identifies as having small impacts, regardless of plant or location, and calls "Category 1" issues. NRC defines "small" as follows:

> Small – For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any attribute of the resource. For the purpose of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed

permissible levels in the Commission's regulations are considered small as the term is used in this table. (10 CFR 51, Subpart A, Appendix B, Table B-1).

The NRC codification and the GEIS discuss the following types of Category 1 environmental issues:

- Surface water quality, hydrology, and use
- Aquatic ecology
- Groundwater use and quality
- Terrestrial resources
- Air quality
- Land use
- Human health
- Postulated accidents
- Socioeconomics
- Uranium fuel cycle and waste management
- Decommissioning

In its decisionmaking for plant-specific license renewal applications, absent new and significant information to the contrary, NRC will rely on its codified findings, as amplified by supporting information in the GEIS, for assessment of environmental impacts from Category 1 issues [10 CFR 51.95(c)(4)]. PECO has adopted by reference the NRC findings and GEIS analyses for all 56[2] applicable Category 1 issues. For plants such as PBAPS that are located near the coastal zone, many of these issues involve impacts to the coastal zone.

The NRC regulation identifies 21 issues as "Category 2," for which license renewal applicants must submit additional, site-specific information.[3] Of these, 14 apply to PBAPS and could involve impacts to the coastal zone. The applicable issues and PECO's impact conclusions are listed below:

- Surface Water Quality, Hydrology, and Use
  - Water Use Conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow) – This issue addresses effects that surface water withdrawals could have on flow of the river and instream riparian and aquatic communities. The PBAPS site has three forced draft cooling towers that would consume relatively small amounts of water (0.4 to 1.5 percent of river flow during periods of extreme drought), if operated. PBAPS uses once-through cooling and does not operate the cooling towers. PECO concludes that these impacts are small during current operations and it has no plans that would change this conclusion for the license renewal term.
- Aquatic Ecology
  - Entrainment of fish and shellfish in early life stages – This issue addresses mortality of organisms small enough to pass through the plant's cooling water system. PECO has conducted studies of this issue under direction of the U.S. Environmental Protection

[2] The other 13 Category 1 issues apply to design or operational features that PBAPS does not have (i.e. cooling ponds and groundwater withdrawal) or to an activity, refurbishment, that PECO will not undertake.
[3] 10 CFR 51, Subpart A, Appendix B, Table B-1 also identifies two issues as "NA" for which NRC could not come to a conclusion regarding categorization. PECO believes that neither of these issues, chronic effects of electromagnetic fields and environmental justice, affect the "coastal zone" as that phrase is defined by the Coastal Zone Management Act [16 USC 1453(1)].

Agency (EPA) and the Commonwealth of Pennsylvania. In issuing the plant's NPDES permit, the Commonwealth has approved the plant's intake structure as best available technology to minimize impacts. PECO concludes that these impacts are small during current operations and it has no plans that would change this conclusion for the license renewal term.

- Impingement of fish and shellfish – This issue addresses mortality of organisms large enough to be caught by intake screens before passing through the plant's cooling water system. The studies and permit discussed above also address impingement. PECO concludes these impacts are small during current operations and it has no plans that would change this conclusion for the license renewal term.
- Heat Shock – This issue addresses mortality of organisms caused by exposure to heated plant effluent. PECO has conducted studies of this issue under direction of the Commonwealth of Pennsylvania. In issuing the plant's NPDES permit, the Commonwealth has determined that more stringent limits on the heated effluent are not necessary to protect the aquatic environment. **[Need to verify statement when new permit is issued. Permit has already been submitted to PA.]** PECO concludes these impacts are small during current operations and it has no plans that would change this conclusion for the license renewal term.

- Groundwater Use and Quality
  - Groundwater Use Conflicts (plants using cooling towers withdrawing make-up water from a small river) – This issue addresses effects that surface water withdrawals from small water bodies could have on aquifer recharge. As discussed above, the PBAPS site has three forced draft cooling towers that would consume relatively small amounts of water, if they were operated. PBAPS currently uses once-through cooling and does not operate the cooling towers. PECO concludes that these impacts are small during current operations and it has no plans that would change this conclusion for the license renewal term.

- Threatened or Endangered Species – This issue addresses effects that PBAPS operations could have on species that are listed under federal law as threatened or endangered. In analyzing this issue, PECO has also considered species that are listed under Commonwealth of Pennsylvania and State of Maryland law. Several species could occur on the PBAPS site, in the vicinity of the site, in the Susquehanna River, or along the associated transmission corridor. PBAPS environmental studies and environmental protection programs have identified no adverse impacts to such species and PECO consultation with cognizant Federal and State agencies has identified no issues of concern. **[Verify after consultations are complete. They are in progress.]** PECO concludes that PBAPS impacts to these species are small during current operations and it has no plans that would change this conclusion for the license renewal term.

- Human Health
  - Microbiological organisms – This issue addresses effects that PBAPS operations could have on the survival of thermophilic microorganisms in public waters. During a three-year study of discharge temperatures from PBAPS, mean monthly temperatures ranged from 81.6 °F to 99.9 °F. These temperatures are below the temperature range for optimal growth and reproduction of thermophilic microorganisms. PBAPS also uses chlorine to disinfect service water systems, which reduces the likelihood that a seed source or inoculant would be introduced to Conowingo Pond. Under certain circumstances, thermophilic organisms may be present in the discharge canal, but not in

sufficient concentration to pose a threat to recreational users of Conowingo Pond or downstream water users. PECO concludes that these impacts are small during current operations and it has no plans that would change this conclusion for the license renewal term.

- Electromagnetic fields, acute effects (electric shock) – This issue addresses the potential for shock from induced currents, similar to static electricity effects, in the vicinity of transmission lines. Because this strictly human-health issue does not directly or indirectly affect natural resources of concern within the Coastal Zone Management Act definition of "coastal zone" [16 USC 1453(1)], PECO concludes that the issue is not subject to the certification requirement.

- Socioeconomics

PECO expects to perform license renewal activities without adding staff. As a conservative measure, however, PECO has assumed, for the purposes of socioeconomic impact analysis, as many as 60 new permanent employees during the license renewal term. PECO assumes these employees would find housing in the same locales where current employees reside.

- Housing – This issue addresses impacts that PECO new-license-renewal-term jobs and concomitant indirect jobs could have on local housing availability. NRC concluded, and PECO concurs, that impacts would be small for plants, such as PBAPS, that are located in high population growth areas with no growth control measures.

- Public services: public utilities – This issue addresses impacts that adding license renewal term employees could have on public water supply systems. PECO has analyzed public water supply availability in candidate locales and it has found no system limitations that would suggest that additional workers would cause significant impacts. PECO concludes that impacts during the license renewal term would be small.

- Offsite land use – This issue addresses impacts that local government spending of plant property tax dollars can have on land use patterns. Land use patterns within York County have not shown significant changes since PBAPS began operations. Based on past practices, PECO concludes that impacts during the PBAPS license renewal term would be small.

- Public services: transportation – This issue addresses impacts that adding license renewal term employees could have on local traffic patterns. PECO's conservative projection of 60 additional employees associated with license renewal for PBAPS represents a 6 percent increase in the current number of employees and an even smaller percentage of employees present onsite during periodic refueling. Given these employment projections and the average number of vehicles per day currently using the access road to PBAPS, PECO concludes that impacts during the license renewal term would be small.

- Historic and archeological resources – This issue addresses impacts that license renewal activities could have on resources of historic or archeological significance. No such resources have been identified on the PBAPS site or the associated transmission line and PECO has no plans for license renewal that would disturb unknown resources. PECO consultation with the Historic Preservation Officer in the State of Maryland has identified no issues of concern **[Need to verify results of consultations. They are in progress.]**. PECO concludes that continued operation of PBAPS would have no adverse impacts to historic resources in the Maryland coastal zone.

- Postulated Accidents
  - Severe accidents – NRC determined that the license renewal impacts from severe accidents would be small, but determined that applicants should perform site-specific analyses of ways to further mitigate impacts. **[PECO is in the process of determining this now but nothing is expected to alter this statement.]**

Another source of information about PBAPS impacts on the coastal zone is the biennial reports by the Maryland Power Plant Research Program (e.g., Reference 4). Maryland law requires the Program to review and evaluate the potential impacts to Maryland's environment from the construction and operation of electric power generating and transmission systems. The Program summarizes these evaluations biennially in a document know as the Cumulative Environmental Impact Report. These reports discuss power plant air, water, terrestrial, radiological, and socioeconomic impacts, as well as topical issues. The 1999 report concluded that radiological impacts from PBAPS operations are insignificant and environmental impacts from nuclear power facilities are generally smaller than impacts from other electricity generating technologies.

State Program

Like many states, Maryland's CZMP is a "networked" program, which means that it is based on a variety of existing State authorities rather than a single law and set of regulations. The Maryland CZMP document (Reference 2) sets forth and discusses these authorities and how the State uses them to assure conformance with the Coastal Zone Management Act (16 USC 1451 et seq.) requirements.[4] Tables 9-1 and 9-2 identify licenses, permits, consultations, and other approvals necessary for PBAPS license renewal and continued operation.

Findings

1. NRC has found that the environmental impacts of Category 1 issues are small. PECO has adopted by reference NRC findings for Category 1 issues applicable to PBAPS.
2. For Category 2 issues applicable to PBAPS, PECO has determined that the environmental impacts are small.
3. To the best of PECO's knowledge, PBAPS is in compliance with Pennsylvania licensing and permitting requirements and is in compliance with its State-issued licenses and permits.
4. PECO's license renewal and continued operation of PBAPS would be consistent with the enforceable provisions of the Maryland CZMP.

STATE NOTIFICATION

By this certification that PBAPS license renewal is consistent with the Maryland CZMP, the State of Maryland is notified that, per 15 CFR 930.63(a), it has six months from the receipt of this letter and accompanying information in which to concur or object to the PECO certification. However, pursuant to 15 CFR 930.63(b), if the State of Maryland has not issued a decision within three months following commencement of State agency review, it shall notify the contacts listed below of the status of the matter

[4] The Maryland Coastal Zone Management Program identifies the key enabling legislation as the Chesapeake Bay Critical Area Protection Act; the Tidal and Nontidal Wetlands Act; and the Economic Growth, Resource Protection, and Planning Act.

and the basis for further delay: The State's concurrence, objection, or notification of review status shall be sent to:

Mr. John Boska, Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike, M/C O-8B1
Rockville, MD 20852

James A. Hutton, Director-Licensing
PECO Nuclear
200 Exelon Way
Kennett Square, PA 19348

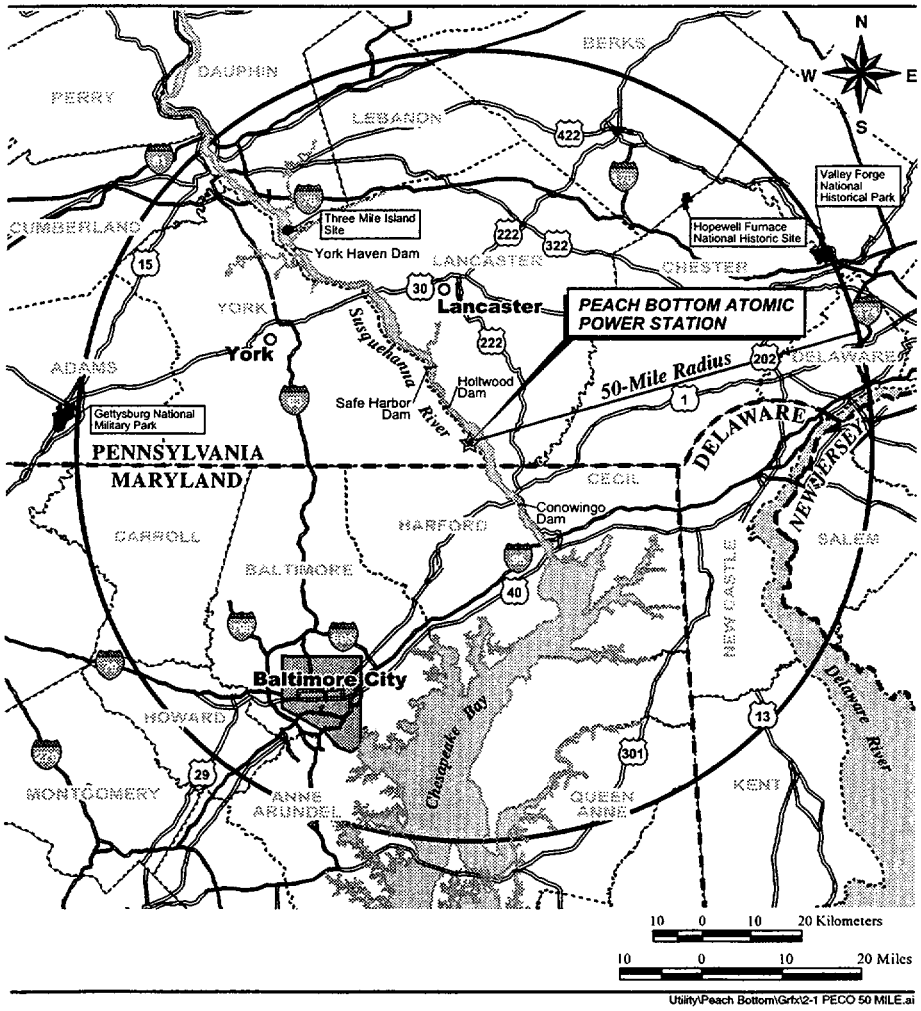
REFERENCES

1. "State of Maryland Coastal Zone Management Program and Final Environmental Impact Statement," U. S. Department of Commerce, August 1978.
2. NRR Office Letter No. 906, Revision 2, "*Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues,*" U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, September 21, 1999.
3. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, U.S. Nuclear Regulatory Commission, May 1996.
4. "Maryland Power Plants and the Environment: A Review of the Impacts of Power Plants and Transmission Lines on Maryland's Natural Resources," PPRP-CEIR-10, Maryland Power Plant Research Program, Maryland Department of Natural Resources, January 1999.

ATTACHMENTS

Figure 2-1
Figure 2-2
Figure 3-2
Table 9-1
Table 9-2

DRAFT
LICENSE RENEWAL APPLICATION
PEACH BOTTOM ATOMIC POWER STATION



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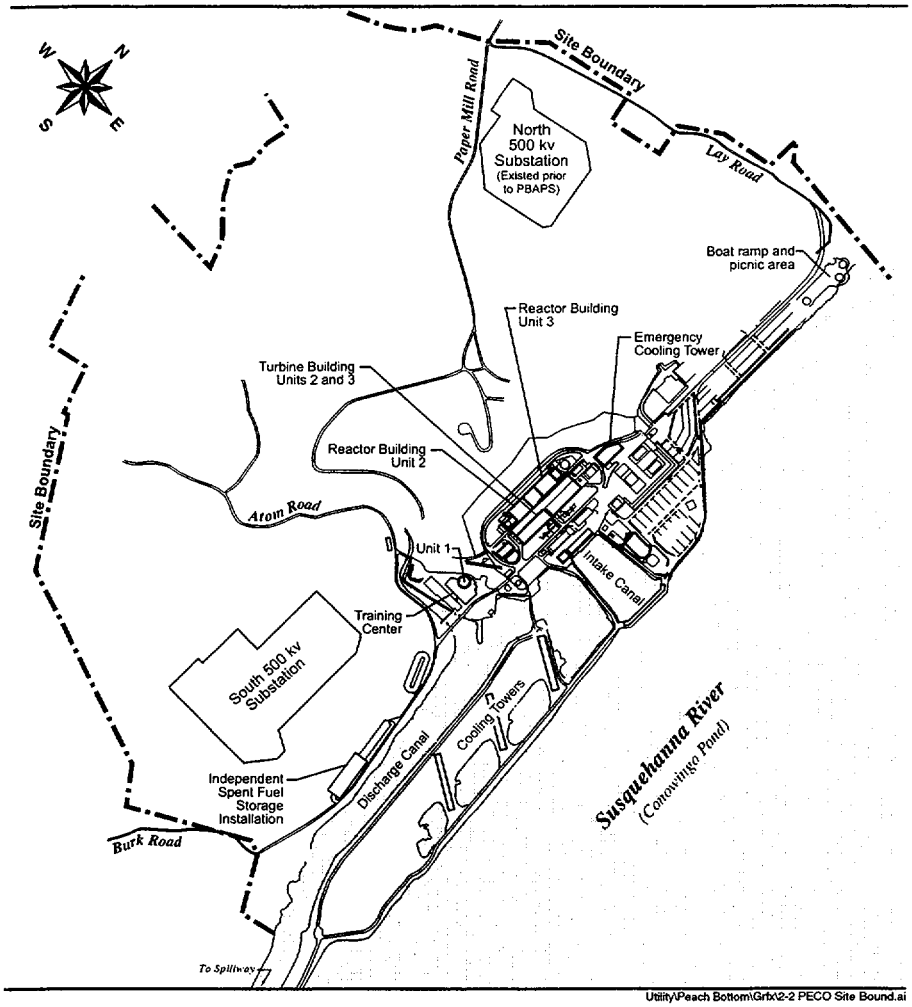
LEGEND

★ **Peach Bottom Atomic Power Station**

FIGURE 2-1
Peach Bottom Atomic Power Station, 50-Mile Vicinity Map
LICENSE RENEWAL APPLICATION

DRAFT
LICENSE RENEWAL APPLICATION
PEACH BOTTOM ATOMIC POWER STATION



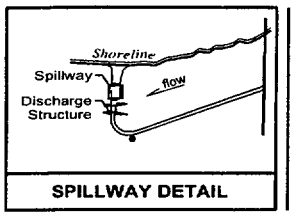


FIGURE 2-2
Peach Bottom Atomic Power Station, Site Boundary
LICENSE RENEWAL APPLICATION

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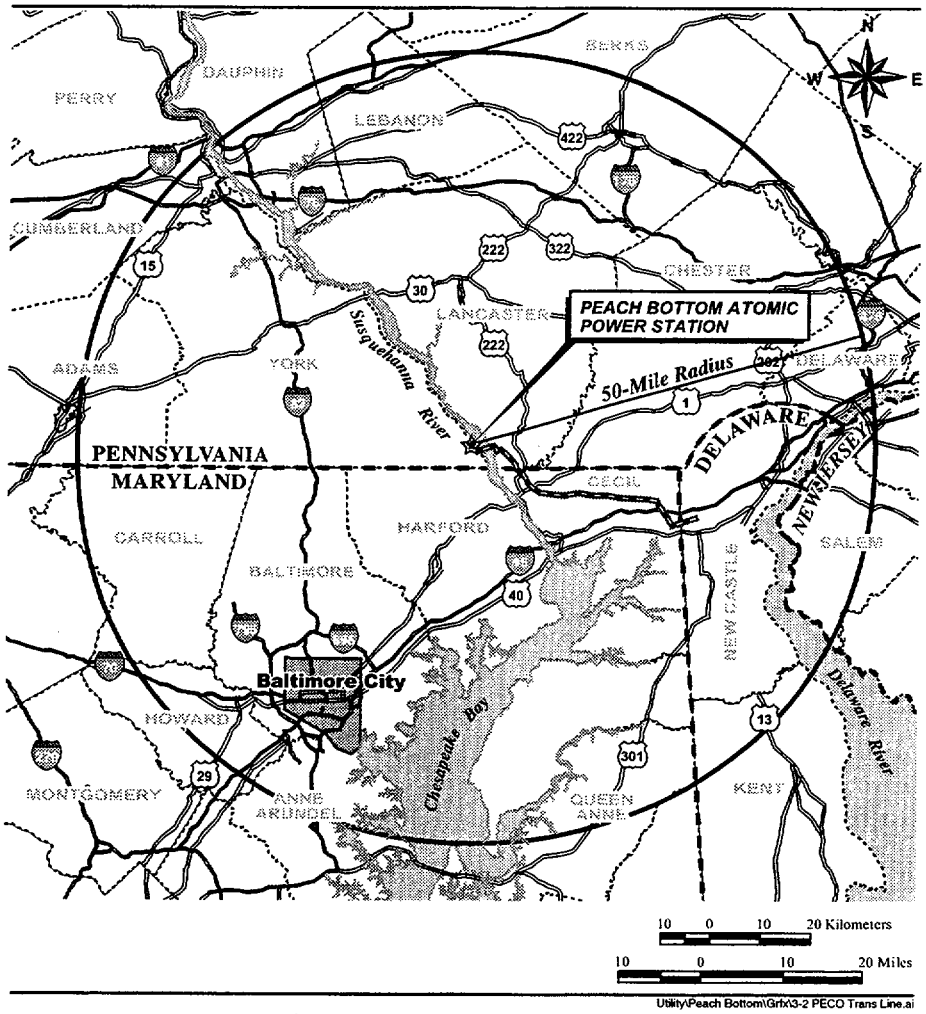
LICENSE RENEWAL APPLICATION
PEACH BOTTOM ATOMIC POWER STATION



LEGEND

- Peach Bottom Atomic Power Station
- Keeney Transmission Line

FIGURE 3-2
Peach Bottom Atomic Power Station, Transmission Line Map
LICENSE RENEWAL APPLICATION

TABLE 9-1
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT PEACH BOTTOM UNITS 2 AND 3 OPERATIONS

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal Requirements to License Renewal					
U. S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	DPR – 44 - Unit 2 DPR – 56 - Unit 3	Issued on 10/25/73 Expires on 08/08/13 (Unit 2) Issued on 07/02/74 Expires on 07/02/14 (Unit 3)	Operation of Units 2 and 3
Commonwealth of Pennsylvania Department of Environmental Resources, Water Management Program	Clean Water Act (33 USC Section 1251 et seq.), Pennsylvania Clean Streams Law (35 P.S. Section 691.1 et seq.)	Individual Discharge Permit	PA 0009733	Issued on 07/07/95 Expires on 07/07/00 (Renewal application has been submitted; 01/05/00)	Contains effluent limits for PBAPS discharges to the Susquehanna River.
U.S. Environmental Protection Agency (EPA), Pennsylvania Department of Environmental Protection (DEP)	Clean Water Act Section 401 (33 USC 1341)	Certification of compliance with state water quality standards	[TBD]	[TBD]	Discharges during license renewal term

TABLE 9-1 (Cont'd)
ENVIRONMENTAL AUTHORIZATIONS FOR CURRENT PEACH BOTTOM UNITS 2 AND 3 OPERATIONS

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
EPA, Pennsylvania DEP	Clean Air Act (42 USC 7661 et seq.) Air Pollution Control Act (25 Pa. Code Chapter 127)	Title V Operating Permit	67-05020	Issued on 03/01/99 Expires on 02/29/04	Establishes emissions limits
Commonwealth of Pennsylvania DEP, Bureau of Watershed Management		Registration	187882	Expires on 06/04/01	Storage Tanks located at PBAPS
Pennsylvania Department of Environmental Resources	Pennsylvania Safe Drinking Water Act (Chapter 109 Sections 4 and 6e)	Permit	6791502	Issued 03/21/94	Public Water Supply Permit

Source: Modified from (Ref. 9.1-2).
CFR - Code of Federal Regulations
DEP - Pennsylvania Department of Environmental Protection
EPA - U.S Environmental Protection Agency

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LICENSE RENEWAL APPLICATION
PEACH BOTTOM ATOMIC POWER STATION

TABLE 9-2
ENVIRONMENTAL AUTHORIZATIONS FOR PEACH BOTTOM UNITS 2 AND 3 LICENSE RENEWAL[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
FWS and NMFS	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with FWS and NMFS (Appendix C)
Pennsylvania Department of Environmental Protection	Clean Water Act Section 401 (33 USC 1341)	Certification	
Pennsylvania Historical and Museum Commission, Bureau of Historic Preservation	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (SHPO). SHPO has concurred that license renewal will not affect any sites listed or eligible for listing (Appendix F)
Maryland Historical Trust	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Appendix F
Delaware Division of Historic and Cultural Affairs, State Historic Preservation Office	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Appendix F
Maryland Department of Natural Resources	Federal Coastal Zone Management Act (16 USC 1451 et seq.)		Requires an applicant to provide certification to the federal agency issuing the license that license renewal would be consistent with the federally-approved state coastal zone management program. Based on its review of the proposed activity, the state must concur with or object to the applicant's certification (Appendix E)

FWS = U.S. Fish and Wildlife Service
NMFS = National Marine Fisheries Service
NPDES = National Pollutant Discharge Elimination System
a. No renewal-related requirements identified for local or other agencies.

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT
2500 Broening Highway • Baltimore, Maryland 21224
(410) 631-3000 • 1-800-633-6101 • http:// www. mde. state. md. us

Parris N. Glendening
Governor

Jane T. Nishida
Secretary

January 29, 2001

Mr. James A. Hutton
Director, Licensing
PECO Energy Company
200 Exelon Way
Kennett Square, Pennsylvania 19348

Dear Mr. Hutton:

The Maryland Department of the Environment (MDE) has reviewed the draft Federal Consistency certification for the Peach Bottom Atomic Power Station (PBAPS) license renewal. MDE appreciates the opportunity to review the draft prior to receiving the formal certification.

Although PBAPS is located in southeastern Pennsylvania, the Station withdraws water from, and discharges water to Conowingo Pond, a portion of which is located in Maryland. As noted in your letter, the proposed action may affect Maryland's coastal zone, and therefore, is subject to the provisions of Section 307 of the Federal Coastal Zone Management Act of 1972, as amended. Section 307 requires that federal activities, such as the license renewal by the Nuclear Regulatory Commission (NRC), be consistent to the maximum extent practicable with a State's federally-approved Coastal Zone Management Program.

