APPENDIX C. MICROBIAL ORGANISMS CORRESPONDENCE

DOH = Florida Department of Health
FPL = Florida Power & Light Company

FPL

PTN-LR-99-0067
September 7, 1999

Dr. Russell Mardon
Florida Department of Health
2020 Capital Circle SE
Bin # A0823
Tallahassee, FL 32399-1712

Subject: Turkey Point Nuclear Plant
License Renewal Project
NRC Informal Consultation Preparation

Dear Dr. Mardon:

Florida Power & Light Company (FPL) is preparing an application to renew the operating license for its Turkey Point Nuclear Plant and we intend the application to be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify adverse impacts that might be associated with the continued operation of, or refurbishment to, a facility. If a cooling pond is used, an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water is required. Turkey Point's cooling canal system is considered to be a cooling pond.

As documented in the Turkey Point NPDES Permit (FL0001562), the cooling canal system does not discharge into waters of the United States. Enclosed is a "Description of the Turkey Point Closed Loop Cooling Canal System".

Dr. E. Zillioux of FPL's Environmental Services Department reviewed this matter and concluded that the cooling canals provided poor conditions for supporting populations of pathogenic organisms. In addition, no pathway for significant human exposure exists, considering there is no mechanism for inhalation exposure from aerosol production (such as spray nozzles or cooling towers), and restrictions against swimming and fishing preclude both direct contact and ingestion routes.

It is our intent that, by contacting you at this point in the process, we can identify any deficiencies, concerns, or data needed so that those areas identified can be addressed to ensure that the consultation process proceeds smoothly and efficiently.

After your review, we would greatly appreciate a letter concurring with Dr. Zillioux's conclusions. You are welcome to visit the site. A copy of your response will be submitted to the NRC as part of the license renewal application.

PTN-LR-99-0067
Page 2 of 2

If you have any comments or questions, please contact T. V. Abbatiello at (305) 246-6581.

Sincerely,

R.J. Hovey
Vice President
Turkey Point Plant

EAT/TVA/sap

Enclosure

ENCLOSURE TO PTN-LR-99-0067
Description of the Turkey Point Closed Loop Cooling Canal System

The Turkey Point Closed-Loop Cooling Canal System (Cooling Canals) services both the Turkey Point Fossil-Fired (2 units) and Nuclear (2 units) Power Plants. The power plant site and the cooling canals are located at southern-most tip of the Florida mainland, south of Miami, Florida. The cooling canals, which were built in the 1970's pursuant to a Consent Decree issued by the Florida Supreme Court, are not connected directly to any waters of the United States (WUS). Prior to building the closed-loop system, the Turkey Point Power Plants utilized a Once-Through Cooling Water System that originally discharged to Biscayne Bay, and later to Card Sound.

Some of the interesting facts and information associated with the cooling canals are:

1. The system is isolated from WUS. There is no direct make-up from or discharge to WUS. System make-up (to replace evaporative losses) is from rainwater.

2. There are a total of 168 miles of cooling canals covering approximately 6,100 acres (4,370 acres of water surface).

3. The average canal depth is 2.8 feet.

4. The total volume of water in the cooling canals is approximately 12,300 acre-feet (4 billion gallons).

5. The entire "water circuit", plant discharge back to plant intake, is 13.2 miles and takes approximately 44 hours.

6. The salinity ranges from 38 to 50 parts/thousand.

7. The temperature rise across the plant, from intake to discharge, averages 15-30°F depending on the unit, unit load, and various other factors. The average intake temperature is 2.5°F above average ambient air temperature.

FLORIDA DEPARTMENT OF HEALTH

Jeb Bush
Governor

Robert Brooks, M.D.
Secretary

November 4, 1999

Tom Abbatiello
Florida Power & Light Company
Turkey Point - Nuclear
9760 S.W. 344 Street
Homestead, FL 33035

Dear Mr. Abbatiello:

The Florida Department of Health (DOH) has reviewed the Comments on Aquatic Microorganisms in the Context of the Turkey Point Cooling Canals and Implications to Human Health Issues prepared by E.J. Zillioux, Ph.D. and concurs with his assessment that there is minimal public health risk from the cooling canals at the Turkey Point Nuclear Plant. The high salinity, high temperature, and high UV penetration in the canals will work to suppress the growth and pathogenicity of bacterial populations. Further, the lack of an exposure pathway between the canals and human populations reduces the likelihood of contact to insignificant levels.

This letter may be used by Florida Power and Light as part of its license renewal package for Turkey Point. I can be reached at 850-414-0034 if you need more information.

Sincerely,

Sharon Heber

Sharon Heber, Dr. P.H., Director
Division of Environmental Health

2020 Capital Circle SE, Bin #A08 • Tallahassee, FL 32399-0712

APPENDIX D. CULTURAL RESOURCES CORRESPONDENCE

FPL = Florida Power & Light Company
SHPO = Florida State Historic Preservation Officer

FPL

PTN-LR-99-0068
September 7, 1999

Mr. George Percy
State Historic Preservation Officer
Division of Historical Resources
500 South Bronough Street
Tallahassee, FL 32399-0250

Subject: Turkey Point Nuclear Plant
License Renewal Project
NRC Informal Consultation Preparation

Dear Mr. Percy :

Florida Power & Light Company (FPL) is preparing an application to renew the operating license for its Turkey Point Nuclear Plant and we intend the application to be consistent with your agency's interests and the priorities of our community. As part of the license renewal process, the Nuclear Regulatory Commission (NRC) requires that applicants identify impacts to cultural resources resulting from the renewal of the license. The NRC will request an informal consultation with your agency. We do not believe there will be any cultural impacts from license renewal activities. These include both license renewal term and any refurbishment activities. There are no land-disturbing refurbishment activities planned to support license renewal.

To assist you in your determination, please find enclosed a figure that depicts the Turkey Point Site and the associated transmission line corridors.

It is our intent that, by contacting you at this point in the process, we can identify any deficiencies, concerns, or data needed so that those areas identified can be addressed to ensure that the consultation process proceeds smoothly and efficiently.

After your review, we would greatly appreciate a letter confirming FPL's conclusion that impacts to cultural resources will be minimal or no impact and that there is no need for mitigation .

If you have any comments or questions, please contact T. V. Abbatiello at (305) 246-6581.

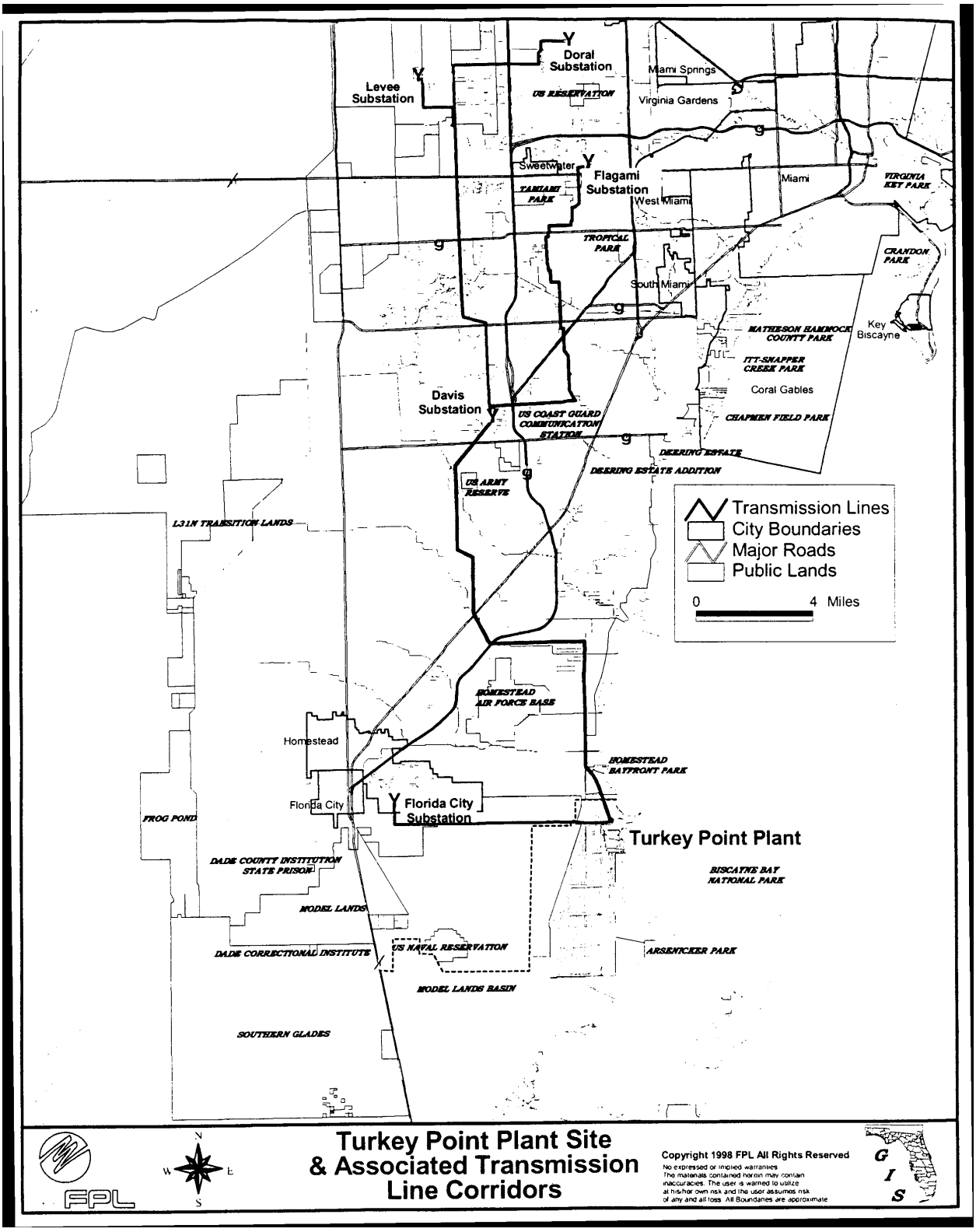
Sincerely yours,

R.J. Hovey
Vice President
Turkey Point Plant

EAT/TVA/sap

Enclosure: Turkey Point Plant Site & Associated Transmission Line Corridors Map

an FPL Group company


Doral Substation
Levee Substation
Flagami Substation
Davis Substation
Florida City Substation
Turkey Point Plant
Miami Springs
Virginia Gardens
Sweetwater
Miami
West Miami
South Miami
Coral Gables
Key Biscayne
Homestead
Florida City
US RESERVATION
TAMIAMI PARK
TROPICAL PARK
VIRGINIA KEY PARK
CRANDON PARK
MATHESON HAMMOCK COUNTY PARK
TT-SNAPPER CREEK PARK
US COAST GUARD COMMUNICATION STATION
CHAPMEN FIELD PARK
DEERING ESTATE
DEERING ESTATE ADDITION
US ARMY RESERVE
L31N TRANSITION LANDS
HOMESTEAD AIR FORCE BASE
HOMESTEAD BAYFRONT PARK
FROG POND
DADE COUNTY INSTITUTION STATE PRISON
BISCAYNE BAY NATIONAL PARK
MODEL LANDS
US NAVAL RESERVATION
ARSENICKER PARK
DADE CORRECTIONAL INSTITUTE
MODEL LANDS BASIN
SOUTHERN GLADES
Transmission Lines
City Boundaries
Major Roads
Public Lands
0
4 Miles
Turkey Point Plant Site & Associated Transmission Line Corridors
Copyright 1998 FPL All Rights Reserved
No expressed or implied warranties
The materials contained hereon may contain inaccuracies. The user is warned to utilize at his/her own risk and the user assumes risk of any and all loss. All Boundaries are approximate
FPL
GIS

DIVISIONS OF FLORIDA DEPARTMENT OF STATE
Office of the Secretary
Office of International Relations
Division of Elections
Division of Corporations
Division of Cultural Affairs
Division of Historical Resources
Division of Library and Information Services
Division of Licensing
Division of Administrative Services

MEMBER OF THE FLORIDA CABINET
State Board of Education
Trustees of the Internal Improvement Trust Fund
Administration Commission
Florida Land and Water Adjudicatory Commission
Siting Board
Division of Bond Finance
Department of Revenue
Department of Law Enforcement
Department of Highway Safety and Motor Vehicles
Department of Veterans' Affairs

FLORIDA DEPARTMENT OF STATE
Katherine Harris
Secretary of State
DIVISION OF HISTORICAL RESOURCES

October 22, 1999

Mr. R.J. Hovey
Florida Power & Light Company
Turkey Point Nuclear Plant
9760 SW 344 Street
Homestead, Florida 33035

RE: DHR Project File No. 997496
Cultural Resource Assessment Request
Nuclear Regulatory Commission
Turkey Point Nuclear Plant License Renewal Project
Homestead, Dade County, Florida

Dear Mr. Hovey:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced project for possible impact to historic properties listed, or eligible for listing, in the *National Register of Historic Places*. The authority for this procedure is the National Historic Preservation Act of 1966 (Public Law 89-665), as amended.

It is the opinion of this agency that because of the project nature (license renewal) it is considered unlikely that archaeological or historical sites will be affected. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing in the National Register.

If you have any questions concerning our comments, please contact Scott Edwards, Historic Preservation Planner, at 850-487-2333 or 800-847-7278. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

James A. Kammerer

for Janet Snyder Matthews
State Historic Preservation Officer

JSM/Ese

R.A. Gray Building • 500 South Bronough Street • Tallahassee, Florida 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 488-1480 • FAX: 488-3355
☐ Archaeological Research (850) 487-2299 • FAX: 414-2207
☑ Historic Preservation (850) 487-2333 • FAX: 922-0496
☐ Historical Museums (850) 488-1484 • FAX: 921-2503
☐ Historic Pensacola Preservation Board (850) 595-5985 • FAX: 595-5989
☐ Palm Beach Regional Office (561) 279-1475 • FAX: 279-1476
☐ St. Augustine Regional Office (904) 825-5045 • FAX: 825-5044
☐ Tampa Regional Office (813) 272-3843 • FAX: 272-2340

APPENDIX E. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

CONTROLLED COPY

PERMIT NO. FL0001562
Major Non-POTW

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et seq.; the "Act"),

Florida Power and Light Company
P.O. Box 088801
North Palm Beach, Florida 33408-8801

is not authorized to discharge from a facility located at

Turkey Point Plant
Palm Drive (9.5 miles east of Florida City)
Dade County
Florida City, Florida 33034

to water of the United States, except as provided in Part II.B of this permit.

The monitoring and reporting requirements and other conditions are set forth herein. This permit consists of this cover sheet, Part I 1 page, Part II 9 pages, and Part III 3 pages.

This permit shall become effective on January 1, 1995.

This permit and the authorization to discharge shall expire at midnight, September 30, 1999.

SEP 12 1994
Date Issued

For James H Scarbrough
Robert F. McGhee, Acting Director
Water Management Division

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - FINAL

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is not authorized to discharge from serial number 001, closed cycle cooling canal system, or any other point source(s) to waters of the United States.

PART II

STANDARD CONDITIONS FOR "NO DISCHARGE" NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions

Any person who violates a permit condition is subject to a civil penalty not to exceed $25,000 per day of such violation. Any person who willfully violates permit conditions is subject to a fine of not less than $5000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or both. Any person who negligently violates permit conditions is subject to a fine of not less than $2500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any violation of this permit which has a reasonable likelihood of adversely affecting human health or the enviroment.

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, terminated or revoked for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;

c. Information newly acquired by the Agency indicating that any condition poses a threat to human health or the environment.

If the permittee believes that any past or planned activity would be cause for modification or revocation and reissuance under 40 CFR 122.62, the permittee must report such information to the Permit Issuing Authority. The submittal of a new application may be required of the permittee. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

5. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" Section B, Paragraph B-3 and "Upsets" Section B, Paragraph B-4, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

6. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

7. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

8. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringemeent of Federal, State or local laws or regulations.

9. Onshore or Offshore Construction

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any waters of the United States (including wetlands).

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

11. Duty to Provide Information

The permittee shall furnish to the Permit Issuing Authority, within a reasonable time, any information which the Permit Issuing Authority may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Permit Issuing Authority upon request, copies of records required to be kept by this permit.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the condition of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility, which is not a designed or established operating mode for the facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass; including an evaluation of the anticipated quality and effect of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section D, Paragraph D-4 (24-hour notice).

c. Prohibition of bypass.

(1) Bypass is prohibited and the Permit Issuing Authority may take enforcement action against a permittee for bypass, unless:

(a) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass (e.g., maintenance of sufficient reserve holding capacity, the use of auxiliary treatment facilities, retention of untreated wastes, waste hauling, maintenance of a sufficient spare parts inventory, maintenance of an emergency power supply, or maintenance during normal periods of equipment downtime, etc.). This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under Paragraph b. of this section.

(2) The Permit Issuing Authority may, within its authority, approve an anticipated bypass, after considering its adverse effects, if the Permit Issuing Authority determines that it will meet the three conditions listed above in Paragraph c.(1) of this section.

4. Upsets

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. An upset constitutes an affirmative defense to an action brought for non-compliance with such technology-based permit limitation if the requirements of 40 CFR 122.41(n)(3) are met. (Note that this provision does not apply to water quality-based requirements.)

5. Removed Substances

This permit does not authorize discharge of solids, sludge, filter backwash, or other pollutants removed in the course of wastewater treatment.

SECTION C. INSPECTION AND ENTRY

The permittee shall allow the Permit Issuing Authority, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit; and

c. Inspect at reasonable time any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Change in Discharge

The permittee shall give notice to the Permit Issuing Authority as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could change the method of disposal.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Permit Issuing Authority of any planned change in the permitted facility or activity which may result in noncompliance with permit requirements. Any maintenance of facilities, which might necessitate unavoidable interruption of operation, shall be scheduled during noncritical water quality periods.

3. Transfer of Ownership or Control

A permit may be automatically transferred to another party if:

a. The permittee notifies the Permit Issuing Authority of the proposed transfer at least 30 days in advance of the proposed transfer date;

b. The notice includes a written agreement between the existing and ne permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

c. The Permit Issuing Authority does not notify the existing permittee of his or her intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph b.

4. Twenty-Four Hour Reporting

The permittee shall orally report any noncompliance which may endanger health or the environment within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, an estimate of the volume discharged and the name of the receiving stream, the period of noncompliance, including exact dates and times; and if the noncompliance has not been corrected, the anticipated time it is expected to continue, and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Permit Issuing Authority may verbally waive the written report, on a case-by-case basis, when the oral report is made.

The following violations shall be included in the 24 hour report:

a. An unanticipated bypass which results in a discharge to waters of the U.S.

b. Any upset which results in a discharge to waters of the U.S.

5. Other Noncompliance

The permittee shall report in narrative form, all instances of noncompliance not previously reported under Section D, Paragraphs D-2 and D-4. The reports shall contain the information listed in Paragraph D-4.

6. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit. The Permit Issuing Authority may grant permission to submit an application less than 180 days in advance but not later than the permit expiration date.

Where EPA is the Permit Issuing Authority, the terms and conditions of this permit are automatically continued in accordance with 40 CFR 122.6, only where the permittee has submitted a timely and complete application for a renewal permit and the Permit Issuing Authority is unable through no fault of the permittee to issue a new permit before the expiration date.

7. Signatory Requirements

All applications, reports, or information submitted to the Permit Issuing Authority shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (1) a president, secretary, treasurer or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy - or decision-making functions for the corporation, or (2) the manager of one or more manufacturing production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Permit Issuing Authority shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Permit Issuing Authority.

c. Certification. Any person signing a document under paragraphs (a) or (b) of this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

8. Availability of Reports

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Permit Issuing Authority. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

9. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false material statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under the Clean Water Act, shall, upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than 2 years, or by both.

SECTION E. DEFINITIONS

1. Permit Issuing Authority.

The Regional Administrator of EPA Region IV or his designee, unless at some time in the future the State receives the authority to administer the NPDES program and assumes jurisdiction over the permit; at which time, the Director of the State program receiving authorization becomes the issuing authority.

2. Act

"Act" means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) Public Law 92-500, as amended by Public Law 95-217, Public Law 95-576 and Public Law 100-4, 33 U.S.C. 1251 et seq.

3. Calendar Day

A calendar day is defined as the period from midnight of one day until midnight of the next day. However, for purposes of this permit, any consecutive 24-hour period that reasonably represents the calendar day may be used for sampling.

CONTROLLED COPY

PART III
OTHER REQUIREMENTS

A. Reporting of Monitoring Results

Reports of compliance with the no discharge to waters of the United States requirement shall be submitted for each calendar month by writing the statement "No Discharge" on a Discharge Monitoring Report (DMR) Form (EPA No. 3320-1). These forms shall be submitted after each calendar month and postmarked no later than the 28th day of the month following the completed calendar month. (For example, data for January shall be submitted by February 28.) Signed copies of these, and all other reports required by Section D of Part II, Reporting Requirements, shall be submitted to the Permit Issuing Authority at the following address:

Environmental Protection Agency
Region IV
Enforcement Section
Water Permits and Enforcement Branch
Water Management Division
345 Courtland Street, N.E.
Atlanta, GA 30365

Reopener Clause

This permit shall be modified, or alternatively, revoked and reissued to comply with any applicable effluent standard or limitation, or sludge disposal requirement issued or approved under Sections 301(b)(2)(c) and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act (the Act), as amended, if the effluent standard or limitation requirement so issued or approved:

(1) Contains different conditions or is otherwise more stringent that any condition in the permit; or

(2) Controls any pollutant, or disposal method not in the permit.

The permit as modified or reissued under this paragraph shall contain any other requirements of the Act then applicable.

C. Polychlorinated Biphenyl Compounds

There shall be no discharge of polychlorinated biphenyl compounds (PCB) such as those commonly used for transformer fluid.

D. Toxic Compounds

The company shall notify the Director in writing at least six months prior to planned use and discharge of any chemical or other product(s) which may be toxic to aquatic life. Such notification shall include:

1. Name and general composition of the chemical,
2. Frequencies of use,
3. Quantities to be used,
4. Proposed discharge concentrations,
5. Any acute and chronic toxicity data (including laboratory reports)
6. Product Data Sheet, and
7. Product label.

Upon receipt of this information, the Permit Issuing Authority will determine if a major modification to this permit is warranted. Discharge of materials subject to this part is prohibited prior to approval from the Permit Issuing Authority.

E. Products Registered Under FIFRA

Discharge of any product under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to any waste stream which may ultimately be released to lakes, rivers, or other waters of the United States is prohibited unless specifically authorized elsewhere in this permit. This requirement is not applicable to products used for lawn and agricultural purposes, or to herbicides if used in accordance with labeled instructions and any applicable State permit.

F. Hydrazine Monitoring Requirements

1. Discharge of hydrazine in boiler or steam generator blowdown is authorized without limitation or monitoring requirements.

2. Hydrazine from plant layup water during overhauls and/or refueling outages shall be measured at the outlet from the unit being serviced. Sampling shall be once per day of discharge by grab sample at the time of maximum expected concentration. Results of sampling will be submitted to EPA upon request. To determine the hydrazine concentration being discharged to the cooling canal system, the following equation shall be used:

$$\frac{\text{(B/S) Blowdown Flow x (B/S) Hydrazine Concentration}}{\text{Once-through Cooling Water Flow}} = \text{Hydrazine concentration at the close cycle cooling canal system}$$

where (B/S) refers to boiler or steam generator.

In the event that any value exceeds 3.4 mg/l, the permittee shall immediately modify its release pattern and resample. EPA shall be notified of the situation within five days.

G. Molybdate, Tolytriazole, and Nitrite Discharge Requirements

The discharge of molybdate, tolytriazole, and nitrite to the closed cycle recirculating cooling canal system during maintenance of the auxiliary closed cooling water system is allowed without limitations and monitoring requirements.

H. Closed Cycle Cooling Canal System Monitoring Requirements

The permittee shall monitor the water quality of the closed cycle cooling canal system. Grab samples shall be taken quarterly at the outlet from Lake Warren and shall include the following parameters:

Salinity	Temperature
Total Suspended Solids	Specific Conductance
Total Recoverable Zinc	pH
Total Recoverable Iron	
Total Recoverable Copper	

Results shall be submitted annually and are due on January 31, of each year.

I. Compliance with Other Provisions

Notwithstanding any other requirements of this "No Discharge" permit, the permittee shall comply with all applicable provisions of the Final Judgement dated September 10, 1971, in Civil Action Number 70-328-CA issued by the U.S. District Judge C. Clyde Atkins of the Southern District of Florida.

Department of
Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

NOTICE OF PERMIT

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

In the Matter of an
Application for Permit
by: Florida Power & Light Company
Turkey Point Power Plant
9670 S.W. 344 Street
Florida City, Florida 33035

DEP File No. FL0001562-001-IW1N
Dade County

Attention: Jim Arkerson

Enclosed is Permit Number FL0001562 for renewal of the facility's "No Discharge" NPDES permit for discharge of wastewater and once-through cooling water to a closed cycle recirculating cooling canal at the Turkey Point Power Plant located at 9670 S.W. 344 Street, Florida City, Dade County, Florida, issued under Section 403.0885, Florida Statutes and DEP Rule 62-620, Florida Administrative Code.

Any party to this order (permit) has the right to seek judicial review of the permit under section 120.68 of the Florida Statutes, by the filing of a Notice of Appeal under rule 9.110 of the Florida Rules of Appellate Procedure, with the Clerk of the Department of Environmental Protection, Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000 and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within thirty days after this notice is filed with the Clerk of the Department.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Mimi Drew

Mimi Drew
Director
Division of Water Resource Management
2600 Blair Stone Road
Tallahassee, FL 32399-2400
(850) 487-1855

"Protect, Conserve and Manage Florida's Environment and Natural Resources"

Printed on recycled paper.

Florida Power & Light Company
Facility ID Number FL0001562

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 01-07-00 to the listed persons.

[Clerk Stamp]

FILING AND ACKNOWLEDGMENT

FILED, on this date, under section 120.52(7), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

G. Shields 01-07-00
(Clerk) (Date)

Copies furnished to:

Chairman, Dade County Board of County Commissioners
Dade County DERM
Douglas Mundrick - EPA
Tim Powell- DEP West Palm Beach
Jennifer Fitzwater – DEP Tallahassee (w/o enclosure)

Department of
Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

STATE OF FLORIDA
INDUSTRIAL WASTEWATER FACILITY PERMIT

PERMITTEE:
Florida Power & Light Company
Turkey Point Power Plant
9760 S.W. 344 Street
Florida City, Fl 33035

Attention: Site Vice-President (Nuclear)
Plant General Manager (Fossil)

PERMIT NUMBER: FL0001562 - Major
ISSUANCE DATE: January 7, 2000
EXPIRATION DATE: January 6, 2005

FACILITY:

Florida Power & Light Company
Turkey Point Power Plant
9760 S.W. 344 Street
Florida City, FL 33035
Dade County

Latitude: 25° 26' 09" N Longitude: 80° 19' 51" W

This permit is issued under the provisions of Chapter 403, Florida Statutes, and applicable rules of the Florida Administrative Code and constitutes authorization to discharge to waters of the state under the National Pollutant Discharge Elimination System. The above named permittee is hereby authorized to operate the facilities shown on the application and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

OPERATION: This facility is a steam electric power generating facility which consists of 2 fossil fuel units (Units1& 2) and 2 nuclear units (Units 3 & 4). Units 1 & 2 each have a 404 megawatt net continuous capability. Units 3 & 4 each have a 693 megawatt net continuous capability. All four units obtain their once through condenser cooling water from and discharge to a closed cycle recirculating cooling canal system. There are no discharges to surface waters of the state.

WASTEWATER TREATMENT: The wastewater treatment system consists of a closed loop cooling canal system and two solids settling basins. Cooling water from units 1, 2, 3, and 4 is discharged to the closed cycle cooling canal system. A portion of the water from the cooling canal is discharged to Class G-III groundwaters through the cooling canal system which consists of an area of approximately 6700 acres. Variable quantities of other waste streams including chemical treatment system wastewater, blowdown water, reverse osmosis concentrate, condensate polishing system backwash water, and industrial/non-industrial stormwater oil/water separator discharges are discharged to the closed loop system directly or through one of two solids settling basins.

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EFFLUENT DISPOSAL:

Surface Water Discharge: The permittee is not authorized to discharge to surface waters of the State.

Ground Water Discharge: A portion of the existing 2763 MGD annual average flow to a closed cycle cooling canal system enters Class G-III groundwaters through an approximately 6700 acre closed cycle cooling canal system located at approximately Latitude: 25° 26' 09" N; Longitude: 80° 19' 51" W.

Other Disposal Methods: This permit authorizes an existing 2763 MGD annual average flow from Outfalls D-001 and D-002 to a closed cycle cooling canal system. The closed cycle cooling canal system, located at approximately Latitude: 25° 26' 09" N; Longitude: 80° 19' 51" W, is not considered surface waters of the State for purposes of this permit.

IN ACCORDANCE WITH: The limitations, monitoring requirements and other conditions as set forth in Part I through Part VIII on pages 3 through 14 of this permit.

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Florida City, FL 33035

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I. Effluent Limitations and Monitoring Requirements

A. Surface Water Discharges

This facility is not permitted to discharge to surface waters of the State.

B. Underground Injection Control Systems

This section is not applicable to this facility.

C. Land Application Systems

This section is not applicable to this facility.

D. Other Methods of Disposal or Recycling

1. During the period beginning upon the issue date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from **Outfall D-001**, once-through non-contact cooling water and other wastewater (as indicated in the permit renewal application) to the closed cycle cooling canal system.

   a. Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS		
EFFLUENT CHARACTERISTIC	Max. Daily Average	Daily Maximum	Daily Minimum	Monitoring Frequency	Sample Type	Sample Point
Salinity (ppth)	NA	Report	NA	Monthly	Grab	EFF-1
Total Suspended Solids (mg/l)	NA	Report	NA	Monthly	Grab	EFF-1
Total Recoverable Zinc (µg/l)	NA	Report	NA	1/Six months	Grab	EFF-1
Total Recoverable Iron (µg/l)	NA	Report	NA	1/Six months	Grab	EFF-1
Total Recoverable Copper (µg/l)	NA	Report	NA	1/Six months	Grab	EFF-1
Temperature (Deg. F)	NA	Report	NA	Monthly	Grab	EFF-1
Specific Conductance (µmhos/cm)	NA	Report	NA	Monthly	Grab	EFF-1
pH (S.U.)	NA	Report	Report	Monthly	Grab	EFF-1

   b. Effluent samples shall be taken at the monitoring site locations as described below:

Sample Point	Description of Monitoring Location
EFF-1	Outlet from Lake Warren

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2. During the period beginning upon the issue date of this permit and lasting through the expiration date of this permit, the permittee is authorized to discharge from **Outfall D-002**, supernatant from two solids settling basins to the closed cycle cooling canal system.

   a. Such discharge shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS		
EFFLUENT CHARACTERISTIC	Max. Daily Average	Daily Maximum	Daily Minimum	Monitoring Frequency	Sample Type	Sample Point
Total Suspended Solids (mg/l)	NA	Report	NA	Monthly	Grab	EFF-2
Total Recoverable Zinc (µg/l)	NA	Report	NA	1/Six months	Grab	EFF-2
Total Recoverable Lead (µg/l)	NA	Report	NA	Monthly	Grab	EFF-2
Total Recoverable Copper (µg/l)	NA	Report	NA	1/Six months	Grab	EFF-2
Specific Conductance (µmhos)	NA	Report	NA	Monthly	Grab	EFF-2
Oil & Grease (mg/l)	NA	Report	NA	1/Six months	Grab	EFF-2
pH, (S.U.)	NA	Report	Report	Monthly	Grab	EFF-2

   b. Effluent samples shall be taken at the monitoring site locations as described below:

Sample Point	Description of Monitoring Location
EFF-2	Discharge from Settling Basins prior to mixing with cooling canal system

E. Other Limitations and Monitoring and Reporting Requirements

1. The sampling and Testing Methods and Method of Detection Limits applicable to this permit shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-601, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantification limits), which is titled "Florida Department of Environmental Protection Table Required By Rule 62-4.246(4) Testing Methods for Discharge to Surface Water" dated June 21, 1996, is available from the Department on request. Any method and corresponding MDL and PQL listed in the above described table may be used for reporting as long as it meets the following requirements;

   a) The PQL for the specific parameter measured is less than or equal to the permit limit or the water quality criteria stated in the applicable section of 62-302 FAC. Parameters that are listed as "report only" in the permit shall use methods that provide a PQL which is equal to or less than the applicable water quality criteria stated in 62-302 FAC.

   b) If the PQL's for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter then the method with the lowest available PQL shall be used.

   c) In general the MDLs and PQLs as described above shall constitute the minimum reporting levels and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above. The permittee may request and the Department shall consider approval for alternative

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methods or for alternative MDLs and PQLs for any approved analytical method, in accordance with the criteria of Rules 62-160.520 (New Methods, Validation Requirements) and 62-160.530 (Approval of Alternate Test Procedures), F.A.C.

d) Unless otherwise specified, sample results shall be reported on the Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), as indicated in the DMR instructions.

2. During the period of operation authorized by this permit, the permittee shall complete and submit to the Department on a quarterly basis Discharge Monitoring Report(s)(DMR), Form 62-620.910(10), as attached to this permit. The permittee shall make copies of the attached DMR form(s) and shall submit the completed DMR form(s) to the Department by the twenty-eighth (28th) of the month, following the end of each quarter (i.e. April, July, Oct and January), of operation at the addresses specified below:

Florida Department of Environmental Protection
Mail Station 3551
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

If no discharge occurs during the reporting period, sampling requirements of this permit do not apply. The DMR form(s) shall be submitted as specified above with the no discharge indicator box checked or the statement "No Discharge" written thereon. If, during the term of this permit, the facility ceases to discharge, the Department shall be notified immediately upon cessation of discharge. Such notification shall be in writing.