MDE commends PECO Energy on preparing a comprehensive and thorough consistency certification and has no substantive comments on the draft document. We look forward to receiving the formal consistency certification when PECO Energy submits an application to the NRC to renew the PBAPS licenses to operate in the summer of 2001.

If you have any questions, please contact me at (410) 631-8093.

Sincerely,

Elder A. Ghigiarelli, Jr.
Chief, Coastal Zone Consistency

EAGJr:cma

TTY Users 1-800-735-2258
via Maryland Relay Service

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APPENDIX F

STATE HISTORIC PRESERVATION OFFICER CORRESPONDENCE

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
200 Exelon Way
Kennett Square, PA 19348

August 9, 2000

D. Noel Stratton
Bureau for Historic Preservation
Pennsylvania Historical and Museum Commission
P. O. Box 1026
Harrisburg, PA 17108-1026

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal: Request for Information on
Historic/Archaeological Resources

Dear Ms. Stratton:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3. Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project." PECO Energy will submit the license renewal application to the NRC in 2001. By contacting your office now, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite your evaluation of the impact of the continued operation of PBAPS on historic and archaeological resources.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached map). Only one new transmission corridor was required to integrate PBAPS into PECO Energy's bulk power system when the facility was constructed. This transmission line, from Peach Bottom to the Keeney Substation in Delaware is the only transmission line/corridor under review during this license renewal process.

The *Final Environmental Statement related to operation of Peach Bottom Atomic Power Station Units 2 and 3* prepared in 1973 by the U.S. Atomic Energy Commission stated that "no artifacts of historical or archaeological significance (were) found within the site boundary" during construction. An archaeologist from the William Penn Museum who conducted an evaluation of the site in 1972 observed that the impoundment of the Susquehanna River in the 1920s to create Conowingo Pond

flooded (the) floodplain and terrace areas most likely to contain cultural artifacts (*Final Environmental Statement*, 1973). PECO Energy has found no artifacts at the site or on the transmission line right-of-way during the 25 years of operation.

PECO Energy does not expect the operation of PBAPS, including maintenance of the identified transmission line, through the license renewal term (an additional 20 years) to adversely affect cultural or historical resources in the area and region. No major structural modifications have been identified for the purposes of supporting license renewal. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is anticipated in support of license renewal. Accordingly, we request your concurrence with our determination that the license renewal process would have no effect on any historic or archeological properties.

Please do not hesitate to call Robert Matty at (610) 765-5514 if you have any questions or require any additional information to review the proposed action. After your review, we would appreciate receiving your input by December 1, 2000, detailing any concerns you may have about historic/archaeological properties in the area or confirming PECO Energy's conclusion that operation of PBAPS over the license renewal term would have no effect on any historic or archaeological properties in Pennsylvania. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

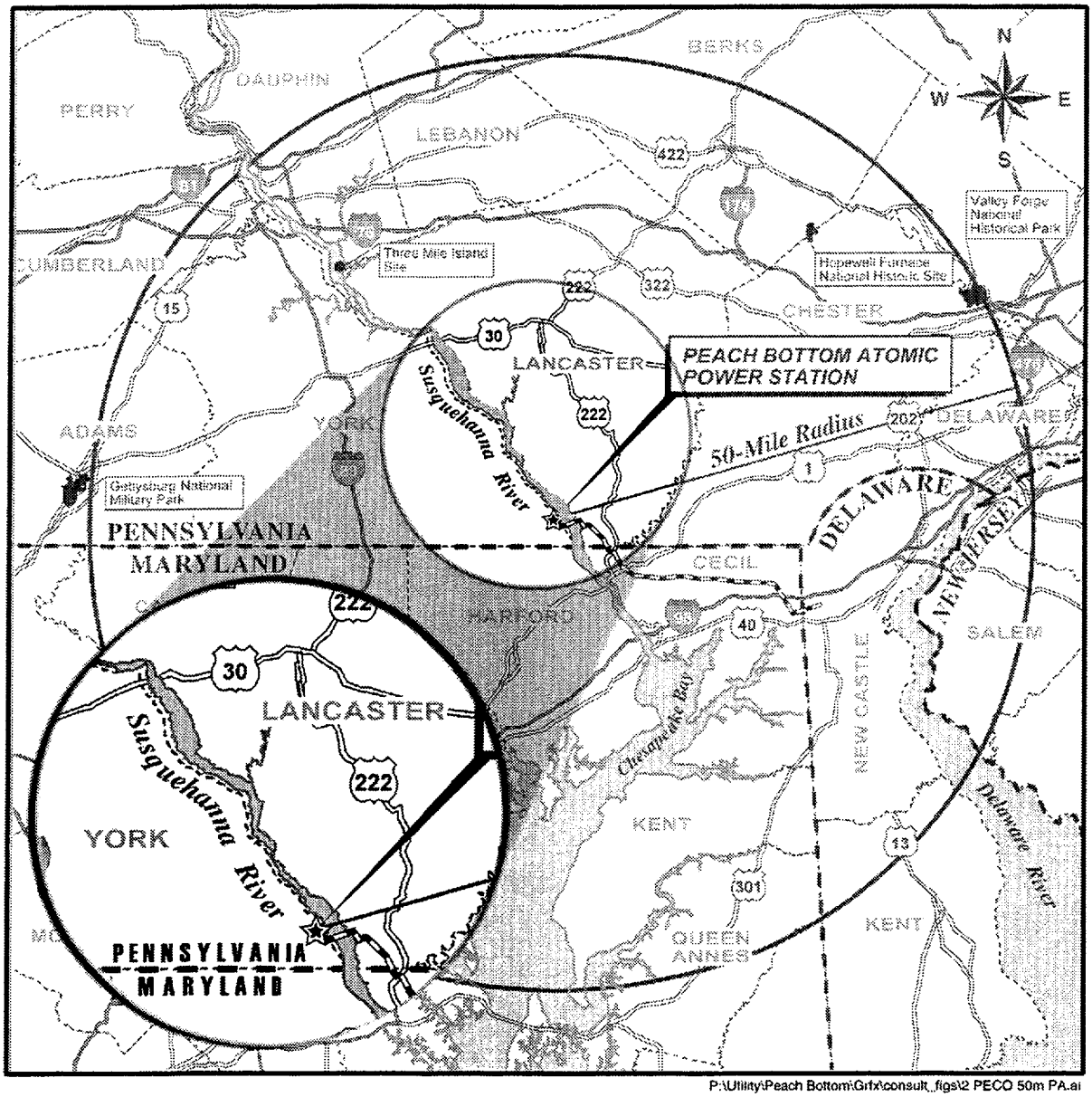
James A. Hutton
Director - Licensing

Enc: Maps of PBAPS vicinity and transmission line route
Holtwood, Wakefield, and Conowingo Quadrangle Maps with Keeney transmission corridor highlighted

cc: K. Patterson, Tetra Tech NUS
F. Polaski, PECO Energy
W. Maher, PECO Energy

License Renewal: Request for Information on
Historic/Archaeological Resources
August 9, 2000
Page 3

bcc: PSE&G, Financial Controls and Co-Owner Affairs
R. I. McLean, State of Maryland
A. F. Kirby, III, Delmarva Power & Light Company
R. R. Janati, Commonwealth of Pennsylvania
G. R. Rainey - 63C-3
C. P Lewis - 63C-3
J. J. Hagan - 62C-3
J. W. Langenbach - 62C-3
J. Doering - PB, SMB4-9
G. L. Johnston - PB, A4-1S
P. J. Davison - PB, SMB3-2A
J. P. Grimes - 63B-1
R. W. Boyce - 63C-3
R. A. Kankus - 63C-2
A. A. Winter - PB, A4-5S
J. G. Hufnagel/TRL - 62A-1
PBAPS ISEG - PB, SMB4-6
Commitment Coordinator - 62A-1
Correspondence Control Desk - 61B-5
DAC - 61B-5



LEGEND

- Peach Bottom Atomic Power Station
- Transmission Line

10 0 10 20 Kilometers

10 0 10 20 Miles

FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120-0093

December 14, 2000

James A. Hutton
PECO Energy Company
200 Exelon Way
Kennett Square PA 19348

TO EXPEDITE REVIEW USE
BHP REFERENCE NUMBER

Re: ER# 2000 3210 133 A
Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal
Peach Bottom Township, York County

Dear Mr. Hutton:

The Bureau for Historic Preservation (the State Historic Preservation Office) has reviewed the above named project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended in 1980 and 1992, and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation. These requirements include consideration of the project's potential effect upon both historic and archaeological resources.

It is our understanding that this project is a request for renewal of the license to operate this facility and involves only operational and maintenance activities at the current facility and an existing transmission line from the PBAPS to Keeney Substation in Delaware. National Register listed and eligible historic and archaeological resources are present in the general vicinity of the PBAPS and this transmission line. In our opinion, the re-licensing and operation of this facility will not affect any of these resources. If any future plans are developed that include expansion or modification of the existing facilities, please notify our office so that we can evaluate those plans for their effects on these resources.

If you need further information in this matter please consult Noël Strattan at (717) 772-4519.

Sincerely,

Kurt W. Carr, Chief
Division of Archaeology &
Protection

cc: NRC
KWC/DNS

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
200 Exelon Way
Kennett Square, PA 19348

August 9, 2000

Ann Bruder
Preservation Officer
Maryland Historical Trust
100 Community Place
Crownsville, MD 21032-2023

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
License Renewal: Request for Information on
Historic/Archaeological Resources

Dear Ms. Bruder:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3. Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project." PECO Energy will submit the license renewal application to the NRC in 2001. By contacting your office now, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite your evaluation of the impact of the continued operation of PBAPS on historic and archaeological resources.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached map). Only one new transmission corridor was required to integrate PBAPS into PECO Energy's bulk power system when the facility was constructed. This transmission line, from Peach Bottom to the Keeney Substation in Delaware, is the only transmission line/corridor under review during this license renewal process. Part of this line runs through Maryland (see attached map).

PECO Energy has found no artifacts at the site or on the transmission line right-of-way during the 25 years of operation.

PECO Energy does not expect the operation of the PBAPS, including maintenance of the identified transmission line, through the license renewal term (an additional 20 years) to adversely affect cultural or historical resources in the area and region.

No major modifications to the transmission line have been identified for the purposes of supporting license renewal. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is anticipated in support of license renewal. Accordingly, we request your concurrence with our determination that the license renewal process would have no effect on any historic or archeological properties.

Please do not hesitate to call Robert Matty at (610) 765-5514 if you have any questions or require any additional information to review the proposed action. After your review, we would appreciate receiving your input by December 1, 2000, detailing any concerns you may have about historic/archaeological properties in the area or confirming PECO Energy's conclusion that operation of PBAPS, including maintenance of the identified transmission line, over the license renewal term would have no effect on any historic or archaeological properties in Maryland. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

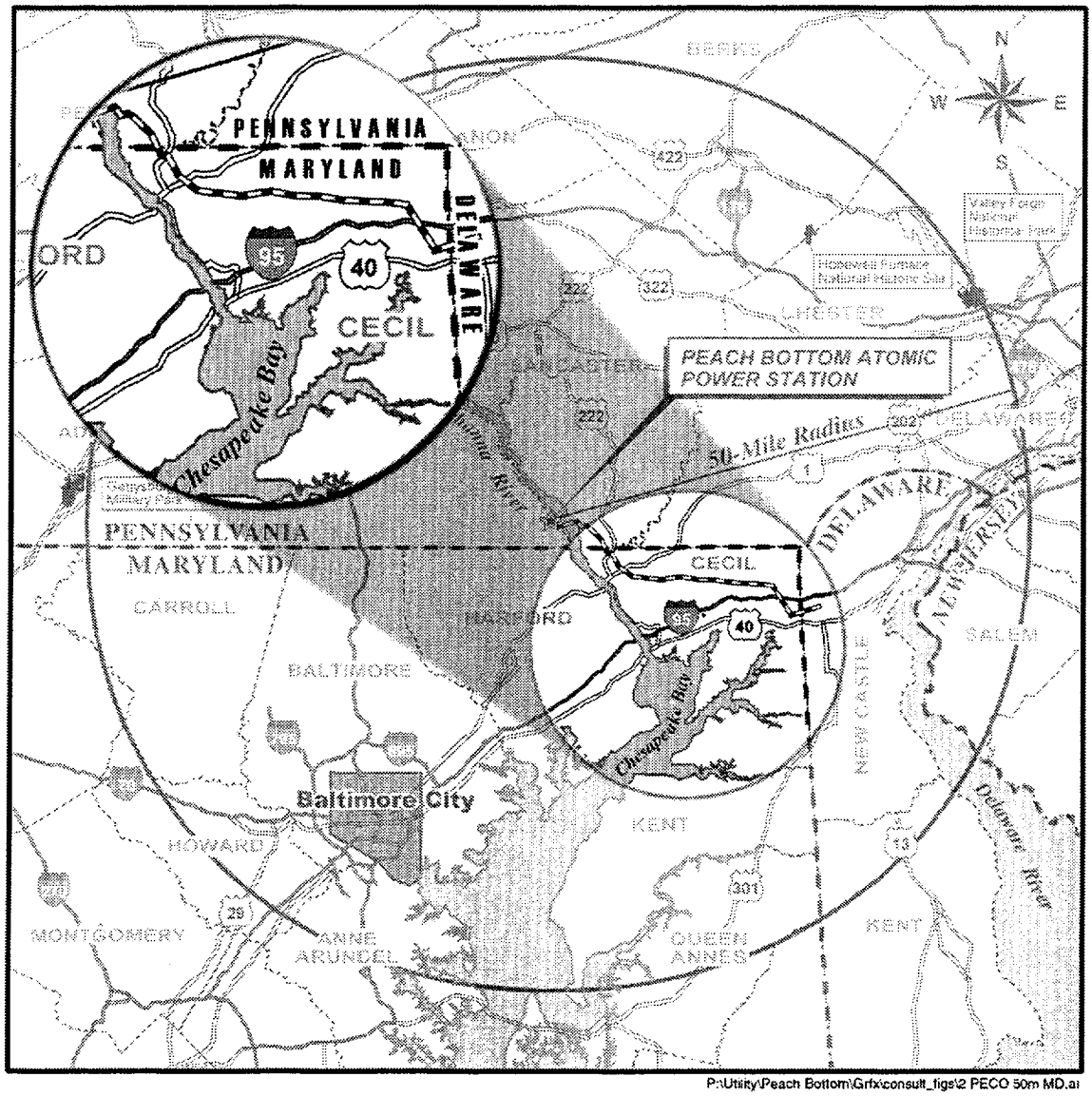
James A. Hutton
Director - Licensing

Enc: Maps of PBAPS vicinity and transmission line route
Rising Sun, Bay View, Conowingo, Newark West, Elkton Quadrangle Maps
with Keeney transmission corridor highlighted

cc R. McLean, Maryland Department of Natural Resources
K. Patterson, Tetra Tech NUS
F. Polaski, PECO Energy
W. Maher, PECO Energy

License Renewal: Request for Information on
Historic/Archaeological Resources
August 9, 2000
Page 3

bcc: PSE&G, Financial Controls and Co-Owner Affairs
R. I. McLean, State of Maryland
A. F. Kirby, III, Delmarva Power & Light Company
R. R. Janati, Commonwealth of Pennsylvania
G. R. Rainey - 63C-3
C. P Lewis - 63C-3
J. J. Hagan - 62C-3
J. W. Langenbach - 62C-3
J. Doering - PB, SMB4-9
G. L. Johnston - PB, A4-1S
P. J. Davison - PB, SMB3-2A
J. P. Grimes - 63B-1
R. W. Boyce - 63C-3
R. A. Kankus - 63C-2
A. A. Winter - PB, A4-5S
J. G. Hufnagel/TRL - 62A-1
PBAPS ISEG - PB, SMB4-6
Commitment Coordinator - 62A-1
Correspondence Control Desk - 61B-5
DAC - 61B-5



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LEGEND

- Peach Bottom Atomic Power Station
- Transmission Line

10 0 10 20 Kilometers

10 0 10 20 Miles

FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

D·H·C·D

Maryland Department of Housing and Community Development

Division of Historical and Cultural Programs

100 Community Place
Crownsville, Maryland 21032

410-514-7600
1-800-756-0119
Fax: 410-987-4071
Maryland Relay for the Deaf:
1-800-735-2258

http://www.dhcd.state.md.us

Parris N. Glendening
Governor

Raymond A. Skinner
Secretary

Marge Wolf
Deputy Secretary

September 22, 2000

JAMES A. HUTTON
LICENSING SECTION
OCT 0 2 2000
REFER TO: /

Mr. James A. Hutton
Director - Licensing
PECO Nuclear
200 Exelon Way
Kennett Square, PA 19348

RE: Relicensing of Peach Bottom Atomic Power Station, Unites 2 and 3
Cecil and Harford Counties, Maryland (Section 106 Review – NRC)

Dear Mr. Hutton:

Thank you for your 9 August 2000 letter which the Maryland Historical Trust received on 21 August 2000 regarding the proposed license renewal of the Peach Bottom facility. Trust staff have reviewed your letter and the enclosed USGS quadrangles, and below are our comments.

Archeology: Because of the prior disturbance in the project area, the Trust concurs that no archeological resources are likely to be impacted and no additional investigations are warranted.

Architecture: Based on a review of our inventory maps and forms, the Trust is of the opinion that no additional architectural investigations will be necessary in order for PECO to complete its license renewal application.

Effect Determination: It is therefore the opinion of the Maryland Historical Trust that the license renewal application will have no effect on historic properties eligible for or listed in National Register of Historic Places, including standing structures and archeological sites.

Thank you for providing us this opportunity to comment. Should you have any questions regarding the review of the project, please contact Ms. Anne Bruder (for structures) at 410-514-7636 or Dr. Gary Shaffer (for archeology) at 410-514-7638.

Sincerely,

Elizabeth J. Cole

Elizabeth J. Cole
Administrator
Project Review and Compliance

EJC/AEB
200003052
cc: Ms. Rosetta O. Virgilio, NRC FPO
Mr. Daniel Griffith, DE SHPO
Dr. Brent D. Glass, PA SHPO
Mr. Ronald Edwards, Cecil County Historical Trust
Mr. David B. Ellenberg, Lower Susquehanna Heritage Greenway, Inc.

PECO NUCLEAR
A Unit of PECO Energy

PECO Energy Company
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

July 5, 2000

Ms. Joan Larrivee
Deputy State Historic Preservation Officer
15 The Green
Dover, DE. 19901-3611

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
Request for Information on Historic/Archaeological Resources

Dear Ms. Larrivee:

PECO Energy Company (PECO Energy) is preparing an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses for Peach Bottom Atomic Power Station (PBAPS). Current operating licenses for the two-unit plant expire in 2013 and 2014. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license applicants to "assess whether any historic or archaeological properties will be affected by the proposed project." PECO Energy will submit the license renewal application to the NRC in 2001. By contacting your office now, we hope to identify any issues that we need to address or any information that we should provide to your office to expedite your evaluation of the continued operation of PBAPS on historic and archaeological resources.

PECO Energy has operated PBAPS and an associated transmission line since 1974. The facility is located on the west bank of Conowingo Pond in York County, Peach Bottom Township, approximately 3 miles north of the Pennsylvania-Maryland line (see attached figure). Only one new transmission corridor was required to integrate PBAPS into PECO Energy's bulk power system when the facility was constructed. This line, from Peach Bottom to the Keeney Substation in Delaware, is the only transmission line/corridor under review during this license renewal process. Part of this line runs through Delaware (see attached map).

PECO Energy has found no artifacts at the site or on the transmission line right-of-way during the 25 years of operation.

PECO Energy does not expect the operation of the PBAPS through the license renewal term (an additional 20 years) to adversely affect cultural or historical resources in the area and region. PECO Energy has no plans to alter current operations over the license renewal period. No major modifications have been

identified for the purposes of supporting license renewal. Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas. No additional land disturbance is anticipated in support of license renewal. Accordingly, we request your concurrence with our determination that the license renewal process would have not effect on any historic or archeological properties.

Please do not hesitate to call Robert Matty at (610) 640-6353 if you have any questions or require any additional information to review the proposed action. After your review, we would appreciate receiving your input by December 1, 2000, detailing any concerns you may have about historic/archaeological properties in the area or confirming PECO Energy's conclusion that operation of PBAPS, including maintenance of the identified transmission line, over the license renewal term would have no effect on any historic or archaeological properties in Delaware. This will enable us to meet our application preparation schedule. PECO Energy will include a copy of this letter and your response in the Environmental Report that will be submitted to the NRC as part of the PBAPS license renewal application.

Sincerely,

James A. Hutton
Director - Licensing

Enc. Map of PBAPS vicinity and transmission line route
Portion of USGS Elkton Quadrangle Map

cc K. Patterson, Tetra Tech NUS
F. Polaski, PECO Energy
W. Maher, PECO Energy

Request for Information on Historic/Archaeological Resources
July 5, 2000
Page 3

bcc: Manager, Financial Controls and Co-Owner Affairs,
Public Service Electric & Gas
R. I. McLean, State of Maryland
A. F. Kirby, III, Delmarva Power & Light Company
R. R. Janati, Commonwealth of Pennsylvania
G. R. Rainey - 63C-3
C. P Lewis - 63C-3
J. J. Hagan - 62C-3
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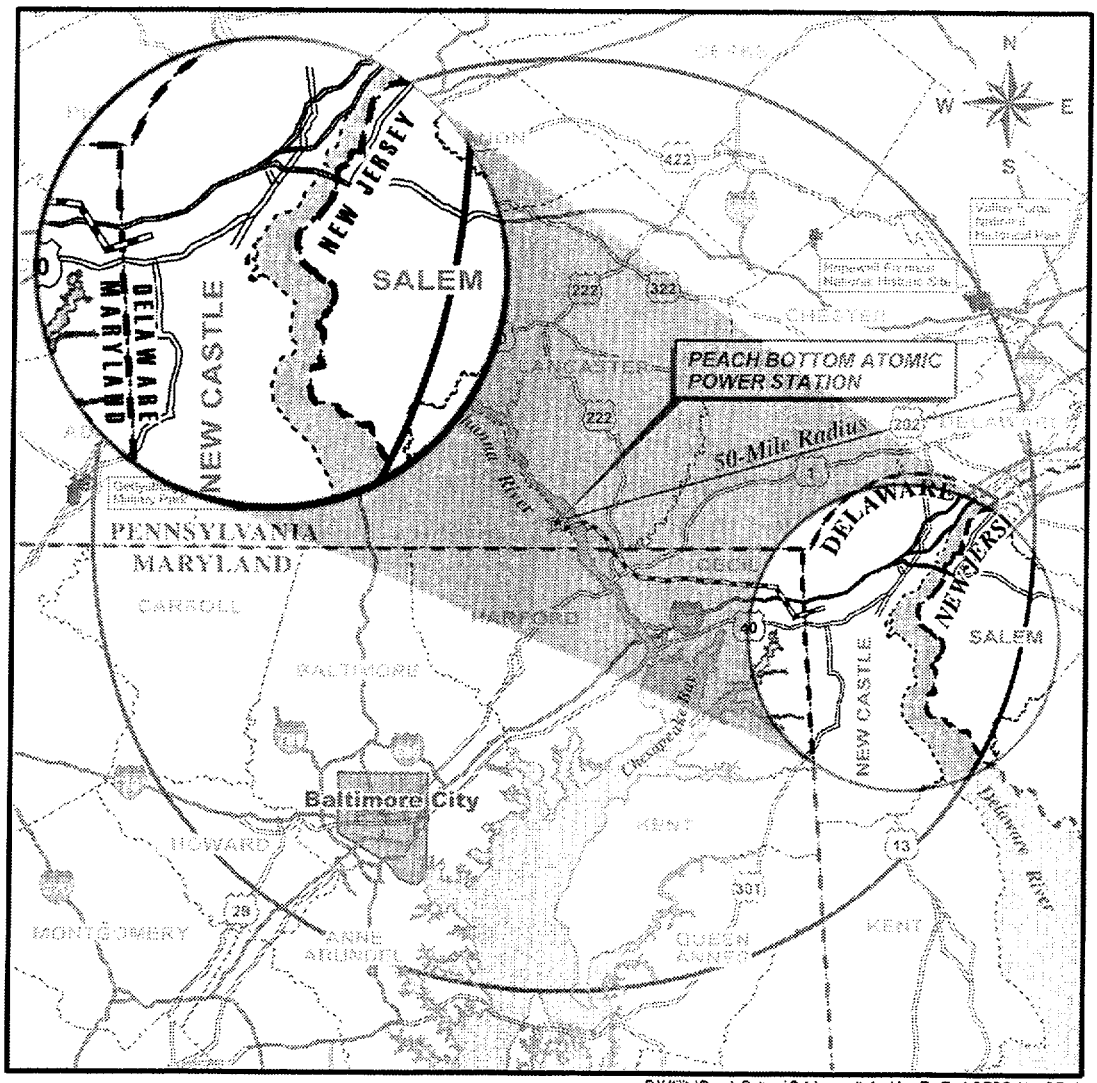
A. A. Winter - PB, A4-5S
J. G. Hufnagel/TRL - 62A-1
PBAPS ISEG - PB, SMB4-6
Commitment Coordinator - 62A-1
Correspondence Control Desk - 61B-5
DAC - 61B-5
R. M. Matty - 62A-4



LEGEND

- Peach Bottom Atomic Power Station
- Transmission Line

10 0 10 20 Kilometers

10 0 10 20 Miles

FIGURE 2. Peach Bottom Atomic Power Station 50-Mile Vicinity Map.