3. Unless specified otherwise in this permit, all reports and notifications required by this permit, including twenty-four hour notifications, shall be submitted to or reported to, as appropriate, the Southeast District Office of the Department at the address specified below:

Florida Department of Environmental Protection
Southeast District Office
400 North Congress Avenue
West Palm Beach, FL 33401
Phone Number (561) 681-6600

4. Monitoring requirements of this permit become effective on the first day of the month following the date of permit issuance.

5. The permittee shall provide safe access points for obtaining representative samples which are required by this permit.

6. There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid.

7. This permit authorizes the use of the following biocides, or their generic equivalents, in various closed cooling water systems without limitations or monitoring; NALCO 7338, NALCO 7330, NALCO 7348, BULAB 6001/6002, BETZ POWERLINE 3610. The Permittee shall notify the Department if there is a discharge of any of these products into the closed cycle cooling canal system in other than deminimus amounts which contain concentrations of active ingredients below the MDL's for those ingredients.

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8. A permit revision from the Department shall be required prior to the use of any biocide or chemical additive, which may be toxic to aquatic life, (except as authorized elsewhere in this permit) in the cooling water system or any other portion of the industrial wastewater system. The permit revision request shall include:

   a. Name and general composition of biocide or chemical
   b. Frequencies of use
   c. Quantities to be used
   d. Proposed effluent concentrations
   e. Acute and/or chronic toxicity data (laboratory reports shall be prepared according to Section 12 of EPA document no. EPA/600/4-90/027 entitled, Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters for Freshwater and Marine Organisms, or most current addition.)
   f. Product data sheet
   g. Product label

   The Department shall review the above information to determine if a major or minor permit revision is necessary. Discharge associated with the use of such biocide or chemical is not authorized without prior authorization by the Department. Permit revisions shall be processed in accordance with the requirements of Chapter 62-620, F.A.C.

9. Discharge of any product registered under the Federal Insecticide, Fungicide, and Rodenticide Act to any waste stream which ultimately may be released to waters of the State is prohibited unless specifically authorized elsewhere in this permit. This requirement is not applicable to products used for lawn and agricultural purposes or to the use of herbicides if used in accordance with labeled instructions and any applicable State permit.

10. Hydrazine and Monoethanolamine (ETA) Monitoring Requirements

    a) Discharge of hydrazine and monoethanolamine (ETA) in the boiler or steam generator blowdown is authorized without limitation or monitoring requirements.

    b) Hydrazine from plant layup water during overhauls and/or refueling outages shall be measured at the outlet from the unit being serviced. Sampling shall be once per day of discharge by grab sample at the maximum expected concentration. Results of sampling will be submitted to the Department upon request. To determine the hydrazine concentration being discharged to the cooling canal system, the following equation shall be used:

    $$\frac{\text{(B/S) Blowdown Flow x (B/S) Hydrazine Concentration}}{\text{Once-through Cooling Water Flow}} = \text{Hydrazine concentration at the closed cycle cooling canal system}$$

    Where (B/S) refers to boiler or steam generator

    In the event that any value exceeds 3.4 mg/l, the permittee shall immediately modify its release pattern and resample. The Department's Southeast District office will be notified of the situation within five days.

11. Molybdate, Tolytriazole, and Nitrite Discharge Requirements

    The discharge of molybdate, tolytriazole, and nitrite to the closed cycle recirculating cooling canal system during maintenance of the auxiliary closed water system is allowed without limitations and monitoring requirements.

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12. Non-discharging/Closed Loop Vehicle Wash Recycle System Requirements
    a) No discharge of recycle system wastewater, including filter backwash water, is authorized to surface water or to ground water.
    b) The rainwater diversion system shall be operated in accordance with the facility's Best Management Practice Procedure as indicated on amended drawing No. 297-036, Alternate No.6, signed and sealed 4/23/99.
    c) A placard shall be conspicuously posted in the area of the non-discharging/closed loop recycle equipment which indicates the proper operation of the rainwater diversion system i.e. TRUCK WASH RAINWATER VALVE OPERATING PROCEDURE as indicated on amended drawing No. 297-036 Alternate No.6, signed and sealed 4/23/99.
    d) Spent process wastewater shall be disposed of at a Department permitted wastewater treatment facility which is capable of treating the wastewater.
    e) Any oil collected from the oil/water separator shall be disposed by a licensed used oil recycler in accordance with Florida Administrative Code 62-710 or otherwise recycled on site through Department approved methods and procedures.
    f) Any accidental discharge to ground water or surface water shall be reported to the Southeast District office.

13. Discharges from this facility shall comply with Metropolitan Dade County Code, Section 24-11.

14. Notwithstanding any other requirements of this "No Discharge" permit, the permittee shall comply with all applicable provisions of the Final Judgement dated September 10, 1971, in Civil Action Number 70-328-CA issued by the U.S. District Judge C. Clyde Atkins of the Southern District of Florida.

15. This permit constitutes certification of compliance with state Water Quality Standards (Section 401, PL 92-500)

II. Industrial Sludge Management Requirements

Sludge or other solids generated from the facility shall be reused, reclaimed, or otherwise disposed of in accordance with the requirements of Chapter 62-701, F.A.C.

The permittee shall keep records of the amount of sludge or residuals disposed of, transported or incinerated. If a person other than the permittee is responsible for sludge transporting, disposal or incineration, the permittee shall also keep the following records, which shall be available to the Department upon request.:
    a) Name, address and telephone number of any transporter and any manifests or bills of lading used;
    b) Name and location of the site of disposal, treatment or incineration;
    c) Name address and telephone number of the entity responsible for the disposal, treatment or incineration.

III. Ground Water Monitoring Requirements

Ground water monitoring is not required for this facility.

IV. Other Land Application Requirements

1. The permittee's discharge to ground water shall not cause a violation of the minimum criteria for ground water specified in Rule 62-520.400, F.A.C. and 62-520.430, F.A.C.

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V. Operation and Maintenance Requirements

A. Operation of Treatment and Disposal Facilities

1. The permittee shall ensure that the operation of this facility is as described in the application and supporting documents.

2. The operation of the pollution control facilities described in this permit shall be under the supervision of a person who is qualified by formal training and/or practical experience in the field of water pollution control.

B. Record keeping Requirements:

The permittee shall maintain the following records on the site of the permitted facility and make them available for inspection:

1. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;
2. Copies of all reports, other than those required in items 1. and 6. of this section, required by the permit for at least three years from the date the report was prepared, unless otherwise specified by Department rule;
3. Records of all data, including reports and documents used to complete the application for the permit for at least three years from the date the application was filed, unless otherwise specified by Department rule;
4. A copy of the current permit;
5. A copy of any required record drawings;
6. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date on the logs or schedule.

VI. Schedules

Not applicable to this facility.

VII. Other Specific Conditions

A. Specific Conditions Applicable to All Permits

1. Drawings, plans, documents or specifications submitted by the permittee, not attached hereto, but retained on file at the Tallahassee Office, are made a part hereof.

2. Where required by Chapter 471 (P.E.) or Chapter 492 (P.G.) Florida Statutes, applicable portions of reports to be submitted under this permit, shall be signed and sealed by the professional(s) who prepared them. This permit satisfies Industrial Wastewater program permitting requirements only and does not authorize operation of this facility prior to obtaining any other permits required by local, state or federal agencies.

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B. Duty to Reapply

1. The permittee shall submit an application to renew this permit at least 180 days before the expiration date of this permit.

2. The permittee shall apply for renewal of this permit on the appropriate form listed in Rule 62-620.910, F.A.C., and in the manner established in Chapter 62-620, F.A.C., and the Department of Environmental Protection Guide to Wastewater Permitting including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C.

3. An application filed in accordance with subsections 1. and 2. of this part shall be considered timely and sufficient. When an application for renewal of a permit is timely and sufficient, the existing permit shall not expire until the Department has taken final action on the application for renewal or until the last day for seeking judicial review of the agency order or a later date fixed by order of the reviewing court.

4. The late submittal of a renewal application shall be considered timely and sufficient for the purpose of extending the effectiveness of the expiring permit only if it is submitted and made complete before the expiration date.

C. Reopener Clause

1. The permit shall be modified, or alternatively, revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act (the Act), as amended, if the effluent standard or limitation so issued or approved:

   a.) Contains different conditions or is otherwise more stringent than any condition in the permit/or;

   b.) Controls any pollutant not addressed in the permit.

   The permit as modified or reissued under this paragraph shall contain any other requirements of the Act then applicable.

2. The permit may be reopened to adjust effluent limitations or monitoring requirements should future wasteload allocation determinations, water quality studies, DEP approved changes in water quality standards, or other information show a need for a different limitation or monitoring requirement.

D. Specific Conditions Related to Existing Manufacturing, Commercial, Mining, and Silviculture Wastewater Facilities or Activities

1. Existing manufacturing, commercial, mining, and silvicultural wastewater facilities or activities that discharge into surface waters shall notify the Department as soon as they know or have reason to believe: [62-620.624(1)]

   (a) That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following levels
   (1) One hundred micrograms per liter,
   (2) Two hundred micrograms per liter for acrolein and acrylonitrile; five hundred micrograms per liter for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter for antimony, or
   (3) Five times the maximum concentration value reported for that pollutant in the permit application.

   (b) That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following levels

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(1) Five hundred micrograms per liter,
(2) One milligram per liter for antimony, or
(3) Ten times the maximum concentration value reported for that pollutant in the permit application.

VIII. General Conditions

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. *[62-620.610(1), F.A.C]*

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. *[62-620.610(2), F.A.C.]*

3. As provided in Subsection 403.087(6), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringements of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. *[62-620.610(3), F.A.C.]*

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. *[62-620.610(4), F.A.C.]*

5. This permit does not relieve the permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. *[62-620.610(5), F.A.C.]*

6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. *[62-620.610(6), F.A.C.]*

7. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. *[62-620.610(7), F.A.C.]*

8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. *[62-620.610(8), F.A.C.]*

9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable,

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upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to

a. Enter upon the permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;
b. Have access to and copy any records that shall be kept under the conditions of this permit;
c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and
d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

[62-620.610(9), F.A.C.]

10. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, Florida Statutes, or Rule 62-620.302, F.A.C. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. [62-*620.610(10), F.A.C.]*

11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. *[62-620.610(11), F.A.C.]*

12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. *[62-620.610(12), F.A.C.]*

13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. *[62-620.610(13), F.A.C.]*

14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. *[62-620.610(14), F.A.C.]*

15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. *[62-620.610(15), F.A.C.]*

PERMITTEE:

Florida Power & Light Company
Turkey Point Power Plant
9760 S.W. 344 Street
Florida City, FL 33035

PERMIT NUMBER: FL0001562 - Major
ISSUANCE DATE: January 7, 2000
EXPIRATION DATE: January 6, 2005

16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300 and the Department of Environmental Protection Guide to Wastewater Permitting at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2) for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. *[62-620.610(16), F.A.C.]*

17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:
    a. A description of the anticipated noncompliance;
    b. The period of the anticipated noncompliance, including dates and times; and
    c. Steps being taken to prevent future occurrence of the noncompliance.
    [62-620.610(17), F.A.C.]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246, Chapter 62-160 and 62-601, F.A.C. and 40 CFR 136, as appropriate.
    a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10).
    b. If the permittee monitors any contaminate more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
    c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.
    d. Any laboratory test required by this permit for domestic wastewater facilities shall be performed by a laboratory that has been certified by the Department of Health and Rehabilitative Services (DHRS) under Chapter 10D41, F.A.C., to perform the test. In domestic wastewater facilities, on-site tests for dissolved oxygen, pH, and total chlorine residual shall be performed by a laboratory certified test for those parameters or under the direction of an operator certified under Chapter 61E12-41, F.A.C.
    e. Under Chapter 62-160, F.A.C., sample collection shall be performed by following the protocols outlined in "DER Standard Operating Procedures for Laboratory Operations and Sample Collection Activities" (DER-QA-001/92). Alternatively, sample collection may be performed by an organization who has an approved Comprehensive Quality Assurance Plan (CompQAP) on file with the Department. The CompQAP shall be approved for collection of samples from the required matrices and for the required tests.
    [62-620.610(18), F.A.C.]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. *[62-620.610(19), F.A.C.]*

20. The permittee shall report to the Department any noncompliance which may endanger health or the environment. Any information shall be provided orally with 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

    a. The following shall be included as information which must be reported within 24 hours under this condition:

PERMITTEE:

Florida Power & Light Company
Turkey Point Power Plant
9760 S.W. 344 Street
Florida City, FL 33035

PERMIT NUMBER: FL0001562 - Major
ISSUANCE DATE: January 7, 2000
EXPIRATION DATE: January 6, 2005

1. Any unanticipated bypass which causes any reclaimed water or the effluent to exceed any permit limitation or results in an unpermitted discharge,
2. Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
3. Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
4. Any unauthorized discharge to surface or ground waters.

b. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department shall waive the written report.

21. The permittee shall report all instances of noncompliance not reported under Conditions VIII. 18 and 19 of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Condition VIII. 20. of this permit. *[62-620.610(21), F.A.C.]*

22. Bypass Provisions.

a. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(3). The permittee submitted notices as required under Condition VIII.22.b. of this permit.

b. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Condition VIII.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

c. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Condition VIII.22 a.(1) through (3) of this permit.

d. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provision of Condition VIII.22.a. through c. of this permit.

[62-620.610(22), F.A.C.]

PERMITTEE:

Florida Power & Light Company
Turkey Point Power Plant
9760 S.W. 344 Street
Florida City, FL 33035

PERMIT NUMBER: FL0001562 - Major
ISSUANCE DATE: January 7, 2000
EXPIRATION DATE: January 6, 2005

23. Upset Provisions

a. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:

(1). An upset occurred and that the permittee can identify the cause(s) of the upset;

(2). The permitted facility was at the time being properly operated;

(3). The permittee submitted notice of the upset as required in Condition VIII.20. of this permit; and

(4). The permittee complied with any remedial measures required under Condition VIII.5. of this permit.

b. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

c. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review. *[62-620.610(23), F.A.C.]*

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Mimi Drew
Director
Division of Water Resource Management

2600 Blair Stone Road
Tallahassee, FL 32399-2400

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed Mail This Report To: Department of Environmental Protection , MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: Florida Power & Light Company
MAILING ADDRESS: 9760 SW 344th Street
Florida City, FL 33035

FACILITY: Turkey Point Power Plant
LOCATION: 9760 SW 344th Street
Florida City, FL 33035
COUNTY: Dade County

PERMIT NUMBER: FL 0001562
MONITORING PERIOD From: _____ To: _____
LIMIT: Final
REPORT: Monthly
CLASS SIZE: Major
GROUP: Industrial
DISCHARGE POINT NUMBER: D-001
DMR Issued: 1/7/00
PLANT SIZE/TREATMENT TYPE:
check if no discharge for reporting period ☐

Please read instructions before completing the form

Parameters		Quantity or Loading			Quality or Concentration				No. Ex.	Frequency of Analysis	Sample Type
		Avg.	Max.	Units	Min.	Avg.	Max.	Units			
Salinity	Sample Measurement										
STORET No. 00480 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	ppth		Monthly	Grab
Total Suspended Solids	Sample Measurement										
STORET No. 00530 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	mg/l		Monthly	Grab
Zinc, Total Recoverable	Sample Measurement										
STORET No. 01094 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	µg/l		1/six months	Grab
Iron, Total Recoverable	Sample Measurement										
STORET No. 00980 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	mg/l		1/six months	Grab

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein; and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Name/Title of Principal Executive Officer or Authorized Agent (Type or Print)	Signature of Principal Executive officer Or Authorized Agent	Telephone No. (incl. area code)	Date (yy/mm/dd)

COMMENT AND EXPLANTION OF ANY VIOLATIONS (Reference all attachments here):

DEP Form 62-620.910(10), effective November 29, 1994

A-1

Part A (Continued)

FACILITY NAME: Turkey Point Power Plant **PERMIT NUMBER: FL0001562** **DISCHARGE POINT NUMBER: D-001**

Parameters		Quantity or Loading			Quality or Concentration				No. Ex.	Frequency of Analysis	Sample Type
		Avg.	Max.	Units	Min.	Avg.	Max.	Units			
Copper, Total Recoverable	Sample Requirement										
STORET No. 01119 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	mg/l		1/six months	Grab
Temperature	Sample Requirement										
STORET No. 00011 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	°F		Monthly	Grab
Specific Conductance	Sample Requirement										
STORET No. 00095 1 Mon. Site No. EFF-1	Permit Requirement						Report Daily Maximum	µmhos		Monthly	Grab
pH	Sample Requirement										
STORET No. 00400 1 Mon. Site No. EFF-1	Permit Requirement				Report Daily Minimum		Report Daily Maximum	Std. Unit		Monthly	Grab

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein; and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Name/Title of Principal Executive Officer or Authorized Agent (Type or Print)	Signature of Principal Executive officer Or Authorized Agent	Telephone No. (incl. area code)	Date (yy/mm/dd)

COMMENT AND EXPLANTION OF ANY VIOLATIONS (Reference all attachments here):