APPENDIX G
SEVERE ACCIDENT MITIGATION ALTERNATIVES (SAMA)

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G.0 APPENDIX G SEVERE ACCIDENT MITIGATION ALTERNATIVES (SAMA)

G.1 METHODOLOGY

The methodology selected for this analysis involves identifying those SAMA candidates that have the highest potential for reducing core damage frequency and person-rem risk and determining whether or not the implementation of those candidates is beneficial on a cost-risk reduction basis. This process consists of the following steps:

- Identify potential SAMA candidates based on NRC and industry documents,
- Screen out Phase 1 SAMA candidates that are not applicable to the Peach Bottom Atomic Power Station (PBAPS) design or are of low benefit in Boiling Water Reactors,
- Extend the current Peach Bottom Probabilistic Safety Analysis (PSA) (PB99 Rev 1) results (an update to Ref. G.8-23) to include both radionuclide releases and the related consequences (a Level 3 analysis). This requires conversion of the PBAPS Level 2 PSA results into the format used in NUREG/CR-4551[1] and scaling the Level 3 output based on those Level 2 PSA results and the demographic information of the surrounding communities at the end of the license extension,
- Determine the maximum averted cost-risk that is possible based on the PBAPS PSA Level 3 results,
- Screen out Phase 2 SAMA candidates whose estimated cost exceeds the maximum possible averted cost-risk,
- Perform a more detailed analysis to determine if the remaining SAMA candidates are desirable modifications or changes. This is based on a comparison of the averted cost-risk associated with implementing the SAMA at the site and the cost required to perform the modification. If the averted cost-risk is greater than the cost of implementation, then the SAMA candidate is considered to be a beneficial modification.

The steps outlined above are described in more detail in the subsections of this appendix.

[1] This is a technical report summarizing the input into NUREG-1150. Both NUREG/CR-4551 and NUREG-1150 are analyses sponsored by the NRC.

G.2 LEVEL 3 PRA ANALYSIS

The SAMA evaluation relies on Level 3 PSA results to measure the effects of potential plant modifications. A Level 3 model was created for PBAPS as part of NUREG-1150 and NUREG/CR-4551 (Ref. G.8-1 and G.8-2, respectively); however, while the Level 1 and 2 PSA models have been updated and enhanced to continually reflect plant changes since the publication of these NUREGs, the Level 3 model has not been updated.

Version 1.5 of the MACCS code (Ref. G.8-3) was used to perform the PBAPS Level 3 PSA in NUREG/CR-4551. The analysis was performed specifically for Peach Bottom Unit 2 and includes data unique to that site. While that report provides thorough documentation of the Level 3 analysis, the results are not directly used in the PBAPS SAMA evaluation. Some of the characteristics of the site data have changed since the performance of NUREG/CR-4551 in 1990 and it is considered necessary to account for these changes prior to applying the evaluation to this analysis.

Severe accidents due to external events, such as fire and seismic events, were evaluated in response to Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities". The fire analysis utilized the Fire Induced Vulnerability Evaluation (FIVE) methodology. The seismic analysis employed the seismic margins methodology. Insights from the PBAPS IPEEE studies have been incorporated and are considered in the SAMA tables.

There are no seismic or fire PSA models that can be used to perform either the baseline SAMA calculation or identify the change in risk that could be attributed to any proposed SAMA. It is judged appropriate to use the internal events PSA as a gauge to effectively describe the risk change that can be attributed to SAMAs.

G.2.1 POPULATION

The population estimate for the area surrounding the site used in the NUREG/CR-4551 analysis was originally based on 1980 census information. This SAMA evaluation requires an estimate of the population at the end of the license extension in 2034. For the purposes of this analysis, the 2034 population

is estimated using a simple, linear growth approximation for the population density in the surrounding area.

Population data from Table 4.2-2 of NUREG/CR-4551 was extrapolated to 50 miles from the plant (assuming a linear growth in population density away form the plant). The 1990 population estimate was derived from US census data and used in conjunction with the 1980 estimate to determine the increase in population per year. Using the 1990 50-mile population as a starting point, the growth rate (assumed to be constant) was applied over 44 years to approximate the population at the end of plant life in 2034. The population data used for this estimate is shown in the Tables G.2-1 and G.2-2. Table G.2-1 provides the information presented in Table 4.2-2 of NUREG/CR-4551 and Table G.2-2 summarizes the 1990 US census information.

TABLE G.2-1
NUREG/CR-4551 POPULATION DATA

Distance from Plant (miles)	Population
1	118
3	1822
10	28,647
30	989,356
100	14,849,112
350	68,008,584
1000	154,828,144

Table G.2-2 was developed using data available on the US Census Bureau's web site (http://www.census.gov). Population from the 1990 census is available by county and was used to estimate the population within the 50 mile radius of the plant. An atlas containing a mileage scale and county borders was used to identify the counties within the 50 mile radius. If the entire county fell within the 50 mile radius, then the entire population was included in the 50 mile estimate. Otherwise, a fraction of the population was counted based on the percentage of the county within the 50 mile radius. The land area within the 50 mile radius is estimated based on visual inspection of the map and the population of that area is estimated assuming uniform distribution of the population within the county. The results are presented below:

TABLE G.2-2
POPULATION WITHIN 50 MILES OF PBAPS
(1990 US CENSUS)

County Name	Total Population	Percent Included Within 50 Miles of PBAPS	Population within 50 Miles of PBAPS
Delaware	547651	85%	465503.35
Montgomery	678111	15%	101716.65
Berks	336523	50%	168261.5
Lebanon	113744	75%	85308
Adams	78274	40%	31309.6
Dauphin	237813	40%	95125.2
Cumberland	195257	10%	19525.7
Carroll	123372	85%	104866.2
Queen Anne's	33953	60%	20371.8
Anne Arundel	427239	30%	128171.7
Howard	187328	50%	93664
Salem	65294	50%	32647
Gloucester	230082	20%	46016.4
Kent, DE	110993	25%	27748.25
York	339574	100%	339574
Lancaster	422822	100%	422822
Chester	376396	100%	376396
Baltimore	692134	100%	692134
Baltimore City	736014	100%	736014
Harford	182132	100%	182132
Cecil	71347	100%	71347
Kent, MD	17842	100%	17842
New Castle	441946	100%	441946
		Total =	4700442.35

The actual number used in the SAMA calculations to adjust the NUREG/CR-4551 results is a ratio of the population density for the area within 50 miles of the plant in the year 2034 to that in 1980. This ratio, $P_{34/80}$, is calculated as follows:

$$P_{34/80} = \left(\frac{\frac{\left(PD_{50(1990)} - PD_{50(1980)}\right)}{(1990-1980)} * 44\,years + PD_{50(1990)}}{PD_{50(1980)}} \right)$$

Where:

$P_{34/80}$ = Ratio of the population density for the area within 50 miles of the plant in 2034 to the population density for the area within 50 miles of the plant in 1980

$PD_{50(1990)}$ = Population density for the area within 50 miles of the plant in 1990 (based on 1990 US census data)

$PD_{50(1980)}$ = Population density for the area within 50 miles of the plant in 1980 (based on NUREG/CR-4551)

$$PD_{50(1980)} = \frac{\left[\frac{\text{pop. within 100 miles}}{(3.14*100^2)} - \frac{\text{pop. within 30 miles}}{(3.14*30^2)}\right]}{70 \text{ miles}} * 20 \text{ miles} + \frac{\text{pop. within 30 miles}}{(3.14*30^2)}$$

$P_{34/80}$ is used to scale the Population Dose Risk (PDR) within 50 miles to reflect the population characteristics of the site area at the end of the proposed life extension. This affects the Offsite Exposure Cost Risk and the Offsite Economic Cost Risk used in the determination of the Baseline Screening Cost and the averted cost-risk for any proposed SAMAs.

Applying census data for the area around PBAPS results in the following:

$$P_{34/80} = \frac{\left[\frac{(598.5-385)}{(1990-1980)} * 44 + 598.5\right]}{385} = 3.99$$

G.2.2 ECONOMY AND AGRICULTURE

As part of NUREG/CR-4551, site specific data were collected on the economic and agricultural characteristics surrounding the Peach Bottom site. It is assumed that the relative distribution of these factors has remained constant and that the overall growth in "economy" and "agriculture" is represented by the growth in population. This growth is reflected by means of scaling the Offsite Economic Cost Risk by the increase in population.

G.2.3 OTHER PLANT SPECIFIC DATA

MACCS, as utilized in NUREG/CR-4551, implemented a large, plant specific input file to account for other site aspects. These factors include evacuation

characteristics, meteorological data, and core inventories that affect the Level 3 analysis. This data is available, including the economic and agricultural demographics, in Volume 2, Part 7 of NUREG/CR-4551. It is assumed that the remaining plant specific data documented there is constant or is treated by the application of the population growth ratio. No changes have been made to update the original input other than the scaling of the population estimates that is described above.

The Peach Bottom generating capacity has been increased from 3293 $MW_{thermal}$ per unit to 3458 $MW_{thermal}$ per unit since the time the NUREG/CR-4551 analysis was performed. The Peach Bottom PSA accounts for the power uprate in the application of success criteria and event timing. The Level 3 results have not been modified to account for the change in fuel design that accompanied the power uprate as the corresponding impact on core inventory is considered to be insignificant compared with the variation that occurs within the core during the course of a fuel cycle.

G.2.4 CONVERSION OF PBAPS PSA MODEL RESULTS TO LEVEL 3 OUTPUT

A major factor related to the use of NUREG/CR-4551 in the SAMA evaluation is that the PBAPS PSA has been enhanced to reflect plant changes and new information. While consistent with, the Individuals Plant Examination (IPE), the level of sophistication of the PSA model has increased and the results have changed as modeling techniques have improved. In addition, the results of the PBAPS PSA Level 2 model are not defined in the same terms as reported in NUREG/CR-4551. In order to use the Level 3 model presented in that document, it was necessary to convert the PBAPS PSA Level 2 model results into a format which allowed for the scaling of the Level 3 results based on current Level 2 output. Finally, as mentioned above, the Level 3 results were modified to reflect the expected change in the site demographics at the end of the proposed license extension. This subsection provides a description of the process used to convert the PBAPS PSA Level 2 model results into a form that can be used to generate Level 3 results using the NUREG/CR-4551 documentation. The Unit 2 PSA model, which has a slightly higher core damage frequency (CDF) between the Unit 2 and Unit 3 models, is used for the calculations in this study. Figure G.2-1 provides a graphical reference of the steps taken in NUREG/CR-4551 to determine the offsite consequences (Level 3 results) based on Level 1 analysis input (Plant Damage State frequencies).

G.2.4.1 Identification of Required Parameters

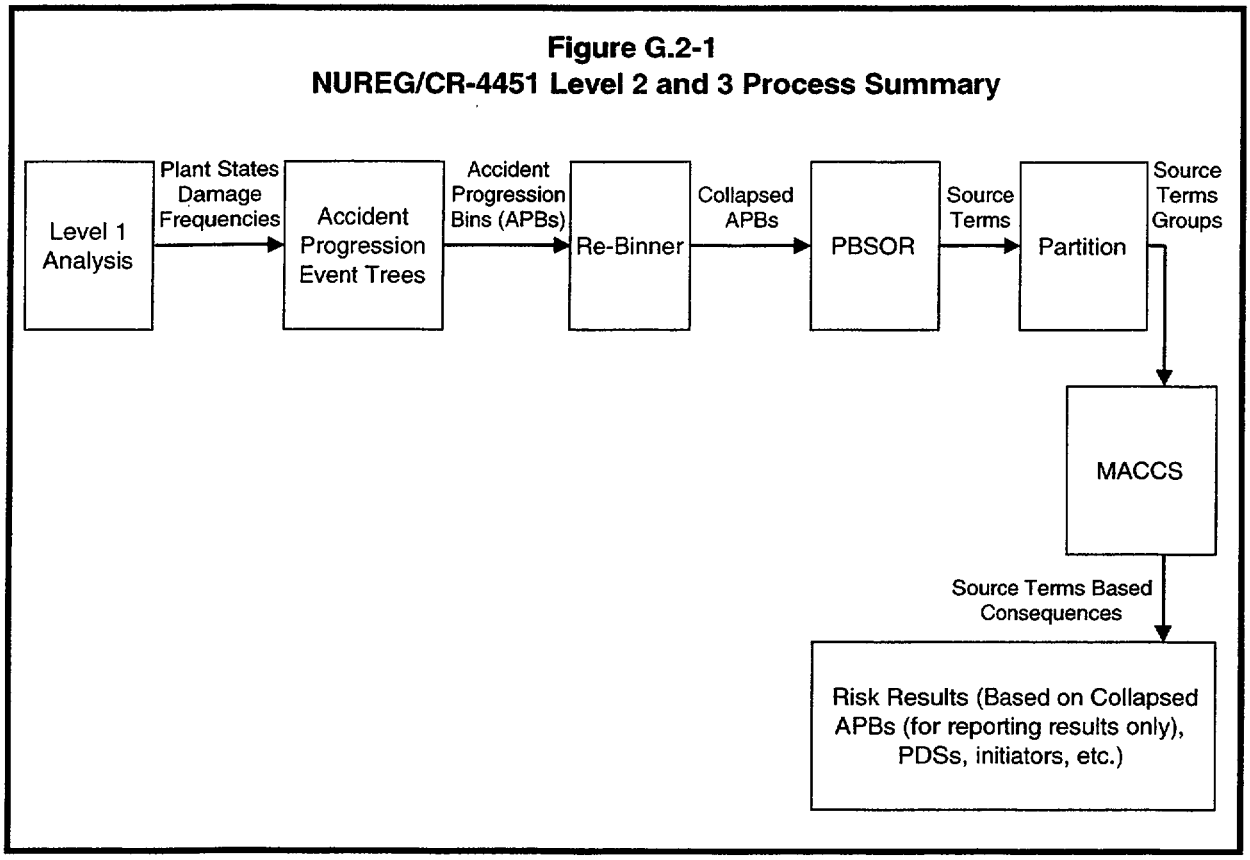
The first step in the conversion of the PBAPS PSA results into a format suitable for updating the NUREG/CR-4551 Level 3 results is to identify the output of the Level 3 model that is required in the cost-benefit calculations, which are described in Section G.3. While the CDF from the Level 1 model is used in these calculations, there are specific Level 3 terms that are needed to complete the analysis. Determination of the Offsite Exposure Cost Risk and the Offsite Economic Cost Risk both require Level 3 input. Offsite Exposure Cost Risk requires an estimate of the Population Dose Risk (0-50 miles) and the Offsite Economic Cost Risk requires the economic cost of an accident. Subsections G.2.4.2 and G.2.4.3 describe how these results are obtained, respectively.

G.2.4.2 Determination of Population Dose Risk (0-50 Miles)

The basic process that was pursued to obtain Level 3 results based on the PBAPS PSA Level 2 model and NUREG/CR-4551 was to define a useful relationship between the Level 2 and Level 3 results. NUREG/CR-4551 defines the fractional contribution of the 10 collapsed Accident Progression Bins (APBs) to the Population Dose Risk at 50 miles (PDR50). It was also determined that the frequency of each collapsed APB could be calculated based on the information provided in NUREG/CR-4551. Given this relationship, it was possible to determine the PDR50 based on the results of the PBAPS PSA model if those results are reported in terms of the same accident bins. For example, for a given collapsed APB:

$$PDR50_{(PBAPSPSA)} = \frac{\text{PBAPS PSA Frequency}}{\text{NUREG/CR} - 4551\text{Frequency}} * \text{Collapsed APB Fractional Contribution} * \text{Total } PDR50_{(NUREG/CR-4551)}$$

Figure G.2-1
NUREG/CR-4451 Level 2 and 3 Process Summary



If this is performed for each of the 10 collapsed APBs and the results are summed, the total is the PDR50 for the PBAPS PSA. In the determination of Offsite Exposure Cost Risk, however, the PDR50 should reflect the site conditions at the end of the renewed license term in 2034 (conservative). This is calculated by scaling the PDR50 results for the PBAPS PSA model by the $P_{34/80}$ ratio to account for the change in population. Table G.2-3 summarizes the results of this process.

TABLE G.2-3
CALCULATION OF PDR50

Collapsed Bin #	Fractional APB Contributions to Risk (MFCR)[1]	NUREG/CR-4551 Population Dose Risk at 50 miles (From a total of 7.9 person-rem, mean)[2](MFCR)	NUREG/CR-4551 Collapsed Bin Frequencies[3] (per year)	PBAPS PSA Collapsed Bin Frequencies[4] (per year)	PBAPS PSA Population Dose Risk at 50 miles (MCFR) (1980 Pop Data)[5] (person-REM)	Population Dose Risk at 50 miles (MCFR) (PBAPS PSA, scaled to 2034 population using $P_{34/80}$) (person-REM)
1	0.021	0.1659	9.55×10^{-8}	0	0.00	0.00
2	0.0066	0.05214	4.77×10^{-8}	0	0.00	0.00
3	0.556	4.3924	1.48×10^{-6}	4.66×10^{-8}	1.38×10^{-1}	5.52×10^{-1}
4	0.226	1.7854	7.94×10^{-7}	1.42×10^{-6}	3.19	1.28×10^{-1}
5	0.0022	0.01738	1.30×10^{-8}	1.17×10^{-7}	1.56×10^{-1}	6.24×10^{-1}
6	0.059	0.4661	2.04×10^{-7}	2.01×10^{-9}	4.59×10^{-3}	1.83×10^{-2}
7	0.118	0.9322	4.77×10^{-7}	2.25×10^{-8}	4.39×10^{-2}	1.75×10^{-1}
8	0.0005	0.00395	7.99×10^{-7}	1.42×10^{-8}	7.02×10^{-5}	2.81×10^{-4}
9	0.01	0.079	3.86×10^{-7}	7.38×10^{-7}	1.51×10^{-1}	6.03×10^{-1}
10	0	0	4.34×10^{-8}	0	0.00	0.00
				Totals	3.69	14.72

Notes to Table G.2-3:

1. From Table 5.2-3 of NUREG/CR-4551

2. The total population dose risk at 50 miles from internal events in person-rem is provided in Table 5.1-1 of NUREG/CR-4551. The contribution for a given APB is the product of the total PDR50 and the fractional APB contribution.

3. NUREG/CR-4551 provides the conditional probabilities of the collapsed APBs in Figure 2.5-6. These conditional probabilities are multiplied by the total internal CDF to calculate the collapsed APB frequency.

4. Determined by re-grouping PBAPS PSA results into the 10 collapsed APBs.

5. This column is the ratio of the PBAPS PSA collapsed APB frequency to the NUREG/CR-4551 collapsed APB frequency multiplied by the NUREG/CR-4551 APB specific PDR50 contribution.

Each sequence of the PBAPS PSA Level 2 model was reviewed and re-categorized into one of the collapsed APBs. The Level 2 model contains a significantly larger amount of information about the accident sequences than what is used in the collapsed APBs in NUREG/CR-4551 and the re-

categorization required simplification of accident progression information and assumptions related to categorizations of certain items.

The collapsed APBs are characterized by 5 attributes related to the accident progression. Unique combinations of the 5 attributes result in a set of 10 bins that are relevant to the analysis. Information from the PBAPS PSA Containment Event Trees (CETs) was used to classify each of the Level 2 sequences using these attributes. The definitions of the 10 collapsed APBs are provided in NUREG/CR-4551 and are reproduced in Table G.2-4 for references purposes:

TABLE G.2-4
COLLAPSED APB DESCRIPTIONS

Collapsed APB Number	Description
1	CD, VB, Early CF, WW Failure, V Pressure > 200 psi at VB Core damage occurs followed by vessel breach. The containment fails early in the wetwell (i.e., either before core damage, during core damage, or at vessel breach) and the RPV pressure is greater than 200 psi at the time of vessel breach (this means DCH is possible).
2	CD, VB, Early CF, WW Failure, V Pressure < 200 psi at VB Core Damage occurs followed by vessel breach. The containment fails early in the wetwell (i.e., either before core damage, during core damage, or at vessel breach) and the RPV pressure is less than 200 psi at the time of vessel breach (this means DCH is not possible).
3	CD, VB, Early CF, DW Failure, V Pressure > 200 psi at VB Core damage occurs followed by vessel breach. The containment fails early in the drywell (i.e., either before core damage, during core damage, or at vessel breach) and the RPV pressure is greater than 200 psi at the time of vessel breach (this means DCH is possible).
4	CD, VB, Early CF, DW Failure, V Pressure < 200 psi at VB Core Damage occurs followed by vessel breach. The containment fails early in the drywell (i.e., either before core damage, during core damage, or at vessel breach) and the RPV pressure is less than 200 psi at the time of vessel breach (this means DCH is not possible).

TABLE G.2-4 (Cont'd)
COLLAPSED APB DESCRIPTIONS

Collapsed APB Number	Description
5	CD, VB, Late CF, WW Failure, N/A Core Damage occurs followed by vessel breach. The containment fails late in the wetwell (i.e., after vessel breach during MCCI) and the RPV pressure is not important since, even if DCH occurred, it did not fail containment at the time it occurred.
6	CD, VB, Late CF, DW Failure, N/A Core Damage occurs followed by vessel breach. The containment fails late in the drywell (i.e., after vessel breach during MCCI) and the RPV pressure is not important since, even if DCH occurred, it did not fail containment at the time it occurred.
7	CD, VB, No CF, Vent, N/A Core Damage occurs followed by vessel breach. The containment never structurally fails, but is vented sometime during the accident progression. RPV pressure is not important (characteristic 5 is N/A) since, even if it occurred, DCH does not significantly affect the source term as the containment does not fail and the vent limits its effect.
8	CD, VB, No CF, N/A, N/A Core damage occurs followed by vessel breach. The containment never fails structurally (characteristic 4 is N/A) and is not vented. RPV pressure is not important (characteristic 5 is N/A) since, even if it occurred, DCH did not fail containment. Some nominal leakage from the containment exists and is accounted for in the analysis so that while the risk will be small it is not completely negligible.
9	CD, No VB, No CF, N/A, N/A Core damage occurs but is arrested in time to prevent vessel breach. There are no releases associated with vessel breach or MCCI. It must be remembered, however, that the containment can fail due to overpressure or venting even if vessel breach is averted. Thus, the potential exists for some of the in-vessel releases to be released to the environment.
10	No CD, N/A, N/A, N/A, N/A Core damage did not occur. No in-vessel or ex-vessel release occurs. The containment may fail on overpressure or be vented. The RPV may be at high or low pressure depending on the progression characteristics. The risk associated with this bin is negligible.

CD = core damage	CF = containment failure	DCH = direct containment heating
DW = drywell	MCCI = mollen concrete interaction	RPV = reactor pressure vessel
VB = vessel research	vent = venting	WW = wetwell

Some general assumptions were made during the classification of the Level 2 CET sequences in order to categorize certain sequences that contained characteristics that did not directly fit into one of the 10 collapsed APBs. As it is

possible for these assumptions to vary between each of the 5 accident classes, each accident class is associated with a unique set of assumptions on a node by node basis. The "nodes" in the CETs represent phenomenological events, operation of plant systems, and operator performance. Table G.2-5 summarizes the accident class definitions and Table G.2-6 summarizes the nodal assumptions used to group the PBAPS PSA Level 2 sequences into the collapsed bins.

TABLE G.2.5
ACCIDENT CLASS DEFINITIONS

Accident Class Designator	Definition
1A	Accident Sequences involving loss of inventory makeup in which the reactor pressure remains high
1B	Accident sequences involving a loss of offsite power and loss of inventory makeup.
1C	Accident sequences involving a loss of inventory makeup induced by an ATWS sequence.
1D	Accident sequences involving a loss of coolant inventory makeup in which reactor pressure has been successfully collapsed to 200 psi. Accident sequences initiated by common mode failures disabling multiple systems (ECCS) leading to loss of coolant inventory makeup.
1E	Accident sequences caused by common mode failures that result in multiple front line system failures with the reactor at high pressure.
2A	Accident sequences involving a loss of containment heat removal and no venting capability.
2F	Accident sequences involving a loss of containment heat removal and no venting capability.
2T	Accident sequences involving a loss of containment heat removal and no venting with injection terminated prior to containment failure.
3A	Accident sequences leading to core vulnerable conditions initiated by vessel rupture where the containment integrity is not breached in the initial time phase of the accident.
3B	Accident sequences initiated by or resulting in small or intermediate LOCAs for which the reactor can not be depressurized.
3C	Accident sequences that are initiated by a LOCA or RPV failure and for which the vapor suppression system is inadequate challenging containment integrity.
4A	Accident sequences involving a failure to insert negative reactivity leading to a containment vulnerable condition due to high containment pressure.
5	Unisolated LOCA outside containment.

TABLE G.2.6
NODAL ASSUMPTIONS

Accident Class	PBAPS PSA Containment Event Tree Node	Assumption
1	IS – Containment Isolation	If the containment is not isolated, it is assumed that it will be open for the equivalent of an un-scrubbed release as soon as the vessel is breached. No depressurization is asked prior to this node; it is assumed that RPV pressure is >= 200 psi for these sequences. This is bin #3.
1	OP – Operator depressurizes the RPV	It is assumed that success on this branch results in RPV pressure below 200 psi.
1	RX – Core Melt Arrested in Vessel	A success on this branch signifies that there is no vessel breach. The sequences following this path are grouped in bin #9. However, there is one case in which combustible gas venting (GV) fails followed by containment failure (CZ); this is assumed to result in a high early release and is categorized as a bin #4 event for low pressure and #3 for high pressure.
1	CX – Containment Intact During Flood, RPV Breach	Failure of containment during flood is assumed to result in an un-scrubbed release. The timing is technically later than vessel breach, but it is conservatively assumed to be "early" and is grouped in bins 3 or 4 depending on RPV pressure.
1	NC – No Large Containment Failure	A large containment failure instigated by high containment pressure following vessel breach is assigned to the "late containment failure" bins. The sequences contributing to these bins need to be separated into either WW or DW failures. While the PB CETs distinguish between these types of failures, the NUREG/CR-4551 analysis appears to take credit for scrubbing for any WW release (with respect to the collapsed bins in section 2.4.3). Not all WW failure in the CETs can be credited with successful scrubbing. Given a large containment failure, the only successful scrubbing path is that in which the WW fails in an area above the water level (success in node WW).
1	MU – Coolant Inventory Makeup	Coolant inventory makeup is assumed only to provide cooling to the core debris. No credit is taken for any potential scrubbing effects that water coverage may yield.
1	RB – Release Mitigated in Reactor Building	The RB node, release mitigated in reactor building, is not credited as a scrubbing mechanism. The only scrubbing accounted for in the collapsed bins is distinguished by indicating a WW release and the amount of scrubbing that the reactor building is capable of providing is not considered to be the equivalent a WW scrub. This is judged to be conservative.
2	RX – Core Melt Arrested in Vessel	A success on this branch signifies that there is no vessel breach. The sequences following this path are grouped in bin #9. However, For accident class 2T sequences in which core melt has been mitigated in the vessel, a failure in the CZ node is also assumed to result in bins 3 or 4 according to RPV pressure. Given that there is no vessel breach, this is judged to be conservative.

TABLE G.2.6 (Cont'd)
NODAL ASSUMPTIONS

Accident Class	PBAPS PSA Containment Event Tree Node	Assumption
2	CZ/SI – Containment Intact/Mark I Shell Failure	Given that the core melt has not been contained in the RPV, failure in node CZ is assumed to result in an un-scrubbed release through the drywell. Failure in node SI is also assumed to result in an un-scrubbed release due to fission product release through the gap between the liner and the concrete. No credit is given to reactor building scrubbing (RB) or to injection to the DW or RPV (TD). The sequences with failures in these nodes are assigned to bins 3 or 4 depending on RPV pressure.
2	RB – Release Mitigated in Reactor Building	The RB node, release mitigated in reactor building, is not credited as a scrubbing mechanism. The only scrubbing accounted for in the collapsed bins is distinguished by indicating a WW release and the amount of scrubbing that the reactor building is capable of providing is not considered to be the equivalent a WW scrub. This is judged to be conservative.
2	SP – Suppression Pool Not Bypassed	The suppression pool bypass node is considered in the PB CETs to determine whether the vent volume passes through the suppression pool or not. This node is currently only quantified for cases in which the core melt has been arrested in the RPV (no VB breach). These sequences are assigned to bin #9 and no further breakdown of the sequences is performed.
3	MU – Coolant Inventory Makeup	Coolant inventory makeup is assumed only to provide cooling to the core debris. No credit is taken for any potential scrubbing effects that water coverage may yield.
3	RB – Release Mitigated in Reactor Building	The RB node, release mitigated in reactor building, is not credited as a scrubbing mechanism. The only scrubbing accounted for in the collapsed bins is distinguished by indicating a WW release and the amount of scrubbing that the reactor building is capable of providing is not considered to be the equivalent a WW scrub. This is judged to be conservative.
3	SP – Suppression Pool Not Bypassed	The suppression pool bypass node is considered in the PB CETs to determine whether the vent volume passes through the suppression pool or not. This node is quantified in Class 3 accidents for both vessel breach and "no breach" cases. For no vessel breach: Bin #9 is assigned unless there is a failure in the CZ node. A failure in the CZ node denotes early containment failure and these sequences are assigned to bin #4 (depressurization is always successful in the Class 3 trees, so there is no use of bin #3.) For vessel breach: If the WW is not bypassed, bin #7 is assigned, which is in accord with the bin definition of "vessel breach, vent". If the WW is bypassed, the conditions are assumed to be similar to bin #6 as the venting will take place late in time as would a late containment failure and the un-scrubbed vent volume will be vented directly to the atmosphere through the stack.

TABLE G.2.6 (Cont'd)
NODAL ASSUMPTIONS

Accident Class	PBAPS PSA Containment Event Tree Node	Assumption
3	CZ/SI – Containment Intact/Mark I Shell Failure	Given that the core melt has not been contained in the RPV, failure in node CZ is assumed to result in an un-scrubbed release through the drywell. Failure in node SI is also assumed to result in an un-scrubbed release due to fission product release through the gap between the liner and the concrete. No credit is given to reactor building scrubbing (RB) or to injection to the DW or RPV (TD). The sequences with failures in these nodes are assigned to bins 3 or 4 depending on RPV pressure.
4	RB – Release Mitigated in Reactor Building	The RB node, release mitigated in reactor building, is not credited as a scrubbing mechanism. The only scrubbing accounted for in the collapsed bins is distinguished by indicating a WW release and the amount of scrubbing that the reactor building is capable of providing is not considered to be the equivalent a WW scrub. This is judged to be conservative.
4	SP – Suppression Pool Not Bypassed	The suppression pool bypass node is considered in the PB CETs to determine whether the vent volume passes through the suppression pool or not. This node is quantified in Class 4 accidents for only "no breach" cases. For no vessel breach Bin #9 is assigned.
4	CZ/SI – Containment Intact/Mark I Shell Failure	Given that the core melt has not been contained in the RPV, failure in node CZ is assumed to result in an un-scrubbed release through the drywell. Failure in node SI is also assumed to result in an un-scrubbed release due to fission product release through the gap between the liner and the concrete. No credit is given to reactor building scrubbing (RB) or to injection to the DW or RPV (TD). The sequences with failures in these nodes are assigned to bins 3 or 4 depending on RPV pressure.
5	N/A	No collapsed bin is available for containment bypass scenarios. The closest match to a bypass scenario is assumed to be a vessel breach with early drywell failure (bins 3 and 4). These bins are assigned based on RPV pressure (failure to depressurize is set to 0.0, so all sequences with non-zero results will be assigned to bin #4).

G.2.4.2.1 Summary

The complete results of the Level 2 re-categorization are not presented here as there are over 1900 sequences in the CETs. Refer to Table G.2-3 for the collapsed bin frequencies calculated for the PBAPS PSA model. The APBs with the most influence on the PDR50 are 3, 4, and 7. The frequency for APB 3 dropped by about 2 orders of magnitude and as a result, this bin is no longer the

dominant contributor to the PDR50. Conversely, the frequency of bin 4 increased by a factor of 2 and the bin now contributes about 87% of the PDR50. APB 7 was collapsed in frequency by a factor of 5 and remains as a significant, but non-dominant contributor to the results. It is also important to note that there were no Level 2 sequences categorized in APBs 1 or 2. This is primarily due to the assumption that failure on the SI node (shell melt through) results in an un-scrubbed release. The collapsed APBs treat a wetwell release as a scrubbed release, thus, the SI failures (this node is 1.0) are binned with the drywell failures to prevent un-scrubbed sequences from being categorized with the scrubbed releases. An early failure of containment due to the effects of vessel breach (CZ) is also assumed to result in an un-scrubbed release and therefore is not binned in APBs 1 or 2. This is judged to be conservative.

The end result is a baseline PDR50 of 14.7 person-rem per year per plant based on the scaled population data for 2034.

G.2.4.3 Determination of Offsite Economic Cost Risk

The Offsite Economic Cost Risk (OECR) results for the PBAPS PSA model depend on the relationship between the collapsed APBs and the Plant Damage States (PDSs) defined in NUREG/CR-4551. Plant damage states are groups of sequences that behave similarly in the Level 2 analysis; their descriptions are reproduced from NURGE/CR-4551 for reference purposes in Table G.2-7.

TABLE G.2-7
PLANT DAMAGE STATE DEFINITIONS

Plant Damage State Number	Description
1	(LOCA) This PDS is composed of two accident sequences: the first is a large LOCA followed by immediate failure of all injection; the second is a medium LOCA with initial HPCI success but almost immediate failure as the vessel depressurizes below working pressure, all other injection has failed. Early core damage results. CRD and containment heat removal are working. Venting is available.
2	(Fast Transient, SORV, RHR avail.) This PDS is composed of four sequences consisting of a transient initiator followed by two stuck open SRVs (the equivalent of an intermediate LOCA). HPCI works initially, but fails when the vessel depressurizes below HPCI working pressure; all other injection has failed and early core damage results. CRD and containment heat removal are working as in PDS 1 but steam is directed through the SRVs to the suppression pool and not to the drywell as in PDS 1. Venting is available.

Table G.2-7 (Cont'd)
Plant Damage State Definitions

Plant Damage State Number	Description
3	(Fast Transient, SORV, RHR not avail.) This PDS is similar to PDS-2 except that the containment heat removal is not working and CRD may not be working for some sub-groups (however, CRD is assumed to be working since the cutsets where it is not are negligible contributors).
4	(Fast Blackout) This PDS is a short term station blackout with DC power failed. It consists of 2 sequences: one with a stuck open SRV and one without a stuck open SRV. Early core damage results from the immediate loss of all injection. Venting is possible if AC power is restored (manual venting is possible if AC is not restored but considered unlikely).
5	(Slow Blackout) This PDS is a long term station blackout. It is composed of three sequences, one of which has a stuck open SRV. High pressure injection is initially working. AC power is not recovered and either: 1) the batteries deplete, resulting in injection failure, reclose of the ADS valves, and re-pressurization of the RPV (in those cases where an SRV is not stuck open), followed by boiloff of the primary coolant and core damage, or 2) HPCI and RCIC fail on high suppression pool temperature or high containment pressure, respectively, followed by boiloff and core damage at low RPV pressure (Since DC has not failed, ADS would still be possible, or an SRV is stuck open). The containment is at high pressure but less than or equal to the saturation pressure corresponding to the temperature at which HPCI would fail (i.e., about 40 psig at the start of core damage).
6	(Fast ATWS, SLC avail.) This PDS is an ATWS with SLC working. HPCI works and the vessel is not manually depressurized. Injection fails on high suppression pool temperature and early core damage ensues. Venting is available.
7	(ATWS, SORV) This PDS is an ATWS with failure of SLC; the initiator is a stuck open SRV. Otherwise, it is the same as PDS 8.
8	(ATWS) This PDS is an ATWS sequence with loss of an AC bus or PCS followed by failure to scram. High pressure injection fails on high suppression pool temperature and the reactor is either: 1) not manually depressurized or 2) the operator depressurizes and uses low pressure injection systems until the injection valves fail due to excessive cycling or, containment fails or is vented and the injection systems fail due to harsh environments in the reactor building or loss of NPSH (condensate cannot supply enough water since the CST can only supply about 800 gpm to the condenser. Condensate can only last a few minutes.). Early core damage ensues in case 1 and late core damage in case 2. Venting will not take place before core damage if the operator does not depressurize; but, it may, if he goes to low pressure systems. RHR and CSS are working and the containment pressure will begin to drop in case 1 or will level off at the venting or SRV reclosure pressure in case 2.
9	(ATWS, LOSP) This PDS is an ATWS with failure of SLC, the initiator is T1 (LOSP); however, other AC is available. Otherwise, this PDS is the same as PDS 8.

As there is no direct relationship documented between the collapsed APBs and the OECR, it was necessary to develop this relationship. This relationship

allowed for the calculation of PBAPS PSA PDS frequencies based on the PBAPS PSA collapsed APB frequencies (the collapsed APB frequencies developed for the PDR50 calculation were also implemented here). A ratio of the PBAPS PSA PDS frequencies to the NUREG/CR-4551 frequencies multiplied by the NUREG/CR-4551 PDS OECR contributions provided the OECR for the PBAPS PSA model. The result was modified to account for the increased population at the end of the license (2034) as it was for the PDR50. The following steps summarize the process used to calculate the OECR for the PBAPS PSA:

1. Using Table C-1 of NUREG/CR-4551, calculate the OECR for each source term by multiplying the mean source term frequency by the Economic Cost associated with the source term.

2. Sum the source term specific OECR values to get a total OECR for the NUREG/CR-4551 analysis.

3. Calculate the fractional contribution of each PDS to each collapsed APB from NUREG/CR-4551. This number is the fraction of the total collapsed APB frequency contributed by a given PDS.

4. Calculate the PDS frequencies for the PBAPS PSA. These are the sums of the products of the collapsed APB frequency and the fractional contribution of each PDS over all collapsed APBs for all PDSs.

5. Calculate the NUREG/CR-4551 PDS contributions to the OECR. This is the total NUREG/CR-4551 OECR multiplied by the fractional contribution of each PDS.

6. Multiply the PDS specific OECR by the ratio of the PBAPS PSA PDS frequencies to the NUREG/CR-4551 PDS frequencies to obtain the OECR for the PBAPS PSA.

Multiply the PBAPS PSA OECR by the P34/80 ratio to obtain the OECR for the Peach Bottom site in 2034. This represents the OECR for a single unit core damage accident (per year).

These steps are discussed in more detail below and are represented graphically in Figure G.2-2.

Steps 1 and 2

The information in Table C-1 of NUREG/CR-4551 is summarized in Table G.2-8. This table includes the source term group identifier, the mean frequency of the source term, the economic cost of a release of the source term to the environment, and the OECR for the source term, which is the product of the source term's mean frequency and its economic cost. The source term groups are the product of the PARTITION computer program. PARTITION receives the individual source terms from PBSOR and organizes them into groups in order to limit the number of calculations that MACCS is required to perform.

Figure G.2-2
PBABS PSA OECR Calculation Process

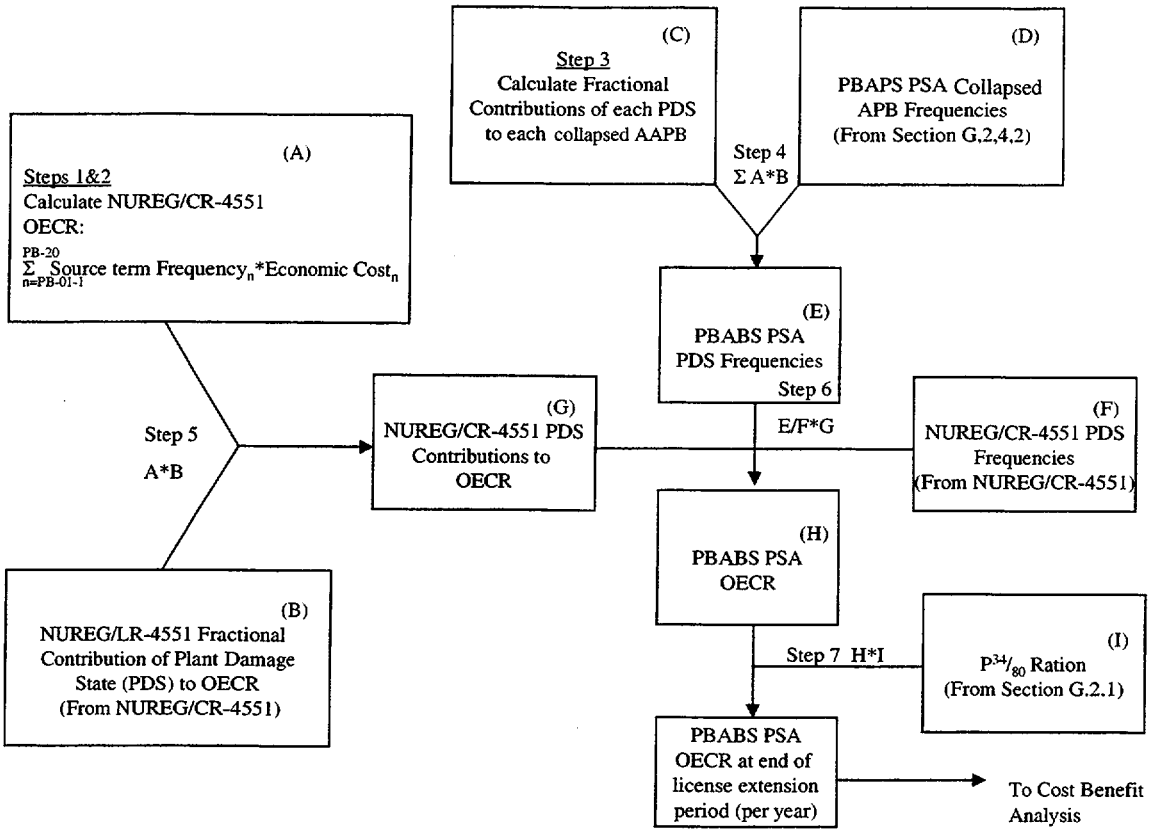


TABLE G.2-8
NUREG/CR-4551 OECR

Source Term Identifier	Mean Frequency	Economic Cost	NUREG/CR-4551 Annual Offsite Economic Cost-Risk (NUREG/CR-4551)
PB-01-1	1.00×10^{-7}	7.12×10^{7}	$7.12
PB-01-3	7.14×10^{-8}	6.99×10^{7}	$4.99
PB-02-1	5.26×10^{-8}	4.57×10^{8}	$24.04
PB-02-3	5.51×10^{-8}	5.01×10^{8}	$27.61
PB-03-1	1.15×10^{-7}	7.18×10^{8}	$82.57
PB-03-3	1.10×10^{-7}	3.11×10^{8}	$34.21
PB-04-1	9.73×10^{-8}	6.57×10^{8}	$63.93
PB-04-3	2.00×10^{-8}	6.32×10^{8}	$12.64
PB-05-1	8.38×10^{-8}	2.05×10^{9}	$171.79
PB-05-3	3.29×10^{-8}	1.36×10^{9}	$44.74
PB-06-1	1.28×10^{-7}	2.68×10^{9}	$343.04
PB-06-3	2.48×10^{-8}	2.43×10^{9}	$60.26
PB-07-1	3.25×10^{-7}	2.62×10^{9}	$851.50
PB-07-3	1.46×10^{-7}	2.36×10^{9}	$344.56
PB-08-1	7.52×10^{-8}	3.27×10^{9}	$245.90
PB-08-3	7.57×10^{-9}	1.10×10^{9}	$8.33
PB-09-1	7.56×10^{-8}	1.12×10^{10}	$846.72
PB-09-3	1.59×10^{-8}	7.31×10^{9}	$116.23
PB-10-1	1.67×10^{-7}	1.03×10^{10}	$1,720.10
PB-10-3	9.56×10^{-9}	7.30×10^{9}	$69.79
PB-11-1	1.90×10^{-7}	6.26×10^{9}	$1,189.40
PB-11-3	5.08×10^{-9}	4.54×10^{9}	$23.06
PB-12-1	5.66×10^{-8}	3.70×10^{10}	$2,094.20
PB-12-3	6.60×10^{-10}	3.60×10^{10}	$23.76
PB-13-1	2.49×10^{-7}	2.48×10^{10}	$6,175.20
PB-13-3	1.52×10^{-8}	2.50×10^{10}	$380.00
PB-14-1	6.08×10^{-7}	1.47×10^{10}	$8,937.60
PB-14-3	6.32×10^{-9}	1.62×10^{10}	$102.38
PB-15-1	1.59×10^{-9}	6.40×10^{10}	$101.76
PB-15-3	5.24×10^{-10}	6.37×10^{10}	$33.38
PB-16-1	4.28×10^{-8}	4.93×10^{10}	$2,110.04
PB-16-3	1.19x10-^{9}	4.74×10^{10}	$56.41
PB-17-1	3.67×10^{-7}	3.67×10^{5}	$0.13
PB-18-1	6.94×10^{-7}	1.15×10^{6}	$0.80
PB-19-1	3.29×10^{-7}	3.49×10^{8}	$114.82
PB-19-3	2.48×10^{-8}	4.39×10^{7}	$1.09
		TOTAL=	$26,424.10

The total OECR for the NUREG/CR-4551 analysis is $26,424.10. The OECRs calculated for other plants, such as Edwin I. Hatch, are significantly lower than

the estimate for PBAPS. This is primarily due to the demographics of the site areas.

Step 3

The next step in the process is to define the relationship between the PDSs and the collapsed APBs. Figure 2.5-5 of NUREG/CR-4551 provides the conditional probabilities for each PDS's contribution to each collapsed APB. These probabilities cannot be used to directly translate between the collapsed APB frequency and the PDS frequency because each PDS only provides a portion of the total collapsed APB frequency. It is necessary to calculate the fraction of the collapsed APB frequency contributed by each PDS. Once this is established, if a new collapsed APB frequency is provided, these fractions can be applied to each PDS and the new APB frequency can be distributed among all of the PDSs. If this is performed for each APB, the sum of the contributions from each APB to a given PDS can be summed to calculate the new PDS frequency. The first part of this process is defining the conditional probabilities for each PDS for each collapsed APB. As mentioned above, NUREG/CR-4551 Figure 2.5-5 provides these results. They are reproduced in Table G.2-9.

TABLE G.2-9
CONDITIONAL PROBABILITIES OF COLLAPSED APBS FOR INTERNAL PDSS

Collapsed APB Number	PDS 1 Conditional Collapsed APB Probability	PDS 2 Conditional Collapsed APB Probability	PDS 3 Conditional Collapsed APB Probability	PDS 4 Conditional Collapsed APB Probability	PDS 5 Conditional Collapsed APB Probability	PDS 6 Conditional Collapsed APB Probability	PDS 7 Conditional Collapsed APB Probability	PDS 8 Conditional Collapsed APB Probability	PDS 9 Conditional Collapsed APB Probability
1	0	0	0	0	0.053	0.005	0	0.008	0.008
2	0.028	0.028	0	0.024	0.01	0.017	0.011	0.004	0.004
3	0	0	0	0.066	0.503	0.084	0	0.4	0.4
4	0.36	0.36	0.27	0.237	0.11	0.218	0.485	0.163	0.163
5	0	0	0.046	0.005	0.007	0	0	0	0
6	0.074	0.074	0.084	0.063	0.061	0.049	0.012	0.009	0.009
7	0.003	0.003	0.271	0.024	0.084	0	0.308	0.236	0.236
8	0.536	0.536	0.078	0.328	0.088	0.424	0.082	0.08	0.08
9	0	0	0.251	0.253	0.085	0.203	0.074	0.073	0.073
10	0	0	0	0	0	0	0.028	0.028	0.028

The fractional contribution of a given PDS to a given collapsed APB is the product of the PDS frequency and the conditional probability for the collapsed

APB divided by the sum of the products of the PDS frequencies and their conditional probabilities for that same collapsed APB. The following equation describes this relationship:

$$F_{PDS1APB1} = \frac{f_{PDS1} * C_{PDS1APB1}}{(f_{PDS1} * C_{PDS1APB1} + f_{PDS2} * C_{PDS2APB1} \cdots + f_{PDS9} * C_{PDS9APB1}}$$

Where:

$F_{PDS1APB1}$ = fractional contribution of PDS 1 to collapsed APB 1

f_{PDS1} = frequency of PDS 1

$C_{PDS1APB1}$ = conditional probability of collapsed APB 1 for PDS 1

f_{PDS2} = frequency of PDS 2

$C_{PDS2APB1}$ = conditional probability of collapsed APB 1 for PDS 2

f_{PDS9} = frequency of PDS 9

$C_{PDS9APB1}$ = conditional probability of collapsed APB 1 for PDS 9

This is performed for all collapsed APBs. Table G.2-10 summarizes these results.

TABLE G.2-10
FRACTIONAL CONTRIBUTIONS

Collapsed APB Number	Fractional Contribution of PDS 1 to APB	Fractional Contribution of PDS 2 to APB	Fractional Contribution of PDS 3 to APB	Fractional Contribution of PDS 4 to APB	Fractional Contribution of PDS 5 to APB	Fractional Contribution of PDS 6 to APB	Fractional Contribution of PDS 7 to APB	Fractional Contribution of PDS 8 to APB	Fractional Contribution of PDS 9 to APB
1	0.00	0.00	0.00	0.00	8.76×10^{-1}	1.54×10^{-2}	0.00	9.80×10^{-2}	1.05×10^{-2}
2	9.11×10^{-2}	1.09×10^{-1}	0.00	1.03×10^{-1}	4.10×10^{-1}	1.29×10^{-1}	2.37×10^{-2}	1.21×10^{-1}	1.30×10^{-2}
3	0.00	0.00	0.00	8.10×10^{-3}	5.89×10^{-1}	1.83×10^{-2}	0.00	3.47×10^{-1}	3.72×10^{-2}
4	7.19×10^{-2}	8.58×10^{-2}	9.52×10^{-4}	6.25×10^{-2}	2.77×10^{-1}	1.02×10^{-1}	6.40×10^{-2}	3.04×10^{-1}	3.25×10^{-2}
5	0.00	0.00	8.50×10^{-3}	6.90×10^{-2}	9.22×10^{-1}	0.00	0.00	0.00	0.00
6	6.01×10^{-2}	7.17×10^{-2}	1.21×10^{-3}	6.75×10^{-2}	6.24×10^{-1}	9.31×10^{-2}	6.45×10^{-3}	6.82×10^{-2}	7.31×10^{-3}
7	8.01×10^{-4}	9.56×10^{-4}	1.28×10^{-3}	8.46×10^{-3}	2.83×10^{-1}	0.00	5.44×10^{-2}	5.88×10^{-1}	6.30×10^{-2}
8	1.17×10^{-1}	1.39×10^{-1}	3.00×10^{-4}	9.43×10^{-2}	2.41×10^{-1}	2.16×10^{-1}	1.18×10^{-2}	1.63×10^{-1}	1.74×10^{-2}
9	0.00	0.00	1.65×10^{-3}	1.24×10^{-1}	3.98×10^{-1}	1.77×10^{-1}	1.82×10^{-2}	2.54×10^{-1}	2.72×10^{-2}
10	0.00	0.00	0.00	0.00	0.00	0.00	6.02×10^{-2}	8.49×10^{-1}	9.10×10^{-2}

Step 4

The next part of the process is calculating the PDS frequencies based on the collapsed APB frequencies from the PBAPS PSA model (the collapsed APB frequencies used here do not include the dual unit Core damage contribution). This document uses the base case for demonstration purposes; the same process is used for the cases representing SAMA model changes to determine the change in OECR. The PBAPS PSA PDS frequencies are determined by summing the products of the PBAPS PSA collapsed APB frequencies and the fractional contributions of each PDS to the collapsed APBs over all collapsed APBs. The following equation describes this relationship:

$$F_{PDS1PSA} = f_{APB1} * F_{PDS1APB1} + f_{APB2} * F_{PDS1APB2} + f_{APB10} * F_{PDS1APB10}$$

Where:

$f_{PDS1PSA}$ = frequency of PBAPS PSA PDS 1

f_{APB1} = frequency of PBAPS PSA collapsed APB 1

$F_{PDS1APB1}$ = fractional contribution of PDS 1 to collapsed APB 1

f_{APB2} = frequency of PBAPS PSA collapsed APB 2

$F_{PDS1APB2}$ = fractional contribution of PDS 1 to collapsed APB 2

f_{APB10} = frequency of PBAPS PSA collapsed APB 10

$F_{PDS1APB10}$ = fractional contribution of PDS 1 to collapsed APB 10

This process is performed for each PDS. The results are provided in Table G.2-11.