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed Mail This Report To: Department of Environmental Protection , MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: Florida Power & Light Company
MAILING ADDRESS: 9760 SW 344th Street
Florida City, FL 33035

FACILITY: Turkey Point Power Plant
LOCATION: 9760 SW 344th Street
Florida City, FL 33035
COUNTY: Dade County

PERMIT NUMBER: FL 0001562
MONITORING PERIOD From: _____ To: _____
LIMIT: Final
CLASS SIZE: Major
DISCHARGE POINT NUMBER: D-002
PLANT SIZE/TREATMENT TYPE:
☐-check if no discharge for reporting period

REPORT: Monthly
GROUP: Industrial
DMR Issued: 1/7/00

Please read instructions before completing the form

Parameters		Quantity or Loading			Quality or Concentration				No. Ex.	Frequency of Analysis	Sample Type
		Avg.	Max.	Units	Min.	Avg.	Max.	Units			
Total Suspended Solids	Sample Measurement										
STORET No. 00530 1 Mon. Site No. EFF-2	Permit Requirement						Report Daily Maximum	mg/l		Monthly	Grab
Zinc, Total Recoverable	Sample Measurement										
STORET No. 01094 1 Mon. Site No. EFF-2	Permit Requirement						Report Daily Maximum	µg/l		1/six months	Grab
Lead, Total Recoverable	Sample Measurement										
STORET No. 01114 1 Mon. Site No. EFF-2	Permit Requirement						Report Daily Maximum	µg/l		Monthly	Grab
Copper, Total Recoverable	Sample Measurement										
STORET No. 01119 1 Mon. Site No. EFF-2	Permit Requirement						Report Daily Maximum	µg/l		1/six months	Grab
Specific Conductance	Sample Measurement										
STORET No. 00095 1 Mon. Site No. EFF-2	Permit Requirement						Report Daily Maximum	µmhos		Monthly	Grab

Name/Title of Principal Executive Officer or Authorized Agent (Type or Print)	Signature of Principal Executive officer Or Authorized Agent	Telephone No. (incl. area code)	Date (yy/mm/dd)

COMMENT AND EXPLANTION OF ANY VIOLATIONS (Reference all attachments here):

DEP Form 62-620.910(10), effective November 29, 1994

A-3

Part A (Continued)

FACILITY NAME: Turkey Point Power Plant **PERMIT NUMBER: FL0001562** **DISCHARGE POINT NUMBER: D-002**

Parameters		Quantity or Loading			Quality or Concentration				No. Ex.	Frequency of Analysis	Sample Type
		Avg.	Max.	Units	Min.	Avg.	Max.	Units			
Oil & Grease	Sample Measurement										
STORET No. 00556 1 Mon. Site No. EFF-2	Permit Requirement						Report Daily Maximum	mg/l		1/six months	Grab
pH	Sample Measurement										
STORET No. 00400 1 Mon. Site No. EFF-2	Permit Requirement				Report Daily Minimum		Report Daily Maximum	Std. Units		Monthly	Grab

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein; and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Name/Title of Principal Executive Officer or Authorized Agent (Type or Print)	Signature of Principal Executive officer Or Authorized Agent	Telephone No. (incl. area code)	Date (yy/mm/dd)

COMMENT AND EXPLANTION OF ANY VIOLATIONS (Reference all attachments here):

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

The DMR consists of four parts--A, B, C, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part C is only applicable for domestic wastewater facilities with limited wet weather discharges permitted under Chapter 62-610.860, F.A.C. Part D is used for reporting ground water monitoring well data.

Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be typed or printed in ink.

In addition to filling in numerical results on various parts of the DMR, the following codes should be used and an explanation provided where appropriate. Note: Codes used by the lab for raw data may be different.

CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.
DRY	Dry Well
FLD	Flood disaster.
IFS	Insufficient flow for sampling.
LS	Lost sample.
MNR	Monitoring not required this period since limit is conditional.

CODE	DESCRIPTION/INSTRUCTIONS
NOD	No discharge from/to site.
OPS	Operations were shutdown so no sample could be taken.
OTH	Other. Please enter an explanation of why monitoring data were not available.
SEF	Sampling equipment failure.
TNTC	Too numerous too count (for fecal coliform bacteria only).

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions and code should be used:

CODE	DESCRIPTION/INSTRUCTIONS
<	If the sampled value is less than the method detection limit (MDL), enter a less than sign followed by the laboratory's MDL value, e.g. < 0.001. In cases where a laboratory reports a value which is less than the parameter's practical quantification limit (PQL), but, not less than the MDL, the value should be reported as the laboratory's MDL value. For example, where the MDL = 0.001, the PQL = 0.005 and the laboratory reports <0.005 (the PQL), the value of 0.001 should be reported on the DMR.

PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.) Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following blanks in the header should be completed by the permittee or authorized representative:

No Discharge From Site: Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number. If there was no discharge of effluent for a particular outfall, reuse, or land application system and the DMR monitoring group includes other monitoring locations (e.g., influent sampling); the "NOD" code should be used to individually denote those parameters for which there was no discharge.
Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Sample Measurement: Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.).
No. Ex.: Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter. If none, enter zero.
Frequency of Analysis: The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.
Sample Type: The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comment and Explanation of Any Violations: Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

PART B - DAILY SAMPLE RESULTS

Month/Year: Enter the month and year during which the data on this report were collected and analyzed.
Three-month Average Daily Flow: Calculate and enter the three-month average daily flow to the treatment facility.
(TMADF/Permitted Capacity) x 100: Divide the three-month average daily flow by the permitted capacity of the treatment facility, multiply by 100, and enter this value.
Daily Monitoring Results: Record the results of daily monitoring for the parameters required to be sampled by your permit. Record the data in the units indicated.
Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.
Type of Effluent Disposal or Reclaimed Water Reuse: Enter the type of effluent disposal or reclaimed water reuse (e.g. surface water discharge, ocean outfall, slow rate land application-public access, slow rate land application-restricted public access, rapid rate land application, absorption field, underground injection).
Limited Wet Weather Discharge Activated: If this plant does not have a limited wet weather discharge permitted under the provision of Rule 62-610.860, F.A.C., check 'Not Applicable.' If the plant activated the wet weather discharge during the reporting month, check 'Yes' and attach PART C - LIMITED WET WEATHER DISCHARGE.

PART C - LIMITED WET WEATHER DISCHARGE

This part is to be completed and submitted each month reclaimed water or effluent is discharged by a limited wet weather discharge permitted under Rule 62-610.860, F.A.C. For months with no discharge, Part C need not be submitted. All information is to be provided for each day on which the limited wet weather discharge was activated.

Month/Year: Enter the month and year during which the data on this report were collected and analyzed.
Rainfall Information: Enter the name and location of the rainfall gauging station, the source of climatological (normal rainfall) data, the cumulative rainfall for the average rainfall year, and the cumulative rainfall to date for this calendar year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which falls during an average rainfall year from January through the month for which this part contains data. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.
Date: Enter the date on which the discharge occurred.
Duration of Discharge: Enter the number of hours, to the nearest 0.1 of an hour (0.1 hr. = 6 min.) during each day of discharge that reclaimed water was actually discharged to surface waters.
Gallons Discharged: Enter the quantity in millions of gallons of reclaimed water discharged during the period shown in duration of discharge. Show the units as millions of gallons (mg), accurate to the nearest 0.01.
Average Discharge Flow Rate: Divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).
Average Upstream Flow Rate: Enter the average flow rate in the receiving stream upstream from the point of discharge for the period shown in duration of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.
Stream Dilution Factor: Enter the actual stream dilution ratio accurate to the nearest 0.1. To calculate the factor, divide the average upstream flow rate by the average discharge flow rate.
$CBOD_5$: Enter the average $CBOD_5$ of the reclaimed water discharged during the period shown in duration of discharge.
TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.
Total P: Enter the cumulative number of days since January 1 of the current year during which the limited wet weather discharge was activated divided by the total number of days since January 1 of the current year multiplied by 100%.
Reason for Discharge: Provide a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.
Sampling Methods: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)
Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).
Preservatives Added: State what preservatives were added to the sample.
Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.
Analysis Result/Units: Record the results of the analysis. If the result was below the minimum detection limit, indicate that. Enter the units associated with the results of the analysis.
Detection Limits/Units: Record the detection limits of the analytical methods used and the units associated with them.
Comments and Explanations: Use this space to make any comments on or explanations of results which are unexpected. If more space is needed, reference all attachments in this area.

APPENDIX F. SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS

Appendix F contains the following sections:

F.1 – Melcor Accident Consequences Code System Modeling

F.2 – Evaluation of Candidate SAMAs

F.3 – Acronyms Used in Appendix F

F.1 MELCOR ACCIDENT CONSEQUENCES CODE SYSTEM MODELING

F.1.1 INTRODUCTION

The following sections describe the assumptions made and the results of modeling performed to assess the risks and consequences of severe accidents (U.S. Nuclear Regulatory Commission Class 9) at Turkey Point Units 3 & 4.

The severe accident consequence analysis was carried out with the Melcor Accident Consequences Code System (MACCS2) code (Ref. F.1-1). MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The principal phenomena considered in MACCS2 are atmospheric transport, mitigative actions based on dose projection, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs.

F.1.2 INPUT

The input data required by MACCS2 are outlined below.

F.1.2.1 CORE INVENTORY

The core inventory (Table F.1-1) is for an uprated power level of 2300 megawatts-thermal. These values were obtained by adjusting the end-of-cycle values for a 3,412 megawatts-thermal pressurized water reactor by a linear scaling factor of 0.6741 (Ref. F.1-1).

F.1.2.2 SOURCE TERMS

The source term input data to MACCS2 were the severe accident source terms presented in the probabilistic risk assessment in the Turkey Point Units 3 & 4 Individual Plant Examination (Ref. F.1-2). This document defines the releases in terms of release modes and demonstrates the method of calculating releases. There are 47 release modes: 20 with early Containment failure, 25 with late Containment failure, and 2 with Containment bypass as the failure mode. Table F.1-2 lists the input release fractions for each MACCS2 nuclide group

TABLE F.1-1
CORE INVENTORY[a]

Nuclide	Core Inventory (becquerels)	Nuclide	Core Inventory (becquerels)
Cobalt-58	2.17×10^{16}	Tellurium-131M	3.15×10^{17}
Cobalt-60	1.66×10^{16}	Tellurium-132	3.14×10^{18}
Krypton-85	1.67×10^{16}	Iodine-131	2.16×10^{18}
Krypton-85M	7.81×10^{17}	Iodine-132	3.19×10^{18}
Krypton-87	1.43×10^{18}	Iodine-133	4.57×10^{18}
Krypton-88	1.93×10^{18}	Iodine-134	5.02×10^{18}
Rubidium-86	1.27×10^{15}	Iodine-135	4.31×10^{18}
Strontium-89	2.42×10^{18}	Xenon-133	4.57×10^{18}
Strontium-90	1.31×10^{17}	Xenon-135	8.58×10^{17}
Strontium-91	3.11×10^{18}	Cesium-134	2.91×10^{17}
Strontium-92	3.24×10^{18}	Cesium-136	8.87×10^{16}
Yttrium-90	1.40×10^{17}	Cesium-137	1.63×10^{17}
Yttrium-91	2.95×10^{18}	Barium-139	4.23×10^{18}
Yttrium-92	3.25×10^{18}	Barium-140	4.19×10^{18}
Yttrium-93	3.68×10^{18}	Lanthanum-140	4.28×10^{18}
Zirconium-95	3.73×10^{18}	Lanthanum-141	3.93×10^{18}
Zirconium-97	3.88×10^{18}	Lanthanum-142	3.79×10^{18}
Niobium-95	3.52×10^{18}	Cerium-141	3.81×10^{18}
Molybdenum-99	4.11×10^{18}	Cerium-143	3.70×10^{18}
Technetium-99M	3.55×10^{18}	Cerium-144	2.30×10^{18}
Ruthenium-103	3.06×10^{18}	Praseodymium-143	3.64×10^{18}
Ruthenium-105	1.99×10^{18}	Neodymium-147	1.63×10^{18}
Ruthenium-106	6.96×10^{17}	Neptunium-239	4.36×10^{19}
Rhodium-105	1.38×10^{18}	Plutonium-238	2.47×10^{15}
Antimony-127	1.88×10^{17}	Plutonium-239	5.57×10^{14}
Antimony-129	6.65×10^{17}	Plutonium-240	7.02×10^{14}
Tellurium-127	1.81×10^{17}	Plutonium-241	1.18×10^{17}
Tellurium-127M	2.40×10^{16}	Americium-241	7.81×10^{13}
Tellurium-129	6.25×10^{17}	Curium-242	2.99×10^{16}
Tellurium-129M	1.65×10^{17}	Curium-244	1.75×10^{15}

a. Ref. F.1-1.

TABLE F.1-2
RELEASE FRACTION BY NUCLIDE GROUP[a]

Release Mode[b]	Xenon/ Krypton	Iodine	Cesium	Tellurium	Strontium	Base Case Frequency per Reactor Year
A1	9.50×10^{-1}	2.58×10^{-5}	2.57×10^{-5}	0	0	2.49×10^{-7}
A2	9.50×10^{-1}	7.80×10^{-2}	7.80×10^{-2}	0	0	1.18×10^{-7}
B1	9.50×10^{-1}	8.87×10^{-4}	4.88×10^{-4}	0	0	8.45×10^{-7}
B2-L	9.50×10^{-1}	9.24×10^{-2}	9.20×10^{-2}	0	0	1.48×10^{-7}
B2-R	9.50×10^{-1}	1.96×10^{-1}	2.30×10^{-1}	0	0	1.47×10^{-7}
B3-L	9.50×10^{-1}	8.87×10^{-4}	4.88×10^{-4}	0	0	2.90×10^{-7}
B3-R	9.50×10^{-1}	2.22×10^{-3}	1.22×10^{-3}	0	0	2.90×10^{-7}
B4-L	9.50×10^{-1}	9.24×10^{-2}	9.20×10^{-2}	0	0	1.01×10^{-7}
B4-R	9.50×10^{-1}	2.31×10^{-1}	2.30×10^{-1}	0	0	1.01×10^{-7}
B5-L	9.50×10^{-1}	1.33×10^{-3}	9.36×10^{-4}	0	8.71×10^{-8}	1.44×10^{-10}
B5-R	9.50×10^{-1}	3.34×10^{-3}	2.34×10^{-3}	0	4.36×10^{-7}	1.44×10^{-10}
B6-L	9.50×10^{-1}	6.45×10^{-2}	6.40×10^{-2}	0	2.64×10^{-4}	6.57×10^{-11}
B6-R	9.50×10^{-1}	1.61×10^{-1}	9.12×10^{-2}	0	1.32×10^{-3}	6.56×10^{-11}
BP-V	1.00	7.84×10^{-1}	7.84×10^{-1}	9.22×10^{-4}	1.46×10^{-2}	6.24×10^{-8}
BP-SGTR	2.87×10^{-1}	1.20×10^{-2}	1.20×10^{-2}	0	1.86×10^{-5}	1.71×10^{-8}
C1-L	9.50×10^{-1}	8.87×10^{-4}	4.88×10^{-4}	1.58×10^{-6}	6.60×10^{-8}	1.06×10^{-6}
C1-R	9.50×10^{-1}	2.22×10^{-3}	1.22×10^{-3}	3.96×10^{-6}	3.30×10^{-7}	1.06×10^{-6}
C2-L	9.50×10^{-1}	9.24×10^{-2}	9.20×10^{-2}	1.58×10^{-3}	6.60×10^{-5}	7.02×10^{-7}
C2-R	9.50×10^{-1}	2.31×10^{-1}	2.30×10^{-1}	3.96×10^{-3}	3.30×10^{-4}	5.96×10^{-7}
C3-L	9.50×10^{-1}	8.87×10^{-4}	4.88×10^{-4}	1.58×10^{-6}	6.60×10^{-8}	1.07×10^{-6}
C3-R	9.50×10^{-1}	2.22×10^{-3}	1.22×10^{-3}	3.96×10^{-6}	3.30×10^{-7}	1.07×10^{-6}
C4-L	9.50×10^{-1}	9.24×10^{-2}	9.20×10^{-2}	1.58×10^{-3}	6.60×10^{-5}	6.46×10^{-7}
C4-R	9.50×10^{-1}	2.31×10^{-1}	2.30×10^{-1}	3.96×10^{-3}	3.30×10^{-4}	5.59×10^{-7}
C5-L	9.50×10^{-1}	1.33×10^{-3}	9.36×10^{-4}	1.58×10^{-6}	1.53×10^{-7}	2.02×10^{-10}
C5-R	9.50×10^{-1}	3.34×10^{-3}	2.34×10^{-3}	3.96×10^{-6}	7.66×10^{-7}	2.02×10^{-10}
C6-L	9.50×10^{-1}	6.45×10^{-2}	6.40×10^{-2}	1.58×10^{-3}	3.30×10^{-4}	1.30×10^{-10}
C6-R	9.50×10^{-1}	1.61×10^{-1}	1.60×10^{-1}	3.96×10^{-3}	1.65×10^{-3}	1.01×10^{-10}
D1-L	1.00	5.15×10^{-3}	4.75×10^{-3}	0	0	0
D1-R	1.00	1.29×10^{-2}	1.19×10^{-2}	0	0	3.25×10^{-10}