TABLE G.2-11
PDS FREQUENCIES

PDS	PBAPS PSA PDS Frequencies
1	1.04×10^{-7}
2	1.24×10^{-7}
3	3.60×10^{-9}
4	1.91×10^{-7}
5	8.33×10^{-7}
6	2.79×10^{-7}
7	1.06×10^{-7}
8	6.50×10^{-7}
9	6.97×10^{-8}

Step 5

The NUREG/CR-4551 PDS OECR values are determined by multiplying the total OECR (calculated in Step 2) by the fraction of the OECR contributed by the PDS. Table D-1 of NUREG/CR-4551 provides the contribution fractions. Table G.2-12 summarizes the results.

TABLE G.2-12
NUREG/CR-4551 PDS CONTRIBUTIONS TO OECR

PDS	Fractional Contribution of PDS to OECR	NUREG/CR-4551 PDS Contributions to OECR
1	0.02506	6.62×10^{2}
2	0.01819	4.81×10^{2}
3	0.00039	1.03×10^{1}
4	0.01751	4.63×10^{2}
5	0.5701	1.51×10^{4}
6	0.02247	5.94×10^{2}
7	0.02115	5.59×10^{2}
8	0.31504	8.32×10^{3}
9	0.01011	2.67×10^{2}

Steps 6 and 7

These steps provide the PBAPS PSA OECR based on end of license conditions. The PBAPS PSA OECR is calculated by multiplying the NUREG/CR-4551 PDS OECR by the ratio of the PBAPS PSA PDS frequency to the NUREG/CR-4551 PDS frequency. The results are then multiplied by the $P_{34/80}$ ratio to reflect the conditions at the end of the license extension. Table G.2-13 summarizes this process.

TABLE G.2-13
PBAPS PSA OECR

PDS	NUREG/CR-4551 PDS Frequencies	PBAPS PSA PDS Frequencies	Fractional Contribution of PDS to OECR	NUREG/CR-4551 PDS Contributions to OECR	Ratio of PDS Frequencies: PBAPS PSA to NUREG/CR-4551	PBAPS PSA OECR	PBAPS PSA PDS OECR for 2034 Population
1	1.50×10^{-7}	1.04×10^{-7}	0.02506	6.62×10^{2}	6.92×10^{-1}	4.59×10^{2}	1.83×10^{3}
2	1.79×10^{-7}	1.24×10^{-7}	0.01819	4.81×10^{2}	6.92×10^{-1}	3.33×10^{2}	1.33×10^{3}
3	2.65×10^{-9}	3.60×10^{-9}	0.00039	1.03×10^{1}	1.36	1.40×10^{1}	5.59×10^{1}
4	1.98×10^{-7}	1.91×10^{-7}	0.01751	4.63×10^{2}	9.62×10^{-1}	4.45×10^{2}	1.78×10^{3}
5	1.89×10^{-6}	8.33×10^{-7}	0.5701	1.51×10^{4}	4.41×10^{-1}	6.64×10^{3}	2.65×10^{4}
6	3.51×10^{-7}	2.79×10^{-7}	0.02247	5.94×10^{2}	7.95×10^{-1}	4.72×10^{2}	1.89×10^{3}
7	9.92×10^{-8}	1.06×10^{-7}	0.02115	5.59×10^{2}	1.07	5.96×10^{2}	2.38×10^{3}
8	1.40×10^{-6}	6.50×10^{-7}	0.31504	8.32×10^{3}	4.64×10^{-1}	3.87×10^{3}	1.54×10^{4}
9	1.50×10^{-7}	6.97×10^{-8}	0.01011	2.67×10^{2}	6.92×10^{-1}	1.24×10^{2}	4.96×10^{2}
							5.17×10^{4}

The PBAPS PSA OECR based on the assumed conditions at the end of the license extension in 2034 is $51,700.

G.3 COST-BENEFIT ANALYSIS

This sub-section explains how PBAPS calculated the monetary value of the status quo (i.e., accident consequences without SAMA implementation). PBAPS also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all PBAPS risk due to at-power internal events.

The cost-benefit analysis described in this section is performed on a site basis. A single unit is examined in the subsections below and the results are modified to account for the second unit. SAMA implementation costs, which are derived for use in the screening and detailed cost-benefit analyses, are also developed with the understanding that the SAMA would have to be implemented in each unit. The reason for performing the analysis on a site basis is that the implementation costs for modifications that affect both plants will be properly accounted for. For instance, a procedure enhancement is largely applicable to both units and the cost of its development is relevant to the site while installation of a unit specific piece of hardware should be doubled to account for its installation in both units. It is simply a means of maintaining expenditures on the same scale. The Unit 2

PSA model, which has the slightly higher base CDF of the two units, is used in the cost-risk calculations for the site.

The impact of a dual unit core damage scenario was examined as part of this study; however, a detailed Level 3 consequence analysis was not available for a simultaneous release from both units. A PSA sensitivity calculation was performed assuming the consequences of a dual unit core damage event are twice those of a single unit core damage event. Based on a review of the consequences associated with a factor of 2 increase in the source term releases presented in NUREG/CR-4551, this appears to be a conservative assumption. The results of the sensitivity analysis indicate that the consequences of a dual unit core damage event would have to be greater than twice those of a single unit core damage event to have any significant impact on the cost-benefit analysis of the proposed plant changes. Therefore, performance of a detailed dual unit core damage evaluation is not considered to be required as part of the SAMA analysis.

Offsite Exposure Cost

The baseline annual offsite exposure risk was converted to dollars using the NRC's conversion factor of $2,000 per person-rem (Ref. G.8-4, Section 5.7.1.2), and discounting to present value using the NRC standard formula (Ref. G.8-4, Section 5.7.1.3):

$$W_{pha} = C * Z_{pha}$$

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) = 0.07/year

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

The calculated value for C using 20 years and a 7 percent discount rate is 10.76. Therefore, calculating the discounted monetary equivalent of accident risk

involves multiplying the dose risk (14.72 person-rem per year) by $2,000 per person-rem and by the C value (10.76). The calculated offsite exposure cost is $316,945.

Offsite Economic Cost Risk

The baseline PBAPS PSA OECR is $51,700. This cost risk is an annual estimate based on the conditions present at the end of the license extension period. The baseline OECR must be discounted to present value as well in order to account for the entire license extension period. This is performed in the same manner as for public health risks and uses the same C value. The resulting estimate is $556,854.

Onsite Exposure Cost Risk

PBAPS evaluated occupational health using the NRC methodology in Ref. G.8-4, 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 equations that NRC recommends using (Ref. G.8-4, Sections 5.7.3 and 5.7.3.3) is:

Equation 1:

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

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 = superscript denoting after implementation of proposed action

r = real discount rate

t_f = years remaining until end of facility life.

The values used in the PBAPS analysis are:

R = $2,000/person-rem

r = 0.07/year

D_{IO} = 3,300 person-rem/accident (best estimate, from Ref. G.8.4, Section 5.7.3.1)

t_f = 20 years (license extension period)

F = 4.5E-6 (baseline CDF) events/year

For the basis discount rate, assuming F_A is zero, the best estimate of the immediate dose cost is:

$$W_{10} = R(FD_{IO})_S * \left\{\frac{[1 - \exp(-rt_f)]}{r}\right\}$$

$$= \quad 2000 * (4.5E-6 * 3{,}300) * \left\{\frac{[1 - \exp(-0.07 * 20)]}{0.07}\right\}$$

$$= \quad \$322$$

Long-Term Dose - For the case where the plant is in operation, the NRC equation (Ref. G.8-4, Sections 5.7.3 and 5.7.3.3) is:

Equation 2:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\} * \left\{\frac{[1 - \exp(-rt_f)]}{r}\right\} * \left\{\frac{[1 - \exp(-rm)]}{rm}\right\}$$

Where:

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

m = years over which long-term doses accrue

The values used in the PBAPS analysis are:

R = $2,000/person-rem

r = 0.07/year

D_{LTO} = 20,000 person-rem/accident (best estimate, Ref. G.8-4, Section 5.7.3.1)

m = 10 years (estimate)

t_f = 20 years (license extension period)

F = 4.5E-6 (baseline CDF) events/year

For the basis discount rate, assuming F_A is zero, the best estimate of the long-term dose is:

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

$$= 2000 * (4.5E-6 * 20{,}000) * \left\{\frac{[1-\exp(-0.07*20)]}{0.07}\right\} * \left\{\frac{[1-\exp(-0.07*10)]}{0.07*10}\right\}$$

= $1,403

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) based one unit's contribution to independent, single unit core damage is:

$$W_O = W_{IO} + W_{LTO} = (\$322 + \$1{,}403) = \$1{,}725$$

Onsite Cleanup and Decontamination Cost

The net present value that NRC provides for cleanup and decontamination for a single event is $1.1 billion, discounted over a 10-year cleanup period

(Ref. G.8-4, Section 5.7.6.1). NRC uses the following equation in integrating the net present value over the average number of remaining service years:

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

Where:

U_{CD} = Net present value of cost of cleanup and decontamination over the life of the facility

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 PBAPS analysis are:

PV_{CD} = \$1.1E9

r = 0.07/year

t_f = 20 years

The resulting net present value of cleanup integrated over the license renewal term, \$1.18E10 must be multiplied by the baseline CDF of 4.5E-6 to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is \$53,643.

Replacement Power Cost

Long-term replacement power costs was determined following the NRC methodology in Ref. G.8-4, Section 5.7.6.2. The net present value of replacement power for a single event, PV_{RP}, was determined using the following equation:

$$PV_{RP} = \left[\frac{\$1.2E8}{r}\right] * [1 - \exp(-rt_f)]^2$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($)

r = 0.07/year

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:

$$U_{RP} = \left[\frac{PV_{RP}}{r}\right] * [1 - \exp(-rt_f)]^2$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year)

After applying a correction factor to account for PBAPS size relative to the "generic" reactor described in NUREG/BR-0184 (i.e., 1159 MWe/910 MWe) and multiplying by 2 to account for the assumption that the remaining unit has to shut down after a core damage event, the replacement power costs are determined to be $2.01×10 ($-year). Multiplying this value by the baseline CDF ($4.5×10^{-6}$) results in a replacement power cost of $91,067.

Baseline Screening

The sum of the baseline costs for a single unit core damage event is as follows:

Offsite exposure cost = $316,945

Offsite economic cost = $556,854

Onsite exposure cost = $1,725

Onsite cleanup cost = $53,643

Replacement Power cost = $91,067

Total cost = $1,020,234

To account for the contribution from both units, this answer is multiplied by 2 to yield $2,040,468.

This combined cost estimate for both Peach Bottom units was used in screening out SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeded $2.04 million, it was 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. On the other hand, if the cost of implementation is less than this value, then a more detailed examination of the potential fractional risk benefit that can be attributed to the SAMA is performed.

G.4 PHASE I SAMA ANALYSIS: SAMA CANDIDATES AND SCREENING PROCESS

An initial list of 207 SAMA candidates was developed from lists of Severe Accident Mitigation Alternatives at other nuclear power plants (Refs. G.8-6, G.8-10, G.8-11, G.8-13, G.8-15, G.8-18, and G.8-19), NRC documents (Refs. G.8-5, G.8-8, G.8-9, G.8-12, G.8-14, G.8-21, and G.8-22), and documents related to advanced power reactor designs (ABWR SAMAs) (Refs. G.8-7, G.8-16, and G.8-17). Table G.4-1 provides this list. This initial list was then screened to remove those that were not applicable to Peach Bottom due to design differences. The SAMA screening process is summarized in Figure G.4-1.

TABLE G.4-1
PHASE I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
1	Cap downstream piping of normally closed component cooling water drain and vent valves.	1	SAMA would 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.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A
2	Enhance loss of component cooling procedure to facilitate stopping reactor coolant pumps.	2	SAMA would reduce the potential for reactor coolant pump (RCP) seal damage due to pump bearing failure.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A
3	Enhance loss of component cooling procedure to present desirability of cooling down reactor coolant system (RCS) prior to seal LOCA.	2	SAMA would reduce the potential for RCP seal failure.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
4	Provide additional training on the loss of component cooling.	2	SAMA would potentially improve the success rate of operator actions after a loss of component cooling (to restore RCP seal damage).	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A
5	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	1 2	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.	#1 - N/A	PWR issue. BWRs do not have charging pumps and seal LOCAs for other BWR pumps are not significant contributors to plant risk.	NUREG-1560	N/A
5A	Procedure changes to allow cross connection of motor cooling for RHRSW pumps.	12	SAMA would allow continued operation of both RHRSW pumps on a failure of one train of PSW.	#1 - N/A	The equivalent system at PBAPS to RHRSW is HPSW. HPSW does not depend on any other systems for cooling. HPSW takes suction directly from the Ultimate Heat Sink and the pump motors are self cooled.	PBAPS PRA	N/A
6	Proceduralize shedding component cooling water loads to extend component cooling heatup on loss of essential raw cooling water.	2	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.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
7	Increase charging pump lube oil capacity.	2	SAMA would lengthen the time before centrifugal charging pump failure due to lube oil.	#1 - N/A	PWR issue. BWRs do not have charging pumps and the potential equivalents, the CRD pumps, are not risk significant components.	NUREG-1560	N/A
8	Eliminate the RCP thermal barrier dependence on component cooling such that loss of component cooling does not result directly in core damage.	2	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.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A
9	Add redundant DC control power for PSW pumps C & D.	3	SAMA would increase reliability of PSW and decrease core damage frequency due to a loss of SW.	#1 - N/A	The equivalent system at PBAPS is the NSW. No NSW system dependencies on plant internal DC are identified in the PRA. The NSW depends on offsite AC only.	PBAPS PRA	N/A
10	Create an independent RCP seal injection system, with a dedicated diesel.	1	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.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
11	Use existing hydro-test pump for RCP seal injection.	4	SAMA would provide an independent seal injection source, without the cost of a new system.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs that do not rely on isolation condensers.	NUREG-1560	N/A
12	Replace ECCS pump motor with air-cooled motors.	1 14	SAMA would eliminate ECCS dependency on component cooling system (but not on room cooling).	#1 - N/A	PBAPS has evaluated this before and determined that this SAMA is not required.	Table 3.4-2 in Evaluation of Peach Bottom Accident Management Insights with Regards to BWROG EPG/SAG Strategies	N/A
13	Install improved RCS pumps seals.	1	SAMA would reduce probability of RCP seal LOCA by installing RCP seal O-ring constructed of improved materials	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.	NUREG-1560	N/A
14	Install additional component cooling water pump.	1	SAMA would reduce probability of loss of component cooling leading to RCP seal LOCA.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.	NUREG-1560	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
15	Prevent centrifugal charging pump flow diversion from the relief valves.	1	SAMA modification would reduce the frequency of the loss of RCP seal cooling if relief valve opening causes a flow diversion large enough to prevent RCP seal injection.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.	NUREG-1560	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.	1	SAMA would reduce CDF from loss of seal cooling.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.	NUREG-1560	N/A
17	Implement procedures to stagger high-pressure safety injection (HPSI) pump use after a loss of service water.	1	SAMA would allow HPSI to be extended after a loss of service water.	#1 - N/A	The approximate equivalent to HPSI in a BWR are the HPCI and RCIC systems; these do not directly depend on NSW/ESW/ECW cooling. Room cooling is provided by these service water systems, but RCIC and HPCI can operate without room cooling. Therefore, staggering their operation is not required.	1) PBAPS PRA 2) DBD No. P-T-13, Rev. 5, p. 57 3) SE-11 Bases, Rev. 11, p. 13	N/A
18	Use fire protection system pumps as a backup seal injection and high-pressure makeup.	1	SAMA would reduce the frequency of the RCP seal LOCA and the SBO CDF.	#1 - N/A	PWR RCP seal leakage issue. Although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to CDF in BWRs.	NUREG-1560	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
19	Enhance procedural guidance for use of cross-tied component cooling or service water pumps.	1 14	SAMA would reduce the frequency of the loss of component cooling water and service water.	Retain			1
20	Procedure enhancements and operator training in support system failure sequences, with emphasis on anticipating problems and coping.	1 2 14	SAMA would potentially improve the success rate of operator actions subsequent to support system failures.	#2 - Similar item is addressed under other proposed SAMAs.	See 19, 24, 54, 60, 61, 62, 67, 108		N/A
21	Improved ability to cool the residual heat removal heat exchangers.	1	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 cross-tie.	Retain			2
22	Provide reliable power to control building fans.	2	SAMA would increase availability of control room ventilation on a loss of power.	#3 - Already installed.	The CR HVAC system is designed with redundant active components and redundant Class 1E power supplies for the CR Fresh Air Supply System and the CR Emergency Ventilation Filter System.	DBD No. P-S-08B, Rev. 8	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
23	Provide a redundant train of ventilation.	1	SAMA would increase the availability of components dependent on room cooling.	#3 – Already installed	It has been determined that room cooling is not required for successful operation of RHR, LPCS, HPCI or RCIC at PBAPS (HPCI and RCIC are modeled such that failure of the gland seal condensers is required before room cooling is considered as a necessary support function). The only system with a true room cooling dependency at PBAPS is the Emergency AC power system. The EDG rooms require room cooling for success, but these rooms are already equipped with redundant fan trains.		N/A
24	Procedures for actions on loss of HVAC.	12 14	SAMA would provide for improved credit to be taken for loss of HVAC sequences (improved affected electrical equipment reliability upon a loss of control building HVAC).	#3 - Already installed.	1) No loss of HVAC initiating events are identified for PBAPS. 2) Loss of HVAC due to SBO is addressed. 3) Placing control room emergency ventilation in service is proceduralized.	1) PBAPS PRA 2) SE-11 procedure 3) SO 40D.7.B	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
25	Add a diesel building switchgear room high temperature alarm.	1 14	SAMA would improve diagnosis of a loss of switchgear room HVAC. Option 1: Install high temp alarm. Option 2: Redundant louver and thermostat	#1 - N/A	Diesel Generator ventilation supply fans start upon a diesel start and supply combustion air as well as ventilation for diesel support equipment within the diesel room. Electrical distribution equipment associated with diesel support equipment is located in open areas of the reactor building and is not subject to failure on loss of ventilation.	DBD No. P-S-07, Rev 12, p. 39	N/A
26	Create ability to switch fan power supply to DC in an SBO event.	1	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.	#1 - N/A	Equipment in the RCIC pump room has demonstrated operability for room temp up to 163F for 12 hrs. In SBO, 163F is not reached at 4 hrs. At 8 hrs, 163F is barely exceeded. Room cooling therefore not required during the mission time of RCIC.	DBD No. P-T-13, Rev. 5, p57	N/A
27	Delay containment spray actuation after large LOCA.	2 14	SAMA would lengthen time of RWST availability.	#1 - N/A	The RHR containment spray modes take suction from the suppression pool. The RWST volume is therefore not affected by containment spray. Capability exists to transfer water from the other unit's CST.	PBAPS PRA Procedures SE-11, SAMP-1, SAMP-2	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
28	Install containment spray pump header automatic throttle valves.	4 8	SAMA would extend the time over which water remains in the RWST, when full CS flow is not needed	#2 - Similar item is addressed under other proposed SAMAs.	See 27		N/A
29	Install an independent method of suppression pool cooling.	5 6	SAMA would decrease the probability of loss of containment heat removal.	Retain			3
30	Develop an enhanced drywell spray system.	5 6 14	SAMA would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	#3 - Already installed.	The HPSW system take suction from the Conowingo Pond and can discharge to the RPV or containment sprays via the RHR system.	PBAPS PRA Procedures T-245, T-205	N/A
31	Provide dedicated existing drywell spray system.	5 6	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.	#3 - Already installed.	The drywell spray function is integral to the RHR system. Procedure T-204-2 provides instructions for manual initiation of the Containment Spray Mode of RHR.	PBAPS PRA. Procedure T-204-2	N/A
32	Install an unfiltered hardened containment vent.	5 6 14	SAMA would provide an alternate decay heat removal method for non-ATWS events, with the released fission products not being scrubbed.	#3 - Already installed.	The hardened (pipe) vent, added to comply with Generic Letter 89-16, is installed between Torus valves AO-7C-2511 and AO-7C-2512, and includes a rupture disc (set at 30 psig).	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
33	Install a filtered containment vent to remove decay heat.	5 6	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	Retain	1) Hardened vent is filtered via the SP	2) A filter-like system could be added	4
34	Install a containment vent large enough to remove ATWS decay heat.	5 6	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	Retain	Add large vent capability		5
35	Create/enhance hydrogen recombiners with independent power supply.	5 11	SAMA would reduce hydrogen detonation at lower cost, Use either 1) a new independent power supply 2) a nonsafety-grade portable generator 3) existing station batteries 4) existing AC/DC independent power supplies.	#1 - N/A	The PBAPS primary containment is inert. The CAD system is designed to control the O2 and H2 concentrations by venting and purging with nitrogen. Hydrogen recombiners have limited capability for conditions with high hydrogen.	PBAPS Level 2 PRA	N/A
35A	Install hydrogen recombiners.	11	SAMA would provide a means to reduce the chance of hydrogen detonation.	#1 - N/A	The PBAPS primary containment is inert. The CAD system is designed to control the O2 and H2 concentrations by venting and purging with nitrogen. Hydrogen recombiners have limited capability for conditions with high hydrogen.	PBAPS Level 2 PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
36	Create a passive design hydrogen ignition system.	4	SAMA would reduce hydrogen denotation system without requiring electric power.	#1 - N/A	The PBAPS primary containment is inert. The CAD system is designed to control the O2 and H2 concentrations by venting and purging with nitrogen. Hydrogen recombiners have limited capability for conditions with high hydrogen.	PBAPS Level 2 PRA	N/A
37	Create a large concrete crucible with heat removal potential under the basemat to contain molten core debris.	5 6	SAMA would ensure that molten core debris escaping from the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt-through of the basemat.	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 (averted cost-risk) compared to an estimated implementation cost of over $1 million (per unit).	Supplement 2 to NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, December 1999 for Oconee Nuclear Station, and IDCOR Technical Summary Report, November 1984	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
38	Create a water-cooled rubble bed on the pedestal.	5 6	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled.	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 (averted cost-risk) compared to an estimated implementation cost of over $1 million (per unit).	Supplement 2 to NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, December 1999 for Oconee Nuclear Station, and IDCOR Technical Summary Report, November 1984	N/A
39	Provide modification for flooding the drywell head.	5 6	SAMA would help mitigate accidents that result in the leakage through the drywell head seal.	#1 - N/A	BWR Mark I risk is typically dominated by events that result in early failure of the drywell shell due to direct contact with core debris and events that bypass the containment. This is also true at Peach Bottom. The head flooding system would, therefore, not be expected to have any significant impact on the overall risk.	Results of Mark I plant IPEs and NUREG-1150	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
40	Enhance fire protection system and/or standby gas treatment system hardware and procedures.	6	SAMA would improve fission product scrubbing in severe accidents.	#1 - N/A	Current Fire Protection and Standby Gas Treatment Systems do not have sufficient capacity to handle the loads from severe accidents that result in a bypass or breach of the containment. Loads produced as a result of RPV or containment blowdown would require large filtering capacities. These filtered vented systems have been previously investigated and found not to provide sufficient cost benefit.	IDCOR Technical Summary Report, November 1984	N/A
41	Create a reactor cavity flooding system.	1 3 7 8 14	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	#3 - Already installed.	Flooding of the PBAPS containment (incl. reactor cavity) is proceduralized in the EOPs. In addition to the normal injection sources, HPSW, Condensate Transfer, Refueling Water Transfer, Fire and SBLC can be used.	Alternate Injection Sources PBAPS Level II PRA System Notebook	N/A
42	Create other options for reactor cavity flooding.	1 14	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	#3 - Already installed.	Flooding of the PBAPS containment (incl. reactor cavity) is proceduralized in the EOPs. In addition to the normal injection sources, HPSW, Condensate Transfer, Refueling Water Transfer, Fire and SBLC can be used.	Alternate Injection Sources PBAPS Level II PRA System Notebook	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
43	Enhance air return fans (ice condenser plants).	1	SAMA would provide an independent power supply for the air return fans, reducing containment failure in SBO sequences.	#1 - N/A	PBAPS is not an ice-condenser plant	PBAPS PRA	N/A
44	Create a core melt source reduction system.	9	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 form the vitrified compound would be facilitated, and concrete attack would not occur	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 compared to an estimated implementation cost of over $1 million.	Supplement 2 to NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, December 1999 for Oconee Nuclear Station, and IDCOR Technical Summary Report, November 1984	N/A
45	Provide a containment inerting capability.	7 8	SAMA would prevent combustion of hydrogen and carbon monoxide gases.	#3 - Already installed.	Containment is inerted with nitrogen during normal operation. CAD system also available.	PBAPS Level 2 PRA	N/A
46	Use the fire protection system as a backup source for the containment spray system.	4	SAMA would provide redundant containment spray function without the cost of installing a new system.	Retain			6

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
47	Install a secondary containment filter vent.	10	SAMA would filter fission products released from primary containment.	#3 - Already installed.	Standby Gas Treatment System inlet can connect the reactor building refueling floor ventilation exhaust duct.	PBAPS Level 2 PRA	N/A
48	Install a passive containment spray system.	10	SAMA would provide redundant containment spray method without high cost.	Retain			7
49	Strengthen primary/secondary containment.	10 11	SAMA would reduce the probability of containment overpressurization to failure.	#5 - Cost would be more than risk benefit	BWR Mark I risk is typically dominated by events that result in early failure of the drywell shell due to direct contact with core debris and events that bypass the containment. Strengthening the primary /secondary containment would have a small impact on the overall risk of these accidents. In addition, the estimated implementation cost would be over $1 million/site.	Results of Mark I plant IPEs and NUREG-1150	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
50	Increase the depth of the concrete basemat or use an alternative concrete material to ensure melt-through does not occur.	11	SAMA would prevent basemat melt-through.	#5 - Cost would be more than risk benefit	Core retention devices have been investigated in previous studies. IDCOR concluded that "core retention devices are not effective risk reduction devices for degraded core events". Other evaluations have shown the worth value for a core retention device to be on the order of $7000 compared to an estimated implementation cost of over $1 million/site.	Supplement 2 to NUREG-1437, Generic Environmental Impact Statement for License renewal of Nuclear Plants, December 1999 for Oconee Nuclear Station, and IDCOR Technical Summary Report, November 1984	N/A
51	Provide a reactor vessel exterior cooling system.	11	SAMA would provide the potential to cool a molten core before it causes vessel failure, if the lower head could be submerged in water.	#2 - Similar item is addressed under other proposed SAMAs.	See 41		N/A
52	Construct a building to be connected to primary/secondary containment that is maintained at a vacuum.	11	SAMA would provide a method to depressurize containment and reduce fission product release.	Retain			8
53	Not used.	N/A	N/A	N/A	#N/A	N/A	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
54	Proceduralize alignment of spare diesel to shutdown board after loss of offsite power and failure of the diesel normally supplying it.	1 3 7	SAMA would reduce the SBO frequency.	Retain	Install spare D/G (See 56)		9
55	Not used.	N/A	N/A	N/A	#N/A	N/A	N/A
56	Provide an additional diesel generator.	1 3 7 11 14	SAMA would increase the reliability and availability of onsite emergency AC power sources.	Retain	Install spare D/G		10
57	Provide additional DC battery capacity.	1 3 7 11 12	SAMA would ensure longer battery capability during an SBO, reducing the frequency of long-term SBO sequences.	Retain	Providing additional DC battery capacity could extend HPCI/RCIC operability and allow more credit for AC power recovery. This would decrease the frequency of core damage and offsite releases.	PBAPS PRA	11
58	Use fuel cells instead of lead-acid batteries.	11	SAMA would extend DC power availability in an SBO.	Retain			12
59	Procedure to cross-tie high-pressure core spray diesel.	1	SAMA would improve core injection availability by providing a more reliable power supply for the high-pressure core spray pumps.	#1 - N/A	PBAPS does not have a high-pressure core spray system. The HPCI (equivalent system) is turbine driven.	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
60	Improve 4.16-kV bus cross-tie ability.	1 14	SAMA would improve AC power reliability.	#3 - Already installed.	Enhancements were made to procedure SE-11 to cross-tie 4kV buses that consider all permutations of diesel generators failures.	SE-11 Evaluation of Peach Bottom Accident Management Insights with Regards to BWROG EPG/SAG Strategies	N/A
61	Incorporate an alternate battery charging capability.	1 8 9 14	SAMA would improve DC power reliability by either cross-tying the AC busses, or installing a portable diesel-driven battery charger.	#3 - Already installed.	Cross-tying of electrical buses, allowing chargers to be supplied from other divisions are proceduralized. Specific direction is given to supply power to all battery chargers. Procedural and hardware enhancements maybe pursued to allow use of portable battery chargers, but is not crucial considering the extensive cross-tie capability.	SE-11	N/A
62	Increase/improve DC bus load shedding.	1 8 14	SAMA would extend battery life in an SBO event.	#3 - Already installed.	Plant DC load shedding procedures have been enhanced to increase the probability of successful load shed during SBO conditions.		N/A
63	Replace existing batteries with more reliable ones.	11 14	SAMA would improve DC power reliability and thus increase available SBO recovery time.	#3 - Already installed.	Reliable batteries are already installed.	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
63A	Mod for DC Bus A reliability.	1	SAMA would increase the reliability of AC power and injection capability. 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.	#1 - N/A	PBAPS Unit 2 has 4 125V DC and 2 250V DC buses. No loss of a single DC bus leads to loss of condenser. Transfer from main transformer to offsite power also not affected.	PBAPS PRA	N/A
64	Create AC power cross-tie capability with other unit.	1 8 9 14	SAMA would improve AC power reliability.	#3 - Already installed.	Procedure SE-11 describes cross-tying 4 kV buses to feed equipment from various 4 kV buses with other diesel generators if the normal diesel generator(s) fails		N/A
65	Create a cross-tie for diesel fuel oil.	1	SAMA would increase diesel fuel oil supply and thus diesel generator, reliability.	#3 - Already installed.	Each of the 4 diesel fuel oil storage tanks can be supplied from 2 other diesel fuel storage tanks.	Procedure AO 52D-1, Rev. 5	N/A
66	Develop procedures to repair or replace failed 4-kV breakers.	1	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16-kV non-emergency busses from unit station service transformers, leading to loss of emergency AC power.	Retain			13

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
67	Emphasize steps in recovery of offsite power after an SBO.	1 14	SAMA would reduce human error probability during offsite power recovery.	#3 - Already implemented.	Restoring power from offsite sources after SBO is proceduralized. Numerous procedural enhancements have been implemented for offsite AC power recovery and to cross-tie AC busses.	SO 53.7.G AO 50F.2-2(3) SE-11 Attachment Z	N/A
68	Develop a severe weather conditions procedure.	1 13	For plants that do not already have one, this SAMA would reduce the CDF for external weather-related events.	#3 - Already implemented.	PREPARATION FOR SEVERE WEATHER guideline provides the station with items to be considered in the event severe weather is forecasted to impact Peach Bottom.	Procedure AG-108, Rev. 4	N/A
69	Develop procedures for replenishing diesel fuel oil.	1	SAMA would allow for long-term diesel operation.	#3 - Already implemented.	Instructions are provided to fill a Diesel Fuel Oil Storage Tank from a fuel oil delivery truck.	SO 52D.3.A	N/A
70	Install gas turbine generator.	1 14	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	Retain			14
71	Not used.	N/A	N/A	N/A	#N/A	N/A	N/A
72	Create a backup source for diesel cooling. (Not from existing system)	1	This SAMA would provide a redundant and diverse source of cooling for the diesel generators, which would contribute to enhanced diesel reliability.	#3 - Already installed.	The ECW pump provides back-up to the ESW system that cools the diesel generators. Each pump (ESW A, ESW B, and the ECW pump are 100% capacity pumps).	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
73	Use fire protection system as a backup source for diesel cooling.	1	This SAMA would provide a redundant and diverse source of cooling for the diesel generators, which would contribute to enhanced diesel reliability.	#2 - Similar item is addressed under other proposed SAMAs.	See 72		N/A
74	Provide a connection to an alternate source of offsite power.	1	SAMA would reduce the probability of a loss of offsite power event.	#3 - Already installed.	The Station Blackout line from Conowingo can provide power to all eight 4 kV buses for the various station blackout scenarios.	PBAPS PRA	N/A
75	Bury offsite power lines.	1	SAMA could improve offsite power reliability, particularly during severe weather.	#3 - Already installed.	The Conowingo tie-line is buried under the river bed from the dam's switchyard to the transformer on the PBAPS site.	DBD No. P-T-13, Revision 6, p. 43	N/A
76	Replace anchor bolts on diesel generator oil cooler.	1	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.	#3 - Already installed.	DGs are Colt Industries Units. An A-46 anchorage evaluation was performed which demonstrated that the anchorage was acceptable.	PBAPS IPEEE	N/A
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.	1	SAMA would reduce risk of 2/4 inverter failure.	#1 - N/A	PWR issue. N/A to BWR		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
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.	12	SAMA would increase the reliability of the 120-VAC Bus.	#4 - No significant safety benefit	1) Loss of 120V AC is not an Initiating Event 2) 120 VAC is not a risk significant support system	PBAPS PRA	N/A
79	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture (SGTR).	1	SAMA would enhance depressurization during a SGTR.	#1 - N/A	PWR issue. N/A to BWR		N/A
80	Improve SGTR coping abilities.	1 4 11	SAMA would improve instrumentation to detect SGTR, or additional system to scrub fission product releases.	#1 - N/A	PWR issue. N/A to BWR		N/A
81	Add other SGTR coping abilities.	4 10 11	SAMA would decrease the consequences of an SGTR.	#1 - N/A	PWR issue. N/A to BWR		N/A
82	Increase secondary side pressure capacity such that an SGTR would not cause the relief valves to lift.	10 11	SAMA would eliminate direct release pathway for SGTR sequences.	#1 - N/A	PWR issue. N/A to BWR		N/A
83	Replace steam generators (SG) with a new design.	1	SAMA would lower the frequency of an SGTR.	#1 - N/A	PWR issue. N/A to BWR		N/A
84	Revise emergency operating procedures to direct that a faulted SG be isolated.	1	SAMA would reduce the consequences of an SGTR.	#1 - N/A	PWR issue. N/A to BWR		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
85	Direct SG flooding after a SGTR, prior to core damage.	10	SAMA would provide for improved scrubbing of SGTR releases.	#1 - N/A	PWR issue. N/A to BWR		N/A
86	Implement a maintenance practice that inspects 100% of the tubes in a SG.	11	SAMA would reduce the potential for an SGTR.	#1 - N/A	PWR issue. N/A to BWR		N/A
87	Locate residual heat removal (RHR) inside of containment.	10	SAMA would prevent intersystem LOCA (ISLOCA) out the RHR pathway.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A
88	Not used.	N/A	N/A	N/A	#N/A	N/A	N/A
89	Install additional instrumentation for ISLOCAs.	3 4 7 8	SAMA would decrease ISLOCA frequency by installing pressure of leak monitoring instruments in between the first two pressure isolation valves on low-pressure inject lines, RHR suction lines, and HPSI lines.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A
90	Increase frequency for valve leak testing.	1	SAMA could reduce ISLOCA frequency.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
91	Improve operator training on ISLOCA coping.	1	SAMA would decrease ISLOCA effects.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A
92	Install relief valves in the CC System.	1	SAMA would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	#1 - N/A	PWR issue. N/A to BWR	IN-92-36, and its additional supplement	N/A
93	Provide leak testing of valves in ISLOCA paths.	1	SAMA would help reduce ISLOCA frequency. At Kewaunee Nuclear Power Plant, four MOVs isolating RHR from the RCS were not leak tested.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A
94	Revise EOPs to improve ISLOCA identification.	1	SAMA would ensure LOCA outside containment could be identified as such. 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.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
95	Ensure all ISLOCA releases are scrubbed.	1	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.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A
96	Add redundant and diverse limit switches to each containment isolation valve.	1	SAMA could reduce the frequency of containment isolation failure and ISLOCAs through enhanced isolation valve position indication.	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A
97	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	1	SAMA would prevent flood propagation, for a plant where internal flooding from turbine building to safeguards areas is a concern.	#4 - No significant safety benefit	Flooding from Turbine Hall into adjacent buildings considered to have negligible impact.	PBAPS Internal Flooding Analysis in PRA	N/A
98	Improve inspection of rubber expansion joints on main condenser.	1 14	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.	#4 - No significant safety benefit	PBAPS has evaluated this before and determined that no additional action would be beneficial in reducing the frequency.	Evaluation of Peach Bottom Accident Management Insights with Regards to BWROG EPG/SAG Strategies	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
99	Implement internal flood prevention and mitigation enhancements.	1	This SAMA would reduce the consequences of internal flooding.	#4 - No significant safety benefit	The total core damage frequency attributable to internal flooding for each Unit is 9E-08 per year. PBAPS is extremely flood resistant for all safety related and ECCS equipment, as shown by the extremely low core damage frequencies	PBAPS Internal Flooding Analysis in PRA	N/A
100	Implement internal flooding improvements such as those implemented at Fort Calhoun.	1	This SAMA would reduce flooding risk by preventing or mitigating rupture in the RCP seal cooler of the component cooling systeman ISLOCA in a shutdown cooling line, an auxiliary feedwater (AFW) flood involving the need to remove a watertight door.	#1 - N/A	PWR issue. N/A to BWR		N/A
101	Install a digital feedwater upgrade.	1	This SAMA would reduce the chance of a loss of main feedwater following a plant trip.	#3 - Already installed.	Already installed at Peach Bottom.	PBAPS PRA Section 5	N/A
102	Perform surveillances on manual valves used for backup AFW pump suction.	1	This SAMA would improve success probability for providing alternative water supply to the AFW pumps.	#1 - N/A	PWR issue. N/A to BWR		N/A
103	Install manual isolation valves around AFW turbine-driven steam admission valves.	1	This SAMA would reduce the dual turbine-driven AFW pump maintenance unavailability.	#1 - N/A	PWR issue. N/A to BWR		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
104	Install accumulators for turbine-driven AFW pump flow control valves (CVs).	4 8	This SAMA would provide control air accumulators for the turbine-driven AFW flow CVs, the motor-driven AFW pressure CVs and SG power-operated relief valves (PORVs). This would eliminate the need for local manual action to align nitrogen bottles for control air during a LOOP.	#1 - N/A	PWR issue. N/A to BWR		N/A
105	Proceduralize intermittent operation of HPCI.	1	SAMA would allow for extended duration of HPCI availability.	Retain	HPCI can normally be shut down within 10 minutes after a LOOP and reactor scram, if RCIC can maintain level.	SE-11 BASES Rev.11 p.13	15
106	Increase the reliability of safety relief valves by adding signals to open them automatically.	12	SAMA reduces the probability of a certain type of medium break LOCA. Hatch evaluated 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.	#4 - No significant safety benefit	The Medium LOCA frequency is 4.8E-05. The MSIV closure freq is 5.51E-2 per year. SRV common cause failure to open freq is 1.12E-6. Total contribution to LOCA is therefore 6.17E-8 or 0.1%, which is insignificant.		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
107	Install motor-driven feedwater pump.	1 12	SAMA would increase the availability of injection subsequent to MSIV closure.	Retain	PBAPS has 3 turbine driven feedwater pumps. This SAMA would increase high pressure make-up capability for scenarios where re-opening of the MSIVs is either not desirable or not proceduralized.		16
108	Enhance procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	12	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.	Retain			17
109	Increase available net positive suction head (NPSH) for injection pumps.	1	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.	#3 - Already installed.	NPSH available can be increased by 1) increasing the levels in the CST and torus. 2) Containment pressure venting 3) Quality of water 4) Cue 5) Temperature. HPSW can be used to inject into the torus. CST can make-up to the torus and vice versa.	T-231-2 T-230-2 T-233-2	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
110	Increase the safety relief valve (SRV) reseat reliability.	1	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after standby liquid control (SLC) injection.	Retain			18
111	Reduce DC dependency between high-pressure injection system and ADS.	1	SAMA would ensure containment depressurization and high-pressure injection upon a DC failure.	#3 - Already installed.	ADS requires either 125 V DC Bus 20D21 or 125 V DC Bus 20D24. RCIC requires 125 V DC Bus 20D21 and bus 20D23. HPCI requires 125 V DC Bus 20D22 and 20D24. Loss of a single DC Bus can not disable ADS AND high pressure make-up systems.		N/A
112	Modify Reactor Water Cleanup (RWCU) for use as a decay heat removal system and proceduralize use.	1	SAMA would provide an additional source of decay heat removal.	Retain	Proceduralizing the use of RWCU as a decay heat removal system could be cost-effective. However, RWCU heat removal capacity may be low.		19
113	Use control rod drive (CRD) for alternate boron injection.	1 14	SAMA provides an additional system to address ATWS with SLC failure or unavailability.	#3 - Already installed.	The CRD can be aligned to take suction from the SBLC tank to allow for alternate boron injection into the RPV.	Procedure T-210-2	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
114	Increase seismic ruggedness of plant components.	11 13 14	SAMA would increase the availability of necessary plant equipment during and after seismic events.	#3 - Already installed.	Many components were identified in the IPEEE and SQUG programs whose seismic ruggedness could be improved. These items have been addressed in response to those efforts and satisfy the intent of this SAMA.	Evaluation of Peach Bottom Accident Management Insights	N/A
115	Allow cross connection of uninterruptable compressed air supply to opposite unit.	12 13	SAMA would increase the ability to vent containment using the hardened vent.	#3 - Already installed.	Vent depends on Instrument Air that can be cross-tied to other unit.	PBAPS PRA	N/A
116	Enhance RPV depressurization capability	14 15	SAMA would decrease the likelihood of core damage in loss of high pressure coolant injection scenarios	#3 - Already installed.	At PBAPS all SRVs have two redundant 125 VDC power supplies. The ADS nitrogen supply valves are powered from emergency buses. The ADS nitrogen supply is backed by bottles and an outside connection for long term nitrogen supply.	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
117	Enhance RPV depressurization procedures	14 15	SAMA would decrease the likelihood of core damage in loss of high pressure coolant injection scenarios	#3 - Already installed.	Both the EOP TRIP and SAMP procedures recognize the benefit of depressurization and referencing the procedures for system backups: SO 16A.7.A, Backup N2 to ADS GP-8E, N2 Isolation Bypass T-261, CAD Tank Backup to N2 In addition, the LOOP SE-11 procedure recognizes the need to provide emergency power to the ADS valves.	Evaluation of Peach Bottom Accident Management Insights	N/A
118	Bypass MSIV isolation in Turbine Trip ATWS scenarios	14	SAMA will afford operators more time to perform actions. The discharge of a substantial fraction of steam to the main condenser (i.e., as opposed to into the primary containment) affords the operator more time to perform actions (e.g., SLC injection, lower water level, depressurize RPV) than if the main condenser was unavailable, resulting in lower human error probabilities	#3 - Already installed.	BWROG EPC Issue 98-07 addresses this issue. The bypass of the MSIV isolation was moved upward in the flowchart. PBAPS implementation has followed the BWROG recommendation in placement of this step	Evaluation of Peach Bottom Accident Management Insights	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
119	Enhance operator actions during ATWS	14	SAMA will reduce human error probabilities during ATWS	#3 - Already installed.	Operator actions during ATWS scenarios are clearly directed in the EOP TRIP procedures and receive attention in training.	Evaluation of Peach Bottom Accident Management Insights	N/A
120	Refill CST	14 16	SAMA would reduce the risk of core damage during events such as extended station blackouts or LOCAs which render the suppression pool unavailable as an injection source due to heat up.	#3 - Already installed.	Capability exists to transfer water from the RWST or other unit's CST to the affected unit's CST. This is proceduralized in the Loss of Offsite Power Procedure SE-11. It has also been added to SAMP-1, Sheet 1 at RPC/F1.1.	Evaluation of Peach Bottom Accident Management Insights	N/A
121	Maintain ECCS suction on CST	14 16	SAMA would maintain suction on the CST as long as possible to avoid pump failure as a result of high suppression pool temperature	#3 - Already installed.	Swap to/from CST source is procedurally directed.	Evaluation of Peach Bottom Accident Management Insights	N/A
122	Early detection and mitigation of ISLOCA	14 16	SAMA would limit the effects of ISLOCA accidents by early detection and isolation	#4 - No significant safety benefit	Related to mitigation of an ISLOCA. Per IN-92-36, and its additional supplement, ISLOCA contributes little risk for BWRs, because of the lower primary system pressures.	IN-92-36, and its additional supplement	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
123	CRD Injection	14 16	SAMA would supply an additional method of level restoration by using a non-safety system.	#3 - Already installed.	Maximization of CRD is covered in the existing EOPs which appropriately refer to T-246 for detailed directions. In addition, for LOOP events, procedure SE-11, Attachment W provides guidance regarding alignment of cooling to maintain CRD availability.	Evaluation of Peach Bottom Accident Management Insights	N/A
124	Condensate Pumps for Injection	14 16	SAMA to provide an additional option for coolant injection when other systems are unavailable or inadequate	#3 - Already installed.	The use of condensate is covered in existing EOPs and in training.	Evaluation of Peach Bottom Accident Management Insights	N/A
125	Align EDG to CRD	14 16	SAMA to provide power to an additional injection source during loss of power events	#3 - Already installed.	CRD pumps at PBAPS are normally fed from diesel-backed emergency 4 kV buses.	Evaluation of Peach Bottom Accident Management Insights	N/A
126	Guard against SLC dilution	14 16	SAMA to control vessel injection to prevent boron loss or dilution following SLC injection.	#3 - Already installed.	SLC initiation and existing procedures guard against dilution (RWCU isolation and overfill prevention).	Evaluation of Peach Bottom Accident Management Insights	N/A
127	Re-open MSIVs	14 16	SAMA to regain the main condenser as a heat sink by re-opening the MSIVs.	#3 - Already installed. (also see 118)	Existing EOPs direct this including bypass of low level interlocks as necessary.	Evaluation of Peach Bottom Accident Management Insights	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
128	Bypass RCIC Turbine Exhaust Pressure Trip	14 16	SAMA would allow RCIC to operate longer.	#4 - No significant safety benefit	Peach Bottom does not have procedures in-place for bypassing the exhaust trip. Bypassing the protective trip or changing the setting could be detrimental and result in the need for constant operator vigilance and dependence on the adequacy of existing instrumentation. In any event, the RCIC turbine exhaust pressure trip is sufficiently high (50 psig) such that it will not be reached for most accident types until many hours (10 - 20). As such, the benefit of such a procedure in reducing plant risk is minimal.	Evaluation of Peach Bottom Accident Management Insights	N/A
129	Bypass Diesel Generator Trips	14 16	SAMA would allow D/Gs to operate for longer.	#3 - Already installed.	Many trips are automatically bypassed on "LOCA start" of diesel. In addition, SE-11 covers troubleshooting of diesel trips and provides guidance on resetting trips and restarting EDGs.	Evaluation of Peach Bottom Accident Management Insights	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
130	Shield electrical equipment from potential water spray	14	SAMA would decrease risk associated with seismically induced internal flooding	#3 - Already installed.	A modification was identified for installation of a drip shield to protect inverter 20D37 from inadvertent spray. No additional modifications to EPGs/SAGs or other plant procedures (or equipment) are judged necessary.	Evaluation of Peach Bottom Accident Management Insights	N/A
131	Replace mercury switches on fire protection systems	14	SAMA would decrease probability of spurious fire suppression system actuation given a seismic event+D114	#3 - Already installed.	The U2 and U3 Reactor Building Water Curtain system manual pull stations have been replaced by manually operated switches. Based on IPEEE insights.	Evaluation of Peach Bottom Accident Management Insights	N/A
132	Provide additional restraints for CO_2 tanks	14	SAMA would increase availability of fire protection given a seismic event.	#3 - Already installed.	Modifications to provide additional restraints for CO_2 tanks 00S101, 20S101, 30S101, and 20S112 have been performed. Based on IPEEE insights.	Evaluation of Peach Bottom Accident Management Insights	N/A
133	Enhance control of transient combustibles	14	SAMA would minimize risk associated with important fire areas.	#3 - Already installed.	Procedures to control the transportation of combustible material are in place at Peach Bottom. Based on IPEEE insights.	Evaluation of Peach Bottom Accident Management Insights	N/A
134	Enhance fire brigade awareness	14	SAMA would minimize risk associated with important fire areas.	#3 - Already installed.	Fire brigade awareness is in place at Peach Bottom. Based on IPEEE insights.	Evaluation of Peach Bottom Accident Management Insights	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
135	Upgrade fire compartment barriers	14	SAMA would minimize risk associated with important fire areas.	#3 - Already installed.	PBAPS fire compartment barriers have been improved to reduce fire propagation. Based on IPEEE insights.	Evaluation of Peach Bottom Accident Management Insights	N/A
136	Enhance procedures to allow specific operator actions	14	SAMA would minimize risk associated with important fire areas.	#3 - Already installed.	Peach Bottom procedures have been enhanced. Based on IPEEE insights.	Evaluation of Peach Bottom Accident Management Insights	N/A
137	Develop procedures for transportation and nearby facility accidents	14	SAMA would minimize risk associated with transportation and nearby facility accidents.	#4 - No significant safety benefit	Creations of Special Event procedures to address these hazards may be pursued but are currently not judged necessary given the calculated low risk impact. As such, no modifications to the EPGs/SAGs or other plant procedures (or equipment) are judged necessary to address this insight	Evaluation of Peach Bottom Accident Management Insights	N/A
138	Enhance procedures to mitigate Large LOCA	14	SAMA would minimize risk associated with Large LOCA	#3 - Already implemented.	SAMP-1 (SH 2,3, 4 and 5) have incorporated EPG/SAG actions to use external water sources for mitigation. This will provide the best potential mitigation.	Evaluation of Peach Bottom Accident Management Insights	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
139	Modify containment flooding procedure to restrict flooding to below TAF	14	SAMA would avoid forcing containment venting	#3 - Already implemented.	PECO has drafted and instituted first revisions of the PBAPS Severe Accident Management Procedures (SAMPs) and Technical Support Guidelines (TSGs) (and have revised the EPG based TRIP procedures). These issues are now appropriately considered and addressed at PBAPS	Evaluation of Peach Bottom Accident Management Insights	N/A
140	Enhance containment venting procedures with respect to timing, path selection and technique.	14	SAMA would improve likelihood of successful venting strategies.	#3 - Already implemented.	PECO has drafted and instituted first revisions of the PBAPS Severe Accident Management Procedures (SAMPs) and Technical Support Guidelines (TSGs) (and have revised the EPG based TRIP procedures). These issues are now appropriately considered and addressed at PBAPS	Evaluation of Peach Bottom Accident Management Insights	N/A
141	1.a. Severe Accident EPGs/AMGs	17	SAMA would lead to improved arrest of core melt progress and prevention of containment failure	#3 - Already implemented.	Latest revision of SAGs implemented. Also, additional procedural items addressed in other specific SAMAs (e.g., 20, 42).	PBAPS EOPs/SAMGs	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
142	1.b. Computer Aided Instrumentation	17	SAMA will improve prevention of core melt sequences by making operator actions more reliable.	#5 - ABWR Design Issue; not practical.	This is a SAMA which was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating. Also, see Table 6 and Section A.4.1.2 of Reference 17.	GE ABWR SAMDAs	N/A
143	1.c/d. Improved Maintenance Procedures/Manuals	17	SAMA will improve prevention of core melt sequences by increasing reliability of important equipment	#3 - Already implemented.	See Table 6 and Section A.4.1.3 of ABWR SAMDAs. Maintenance rule practices have helped evolve the performance of maintenance activities and have improved procedures and training.	GE ABWR SAMDAs	N/A
144	Not used	N/A	N/A	N/A	#N/A	N/A	N/A
145	1.e. Improved Accident Management Instrumentation	17	SAMA will improve prevention of core melt sequences by making operator actions more reliable.	#2 - Similar item is addressed under other proposed SAMAs.	Part of 142		N/A
146	1.f. Remote Shutdown Station	17	This SAMA would allow alternate system control in the event that the control room becomes uninhabitable.	#3 - Already implemented.	PBAPS already has a remote shutdown station.	PBAPS PRA	N/A
147	1.g. Security System	17	This SAMA would reduce the potential for sabotage.	#3 - Already implemented.	Electronic safety measures and trained security personnel provide surveillance for the PBAPS site.		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
148	1.h. Simulator Training for Severe Accident	17	SAMA would lead to improved arrest of core melt progress and prevention of containment failure	#2 - Similar item is addressed under other proposed SAMAs.	Training provided as part of 141		N/A
149	2.a. Passive High Pressure System	17	SAMA will improve prevention of core melt sequences by providing additional high pressure capability to remove decay heat through an isolation condenser type system	Retain	See Table 6 and Section A.4.2.1 of ABWR SAMDAs.		20
150	2.b. Improved Depressurization	17	SAMA will improve depressurization system to allow more reliable access to low pressure systems.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed in SAMAs 106, 116 and 117		N/A
151	2.c. Suppression Pool Jockey Pump	17	SAMA will improve prevention of core melt sequences by providing a small makeup pump to provide low pressure decay heat removal from the RPV using the suppression pool as a source of water.	Retain	Section A.4.2.3 - Similar to firewater injection and spray capability (#46), but it would have the advantage that long term containment inventory concerns would not occur.		21
152	2.d. Improved High Pressure Systems	17	SAMA will improve prevention of core melt sequences by improving reliability of high pressure capability to remove decay heat.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed in SAMA 107		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
153	2.e. Additional Active High Pressure System	17	SAMA will improve reliability of high pressure decay heat removal by adding an additional system.	Retain			22
154	2.f. Improved Low Pressure System (Firepump)	17	SAMA would provide fire protection system pump(s) for use in low pressure scenarios.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed in SAMA 46		N/A
155	2.g. Dedicated Suppression Pool Cooling	17	SAMA would decrease the probability of loss of containment heat removal.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 29		N/A
156	2.h. Safety Related Condensate Storage Tank	17	SAMA will improve availability of CST following a Seismic event	Retain	See Table 6 and Section A.4.2.4 of ABWR SAMDAs.		23
157	2.i. 16 hour Station Blackout Injection	17	SAMA includes improved capability to cope with longer station blackout scenarios.	#2 - Similar item is addressed under other proposed SAMAs.	Part of 197		N/A
158	Not used	N/A	N/A	N/A	N/A	N/A	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
159	3.a. Larger Volume Containment	17	SAMA increases time before containment failure and increases time for recovery	#2 - Similar item is addressed under other proposed SAMAs.	SAMA 52 addresses this issue.		N/A
160	3.b. Increased Containment Pressure Capability (sufficient pressure to withstand severe accidents)	17	SAMA minimizes likelihood of large releases	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 49		N/A
161	3.c. Improved Vacuum Breakers (redundant valves in each line)	17	SAMA reduces the probability of a stuck open vacuum breaker.	Retain	See Table 6 and Section A.4.3.3 of ABWR SAMDAs.		24
162	3.d. Increased Temperature Margin for Seals	17	This SAMA would reduce the potential for containment failure under adverse conditions.	#2 - Similar item is addressed under other proposed SAMAs.	Part of 160 (increased containment pressure capability)		N/A
163	3.e. Improved Leak Detection	17	The intent of this SAMA is to increase piping surveillance in order to identify leaks prior to the onset of complete failure. Improved leak detection would potentially reduce the LOCA frequency.	#1 - N/A	Containment inerting obviates the need for leak detection.	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
164	3.f. Suppression Pool Scrubbing	17	This SAMA would reduce the consequences of venting the containment by directing the ventpath through the water contained in the suppression pool.	#3 - Already implemented.	The PBAPS Torus Vent in located in the Wetwell airspace.	PBAPS PRA	N/A
165	3.g. Improved Bottom Penetration Design	17	SAMA reduces failure likelihood of RPV bottom head penetrations	#5 - ABWR Design Issue; not practical.	This is a SAMA which was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating.	ABWR SAMDAs	N/A
166	4.a. Larger Volume Suppression Pool (double effective liquid volume)	17	SAMA would increase the size of the suppression pool so that heatup rate is collapsed, allowing more time for recovery of a heat removal system	#5 - ABWR Design Issue; not practical.	This is a SAMA which was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating.	ABWR SAMDAs	N/A
167	4.b. CUW Decay Heat Removal	17	This SAMA provides a means for Alternate Decay Heat Removal.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 112. The CUW system in ABWR is equivalent to the RWCU system.		N/A
168	4.c. High Flow Suppression Pool Cooling	17	SAMA would improve suppression pool cooling.	#3 - Already implemented.	The Suppression Pool Cooling system is already sized to accommodate flow to remove all decay heat and operate under ATWS conditions.	PBAPS PRA	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
169	4.d. Passive Overpressure Relief	17	This SAMA will prevent catastrophic failure of the containment. Controlled relief through a selected vent path has a greater potential for reducing the release of radioactive material than through a random break.	#3 - Already implemented.	The Torus Vent is equipped with a rupture disk.	PBAPS PRA	N/A
170	5.a/d. Unfiltered Vent	17	SAMA would provide an alternate decay heat removal method with the released fission products not being scrubbed.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 32		N/A
171	5.b/c. Filtered Vent	17	SAMA would provide an alternate decay heat removal method with the released fission products being scrubbed.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 33 and 47		N/A
172	6.a. Post Accident Inerting System	17	SAMA would reduce likelihood of gas combustion inside containment	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 45		N/A
173	6.b. Hydrogen Control by Venting	17	This SAMA will prevent catastrophic failure of the containment due to hydrogen detonation by venting the hydrogen gas prior to reaching detonable concentration.	#3 - Already implemented.	Addressed in EPGs/SAMGs	PBAPS EOPs/SAMGs	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
174	6.c. Pre-inerting	17	SAMA would reduce likelihood of gas combustion inside containment	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 45		N/A
175	6.d. Ignition Systems	17	This SAMA will prevent catastrophic failure of the containment due to hydrogen detonation by burning the hydrogen gas prior to reaching detonable concentration.	#1 - N/A	Not applicable, since containment is inerted.	PBAPS PRA	N/A
176	6.e. Fire Suppression System Inerting	17	This SAMA will prevent catastrophic failure of the containment due to hydrogen detonation by inerting the containment with the fire suppression system.	#1 - N/A	Not applicable, since containment is inerted.	PBAPS PRA	N/A
177	7.a. Drywell Head Flooding	17	SAMA would provide intentional flooding of the upper drywell head such that if high drywell temperatures occurred, the drywell head seal would not fail.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 39		N/A
178	7.b. Containment Spray Augmentation	17	SAMA would provide a redundant source of water to the containment to control containment pressure when used in conjunction with containment heat removal.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 30, 31		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
179	8.a. Additional Service Water Pump	17	SAMA might conceivably reduce common cause dependencies from SW system and thus reduce plant risk through system reliability improvement.	#2 - Similar item is addressed under other proposed SAMAs.	Although this SAMA is not directly addressed elsewhere, SAMAs 21 and 73 suggest using Fire Pumps as alternate service water sources.		N/A
180	8.b. Improved Operating Response	17	This SAMA would improve the likelihood of success of operator actions taken in response to an abnormal condition.	#3 - Already implemented.	Operator response has been a focus at PBAPS over the past decade. Training has been improved and procedures have been re-written in an ongoing effort to improve operator reliability.		N/A
181	8.c. Diverse Injection System	17	SAMA will improve prevention of core melt sequences by providing additional injection capabilities.	#2 - Similar item is addressed under other proposed SAMAs.	Part of 149, 153		N/A
182	8.d. Operation Experience Feedback	17	This SAMA would provide information on the effectiveness of maintenance practices and equipment reliability.	#3 - Already implemented.	Operational experienced is tracked and incorporated into future plant operating philosophy via programs such as the maintenance rule. Already incorporated at PBAPS.		N/A
183	8.e. Improved MSIV Design	17	This SAMA would decrease the likelihood of containment bypass scenarios.	Retain			25