TABLE F.1-2 (Cont'd)
RELEASE FRACTION BY NUCLIDE GROUP[a]

Release Mode[b]	Xenon/ Krypton	Iodine	Cesium	Tellurium	Strontium	Base Case Frequency per Reactor Year
D2-L	1.00	1.44×10^{-1}	1.44×10^{-1}	0	0	0
D2-R	1.00	3.61×10^{-1}	3.60×10^{-1}	0	0	1.74×10^{-10}
D3-L	1.00	2.12×10^{-2}	2.07×10^{-2}	7.44×10^{-2}	6.35×10^{-3}	0
D3-R	1.00	5.29×10^{-2}	5.18×10^{-2}	1.86×10^{-1}	3.18×10^{-2}	3.32×10^{-12}
D4-L	1.00	8.85×10^{-2}	8.80×10^{-2}	7.44×10^{-2}	6.89×10^{-3}	0
D4-R	1.00	2.21×10^{-1}	2.20×10^{-1}	1.86×10^{-1}	3.44×10^{-2}	1.55×10^{-12}
E1-L	1.00	5.15×10^{-3}	4.75×10^{-3}	1.58×10^{-3}	3.30×10^{-5}	0
E1-R	1.00	1.29×10^{-2}	1.19×10^{-2}	3.96×10^{-3}	1.65×10^{-4}	6.36×10^{-9}
E2-L	1.00	1.44×10^{-1}	1.44×10^{-1}	4.80×10^{-2}	1.00×10^{-3}	0
E2-R	1.00	3.61×10^{-1}	3.60×10^{-1}	1.20×10^{-1}	5.00×10^{-3}	3.13×10^{-10}
E3-L	1.00	5.15×10^{-3}	4.75×10^{-3}	1.58×10^{-3}	3.30×10^{-5}	0
E3-R	1.00	1.29×10^{-2}	1.19×10^{-2}	3.96×10^{-3}	1.65×10^{-4}	4.73×10^{-9}
E4-L	1.00	1.44×10^{-1}	1.44×10^{-1}	4.80×10^{-2}	1.00×10^{-3}	0
E4-R	1.00	3.61×10^{-1}	3.60×10^{-1}	1.20×10^{-1}	5.00×10^{-3}	2.35×10^{-10}
E5-L	1.00	2.12×10^{-2}	2.07×10^{-2}	7.56×10^{-2}	6.38×10^{-3}	0
E5-R	1.00	5.29×10^{-2}	5.18×10^{-2}	1.89×10^{-1}	3.19×10^{-2}	2.68×10^{-11}
E6-L	1.00	8.85×10^{-2}	8.80×10^{-2}	1.11×10^{-1}	7.66×10^{-3}	0
E6-R	1.00	2.21×10^{-1}	2.20×10^{-1}	2.78×10^{-1}	3.83×10^{-2}	4.79×10^{-13}

a. Ref. F.1-2.
b. Release Modes notation:
A, B, C are late releases
BP-V and BP-SGTR are bypass release modes
D, E are early releases
-R is a containment rupture
-L is a containment leak

together with the source category frequencies as calculated in the probabilistic risk assessment. For all modes the RU, LA, CE, and BA fractions of the usual MACCS2 species are set to zero, as they were not reported in the Individual Plant Examination (IPE) submittal. The assignment of the radionuclides in Table F.1-1 to these nuclide groups is the same as that given in the standard MACCS2 input. Where other related source term data were not reported, such as release durations and energies, these were evaluated by comparison with similar releases reported in the NUREG-1150 studies for the Surry plant (Ref. F.1-3). For the purpose of comparing the sensitivity case runs, the Base Case annual frequencies are included for each release mode in the last column of the table.

The IPE-reported release fractions for late releases appear to be rather high, with little credit having been taken for in-containment mitigation mechanisms, such as fallout and deposition, between release from the primary system and Containment failure. To gauge the effect of these, a sensitivity case was run with reduced source terms for two of the large contributors (C2-R and C4-R). In the original source term estimation, done in a "SURSOR"-like manner (Ref. F.1-3), the factor FCONV (Ref. F.1-2) that was used to estimate this mechanism was set at 0.3. There is good reason to say that this could have been set as low as 0.03. In the Source Term sensitivity case the Iodine and Cesium release fractions were adjusted by using a value of 0.1 instead of 0.3 for these two release modes. The effects of this are discussed in Section F.1.3, Results.

The amount (becquerels) of each radionuclide released to the atmosphere for each accident sequence or release category is obtained by multiplying the (adjusted) core inventory at the time of the hypothetical accident (Table F.1-1) by the release fractions (Table F.1-2).

The offsite consequences are summed for all the release modes weighted by the annual frequency, to obtain the total annual accident risk for the base case and for each of the severe accident mitigation alternative (SAMA) concepts evaluated. This summation calculation is performed outside of the MACCS2 code as part of the SAMA cost-benefit analyses. Selected results are presented in Section F.1.3 to show the effects of the various sensitivity cases.

F.1.2.3 METEOROLOGICAL DATA

The MACCS2 input uses a full year of consecutive hourly values of wind speed, wind direction, stability class, and precipitation. This file describes one year's worth of hourly meteorological data for the plant as recorded at the site meteorological tower. The data for this file are extracted into MACCS2 format

from hourly data recorded by Florida Power & Light (FPL) as the "TURKEY POINT METEOROLOGICAL DATA: SOUTH DADE SITE" for the calendar year 1998. The seasonal mixing heights for this area of Florida were taken from maps of mixing heights for the United States.

MACCS2 calculations examine a representative subset of the 8,760 hourly observations contained in one year's data set (typically about 150 sequences). The representative subset is selected by sampling the weather sequences after sorting them into weather bins defined by wind speed, atmospheric stability, and rain conditions at various distances from the site.

F.1.2.4 POPULATION DISTRIBUTION

The predicted permanent resident population around the site for the year 2025 was distributed by location in a grid consisting of sixteen directional sectors, the first of which is centered on due north, the second on 22.5 degrees east of north, and so on. A summary of the population distribution is shown in Table F.1-3. The direction sectors are divided into 12 radial intervals extending out to 50 miles. The habitable land fraction for each grid element was calculated from land fraction data within a 50-mile radius of the plant.

The computer program SECPOP90 (Ref. F.1-4) was used to process block-level 1990 census data (Ref. F.1-5), as extracted in part to SECPOP90 data files, for preparing population estimates for the region surrounding the plant. The SECPOP90 census data file contains a record for the location (geometric centroid coordinates) and the population of each census block (6,660,337 records) in the continental U.S. If the centroid point meets the distance criteria, it is then processed to determine the exact grid element in which it lies based on its radial distance and direction from the site. The population associated with that data point is then added to the population of that grid section. This process produces the raw 1990 population estimate for each rosette section.

The county-wide 1998 population estimates (Ref. F.1-6) were then utilized to update the 1990 estimates to 1998. For each rosette section, the fraction of its area in each county was estimated. These fractions were then used to calculate a county-area weighted population growth factor (1998 county population divided by 1990 county population) for the section. The 1990 section population was then multiplied by this growth factor to produce the 1998 population estimate for that section.

TABLE F.1-3
REGIONAL POPULATION DISTRIBUTION YEAR 2025

Sector	0 to 5 miles	5 to 10 miles	10 to 20 miles	20 to 30 miles	30 to 40 miles	40 to 50 miles	Totals
N	0	15,729	299,872	614,457	492,282	532,278	1,954,618
NNE	0	0	14,556	637,929	526,163	312,584	1,491,232
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	9	0	0	0	0	9
ESE	0	10	0	0	0	0	10
SE	0	0	0	0	0	0	0
SSE	0	1,887	0	0	0	0	1,887
S	0	0	2,705	176	0	0	2,881
SSW	4	0	382	14,974	10,373	2,420	28,153
SW	0	0	0	0	0	18	18
WSW	0	85	0	4,866	87	291	5,329
W	0	8,955	6,011	0	0	0	14,966
WNW	6	53,789	20,179	574	0	30	74,578
NW	0	38,002	12,268	3	141	26	50,440
NNW	39	22,392	229,262	76,199	352	332	328,576
TOTALS	49	140,858	585,235	1,349,178	1,029,398	847,979	3,952,697

The state-wide 1995-2025 Bureau of the Census data (Ref. F.1-7), were then used to project the future rosette section populations to the year 2025. A statewide growth factor is calculated by dividing the state population projection for that year by the 1998 state population estimate. The section population projection for this step year is then calculated by multiplying the 1998 section population by the state growth factor. In fact it may be noted that most of the population is in Miami-Dade County in a northerly direction, along with two sectors (40-50 miles N and NNE) in Broward County. More than 95 percent of the projected year 2025 population is in the three most northerly direction sectors (NNW, N, NNE) with more than 80 percent of the population more than 20 miles from the plant. The permanent population projected within a 5-mile radius of the plant is 39 persons. Examination of the population data file shows many sectors with zero or very small populations.

Year 2025 population projections were used for the MACCS2 analyses, as these are the endmost data produced by the Bureau of the Census and because it is approximately the midterm year of the proposed license extension period.

F.1.2.5 EMERGENCY RESPONSE

As have other U.S. utilities that operate nuclear reactors, FPL has developed a plan for the evacuation of the population within the plume exposure emergency planning zone. This zone is approximately a 10-mile radius centered on the plant site. The average evacuation speed is estimated by the station emergency planning staff to be on the order of 35 miles per hour (15.6 meters per second), with evacuation starting at the time of warning. This is a high value compared to other plants. The plant staff base this on the wide streets in the evacuation area and their estimation of the population reaction. For the purposes of this analysis an average evacuation speed of 12 meters per second is used, with a delay time of 5,130 seconds in the evacuation start time.

For this analysis it was conservatively assumed that people beyond 10 miles would continue their normal activities unless the following predicted radiation dose levels are exceeded. At locations for which 50 rem whole-body effective dose equivalent in 1 week is predicted, it was assumed that relocation would take place after half a day. If 25 rem whole-body dose equivalent in 1 week is predicted, relocation of individuals in those sectors was assumed to take place after 1 day.

A sensitivity analysis was performed where it was assumed that only 95 percent of the people within the emergency planning zone would participate in the evacuation. The remaining 5 percent were assumed to be unable or unwilling to evacuate and

were assumed to go about their normal activities. It was further assumed in this sensitivity analysis that the evacuation speed was 1.0 meters per second and that the evacuation delay time was 7,200 seconds. The results were not significantly different on the whole from the complete evacuation case. While the population doses increased and the evacuation costs decreased, the overall population exposure and accident mitigation costs are governed mainly by the long-term effects over the whole 50-mile zone, and so the net changes were small, under one percent, which is not considered significant.

The long-term phase is assumed to begin after 1 week and extend for 5 years. Long-term relocation is assumed to be triggered by a 4 rem whole-body effective dose equivalent. Long-term protective measures were assumed to be based on generic protective action guideline levels for actions such as decontamination, temporary relocation, contaminated crops and milk condemnation, and farmland production prohibition.

F.1.2.6 ECONOMIC DATA

Land use statistics, including farmland values, farm product values, dairy production, and growing season information were provided on a county-wide basis within 50 miles.

Much of the data are prepared by the computer program SECPOP90 (Ref. F.1-4). It contains a database extracted from Bureau of the Census PL 94-171 (block level census) CD-ROMS (Ref. F.1-5), the 1992 Census of Agriculture CD ROM Series 1B, the 1994 US Census County and City Data Book CD-ROM, the 1993 and 1994 Statistical Abstract of the United States, and other minor sources. The reference contains details on how the database was created and checked. The SECPOP90 regional economic values, and related miscellaneous unit costs as given in the NUREG-1150 studies (Ref. F.1-8), were updated to 1997 using the Consumer Price Index (Ref. F.1-9) and other data from the Bureau of the Census. Farmland data were taken mainly from Department of Agriculture data for Florida (Ref. F.1-10).

Economic consequences were estimated by summing the following costs:

- Costs of evacuation,
- Costs for temporary relocation (food, lodging, lost income),
- Costs of decontaminating land and buildings,

- Lost return-on-investments from properties that are temporarily interdicted to allow contamination to be decreased by decay of nuclides,

- Costs of repairing temporarily interdicted property,

- Value of crops destroyed or not grown because they were contaminated by direct deposition or would be contaminated by root uptake, and

- Value of farmland and of individual, public, and non-farm commercial property that is condemned.

Costs associated with damage to the reactor, the purchase of replacement power, medical care, life-shortening, and litigation are not calculated by MACCS2.

F.1.3 RESULTS

Based on the preceding input data, MACCS2 was used to estimate the following:

- The downwind transport, dispersion, and deposition of the radioactive materials released to the atmosphere from the failed reactor Containment.

- The short- and long-term radiation doses received by exposed populations via direct (cloudshine, plume inhalation, groundshine, and resuspension inhalation) and indirect (ingestion) pathways.

- The mitigation of those doses by protective actions (evacuation, sheltering, and post-accident relocation of people; disposal of milk, meat, and crops; and decontamination, temporary interdiction, or condemnation of land and buildings).

- The early fatalities and injuries expected to occur within 1 year of the accident (early health effects) and the delayed (latent) cancer fatalities and injuries expected to occur over the lifetime of the exposed individuals.

- The offsite costs of short-term emergency response actions (evacuation, sheltering, and relocation), of crop and milk disposal, and of the decontamination, temporary interdiction, or condemnation of land and buildings.

The consequences calculated with the MACCS2 model in terms of the population dose and offsite economic costs for the SAMA Base Case and the two evacuation model sensitivity cases (95 percent Evacuation and Reduced Source Term) are shown in Table F.1-4. It is observed that the evacuation parameters have little effect on the overall results because of the small population in the evacuation zone compared to the much larger population elsewhere in the 50-mile radius. Significant reductions in offsite risk are observed for the reduced source term case, as would be expected.

A common way in which this combination of factors is used to estimate risk is to multiply the frequencies by the consequences. The resultant risk is then expressed as the number, or magnitude, of consequences expected per unit time. Table F.1-5 shows average values of risk. These average values were obtained by summing the frequency multiplied by the consequences over the entire range of distributions. Because the probabilities are on a per-reactor-year basis, the averages shown are also on a per-reactor-year basis. A twenty-year value is obtained by using a discount factor of 7 percent per annum and a $2000 per rem dose equivalence factor.

It is observed that the results are (1) insensitive to evacuation parameters, and (2) conservative in that the base case values are based on source term estimates that are, in themselves, conservative (i.e., high).

TABLE F.1-4
SUMMARY OF OFFSITE CONSEQUENCE RESULTS FOR EACH RELEASE MODE

	Population Dose, Sieverts			Offsite Economic Costs, $		
Release Mode[a]	Base Case	95 Percent Evacuation @ 1 meter per second	Reduced Source Term C2R/C4R	Base Case	95 Percent Evacuation @ 1 meter per second	Reduced Source Term C2R/C4R
A1	5.46×10^{1}	5.49×10^{1}	5.46×10^{1}	1.18×10^{7}	1.19×10^{4}	1.18×10^{7}
A2	2.48×10^{4}	2.48×10^{4}	2.48×10^{4}	4.48×10^{9}	4.47×10^{9}	4.48×10^{9}
B1	8.46×10^{2}	8.47×10^{2}	8.46×10^{2}	1.49×10^{7}	3.06×10^{6}	1.49×10^{7}
B2-L	2.64×10^{4}	2.65×10^{4}	2.64×10^{4}	5.11×10^{9}	5.10×10^{9}	5.11×10^{9}
B2-R	3.73×10^{4}	3.74×10^{4}	3.73×10^{4}	9.37×10^{9}	9.36×10^{9}	9.37×10^{9}
B3-L	8.46×10^{2}	8.47×10^{2}	8.46×10^{2}	1.49×10^{7}	3.06×10^{6}	1.49×10^{7}
B3-R	1.92×10^{3}	1.92×10^{3}	1.92×10^{3}	5.12×10^{7}	3.93×10^{7}	5.12×10^{7}
B4-L	2.64×10^{4}	2.65×10^{4}	2.64×10^{4}	5.11×10^{9}	5.10×10^{9}	5.11×10^{9}
B4-R	3.78×10^{4}	3.78×10^{4}	3.78×10^{4}	9.38×10^{9}	9.37×10^{9}	9.38×10^{9}
B5-L	1.54×10^{3}	1.54×10^{3}	1.54×10^{3}	2.74×10^{7}	1.56×10^{7}	2.74×10^{7}
B5-R	3.28×10^{3}	3.28×10^{3}	3.28×10^{3}	1.23×10^{8}	1.12×10^{8}	1.23×10^{8}
B6-L	2.29×10^{4}	2.29×10^{4}	2.29×10^{4}	3.84×10^{9}	3.83×10^{9}	3.84×10^{9}
B6-R	2.74×10^{4}	2.74×10^{4}	2.74×10^{4}	5.10×10^{9}	5.09×10^{9}	5.10×10^{9}
BP-V	4.46×10^{4}	4.86×10^{4}	4.46×10^{4}	1.27×10^{10}	1.27×10^{10}	1.27×10^{10}
BY-SGTR	8.07×10^{3}	8.08×10^{3}	8.07×10^{3}	7.99×10^{8}	7.93×10^{8}	7.99×10^{8}
C1-L	8.46×10^{2}	8.47×10^{2}	8.46×10^{2}	1.49×10^{7}	3.06×10^{6}	1.49×10^{7}
C1-R	1.92×10^{3}	1.92×10^{3}	1.92×10^{3}	5.12×10^{7}	3.93×10^{7}	5.12×10^{7}
C2-L	2.65×10^{4}	2.65×10^{4}	2.65×10^{4}	5.11×10^{9}	5.10×10^{9}	5.11×10^{9}
C2-R	3.79×10^{4}	3.80×10^{4}	2.48×10^{4}	9.38×10^{9}	9.37×10^{9}	4.37×10^{9}
C3-L	8.46×10^{2}	8.47×10^{2}	8.46×10^{2}	1.49×10^{7}	3.06×10^{6}	1.49×10^{7}
C3-R	1.92×10^{3}	1.92×10^{3}	1.92×10^{3}	5.12×10^{7}	3.93×10^{7}	5.12×10^{7}
C4-L	2.65×10^{4}	2.65×10^{4}	2.65×10^{4}	5.11×10^{9}	5.10×10^{9}	5.11×10^{9}
C4-R	3.79×10^{4}	3.80×10^{4}	2.48×10^{4}	9.38×10^{9}	9.37×10^{9}	4.37×10^{9}
C5-L	1.54×10^{3}	1.54×10^{3}	1.54×10^{3}	2.74×10^{7}	1.56×10^{7}	2.74×10^{7}
C5-R	3.28×10^{3}	3.28×10^{3}	3.28×10^{3}	1.23×10^{8}	1.12×10^{8}	1.23×10^{8}
C6-L	2.29×10^{4}	2.30×10^{4}	2.29×10^{4}	3.84×10^{9}	3.83×10^{9}	3.84×10^{9}
C6-R	3.27×10^{4}	3.27×10^{4}	3.27×10^{4}	7.56×10^{9}	7.55×10^{9}	7.56×10^{9}
D1-L	5.63×10^{3}	5.64×10^{3}	5.63×10^{3}	3.18×10^{8}	3.07×10^{8}	3.18×10^{8}
D1-R	8.20×10^{3}	8.83×10^{3}	8.20×10^{3}	8.01×10^{8}	7.95×10^{8}	8.01×10^{8}
D2-L	3.04×10^{4}	3.07×10^{4}	3.04×10^{4}	6.98×10^{9}	6.97×10^{9}	6.98×10^{9}
D2-R	2.87×10^{4}	3.92×10^{4}	2.87×10^{4}	8.78×10^{9}	8.77×10^{9}	8.78×10^{9}
D3-L	1.63×10^{4}	1.64×10^{4}	1.63×10^{4}	1.77×10^{9}	1.76×10^{9}	1.77×10^{9}
D3-R	1.89×10^{4}	2.28×10^{4}	1.89×10^{4}	3.41×10^{9}	3.41×10^{9}	3.41×10^{9}

TABLE F.1-4 (Cont'd)
SUMMARY OF OFFSITE CONSEQUENCE RESULTS FOR EACH RELEASE MODE

	Population Dose, Sieverts			Offsite Economic Costs, $		
Release Mode[a]	Base Case	95 percent Evacuation @ 1 meter per second	Reduced Source Term C2R/C4R	Base Case	95 Percent Evacuation @ 1 meter per second	Reduced Source Term C2R/C4R
D4-L	2.73×10^4	2.76×10^4	2.73×10^4	5.23×10^9	5.22×10^9	5.23×10^9
D4-R	2.69×10^4	3.56×10^4	2.69×10^4	7.14×10^9	7.14×10^9	7.14×10^9
E1-L	5.70×10^3	5.72×10^3	5.70×10^3	3.18×10^8	3.07×10^8	3.18×10^8
E1-R	8.38×10^3	9.05×10^3	8.38×10^3	8.02×10^8	7.95×10^8	8.02×10^8
E2-L	3.20×10^4	3.23×10^4	3.20×10^4	6.98×10^9	6.97×10^9	6.98×10^9
E2-R	3.05×10^4	4.22×10^4	3.05×10^4	8.78×10^9	8.78×10^9	8.78×10^9
E3-L	5.70×10^3	5.72×10^3	5.70×10^3	3.18×10^8	3.07×10^8	3.18×10^8
E3-R	8.38×10^3	9.05×10^3	8.38×10^3	8.02×10^8	7.95×10^8	8.02×10^8
E4-L	3.20×10^4	3.23×10^4	3.20×10^4	6.98×10^9	6.97×10^9	6.98×10^9
E4-R	3.05×10^4	4.22×10^4	3.05×10^4	8.78×10^9	8.78×10^9	8.78×10^9
E5-L	1.63×10^4	1.64×10^4	1.63×10^4	1.77×10^9	1.76×10^9	1.77×10^9
E5-R	1.89×10^4	2.29×10^4	1.89×10^4	3.41×10^9	3.41×10^9	3.41×10^9
E6-L	2.83×10^4	2.86×10^4	2.83×10^4	5.26×10^9	5.25×10^9	5.26×10^9
E6-R	2.83×10^4	3.80×10^4	2.83×10^4	7.15×10^9	7.14×10^9	7.15×10^9

a. Release Modes notation:
A, B, C are late releases
BP-V and BP-SGTR are bypass release modes
D, E are early releases
-R is a containment rupture
-L is a containment leak

TABLE F.1-5
SUMMED AVERAGE RISKS

	Base Case	95 Percent Evacuation @ 1 meter per second	Reduced Source Term C2R/C4R
Annual Offsite Risks			
REMs	10.8803	10.9227	9.3674
Property, $	22,850	22,748	17,064
20-Year Offsite Risks			
Dose, $	234,207	235,120	201,641
Property, $	245,932	244,835	183,658
Difference from 20-Year Base Case			
Dose, $		0.4 percent	-13.9 percent
Property, $		-0.4 percent	-25.3 percent

F.1.4 REFERENCES

Ref. F.1-1 Chanin, D. I., et al., "Code Manual for MACCS2: Volume 1, User's Guide," SAND07-054, March 1997. SEE ALSO:

Oak Ridge National Laboratory RISCC Computer Code Collection, MACCS2 V.1.12, CCC-652 Code Package, 1997.
Jow, H. N, et al., "MELCOR Accident Consequences Code System (MACCS) Model Description," NUREG/CR-4691, SAND86-1562, February 1990.

Ref. F.1-2 "Turkey Point Units 3 & 4 Probabilistic Risk Assessment Individual Plant Examination; Final Report," Florida Power & Light Company, June 1991.

Ref. F.1-3 Breeding, R. J., et al., "Evaluation of Severe Accident Risks: Surry 1 Main Report," NUREG/CR-4551, Vol. 3, Rev. 1, Part 1, October 1990.

Ref. F.1-4 Humphreys, S. L., et al., "SECPOP90: Sector Population, Land Fraction, and Economic Estimation Program," NUREG/CR-6525, September 1997.

Ref. F.1-5 "Census of Population and Housing, 1990: Public Law (P. L.) 94-171, Data Technical Documentation," CD – ROM set, Bureau of the Census, U.S. Dept. of Commerce, 1991.

Ref. F.1-6 "County Population Estimates for July 1, 1998 and Population Change for April 1, 1990 to July 1, 1998 (includes revised April 1, 1990 Census Population Counts)," CO-98-002, Released to Internet, Bureau of the Census, Statistical Information Staff, Population Division, March 12, 1999.

Ref. F.1-7 "Population Projections: States, 1995-2025," Bureau of the Census, U.S. Department of Commerce, P25-1131, May 1997.

Ref. F.1-8 Sprung, J. L. et al., "Evaluation of Severe Accident Risks: Quantification of Major Input Parameters MACCS Input," NUREG/CR 4557, Vol. 2, Rev. 1., Part 7, December 1990.

Ref. F.1-9 "Consumer Price Index-All Urban Consumers," Series Catalog: Series ID: CUUR0300SA0, U.S. Bureau of Labor, 1999.

Ref. F.1-10 "1997 Census of Agriculture," U.S. Department of Agriculture, National Agricultural Statistics Service / Florida Agricultural Service, 1997.

F.2 EVALUATION OF CANDIDATE SAMAS

This section describes the generation of the initial list of potential Severe Accident Mitigation Alternatives (SAMAs) for Turkey Point Units 3 & 4, the screening methods, and the analyses of the remaining SAMAs.

F.2.1 SAMA LIST COMPILATION

FPL has generated a list of candidate SAMAs by reviewing industry documents and considering plant-specific enhancements not considered in published industry documents. Industry documents FPL has reviewed include the following:

- The Turkey Point Units 3 & 4 IPE submittal (Ref. F.2-1)
- The Watts Bar Nuclear Plant Unit 1 Probabilistic Risk Analysis (PRA)/IPE submittal (Ref. F.2-2)
- The Limerick Severe Accident Mitigation Design Alternative (SAMDA) cost estimate report (Ref. F.2-3)
- NUREG-1437 description of Limerick SAMDA (Ref. F.2-4)
- NUREG-1437 description of Comanche Peak SAMDA (Ref. F.2-5)
- Watts Bar SAMDA submittal (Ref. F.2-6)
- TVA response to U.S. Nuclear Regulatory Commission's (NRC's) request for additional information (RAI) on the Watts Bar SAMDA submittal (Ref. F.2-7)
- Westinghouse AP600 SAMDA (Ref. F.2-8)
- Safety Assessment Consulting (SAC) presentation by Wolfgang Werner at the NUREG-1560 conference (Ref. F.2-9)
- NRC IPE Workshop – NUREG-1560 NRC Presentation (Ref. F.2-10)
- NUREG-0498, supplement 1, section 7 (Ref. F.2-11)

- NUREG/CR-5567, "Pressurized Water Reactor (PWR) Dry Containment Issue Characterization" (Ref. F.2-12)
- NUREG-1560, Volume 2, NRC Perspectives on the IPE Program (Ref. F.2-13)
- NUREG/CR-5630, "PWR Dry Containment Parametric Studies" (Ref. F.2-14)
- NUREG/CR-5575, "Quantitative Analysis of Potential Performance Improvements for the Dry PWR Containment" (Ref. F.2-15)
- CE System 80 + Submittal (Ref. F.2-16)
- NUREG-1462, NRC Review of ABB/CE System 80 + Submittal (Ref. F.2-17)
- An ICONE paper by C. W. Forsberg, et al., on a core-melt source reduction system (Ref. F.2-18)

In addition, the top cutsets from the current Probabilistic Safety Assessment (PSA) model have been reviewed to assure that faults associated with each cutset are addressed by one or more of the potential SAMAs identified.

Although the plant is a Westinghouse design, each of the above documents have been reviewed for potential SAMAs even if they are not necessarily applicable to a Westinghouse plant. Those items found not applicable are subsequently screened from this list. The containment performance improvement programs for boiling water reactors and ice condenser plants are not reviewed (and the NUREG-1560 portion of the containment performance improvement for these are not reviewed). FPL assumes that any issues from these documents are included in the large, dry containment performance improvement program (NUREG/CR-5567). Conceptual enhancements for which no specific details are available (e.g., "improve diesel reliability" or "improve procedures for loss of support systems") are not included, unless they are considered vulnerabilities in the plant's IPE.

FPL also reviewed the SAMAs from the Oconee SAMA analysis (Ref. F.2-19). Most of the SAMAs identified in that analysis were eliminated because they had already been specifically identified by the review of the industry documents listed above and were already considered, or the intent had already been met, or they are

covered by the Turkey Point Units 3 & 4 Severe Accident Management Guidelines program. However, 4 items were added to the SAMA list from this review.

F.2.2 QUALITATIVE SCREENING OF SAMAS

The initial list of potential SAMAs is presented in Table F.2-1. Table F.2-1 also presents a qualitative screening of the initial list. Items are eliminated from further evaluation based on one of the following criteria:

- The SAMA is not applicable at Turkey Point Units 3 & 4, either because the enhancement is only for boiling water reactors, the Westinghouse AP600 design or pressurized water reactor ice condenser containments, or it is a plant-specific enhancement that does not apply (Screening Criterion "A"); or

- The SAMA is already implemented at Turkey Point Units 3 & 4 (or the design meets the intent of the SAMA, as determined by plant review of each SAMA) (Screening Criterion "B").

Based on preliminary screening, 93 improvements are eliminated, leaving 76 subject to the final screening and evaluation process. These improvements are listed in Table F.2-2.

The final screening process involves identifying and eliminating those items whose cost exceeds their benefit. Table F.2-2 provides a description of the evaluation of each and provides the basis for their elimination, or describes their final resolution.

F.2.3 ANALYSIS OF POTENTIAL SAMAS

The approach for this portion of the analysis (potential SAMAs to reduce core damage frequency) is to calculate the value of the averted risk to the public for each alternative. It relies on the NRC's Regulatory Analysis Guide (Ref. F.2-20) to convert public health risk (person-rem) into dollars to estimate the cost of the public health consequences. The requirement established in this guide is to use $2,000 per person-rem to convert public health consequences to dollars (not indexed to inflation). Therefore, the value (or safety improvement) of implementing an alternative is expressed in terms of averted cost to the public (public benefit).