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
184	8.e. Improved SRV Design	17	This SAMA would improve SRV reliability, thus increasing the likelihood that sequences could be mitigated using low pressure heat removal.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 106, 110		N/A
185	9.a. Steam Driven Turbine Generator	17	This SAMA would provide a steam driven turbine generator which uses reactor steam and exhausts to the suppression pool. If large enough, it could provide power to additional equipment.	Retain	See Table 6 and A.4.9.1 of ABWR SAMDAs		26
186	9.b. Alternate Pump Power Source	17	This SAMA would provide a small dedicated power source such as a dedicated diesel or gas turbine for the feedwater or condensate pumps, so that they do not rely on offsite power.	#2 - Similar item is addressed under other proposed SAMAs.	Firewater pump provides low pressure injection without offsite power (#46). Additional or passive high pressure systems addressed in other SAMAs, as is motor driven FW pump.		N/A
187	9.d. Additional Diesel Generator	17	SAMA would reduce the SBO frequency.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 54, 56		N/A
188	9.e. Increased Electrical Divisions	17	SAMA would provide increased reliability of AC power system to reduce core damage and release frequencies.	#5 - ABWR Design Issue; not practical.	This is a SAMA which was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating.	GE ABWR SAMDAs	N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
189	9.f. Improved Uninterruptable Power Supplies	17	SAMA would provide increased reliability of power supplies supporting front-line equipment, thus reducing core damage and release frequencies.	Retain			27
190	9.g. AC Bus Cross-Ties	17	SAMA would provide increased reliability of AC power system to reduce core damage and release frequencies.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 60, 64		N/A
191	9.h. Gas Turbine	17	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 70		N/A
192	9.i. Dedicated RHR (bunkered) Power Supply	17	This SAMA would improve the reliability of the RHR system by enhancing the AC power supply system.	Retain			28
193	10.a. Dedicated DC Power Supply	17	This SAMA addresses the use of a diverse DC power system such as an additional battery or fuel cell for the purpose of providing motive power to certain components (e.g., RCIC).	Retain			29

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
194	10.b. Additional Batteries/Divisions	17	This SAMA addresses the use of a diverse DC power system such as an additional battery or fuel cell for the purpose of providing motive power to certain components (e.g., RCIC).	#2 - Similar item is addressed under other proposed SAMAs.	Part of 193		N/A
195	10.c. Fuel Cells	17	SAMA would extend DC power availability in an SBO.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 58		N/A
196	10.d. DC Cross-ties	17	This SAMA would improve DC power reliability.	Retain	Only partially addressed by SAMA 61		30
197	10.e. Extended Station Blackout Provisions	17	SAMA would provide reduction in SBO sequence frequencies.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 57, 62, 63, 26, 195, 54, 67, 69		N/A
198	11.a. ATWS Sized Vent	17	This SAMA would be provide the ability to remove reactor heat from ATWS events.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 34		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
199	11.b. Improved ATWS Capability	17	This SAMA includes items which reduce the contribution of ATWS to core damage and release frequencies.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed by SAMAs 113, 118, 119		N/A
200	12.a. Increased Seismic Margins	17	This SAMA would reduce the risk of core damage and release during seismic events.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 76, 114		N/A
201	12.b. Integral Basemat	17	This SAMA would improve containment survivability under severe seismic activity.	#1 - N/A	Not applicable to PBAPS design	GE ABWR SAMDAs	N/A
202	13.a. Reactor Building Sprays	17	This SAMA provides the capability to use firewater sprays in the reactor building to mitigate release of fission products into the Rx Bldg following an accident.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 40		N/A
203	13.b. System Simplification	17	This SAMA is intended to address system simplification by the elimination of unnecessary interlocks, automatic initiation of manual actions or redundancy as a means to reduce overall plant risk.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed by SAMAs 12, 72, 78, 96, 106, 109, 111		N/A

Table G.4-1 (Cont'd)
Phase I SAMA

Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Screening Criteria	Disposition	Disposition Reference	Phase II SAMA ID number
204	13.c. Reduction in Reactor Building Flooding	17	This SAMA reduces the Reactor Building Flood Scenarios contribution to core damage and release.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMAs 97, 99		N/A
205	14.a. Flooded Rubble Bed	17	SAMA would contain molten core debris dropping on to the pedestal and would allow the debris to be cooled.	#2 - Similar item is addressed under other proposed SAMAs.	See SAMA 38		N/A
206	14.b. Reactor Cavity Flooder	17	SAMA would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	#2 - Similar item is addressed under other proposed SAMAs.	Addressed in SAMAs 41 & 51		N/A
207	14.c. Basaltic Cements	17	SAMA minimizes carbon dioxide production during core concrete interaction.	#5 - ABWR Design Issue; not practical.	This is a SAMA which was considered for ABWR design. It is not practical to backfit this modification into a plant which is already built and operating.	ABWR SAMDAs	N/A

Notes to Table G.4-1:

1. NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," Volume 2, NRC, December 1997.

2. Letter from Mr. M. O. Medford (Tennessee Valley Authority) to NRC Document Control Desk, dated September 1, 1992, "Watts Bar Nuclear Plant Units 1 and 2 – Generic Letter (GL) – Individual Plant Examination (IPE) for Severe Accident Vulnerabilities – Response".

3. NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.36 Listing of SAMDAs considered for the Comanche Peak Steam Electric Station, NRC, May 1996.

4. Letter from Mr. D. E. Nunn (Tennessee Valley Authority) to NRC Document Control Desk, dated October 7, 1994, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA) – Response to Request for Additional Information (RAI)".

5. "Cost Estimate for Severe Accident Mitigation Design Alternatives, Limerick Generating Station for Philadelphia Electric Company," Bechtel Power Corporation, June 22, 1989.

6. NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.35, Listing of SAMDAs considered for the Limerick, NRC, May 1996.

7. Letter from Mr. W. J. Museler (Tennessee Valley Authority) to NRC Document Control Desk, dated October 7, 1994, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA)."

8. NUREG-0498, "Final Environmental Statement related to the operation of Watts Bar Nuclear Plant, Units 1 and 2," Supplement No. 1, NRC, April 1995.

9. Letter from Mr. D. E. Nunn (Tennessee Valley Authority) to NRC Document Control Desk, dated June 30, 1994. "Watts Bar Nuclear Plant (WBN) Unit 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDAs) Evaluation from Updated Individual Plant Evaluation (IPE)."

10. Letter from N. J. Liparulo (Westinghouse Electric Corporation) to NRC Document Control Desk, dated December 15, 1992, "Submittal of Material Pertinent to the AP600 Design Certification Review."

11. NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," NRC, August 1994.

12. Hatch Individual Plant Examination.

13. Hatch Individual Plant Examination of External Events.

14. PBAPS Report on Accident Management Insights (includes disposition of IPE/PRA Level 1 and 2 insights and IPEEE insights)

15. GL 88-20, Supplement 1, NUREG-1335, "Individual Plant Examination: Submittal Guidance," August 29, 1989.

16. GL 88-20, Supplement 2, "Accident Management Strategies for Consideration in the IPE Process, "April 4, 1990.

17. GE Nuclear Energy, "Technical Support Document for the ABWR," 25A5680, Rev. 1, November 1994.

Screening Criteria for Table G.4-1:

#1: Not applicable.

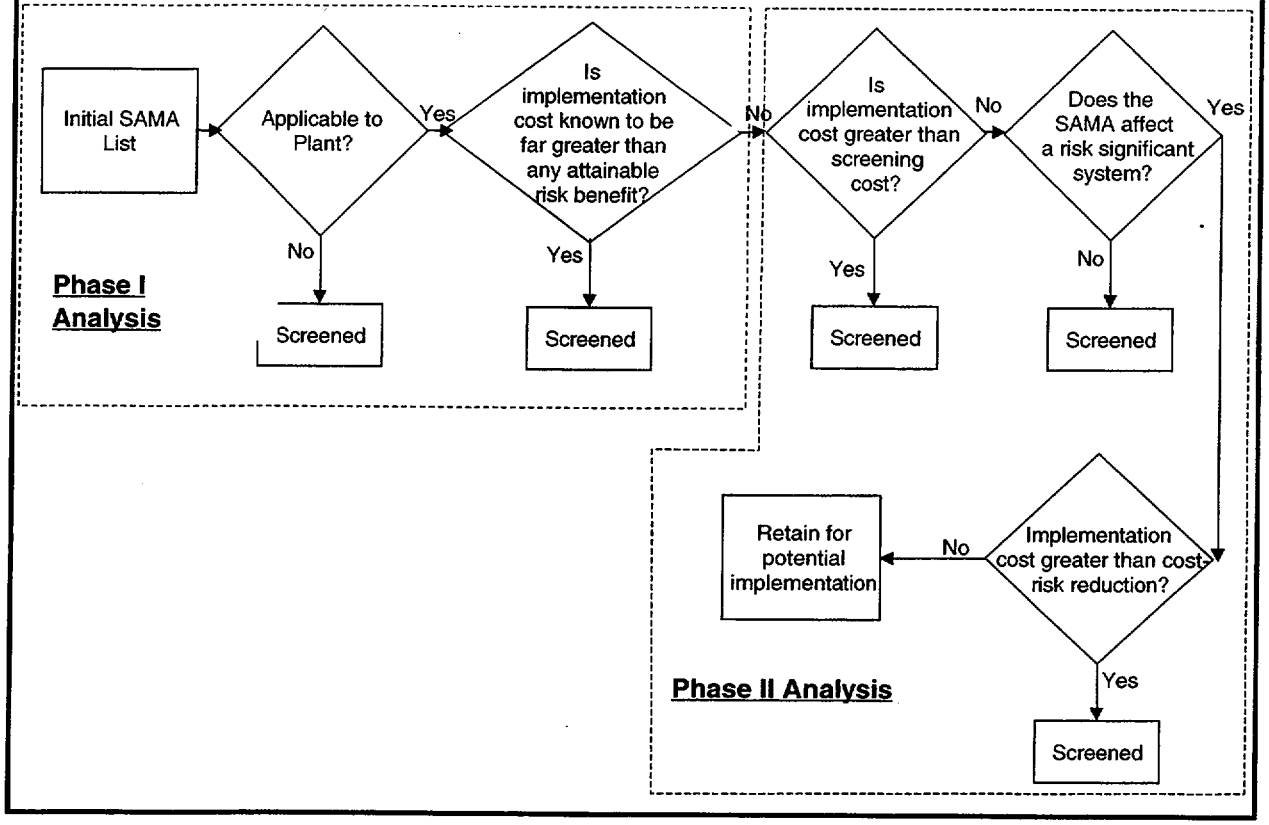
#2: Similar item is addressed under other proposed SAMA.

#3: Already installed.

#4: No significant safety benefit

#5: Cost would be more than risk benefit

Figure G.4-1
SAMA Screening Process



A majority of the SAMAs were removed from further consideration as they did not apply to the BWR-4/Mark I design used at PBAPS. An additional set of candidates was removed from consideration because all of those within the group were related to mitigation of an interfacing system Loss of Coolant Accident (ISLOCA). According to NRC Information Notice 92-36 and its supplement, ISLOCA contributes little risk for boiling water reactors because of the lower primary pressures. Review of the PBAPS PSA confirms that ISLOCA is a low contributor to risk (less than 0.1% of the internal CDF and less than 1.5% of internal LERF) and the risk benefit associated with improving ISLOCA mitigation in not significant. SAMA candidates related to Reactor Coolant Pump seal leakage were also removed from consideration. NUREG-1560 (Reference 5) indicates that although RCP seal leakage is important for PWRs, recirculation pump leakage does not significantly contribute to core damage frequency in BWRs.

The SAMA candidates that were found to be in place at PBAPS were screened from further consideration.

The SAMAs related to design changes prior to construction (primarily consisting of those candidates taken from the ABWR SAMAs) were removed as they were not practicable to an existing plant. For example, using basalfie cement (SAMA 207) would require dismantling of the reactor pedestal structure and replacement of the containment floor. This would result in exorbitant costs to implement. Any candidate known to have an implementation cost that far exceeds any possible risk benefit is screened from further analysis. Any SAMA candidates that were sufficiently similar to other SAMA candidates were treated in the same manner to those that they were related to; either combined or screened from further consideration. This screening left 30 unique SAMA candidates (Table G.4-2) that were potentially applicable to PBAPS and were of potential value in averting the risk of severe accidents. Section G.5 describes the process used to disposition the remaining SAMAs.

Section G.5 describes the results of the detailed cost benefit analysis.