TABLE F.2-1
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
1	Cap downstream piping of normally closed Component Cooing Water (CCW) drain and vent valves.	Reduces the frequency of loss of CCW initiating event, a large portion of which was derived from catastrophic failure of one of the many single isolation valves.	(13)	B	Based on 5613-M-3030 drawing, downstream piping of the normally closed CCW drain and vent valves is already capped. Intent met or implemented.
2	Enhance Loss of CCW (or loss of service water) procedure to facilitate stopping RCPs.	Reduces potential for RCP seal damage due to pump bearing failure.	(2), (10), (13)	B	Procedure will stop RCPs on loss of seal cooling (not just on loss of CCW). Intent met or implemented.
3	Enhance Loss of CCW procedure to present desirability of cooling down Reactor Coolant System (RCS) prior to seal loss-of-coolant accident (LOCA).	Potential reduction in the probability of RCP seal failure.	(2)	B	On loss of one unit CCW, connection to other unit would be established per procedure. The unit cross-tie requires 45-60 minutes, and seal LOCA may occur after 90 minutes. The cross-tie to opposite unit CCW would reduce the likelihood of RCP seal failure given a loss of CCW at one unit. Thus the intent of this SAMA is met or implemented.
4	Provide additional training on the Loss of CCW.	Potential improvement in success rate of operator actions after a loss of CCW.	(2)	B	On loss of one unit CCW, connection to other unit would be established per 3/4-ONOP-030. The unit cross-tie requires 45-60 minutes, and seal LOCA may occur after 90 minutes. The operators are well-trained on this activity. The cross-tie to opposite unit CCW would reduce the likelihood of RCP seal failure given a loss of CCW at one unit. Thus the intent of this SAMA is met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
5	Provide hardware connections to allow another Emergency Raw Cooling Water (ERCW) Service Water (SW) to cool charging pump seals.	Reduce effect of loss of CCW by providing a means to maintain the charging pump seal injection after a loss of CCW. Note, in Watts Bar, this capability was already there for one charging pump at one unit, and the potential enhancement identified was to make it possible for all the charging pumps.	(2), (6), (11), (13)	B	Turkey Point Units 3 & 4 charging pump seals currently have connections for cooling via SW (domestic) on loss of CCW. Intent met or implemented.
6	On loss of ERCW, proceduralize shedding CCW loads to extend the CCW heatup time.	Increase time before the loss of CCW (and RCP seal failure) in the loss of ERCW sequences.	(2)	B	On loss of one unit CCW, connection to other unit would be established per procedure. This procedure also includes instructions for shedding CCW loads. Intent met or implemented.
7	Increase charging pump lube oil capacity.	Would lengthen time before charging pump failure due to lube oil overheating in loss of CCW sequences.	(2)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
8	Eliminate RCP thermal barrier dependence on CCW, such that loss of CCW does not result directly in core damage.	Would prevent loss of RCP seal integrity after a loss of CCW. Watts Bar IPE stated they could do this with ERCW connection to charging pump seals.	(2), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
9	Provide additional SW pump.	Providing another pump would decrease core damage frequency due to a loss of SW.	(5)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
10	Create an independent RCP seal injection system, with dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing core damage frequency (CDF) from loss of CCW or SW, or station blackout (SBO).	(6), (11), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
11	Create an independent RCP seal injection system, without dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of CCW or SW, or SBO.	(11)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
12	Use existing hydro test pump for RCP seal injection.	Independent seal injection source, without cost of a new system.	(7)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
13	Replace Emergency Core Cooling System (ECCS) pump motors with air-cooled motors.	Remove dependency on CCW.	(10), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
14	Install improved RCP seals.	RCP seal O-rings constructed of improved materials would reduce chances of RCP seal LOCA.	(11), (13)	B	All of the Turkey Point Units 3 & 4 RCPs have been upgraded since 1990, with new high-temperature O-rings and silicon nitride #1 seal faces. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
15	Add a third CCW pump.	Reduce chance of loss of CCW leading to RCP seal LOCA.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
16	Prevent charging pump flow diversion from the relief valves.	If relief valve opening causes a flow diversion large enough to prevent RCP seal injection, then modification can reduce frequency of loss of RCP seal cooling.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
17	Change procedures to isolate RCP seal letdown flow on loss of CCW, and guidance on loss of injection during seal LOCA.	Reduce CDF from loss of seal cooling.	(13)	B	EOPs already include instructions to isolate the RCP seal letdown on loss of CCW, and guidance for loss of injection following RCP seal LOCA. Intent met or implemented.
18	Procedures to stagger high-pressure safety injection (HPSI) pump use after a loss of SW.	Allow high-pressure injection to be extended after a loss of SW.	(13)	B	Turkey Point Units 3 & 4 HHSI pumps are shared 2 per unit, each cooled by own unit CCW and suction from own Refueling Water Storage Tank (RWST); on safety injection (SI) all 4 high head safety injection (HHSI) pumps start, and operator stops the 2 pumps for the unaffected unit. Intent met or implemented.
19	Use firewater pumps as a backup seal injection and high-pressure makeup.	Reduce RCP seal LOCA frequency and SBO core damage frequency.	(13)	A	Firewater pumps cannot be used as a backup seal and high pressure makeup since the firewater is at considerably lower pressure.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
20	Develop procedural guidance for use of cross-tied CCW or SW pumps.	Can reduce the frequency of the loss of either of these.	(13)	B	Procedure provides for cross-tie between Turkey Point Units 3 & 4 CCW Systems. Intent met or implemented.
21	Implement procedure & operator training enhancements in support system failure sequences, with emphasis on anticipating problems and coping.	Potential improvement in success rate of operator actions after support system failures.	(2), (13)	B	Support system initiators dominated by loss of instrument air and loss of 4kV bus. Reasonable procedures and training exist for manual operation of feedwater (FW) bypass valves on loss of air, and for response to loss of a 4kV bus. Intent met or implemented.
22	Improve ability to cool residual heat removal (RHR) heat exchangers.	Reduced chance of loss of Decay Heat Removal (DHR) by 1) Performing procedure and hardware modification to allow manual alignment of Fire Protection System to the CCW system, or 2) Installing a CCW header cross-tie.	(12), (13)	B	CCW header and unit cross-ties exist now. Parallel fire protection supply would get a diesel pump involved but the RHR would still be alternating current (AC) dependent. Intent met or implemented.
23	Stage backup fans in Switchgear rooms.	Provides alternate ventilation in the event of a loss of switchgear ventilation.	(13)	B	Load Center (LC)/Switchgear (SWGR) rooms have emergency wall-mount exhaust fans (3/4V15) to cool equipment if AC trains failed. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
24	Provide redundant train of ventilation to 480V board room.	Would improve reliability of 480V Heating, Ventilation, and Air Conditioning (HVAC). At Watts Bar, only one train of HVAC cools the 480V board room that contains the unit vital inverters, and recovery actions are heavily relied on. Watts Bar IPE said their corrective action program is dealing with this.	(2), (13)	B	480V load center room contains 1 AC unit. In past have opened doors and used portable fans. Intent met or implemented.
25	Develop procedures for temporary HVAC.	Provides for improved credit to be taken for loss-of-HVAC sequences.	(11), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
26	Add a switchgear room high temp alarm.	Improve diagnosis of a loss of switchgear HVAC.	(13)	B	Each LC/SWGR room has temperature switch for high temperature annunciator and shiftly walkdown by operators is performed. Intent met or implemented.
27	Create ability to switch fan power supply to direct current (DC) in SBO.	[Was created for a boiling water reactor (BWR) Reactor Core Isolation Cooling (RCIC) room, Fitzpatrick; possible for turbine Auxiliary Feedwater (AFW) if has its own fan] Allow continued operation in SBO.	(13)	A	AFW cooling not required; AFW in open area.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
28	Delay containment spray actuation after large LOCA.	When ice remains in the ice condenser at such plants, containment sprays have little impact on containment performance, yet rapidly drain down the RWST. This improvement would lengthen time of RWST availability.	(2), (6)	A	No ice condenser at Turkey Point Units 3 & 4.
29	Install containment spray throttle valves.	Can extend the time over which water remains in the RWST, when full containment spray flow is not needed.	(11), (12), (13)	B	Turkey Point Units 3 & 4 HHSI systems, including RWST, are cross-tied to provide additional RWST capacity if needed. Intent met or implemented.
30	Install an independent method of suppression pool cooling.	Would decrease frequency of loss of containment heat removal.	(3), (4)	B	CCW header and unit crossties exist now to support RHR heat exchanger cooling. Intent met or implemented.
31	Develop an enhanced drywell spray system.	Would provide a redundant source of water to the Containment to control containment pressure, when used in conjunction with containment heat removal.	(3), (4), (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
32	Provide a dedicated existing drywell spray system.	Identical to the previous concept, except that one of the existing spray loops would be used instead of developing a new spray system.	(3), (4) [similar option in (5), (6), (11)]	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
33	Install a containment vent large enough to remove ATWS decay heat.	Assuming injection is available, would provide alternative decay heat removal in an ATWS.	(3), (4)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
34	Install a filtered containment vent to remove decay heat.	Assuming injection is available (non-ATWS sequences), would provide alternate decay heat removal with the released fission products being scrubbed.	(3), (4) [similar options in (5), (6), (8), (11), (12), (16), (17)]	N	Not initially screened. Considered further in the final (cost-benefit) screening.
35	Install an unfiltered hardened containment vent.	Provides an alternate decay heat removal method (non-ATWS), which is not filtered.	(3), (4), (9), (14)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
36	Create/enhance hydrogen ignitors with independent power supply.	Use either a new, independent power supply, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies such as the security system diesel. Would reduce hydrogen detonation at lower cost.	(3), (5), (6), (7), (9), (12), (13), (14), (15), (16), (17)	A	Turkey Point Units 3 & 4 do not have hydrogen recombiners (operation of ECCS also mitigates hydrogen levels); but have provisions to obtain within 7 days post accident (including needed penetrations). Hydrogen concentration or pockets are not likely based on IPE insights.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
37	Create a passive hydrogen ignition system.	Reduce hydrogen detonation potential without requiring electric power.	(7), (11), (16), (17)	A	Turkey Point Units 3 & 4 do not have hydrogen recombiners (operation of ECCS also mitigates hydrogen levels); but have provisions to obtain within 7 days post accident (including needed penetrations). Hydrogen concentration or pockets are not likely based on IPE insights. In addition, SAMA may not work for accident hydrogen levels.
38	Create a giant concrete crucible with heat removal potential under the basemat to contain molten debris.	A molten core escaping from the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt through.	(3), (4), (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
39	Create a water-cooled rubble bed on the pedestal.	This rubble bed would contain a molten core dropping onto the pedestal, and would allow the debris to be cooled.	(3), (4), (8), (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
40	Provide modification for flooding of the drywell head.	Would help mitigate accidents that result in leakage through the drywell head seal.	(4), (9)	A	BWR item. For PWR, similar system intent would be to flood area around reactor vessel to prevent vessel breach and late Containment failure. Wet cavity design at Turkey Point Units 3 & 4 will fill to 1/3 (or higher) vessel height during severe accident to provide similar protection. Intent met or implemented.
41	Enhance Fire Protection System and/or standby gas treatment system hardware and procedures.	Improve fission product scrubbing in severe accidents.	(4)	A	BWR item; similar SAMA for PWR presented by SAMA Number 47.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
42	Enhance air return fans (ice condenser containment).	Provide an independent power supply for the air return fans, reducing Containment failure in SBO sequences.	(6), (11)	A	Applicable to ice condenser plant only.
43	Create a reactor cavity flooding system.	Would enhance debris coolability, reduce core concrete interaction, and provide fission product scrubbing.	(5), (6), (9), (11), (12), (13), (15), (16), (17)	B	Wet cavity design. Intent met or implemented.
43.1	Creating other options for reactor cavity flooding (Part a).	(a) Use water from dead-ended volumes, the condensed blowdown of the RCS, or secondary system by drilling pathways in the reactor vessel support structure to allow drainage from the steam generator compartments, refueling canal, sumps, etc., to the reactor cavity. Also (for ice condensers), allow drainage of water from melted ice into the reactor cavity.	(7), (9), (13)	B	Wet cavity design. Intent met or implemented.
43.2	Creating other options for reactor cavity flooding (Part b).	(b) Flood cavity via systems such as diesel driven fire pumps.	(7), (9), (13)	B	Intent of SAMA is to flood area around reactor vessel to prevent vessel breach and late Containment failure. Wet cavity design at Turkey Point Units 3 & 4 will fill to 1/3 (or higher) vessel height during severe accident to provide similar protection. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
44	Provide a core debris control system.	(intended for ice condenser plants:) Would prevent the direct core debris attack of the primary containment steel shell by erecting a barrier between the seal table and containment shell.	(6), (11)	A	Applicable to ice condenser plant only.
45	Create a core-melt source reduction system (COMSORS).	Place enough glass underneath the reactor vessel such that a molten core falling on the glass would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur (such benefits are theorized in the reference).	(18)	B	Intent of SAMA is to prevent late Containment failure. Wet cavity design at Turkey Point Units 3 & 4 will fill to 1/3 (or higher) vessel height during severe accident to provide similar protection. Intent met or implemented.
46	Provide containment inerting capability.	Would prevent combustion of hydrogen and carbon monoxide gases.	(6), (9), (11), (14)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
47	Use fire water spray pump for containment spray	Redundant containment spray method without high cost.	(7), (9), (10), (12)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
48	Install a passive containment spray system.	Containment spray benefits at a very high reliability, and without support systems.	(8)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
49	Provide secondary containment filtered ventilation.	For plants with a secondary Containment, would filter fission products released from the primary Containment.	(8)	A	No secondary Containment.
50	Increase containment design pressure.	Reduce chance of containment overpressure.	(8)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
51	Increase the depth of the concrete basemat, or use an alternative concrete material to ensure melt-through does not occur.	Prevent basemat melt-through.	(16), (17)	A	Applicable to new design, not to existing containments.
52	Provide a reactor vessel exterior cooling system.	Potential to cool a molten core before it causes vessel failure, if the lower head can be submerged in water.	(16), (17)	B	Wet cavity design at Turkey Point Units 3 & 4 will fill to 1/3 (or higher) vessel height during severe accident. Intent met or implemented.
53	Create another building, maintained at a vacuum, to be connected to Containment.	In an accident, connecting the new building to Containment would depressurize Containment and reduce any fission product release.	(17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
54	Add ribbing to the containment shell.	Would reduce the chance of buckling of Containment under reverse pressure loading.	(17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
55	Train operations crew for response to inadvertent actuation signals.	Improves chances of a successful response to the loss of two 120V AC buses, which causes inadvertent signals.	(13)	A	Not applicable. Turkey Point Units 3 & 4 features are different from other plants. Turkey Point Units 3 & 4 have two battery chargers on each vital bus, rather than one, to minimize likelihood of inadvertent actuation due to simultaneous loss of two vital buses.
56	Proceduralize alignment of spare diesel to shutdown board after loss of power (LOP) and failure of the diesel normally supplying it.	Reduced SBO frequency.	(2)	B	SBO cross-tie provides this flexibility. Intent met or implemented.
57	Provide an additional diesel generator.	Would increase onsite emergency AC power reliability and availability (decrease SBO). The ANO-1 IPE reported that ANO committed to install an alternate alternating current power source capable of supplying the loss of offsite power (LOOP) loads of any one of the four safety buses. This source would be available within 10 minutes after determination of SBO conditions.	(5), (6), (10), (13) (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
58	Provide additional DC battery capability.	Would ensure longer battery capability during a SBO, reducing frequency of long-term SBO sequences.	(5), (6), (13), (16), (17)	B	Have installed spare battery (D52) that can be used in place of any of 4 vital batteries. Non-vital batteries can be tied to each other but not to vital. Intent met or implemented.
59	Use fuel cells instead of lead-acid batteries.	Extend DC power availability in a SBO.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
60	Procedure to cross-tie HPCS diesel.	(BWR 5/6)	(10)	A	BWR item.
61	Improve bus cross-tie ability.	Improved AC power reliability.	(10), (13)	B	Intertied by design, SBO cross-tie adds more flexibility. Intent met or implemented.
62	Alternate battery charging capability.	Improved DC power reliability. Either cross-tie of AC buses, or a portable diesel-driven battery charger.	(10), (11), (12), (13)	B	Intertied by design, SBO cross-tie adds more flexibility. Intent met or implemented.
63	Increase/improve DC bus load shedding.	Improved battery life in station blackout.	(10), (11), (12), (13)	B	Battery calculations (PTN-BFJE-94-002, 6/23/97, for 3A, 3B, 4A, 4B) confirm 2-hour life without shedding of loads. No battery failure events appear in cutsets. Intent met or implemented.
64	Replace batteries.	Improved reliability.	(10)	B	The batteries were already replaced with current technology batteries. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
65	Create AC power cross-tie capability across units at a multi-unit site.	Improved AC power reliability.	(11), (12), (13)	B	Intertied by design, SBO cross-tie adds more flexibility. Intent met or implemented.
66	Create a cross-unit tie for diesel fuel oil.	For multi-unit sites, adds diesel fuel oil redundancy.	(13)	B	Intertied by design, SBO cross-tie adds more flexibility. Intent met or implemented.
67	Develop procedures to repair or change out failed 4kV breakers.	Offers a recovery path from a failure of breakers that perform transfer of 4.16kV non-emergency buses from unit station service transformers to system station service transformers, leading to loss of emergency AC power (i.e., in conjunction with failures of the diesel generators).	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
68	Emphasize steps in recovery of offsite power after a SBO.	Reduced human error probability of offsite power recovery.	(13)	B	Turkey Point Units 3 & 4 training adequate. Intent met or implemented.
69	Develop a severe weather conditions procedure.	For plants that do not already have one, reduces the likelihood of external events CDF.	(13)	B	Turkey Point Units 3 & 4 procedure (i.e., hurricane) adequate. Intent met or implemented.
70	Develop procedures for replenishing diesel fuel oil.	Allow long term diesel operation.	(13)	B	Turkey Point Units 3 & 4 procedure adequate. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
71	Install gas turbine generators.	Improve onsite AC power reliability.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
72	Install tornado protection on gas turbine generator.	If the unit has a gas turbine, the tornado-induced SBO frequency would be reduced.	(16), (17)	A	No gas turbine.
73	Create a river water backup for diesel cooling.	Provides redundant source of diesel cooling.	(13)	A	Diesels are air cooled.
74	Use firewater as a backup for diesel cooling.	Redundancy in diesel support systems.	(13)	A	Diesels are air cooled.
75	Provide a connection to alternate offsite power source.	Increase offsite power redundancy.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
76	Implement underground offsite power lines.	Could improve offsite power reliability, particularly during severe weather.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
77	Replace anchor bolts on diesel generator oil cooler.	Millstone 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.	(13)	A	Seismic risk extremely low; need for bolts on Emergency Diesel Generator (EDG) oil coolers very plant specific.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