TABLE G.4-2
PHASE II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
1	19	Enhance procedural guidance for use of cross-tied component cooling or service water pumps.	1 14	SAMA would reduce the frequency of the loss of component cooling water and service water.	$50K	Assume $50K for site procedure change	Detailed cost-benefit analysis performed. Net value of -$41,591 indicates that the SAMA is not beneficial. Refer to section G.5.1.
2	21	Improved ability to cool the residual heat removal heat exchangers.	1	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 cross-tie.	$250K (procedure enhancement and minor mod) >$2M for new pumps	Assume $200K for minor modification and $50K for procedure change (both per site). Could also include installing additional SW pump(s) per Phase 1 SAMA #73	Screened. Procedure already in place to X-tie to opposite unit HPSW pumps; this is included in the model, but not credited. Small effect on CDF. A X-tie to FPS would not provide required flow. Cost for new hardware addition is >$2 million.
3	29	Install an independent method of suppression pool cooling.	5 6	SAMA would decrease the probability of loss of containment heat removal.	>$2M	[>$1M/Unit x 2] NUREG-1437 cost for independent Containment Spray System is >$1M.	Screened ($)
4	33	Install a filtered containment vent to remove decay heat.	5 6	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	>$2M	[$3M/Unit X 2] - Ref. G.8-17, Section A.5.5.1	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
5	34	Install a containment vent large enough to remove ATWS decay heat.	5 6	Assuming that injection is available, this SAMA would provide alternate decay heat removal in an ATWS event.	>$2M	[$300K/Unit x 2] - Ref. G.8-17, Section A.5.11.1, but installation of hard pipe vent at PB cost >$2 million (Ref. G.8-18)	Screened ($)
6	46	Use the fire protection system as a backup source for the containment spray system.	4	SAMA would provide redundant containment spray function without the cost of installing a new system.	$50K	[$25K/Unit x 2] - Hatch Submittal, Section 5.1. Also consider as a fire protection as a means for low pressure injection per Phase 1 SAMA #154	Screened. Hardware failure of containment spray is not a factor in the system evaluation. The drywell spray initiation limit defined by the EOPs prevents its use in the cases where it would potentially provide benefit (flooding the drywell floor prior to vessel failure). Introducing an additional source of water to the CS system will not affect the model's quantification. No detailed analysis required.
7	48	Install a passive containment spray system.	10	SAMA would provide redundant containment spray method without high cost.	>$2M	Assumed to be similar in cost to passive HP system (SAMA 149)	Screened ($)
8	52	Construct a building to be connected to primary/secondary containment that is maintained at a vacuum.	11	SAMA would provide a method to depressurize containment and reduce fission product release.	>$2M	$'s per engineering judgment	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
9	54	Proceduralize alignment of spare diesel to shutdown board after loss of offsite power and failure of the diesel normally supplying it.	1 3 7	SAMA would reduce the SBO frequency.	See SAMA 56	Need to install spare D/G to benefit from this SAMA. Spare DG is screened based on cost (See SAMA 56)	Screened ($)
10	56	Provide an additional diesel generator.	1 3 7 11 14	SAMA would increase the reliability and availability of onsite emergency AC power sources.	>$2M	$'s per engineering judgment. Ref. G.8-17 lists cost at approximately $1.2M. However, this is significantly less than cost of installing new DGs after plant is built (Calvert Cliffs >$100M for 2 new DGs).	Screened ($)
11	57	Provide additional DC battery capacity.	1 3 7 11 12	SAMA would ensure longer battery capability during an SBO, reducing the frequency of long-term SBO sequences.	$1.6M	Assume $200K/battery x 8 batteries (includes analysis, equipment, and modification implementation)	Detailed cost-benefit analysis performed. Net value of -$1,334,903 indicates that this modification is not beneficial. Refer to section G.5.2.
12	58	Use fuel cells instead of lead-acid batteries.	11	SAMA would extend DC power availability in an SBO.	>$2M	[$6M] - Ref. G.8-17, Section A.5.10.1	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
13	66	Develop procedures to repair or replace failed 4-kV breakers.	1	SAMA would offer a recovery path from a failure of the breakers that perform transfer of 4.16-kV nonemergency busses from unit station service transformers, leading to loss of emergency AC power.	$50K	Assume $50K for site procedure change	Detailed cost-benefit analysis performed. Net value of -$49,612 indicates that the SAMA is not beneficial. Refer to section G.5.3.
14	70	Install gas turbine generator.	1 14	SAMA would improve onsite AC power reliability by providing a redundant and diverse emergency power system.	>$2M	$'s per engineering judgment	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
15	105	Proceduralize intermittent operation of HPCI.	1	SAMA would allow for extended duration of HPCI availability.	$50K	Hatch estimate is $22,200/unit (Section 5.2). Assume $50K for site procedure change at PBAPS.	Screened. Intermittent operation of HPIC for SBO cases is detrimental to battery life and is judged not to be desirable. For LOOP cases, room cooling was determined not to be required (ECR 96-00367) for operation of HPCI; however, procedures already exist to align alternate room cooling for extended operation should the need arise and are considered more appropriate than multiple turbine restarts. It should also be noted that RCIC is preferred if both systems are available during LOOP and HPCI would potentially be terminated by 10 minutes after trip (per SE-11 bases, section B-6).
16	107	Install motor-driven feedwater pump.	1 12	SAMA would increase the availability of injection subsequent to MSIV closure.	>$2M	$'s per engineering judgment	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
17	108	Enhance procedure to instruct operators to trip unneeded RHR/CS pumps on loss of room ventilation.	12	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	Assume $50K for site procedure change	Screened. The largest Risk Reduction Worth associated with CS, LPCI, and NSW, including common cause failures is 1.003. This indicates that no significant change to the PSA will occur if the room cooling dependency is improved or removed from the model; thus, a positive net value is not achievable. No detailed analysis is required.
18	110	Increase the safety relief valve (SRV) reseat reliability.	1	SAMA addresses the risk associated with dilution of boron caused by the failure of the SRVs to reseat after standby liquid control (SLC) injection.	$2M	Assume $200K/SRV x 10 ADS SRVs (5 per site) plus additional 12 non-ADS SRVs. This includes analysis, equipment (assumes replacing SRVs with new models) and modification implementation.	Detailed cost-benefit analysis performed. Net values of -$1,906,215 (Case A) and -$1,825,762 (Case B) indicate that the SAMA is not beneficial. Refer to section G.5.4.
19	112	Modify Reactor Water Cleanup (RWCU) for use as a decay heat removal system and proceduralize use.	1	SAMA would provide an additional source of decay heat removal.	>$2 million for hardware upgrade	RWCU heat removal capacity is low.	Screened. The PBAPS RWCU system is incapable of serving as the sole DHR system until many days after shutdown and therefore is virtually ineffective for accidents at full power. No detailed analysis required.

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
20	149	2.a. Passive High Pressure System	17	SAMA will improve prevention of core melt sequences by providing additional high presssure capability to remove decay heat through an isolation condenser type system	>$2M	[$1.7M x 2] - Ref. G.8-17, Section A.5.2.1	Screened ($)
21	151	2.c. Suppression Pool Jockey Pump	17	SAMA will improve prevention of core melt sequences by providing a small makeup pump to provide low pressure decay heat removal from the RPV using the suppression pool as a source of water.	$480K	Ref. G.8-17, Section A.5.2.3 lists cost as $120K (per unit). However, since this is for a plant not yet built, estimate a factor of 2 more cost for PBAPS. Therefore, cost is $120K/unit x 2 Units x 2 = $480K	Detailed cost-benefit analysis performed. Net value of -$129,044 indicates that the SAMA is not beneficial. Refer to section G.5.5.
22	153	2.e. Additional Active High Pressure System	17	SAMA will improve reliability of high pressure decay heat removal by adding an additional system.	>$2M	Assumed to be similar in cost to passive HP system (SAMA 149)	Screened ($)
23	156	2.h. Safety Related Condensate Storage Tank	17	SAMA will improve availability of CST following a Seismic event	>$2M	[>$1M x 2] - Ref. G.8-17, Section A.5.2.4	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
24	161	3.c. Improved Vacuum Breakers (redundant valves in each line)	17	SAMA reduces the probability of a stuck open vacuum breaker.	>$2M	$'s per engineering judgment. ABWR, Section 5.3.3 lists cost as >$100K (per unit). However, this is for a plant not yet built. This is an extensive modification, so cost is estimated at >$1M/unit.	Screened ($)
25	183	8.e. Improved MSIV Design	17	This SAMA would decrease the likehood of containment bypass scenarios.	>$2M	Assume $200K/MSIV x 16 MSIVs (8 per unit)	Screened ($)
26	185	9.a. Steam Driven Turbine Generator	17	This SAMA would provide a steam driven turbine generator which uses reactor steam and exhausts to the suppression pool. If large enough, it could provide power to additional equipment.	>$2M	[$6M x 2} - Ref. G.8-17, Section A.5.9.1	Screened ($)
27	189	9.f. Improved Uninterruptable Power Supplies	17	SAMA would provide increased reliability of power supplies supporting front-line equipment, thus reducing core damage and release frequencies.			Screened. The UPSs are not included in the PBAPA PSA and are not considered to be risk significant; thus, it is not possible to obtain a positive net value with this SAMA. No detailed analysis required.

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
28	192	9.i. Dedicated RHR (bunkered) Power Supply	17	This SAMA would improve the reliability of the RHR system by enchancing the AC power supply system.	>$2M	[$1.2M x 2] - Ref. G.8-17, Section A.5.9.2	Screened ($)
29	193	10.a. Dedicated DC Power Supply	17	This SAMA addresses the use of a diverse DC power system such as an additional battery or fuel cell for the purpose of providing motive power to certain components (e.g., RCIC).	>$2M	[$3M x 2] - Ref. G.8-17, Section A.5.10.1	Screened ($)

Table G.4-2 (Cont'd)
Phase II SAMA

Phase II SAMA ID number	Phase I SAMA ID number	SAMA title	Source Reference of SAMA [See Notes]	Result of potential enhancement	Estimated Cost	Comment	Phase II Disposition
30	196	10.d. DC Cross-ties	17	This SAMA would improve DC power reliability.	$250K	Assume $200K for minor modification, plus $50K for procedure change. Only partially addressed by SAMA 61	Screened. The PBAPS SE-11 procedure has been developed to optimize cross-tie capabilities of the 4 kV buses and various power supplies afforded by the emergency diesel generators and the dedicated offsite power source from Conowingo Dam. One of the main tenets of this procedure is to ensure that 4 kV power is available to all necessary DC bus chargers. It is judged that adding DC cross-tie capabilities would not be cost effective since the optimum benefit is already obtained from the SE-11 procedure. The DC buses and batteries are very reliable, and providing 4 kV power to the battery chargers is the most beneficial way of ensuring that DC power remains available.

G.5 PHASE II SAMA ANALYSIS

A preliminary cost estimate was prepared for each of the remaining candidates to focus on those that had the possibility of having a positive benefit and to eliminate those whose costs were beyond the possibility of any corresponding benefit. When the screening cutoff of $2,040,468 was applied, 18 candidates were eliminated that were more expensive than the maximum postulated benefit associated with the elimination of all risk associated with full power internal events. This left 12 candidates for further analysis. Those SAMAs which required a more detailed cost benefit analysis were evaluated using the combined methods described in Sections G.2 and G.3. Other SAMA candidates were screened from further analysis based on plant specific insights regarding the risk significance of the systems that would be affected by the proposed SAMAs. The SAMAs related to non-risk significant systems were screened from a detailed cost benefit analysis as any change in the reliability of these systems is known to have a negligible impact on the PSA evaluation.

For each of the remaining SAMA candidates not eliminated based on screening cost or PSA/application insights, a more detailed conceptual design was prepared along with a more detailed estimated cost. This information was then used to evaluate the candidates' effects on the plant safety model.

The final cost-risk based screening method used to determine the desirability of implementing the SAMA is defined by the following equation:

Net Value = (baseline cost-risk of plant operation – cost-risk of plant operation with SAMA implemented) – cost of implementation

If the net value of the SAMA is negative, the cost of implementation is larger than the benefit associated with the SAMA and the SAMA is not considered beneficial. The baseline cost-risk of plant operation was derived using the methodology presented in Section G.3. The cost-risk of plant operation with the SAMA implemented is determined in the same manner with the exception that the PSA results reflect the application of the SAMA to the plant (the baseline input is replaced by the results of a PSA sensitivity with the SAMA change in effect).

Subsections G.5.1 – G.5.5 describe the detailed cost-benefit analysis that was used to determine how the remaining candidates were ultimately treated. The results are presented on a site (2 units) basis.

G.5.1 PHASE II SAMA NUMBER 1, ENHANCE PROCEDURAL GUIDANCE FOR USE OF CROSS-TIED COMPONENT COOLING OR SERVICE WATER PUMPS

Description: In this sensitivity, it was assumed that the guidance would virtually eliminate initiating events related to loss of service water. For PBAPS, this was assumed to relate to the loss of service water initiating event, the loss of TBCCW initiating event, and the loss of RBCCW initiating event. This impact was chosen for the study because the importance of these systems from a mitigation perspective is already low and because the impact of improving their reliabilities would maximize the calculated benefit by virtually eliminating these systems as initiating events.

To implement this change, the following basic event values were changed as indicated in Table G.5.1-1 in the PBAPS Unit 2 model to simulate almost totally reliable service water systems from an initiating event perspective.

TABLE G.5.1-1
PHASE II SAMA NUMBER 1 MODEL CHANGES

System: Basic Events	Original Value	Revised Value
Service Water Pumps fail to run in 8760 hours:		
PPMAP04I2	0.231	0.00
PPMBP04I2	0.231	0.00
PPMCP04I2	0.231	0.00
TBCCW Pumps fail to run in 8760 hours:		
TPMA144I2	0.231	0.00
TPMB144I2	0.231	0.00
RBCCW Pumps fail to run in 8760 hours:		
BPMAP10I2	0.231	0.00
BPMBP10I2	0.231	0.00

PSA Model Results (Phase II SAMA Number 1)

The results from this case indicate about a 0.7% reduction in Unit 2 CDF (CDF_{new}=4.5E-6/yr) and a 0.2% reduction in LERF ($LERF_{new}$=6.2E-8/yr). The results of the cost-benefit analysis are shown in Table G.5.1-2.

TABLE G.5.1-2
PHASE II SAMA NUMBER 1 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 1: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040468	$2,032,059	$8,409	$50,000	-$41,591

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

G.5.2 PHASE II SAMA NUMBER 11, PROVIDE ADDITIONAL DC BATTERY CAPACITY

Description: In this sensitivity, it was assumed that the battery life could be extended to 4 hours each to simulate additional battery capacity. The 4 hour battery life could be obtained by installing improved batteries. This enhancement would impact the loss of offsite power cases with HPCI and/or RCIC available (i.e., the Te1a, Te1b, Te2a, Te2b, Te3a, Te3b, Te5a, and Te5b event trees). With HPCI or RCIC available, but with no AC power to the corresponding battery charger that supports HPCI or RCIC operation, 2.5 hours is assumed to be available to recover offsite power based on two hours of battery life and one half hour of boildown time. The 2.5-hour assumption is changed to 5 hours in this SAMA case (4 hours of battery life and 1 hour for boildown). Correspondingly, with both HPCI and RCIC available, but no AC power to the corresponding battery chargers, 5 hours is assumed to be available to recover offsite power before both HPCI and RCIC are lost due to loss of DC (4 hours of battery life and 1 hour for boildown). The 5-hour assumption is changed to 10 hours in this SAMA case (8 hours of battery life and 2 hours for boildown. Containment heat removal is also assumed to be necessary).

Table G.5.2-1 summarizes the changes made in the PBAPS Unit 2 PSA model to simulate the effects of this SAMA.

TABLE G.5.2-1
PHASE II SAMA NUMBER 11 MODEL CHANGES

Basic Event: Description	Original Value	Revised Value
ROSP2U Fail to recover offsite power Changed from 2.5 hour value to 5 hour value	0.225	0.113
ROSP5 Fail to recover offsite power Changed from 5 hour value to 10 hour value	0.113	0.041
NOSP10U Fail to recover at 10 hours given not recovered at 2.5. Changed from 10/2.5 value to 10/5 value	0.182	0.363
NOSP105 Fail to recover at 10 hours given not recovered at 2.5. Changed from 10/5 value to 10/10 value	0.363	1.0

PSA Model Results (Phase II SAMA Number 11)

The PSA results for this case indicate about a 19% reduction in Unit 2 CDF (CDF_{new}= 3.7E-6/yr) and a 10% reduction in LERF ($LERF_{new}$=5.6E-8/yr). The results of the cost-benefit analysis for Phase II SAMA 11 are shown in Table G.5.2-2.

TABLE G.5.2-2
PHASE II SAMA NUMBER 11 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 11: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,775,371	$265,097	$1,600,000	-$1,334,903

The negative net value of this SAMA candidate (installation of new batteries) indicates that its implementation is not beneficial.

G.5.3 PHASE II SAMA NUMBER 13, DEVELOP PROCEDURES TO REPAIR OR REPLACE FAILED 4-KV BREAKERS

Description: In this model run, it was assumed that the improved procedures to repair or replace failed 4 kV breakers would result in collapsed 4 kV breaker "fail to close rates". However, since these failures only manifest themselves in the model for implementation of the PBAPS SE-11 procedure for cross-tying buses, an additional change was also made to the 4 kV bus failure rates to further simulate the improved performance that could be obtained from this SAMA.

To implement this change, basic event values were changed as indicated in Table G.5.3-1 in the PBAPS Unit 2 model to simulate alternate 4-kV breaker capability.

TABLE G.5.3-1
PHASE II SAMA NUMBER 13 MODEL CHANGES

System: Basic Events	Original Value	Revised Value
4 kV Circuit Breakers fail to close:		
ECB1505N2	5.0×10^{-4}	0.00
ECB1505N3	5.0×10^{-4}	0.00
ECB1605N2	5.0×10^{-4}	0.00
ECB1605N3	5.0×10^{-4}	0.00
ECB1705N2	5.0×10^{-4}	0.00
ECB1705N3	5.0×10^{-4}	0.00
ECB1806N2	5.0×10^{-4}	0.00
ECB1806N3	5.0×10^{-4}	0.00
4 kV Buses fail:		
EBSA15XW2	2.4×10^{-6}	2.4×10^{-7}
EBSA15XW3	2.4×10^{-6}	2.4×10^{-7}
EBSA16XW2	2.4×10^{-6}	2.4×10^{-7}
EBSA16XW3	2.4×10^{-6}	2.4×10^{-7}
EBSA17XW2	2.4×10^{-6}	2.4×10^{-7}
EBSA17XW3	2.4×10^{-6}	2.4×10^{-7}
EBSA18XW2	2.4×10^{-6}	2.4×10^{-7}
EBSA18XW3	2.4×10^{-6}	2.4×10^{-7}

PSA Model Results (Phase II SAMA Number 13)

The results from this case indicate about a 0.1% reduction in CDF ($CDF_{new}=4.5\times10^{-6}$/yr) and a 0.1% reduction in LERF ($LERF_{new}=6.2\times10^{-6}$/yr). The results of the cost-benefit analysis are shown in Table G.5.3-2.

TABLE G.5.3-2
PHASE II SAMA NUMBER 13 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 13: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$2,040,080	$388	$50,000	-$49,612

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

G.5.4 PHASE II SAMA NUMBER 18, INCREASE THE SAFETY RELIEF VALVE RE-SEAT RELIABILITY

Description: In this model run, it was assumed that the improved reliability of the SRVs would result in collapsed "fail to reseat" probabilities for the SRVs. This issue is included to address the risk associated with dilution of boron caused by the failure of the SRVs to re-seat after standby liquid control (SLC) injection. However, the improved reliability would impact non-ATWS cases as well in collapsed consequential stuck open relief valve scenarios, and in stuck open relief valve initiating events.

To implement this change, basic event values were changed as indicated in Table G.5.4-1 in the PBAPS Unit 2 model to simulate improved SRV re-seat reliability.

TABLE G.5.4-1
PHASE II SAMA NUMBER 18 MODEL CHANGES

System: Basic Events	Original Value	Revised Value
SRV(s) fail to re-seat (Included in SAMA Case 18a and 18b):		
P	7.99×10^{-2}	7.99×10^{-3}
P1	1.33×10^{-2}	1.33×10^{-3}
P2	2.66×10^{-2}	2.66×10^{-3}
P3	1.97x10-3	1.97×10^{-4}
P12	1.97×10^{-3}	1.97×10^{-4}
P22	1.97×10^{-6}	1.97×10^{-7}
P32	1.97×10^{-6}	1.97×10^{-7}
SORV Initiating Event (Included in SAMA Case 18b only):		
IETI	5.75×10^{-2}	5.75×10^{-3}

PSA Model Results (Phase II SAMA Number 18a)

The results from this case indicate about a 4% reduction in CDF ($CDF_{new}=4.4\times10^{-6}$/yr) and a 2% reduction in LERF ($LERF_{new}=6.0\times10^{-6}$/yr). The results of the cost-benefit analysis are shown in Table G.5.4-2.

TABLE G.5.4-2
PHASE II SAMA NUMBER 18A NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 18a: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,946,683	$93,785	$2,000,000	-$1,906,215

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

PSA Model Results (Phase II SAMA 18b)

The results from this case indicate about a 6% reduction in CDF ($CDF_{new}=4.3\times10^{-6}$/yr) and a 2% reduction in LERF ($LERF_{new}=6.0\times10^{-8}$/yr). The results of the cost-benefit analysis are shown in Table G.5.4-3.

TABLE G.5.4-3
PHASE II SAMA NUMBER 18B NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 18b: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,866,230	$174,238	$2,000,000	-$1,825,762

The negative net value of this SAMA candidate indicates that even if the improved SRV re-seat reliability also leads to a reduction in stuck open relief valve initiating events, its implementation is still not beneficial.

G.5.5 PHASE II SAMA NUMBER 21, INSTALL SUPPRESSION POOL JOCKEY PUMP FOR ALTERNATE INJECTION TO THE RPV

Description: In this model run, it was assumed that the installation of a suppression pool jockey pump would provide an independent means of providing long term injection to the RPV. Currently, the PBAPS model includes a simple representation of the fire pump to perform a similar function. Minimal credit is taken for success of the fire pump since it requires installation of separate cross-tie components. To simulate the potential impact of the dedicated jockey pump to perform this role, it was determined that the failure probability for the fire pump could be adjusted.

To implement this change, the following basic event value was changed as indicated in Table G.5.5-1 in the PBAPS Unit 2 model to simulate the incorporation of a dedicated independent system to provide injection from the suppression pool that could potentially be provided by the addition of a suppression pool jockey pump. The revised value of 0.01 is considered somewhat optimistic for the combined failure rate (including all dependencies and human error contribution) for this system. This optimistic value would lead to the maximum potential benefit from this SAMA.

TABLE G.5.5-1
PHASE II SAMA NUMBER 21 MODEL CHANGES

System: Basic Events	Original Value	Revised Value
Suppression Pool Jockey Pump fails: FIREPUMP	0.80	0.01

PSA Model Results (Phase II SAMA Number 21)

The results from this case indicate about an 8% reduction in CDF ($CDF_{new}=4.2\times10^{-6}$/yr) and no reduction in LERF. While the PBAPS PSA results show no decrease in LERF, the translation of the PBAPS PSA model's Level 2 endstates into the collapsed APBs conservatively grouped "late" releases into the "early" bins due to the definition of the collapsed APBs. This is conservative and results in a more dramatic decrease in cost-risk than would be expected from the installation of the jockey pump considering the PBAPS PSA Level 2 model. The results of the cost-benefit analysis are shown in Table G.5.5-2.

TABLE G.5.5-2
PHASE II SAMA NUMBER 21 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 21: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,689,512	$350,956	$480,000	-$129,044

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

G.6 PHASE II SAMA ANALYSIS SUMMARY

The SAMA candidates not eliminated from consideration by the baseline screening process or other PSA insights required the performance of a detailed analysis of the averted cost-risk and SAMA implementation costs. SAMA candidates are judged to be justified modifications if the averted cost-risk

resulting from the modification is greater that the cost of implementing the SAMA. Table G.6-1 summarizes the results of the detailed analyses that were performed for the SAMA candidates. None of the SAMAs analyzed were found to be cost-beneficial as defined by the methodology used in this study.

TABLE G.6-1
SUMMARY OF THE DETAILED SAMA ANALYSES

Phase II SAMA ID	Averted Cost-Risk	Cost of Site Implementation	Net Value
1	$8,409	$50,000	-$41,591
11	$265,097	$1,600,000	-$1,334,903
13	$388	$50,000	-$49,612
18(a)	$93,785	$2,000,000	-$1,906,215
18(b)	$174,238	$2,000,000	-$1,825,762
21	$350,956	$480,000	-$129,044

G.7 CONCLUSIONS

The results of this study indicate that none of the SAMA candidates would yield a significant reduction in public risk relative to the cost required to implement the SAMA. No plant changes or modifications have been identified for implementation or further review at PBAPS.

G.8 REFERENCES

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Ref. G.8-2 C. Payne, R. J. Breeding, H. –N. Jow, J. C. Helton, L. N. Smith, A. W. Shiver, "Evaluation of Severe Accident Risks: Peach Bottom, Unit 2," NUREG/CR-4551, SAND86-1309, Volume 4, Parts 1 and 2, Sandia National Laboratories, December 1990.

Ref. G.8-3 D. I. Chanin, J. L. Sprung, L. T. Ritchie and H. –N. Jow, "MELCOR Accident Consequence Code System (MACCS): User's Guide," NUREG/CR-4691, SAND86-1562, Volumes 1-3, Sandia National Laboratories, February 1990.

Ref. G.8-4 U.S. Nuclear Regulatory Commission, "Regulatory Analysis Technical Evaluation Handbook," NUREG/BR-0184, 1997.

Ref. G.8-5 NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," Volume 2, NRC, December 1997.

Ref. G.8-6 Edwin I. Hatch Nuclear Plant Application for License Renewal, Environmental Report, Appendix D, Attachment F, February 2000.

Ref. G.8-7 General Electric Nuclear Energy, Technical Support Document for the ABWR, 25A5680, Revision 1, January 18, 1995.

Ref. G.8-8 Letter from Mr. M. O. Medford (Tennessee Valley Authority) to NRC Document Control Desk, dated September 1, 1992, "Watts Bar Nuclear Plant Units 1 and 2 – Generic Letter (GL) – Individual Plant Examination (IPE) for Severe Accident Vulnerabilities – Response".

Ref. G.8-9 NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.36 Listing of SAMDAs considered for the Comanche Peak Steam Electric Station, NRC, May 1996.

Ref. G.8-10 Letter from Mr. D. E. Nunn (Tennessee Valley Authority) to NRC Document Control Desk, dated October 7, 1994, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA) – Response to Request for Additional Information (RAI)".

Ref. G.8-11 "Cost Estimate for Severe Accident Mitigation Design Alternatives, Limerick Generating Station for Philadelphia Electric Company," Bechtel Power Corporation, June 22, 1989.

Ref. G.8-12 NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.35, Listing of SAMDAs considered for the Limerick, NRC, May 1996.

Ref. G.8-13 Letter from Mr. W. J. Museler (Tennessee Valley Authority) to NRC Document Control Desk, dated October 7, 1994, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA)."

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Ref. G.8-17 NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," NRC, August 1994.

Ref. G.8-18 Hatch Individual Plant Examination.

Ref. G.8-19 Hatch Individual Plant Examination of External Events.

Ref. G.8-20 PBAPS Report on Accident Management Insights (includes disposition of IPE/PRA Level 1 and 2 insights and IPEEE insights).

Ref. G.8-21 GL 88-20, Supplement 1, NUREG-1335, "Individual Plant Examination: Submittal Guidance," August 29, 1989

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