78	Proceduralize use of pressurizer vent valves during Steam Generator Tube Rupture (SGTR) sequences.	CCNPP procedures direct the use of pressurizer sprays to reduce RCS pressure after a SGTR. Use of the vent valves provides a backup method.	(13)	B	Turkey Point Units 3 & 4 procedure for use of power operated relief valves (PORVs) and Auxiliary Spray adequate (SGTR low contributor). Intent met or implemented.
79	Install a redundant spray system to depressurize the primary system during a SGTR.	Enhanced depressurization ability during SGTR.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
80	Improve SGTR coping abilities.	Improved instrumentation to detect SGTR, or additional systems to scrub fission product releases.	(7), (9), (10), (13), (14), (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
81	Add other SGTR coping features.	(a) A highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources, (b) A system which returns the discharge from the steam generator relief valve back to the primary Containment, (c) An increased pressure capability on the steam generator shell side with corresponding increase in the safety valve setpoints.	(7), (8), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
82	Increase secondary-side pressure capacity such that a SGTR would not cause the relief valves to lift.	SGTR sequences would not have a direct release pathway.	(8), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
83	Replace steam generators with new design.	Lower frequency of SGTR.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
84	Direct steam generator flooding after a SGTR, prior to core damage.	Would provide for improved scrubbing of SGTR releases.	(14), (15)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
85	Implement a maintenance practice that inspects 100 percent of the tubes in a steam generator.	Reduce chances of tube rupture.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
86	Revise Emergency Operating Procedures (EOPs) to direct that a faulted steam generator be isolated.	For those plants whose EOPs don't already direct this, would reduce consequences of SGTR.	(13)	B	Procedure addresses isolation of a faulted steam generator for main steam line break, main feed line break, and other secondary line breaks. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
87	Locate RHR inside of Containment.	Would prevent Interfacing System Loss of Coolant Accident (ISLOCA) out the RHR pathway.	(8)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
88	Self-actuating containment isolation valves.	For plants that don't have this, it would reduce the frequency of isolation failure.	(8)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
89	Install additional instrumentation for ISLOCA sequences.	Pressure or leak monitoring instruments installed between the first two pressure isolation valves on low-pressure injection lines, RHR suction lines, and high-pressure injection lines would decrease ISLOCA frequency.	(5), (6), (11), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
90	Increase frequency of valve leak testing.	Decrease ISLOCA frequency.	(12)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
91	Improve operator training on ISLOCA coping.	Decrease ISLOCA effects.	(12), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
92	Install relief valves in the Component Cooling Water System.	Would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
93	Provide leak testing of valves in ISLOCA paths.	At Kewaunee, four motor-operated valves (MOVs) isolating RHR from the RCS were not leak tested. Would help reduce ISLOCA frequency.	(13)	B	Turkey Point Units 3 & 4 currently perform leak-testing of valves in ISLOCA flow paths. This can only be done at cold shutdown. Intent met or implemented.
94	Revise EOPs to improve ISLOCA identification.	Salem had a scenario in which a RHR ISLOCA could direct initial leakage back to the Pressurizer Relief Tank, giving indication that the LOCA was inside Containment. Procedure enhancement would ensure a LOCA outside Containment would be observed.	(13)	B	Turkey Point Units 3 & 4 procedure adequate. Intent met or implemented.
95	Ensure all ISLOCA releases are scrubbed.	Would scrub ISLOCA releases. One suggestion was to plug drains in the break area so the break point would cover with water.	(14), (15)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
96	Add redundant and diverse limit switch to each containment isolation valve.	Enhanced isolation valve position indication, which would reduce frequency of containment isolation failure and ISLOCAs.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
97	Modify swing direction of doors separating Turbine Building basement from areas containing safeguards equipment.	For a plant where internal flooding from Turbine Building to safeguards areas is a concern, this modification can prevent flood propagation.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
98	Improve inspection of rubber expansion joints on main condenser.	For a plant where internal flooding due to failure of circulating water expansion joint is a concern, this can help reduce the frequency.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
99	Deploy internal flood prevention and mitigation enhancements.	1) Use of submersible MOV operators. 2) Back flow prevention in drain lines.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
100	Internal flooding improvements at Fort Calhoun Station	Prevention or mitigation of 1) A rupture in the RCP seal cooler of the CCW System, 2) An ISLOCA in a shutdown cooling line, 3) An AFW flood involving the need to possibly remove a water-tight door. For a plant where any of these apply, would reduce flooding risk.	(13)	A	Applicable to Fort Calhoun Station specifically. These items were not identified in the flooding analysis performed on Turkey Point Units 3 & 4.
101	Implement digital feedwater upgrade.	Reduces chance of loss of Main Feedwater following a plant trip.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
102	Perform surveillances on manual valves used for backup AFW pump suction.	Improves success probability for providing alternate water supply to AFW pumps.	(13)	B	Turkey Point Units 3 & 4 Condensate Storage Tanks (CSTs) are connected, each can provide sufficient AFW flow to maintain a unit at hot standby for 15 hours, followed by 4 hours of cooldown; or 23 hours at hot standby (Turkey Point Units 3 & 4 PRA 2.A, 110). Intent met or implemented.
103	Install manual isolation valves around AFW turbine-driven steam admission valves.	Reduces the dual turbine driven pump maintenance unavailability.	(13)	B	Intent met or implemented.
104	Install accumulators for turbine-driven AFW pump flow control valves.	Provide control air accumulators for the turbine driven AFW flow control valves, the motor-driven AFW pressure control valves, and steam generator PORVs. This would eliminate the need for local manual action to align nitrogen bottles for control air during a LOP.	(11)	B	Diesel generator-driven instrument air compressor adequately reduces the impact of loss of Instrument Air on LOP. Intent met or implemented.
105	Install a new CST (AFW Storage Tank).	Either replace old tank with a larger one, or install a backup tank.	(13), (16), (17)	B	Demineralized Water Storage Tank (DWST) provides this function. Two standby steam generators feed pumps supplied by DWST provide a backup to AFW. Intent met or implemented.
106	Enable cooling of steam-driven AFW pump in a SBO.	1)Use firewater to cool pump, or 2) Make the pump self-cooled. Would improve success chances in a SBO.	(13)	A	AFW cooling not required; AFW in open area.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
107	Proceduralize local manual operation of AFW when control power is lost.	Lengthen AFW availability in SBO. Also provides a success path should AFW control power be lost in non-SBO sequences.	(13)	B	Turkey Point Units 3 & 4 have a diesel-driven standby steam generator feed pump (SSGFP) for SBO (dedicated battery - no control power dependency). Intent met or implemented.
108	Provide portable generators to be hooked in to the turbine driven AFW, after battery depletion.	Extend AFW availability in a SBO (assuming the turbine-driven AFW requires DC power).	(16), (17)	B	Turkey Point Units 3 & 4 have a diesel-driven SSGFP for SBO (dedicated battery - no control power dependency). Intent met or implemented.
109	Add a motor train of AFW to the steam trains.	For PWRs that do not have any motor trains of AFW, this can increase reliability in non-SBO sequences.	(13)	B	SSGFPs from DWST (one is motor driven) provide this function. Intent met or implemented.
110	Create ability for emergency connections of existing or alternate water sources to feedwater/ condensate.	Would be a backup water supply for the Feedwater/Condensate Systems.	(12)	B	SSGFPs from DWST (one diesel-driven, one motor-driven) provide this function. Intent met or implemented.
111	Use firewater as a backup for steam generator inventory.	Would create a backup to Main and Auxiliary Feedwater for steam generator water supply.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
112	Procure a portable diesel pump for isolation condenser makeup.	Backup to the city water supply and diesel firewater pump in providing isolation condenser makeup.	(13)	A	Applicable to isolation condenser plant only.
113	Install an independent diesel for the Condensate Storage Tank makeup pumps.	Would allow continued inventory in CST during a SBO.	(13)	B	SSGFPs from DWST (one is motor driven) provide this function. Intent met or implemented.
114	Change failure position of condenser makeup valve.	If the condenser makeup valve fails open on loss of air or power, this can result in CST flow diversion to condenser. Allows greater inventory for the AFW pumps.	(13)	A	CST supplies AFW only, no connection to condenser. DWST supplies SSGFP and condenser makeup. If makeup valve (CV-1519) fails open, and if the flow regulating valve is open (typically closed), flow may be diverted, but when condenser level rises > 84 percent, flow will be directed back to DWST - no inventory loss.
115	Create passive secondary-side coolers.	Provide a passive heat removal loop with a condenser and heat sink. Would reduce CDF from the loss of feedwater.	(17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
116	Provide capability for diesel-driven, low-pressure vessel makeup.	Extra water source in sequences in which the reactor is depressurized and all other injection is unavailable (e.g., firewater).	(4), (5), (13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
117	Provide an additional high-pressure injection pump with independent diesel.	Reduce frequency of core melt from small LOCA sequences, and from SBO sequences.	(6), (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
118	Install independent AC high-pressure injection system.	Would allow makeup and feed and bleed capabilities during a SBO.	(11)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
119	Create the ability to manually align ECCS recirculation.	Provides a backup should automatic or remote operation fail.	(12)	B	Recirc alignment is remote manual operation only. Intent met or implemented.
120	Implement an RWST makeup procedure.	Decrease core damage frequency from ISLOCA scenarios, some smaller break LOCA scenarios, and SGTR.	(12), (13)	B	RWST refill continuous injection capability meet the intent. Intent met or implemented.
121	Stop low-pressure injection pumps earlier in medium or large LOCAs.	Would give more time to perform recirculation swapover.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
122	Emphasize timely recirc swapover in operator training.	Reduce human error probability of recirculation failure.	(13)	B	Recirc alignment is remote manual operation only, and for which operators are trained. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
123	Upgrade Chemical and Volume Control System (CVCS) to mitigate small LOCAs.	For a plant like the AP600, where CVCS can't mitigate small LOCA, an upgrade would decrease CDF from small LOCA.	(8)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
124	Install an active high-pressure SI system.	For a plant like the AP600, where an active high-pressure safety injection system does not exist, would add redundancy in high-pressure injection.	(8)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
125	Change "in-Containment" RWST suction from 4 check valves to 2 check and 2 air operated valves.	Remove common mode failure of all four injection paths.	(8)	A	This SAMA refers to AP600 design with RWST inside Containment. At Turkey Point Units 3 & 4, RWSTs are outside Containment. Suction line to HHSI/(low head safety injection (LHSI) pumps contains 2 locked open MOVs and a locked open manual valve in series. Since valves are not required to change state, no common cause failure applied.
126	Replace two of the four safety injection pumps with diesel pumps.	Intended for System 80+, which has four trains of SI. This would reduce common cause failure probability.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
127	Align low-pressure coolant injection (LPCI) or core spray to CST on loss of suppression pool cooling.	Low pressure ECCS can be maintained in loss of suppression pool cooling scenarios.	(10), (13)	B	RWST refill and continuous injection capability exist, along with cross-tie to opposite unit RWST. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
128	Raise High-Pressure Coolant Injection (HPCI)/RCIC backpressure trip setpoints.	Ensures HPCI/RCIC availability when high suppression pool temperatures exist.	(13)	A	BWR Item.
129	Improve the reliability of the Automatic Depressurization System.	Reduce frequency of high-pressure core damage sequences.	(4)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
130	Disallow automatic vessel depressurization in non-ATWS scenarios.	Improve operator control of plant.	(13)	A	BWR Item.
131	Create automatic swapover to recirculation on RWST depletion.	Would remove human error contribution from recirculation failure.	(5), (6), (11)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
132	Modify EOPs for ability to align diesel power to more air compressors.	For plants which do not have diesel power to all normal and backup air compressors, this change allows increased reliability of Instrument Air after a LOP.	(13)	B	A diesel-driven air compressor is in place and in use. Procedures are implemented. Intent met or implemented.
133	Replace old air compressors with more reliable ones.	Improve reliability and increase availability of instrument air compressors.	(13)	B	In 1993 the air compressors were replaced with more reliable ones. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
134	Install nitrogen bottles as backup gas supply for safety relief valves (SRVs).	Extend operation of safety relief valves during SBO and loss of air events (BWRs).	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
135	Install motor generator set trip breakers in Control Room.	Provides trip breakers for the motor generator sets in the Control Room. Currently, at Watts Bar, an ATWS would require an immediate action outside the Control Room to trip the motor generator sets. Would reduce ATWS CDF.	(11)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
136	Add capability to remove power from the bus powering the control rods.	Decrease time to insert control rods if the reactor trip breakers fail (during a loss of feedwater ATWS that has rapid pressure excursion).	(13)	B	Turkey Point Units 3 & 4 have capability to remove power from control rods. Intent met or implemented.
137	Create cross-connect ability for standby liquid control (SLC) trains.	Improved reliability for boron injection during ATWS.	(13)	A	BWR Item.
138	Create an alternate boron injection capability (backup to SLC).	Improved reliability for boron injection during ATWS.	(13)	A	BWR Item.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
139	Remove or allow override of LPCI injection during ATWS.	On failure of HPCI and Condensate, the Susquehanna units direct reactor depressurization followed by 5 minutes of automatic LPCI injection. Would allow control of LPCI immediately.	(13)	A	BWR Item.
140	Install a system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	Would improve equipment availability after an ATWS.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
141	Create a boron injection system to back up the mechanical control rods.	Provides a redundant means to shut down the reactor.	(16), (17)	B	Turkey Point Units 3 & 4 have capability for emergency boration. Intent met or implemented
142	Provide an additional Instrumentation and Control System (e.g., AMSAC).	Improve instrumentation and control redundancy and reduce ATWS frequency.	(16), (17)	B	Event for logic circuits fail to generate trip signal CDF risk reduction worth (RRW) = 1.001; adequate reliability. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
143	Provide capability for remote operation of secondary-side PORVs in SBO.	Manual operation of these valves is required in a SBO scenario. High area temperatures may be encountered in this case (no ventilation to main steam areas), and remote operation could improve success probability.	(2)	B	Automatic Depressurization Valves (ADVs) air-operated with N2 backup for SBO; can be operated in automatic or manual mode from Control Room, or manual mode from alternate shutdown panel (Ref. F.2-1, Section 2.F, pg. 7). Intent met or implemented.
144	Create/enhance Reactor Coolant System depressurization ability.	Either with a new depressurization system, or with existing PORVs, head vents, and secondary-side valve, RCS depressurization would allow low-pressure ECCS injection. Even if core damage occurs, low RCS pressure alleviates some concerns about high-pressure melt ejection.	(5), (6), (9), (11), (12), (13), (14), (15), (16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
145	Make procedural changes only for the RCS depressurization option.	Reduce RCS pressure without cost of a new system.	(7), (9), (13)	B	RCS depressurization during small LOCA or transient cooldown is via steam dumps (ADVs). Contribution of human error probabilities and valve failures for depressurization insignificant to CDF (RRW = 1). Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
146	Defeat 100 percent load rejection capability. INTERPRET AS "PROVIDE 100 percent…"	Eliminates the possibility of a stuck open PORV after a LOP, since PORV opening wouldn't be needed.	(13)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
147	Change control rod drive flow control valve failure position.	Change failure position to the 'fail-safest' position.	(13)	A	BWR item.
148	Install secondary-side guard pipes up to the main steam isolation valves (MSIVs).	Would prevent secondary-side depressurization should a steam line break occur upstream of the MSIVs. Would also guard against or prevent consequential multiple SGTR following a main steam line break event.	(16), (17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
149	Install digital large break LOCA protection.	Upgrade plant instrumentation and logic to improve the capability to identify symptoms/precursors of a large break LOCA (a leak before break).	(17)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
150	Increase seismic capacity of the plant to a high confidence of low probability of failure of twice the Safe Shutdown Earthquake.	Reduced seismic CDF.	(17)	A	Seismic risk extremely low, thus very low benefit.
151	Provide self-cooled ECCS seals.	ECCS pump seals are CCW cooled.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
152	Separate non-vital buses from vital buses.	Some non-vital loads mixed with vital loads on load centers causing load shedding difficulties.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
153	Make CCW trains separate.	Current cross-tie capability creates a potential common mode failure mechanism for both trains (and both stations).	Turkey Point Units 3 & 4	B	Capability to isolate the trains exists. The probability of this specific common mode failure of both trains (rupture of the isolation valve) is very small. Intent met or implemented.
154	Make Intermediate Cooling Water (ICW) trains separate.	Current cross-tie capability creates a potential common mode failure mechanism for both trains (and both stations).	Turkey Point Units 3 & 4	B	Capability to isolate the trains exists. The probability of this specific common mode failure of both trains (rupture of the isolation valve) is very small. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
155	Provide a centrifugal charging pump.	Currently charging pumps are positive displacement pumps.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
156	Provide a motor-operated AFW pump.	Currently AFW pumps are both turbine driven.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
157	Provide containment isolation design per General Design Criteria and Standard Review Plan.	Enhance containment isolation capability.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
158	Improve RHR sump reliability.	Common mode failure of RHR due to debris in sump.	Turkey Point Units 3 & 4	B	The benefit of eliminating the common mode failure is very small. The capability to refill the RWST and to provide continuous injection further reduces the need for improving the sump reliability. Intent met or implemented.
159	Provide Auxiliary Building vent/seal structure.	Enhance ventilation in Auxiliary Building.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
160	Add charcoal filters on Auxiliary Building exhaust.	Enhance fission product removal after ISLOCA.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
161	Add penetration valve leakage control system.	Enhance capability to detect/control leakage from penetrations valves.	Turkey Point Units 3 & 4	N	Not initially screened. Considered further in the final (cost-benefit) screening.
162	Enhance screen wash.	Potential for loss of ICW due to clogging of sea water screens.	Turkey Point Units 3 & 4	B	Operators currently keep the screens clean and have adequate indication and time to successfully perform this task. Intent met or implemented.
163	Enhance training for important operator actions.	Key operator actions are: U3OPS2HPR (0.0078) ZZXCROSST (0.0501) XMANBYPASS (0.016) U3OPMLPR (0.03) X3OPKMRODI (0.1) U0RABFAN (0.01) U3OPALHR (0.12) AHFL0N2BKU (0.003) UISOPMP (0.0003) U3T3CD4-3 (0.003)	Turkey Point Units 3 & 4	B	Discussion among the FPL SAMA evaluation team indicated that these operator actions have been highlighted in the PSA training. It is therefore judged that enhancements to training on these operator actions are not likely to reduce their probabilities of failure measurably. Intent met or implemented.
164	Minimize tornado damage to RWST and penetration rooms.	Penetration rooms are tornado protected. Tornado category F2 and higher can generate heavy enough missiles that they could impact and damage the RWST.	(19)	B	Turkey Point Units 3 & 4 have redundant RWSTs. Intent met or implemented.

TABLE F.2-1 (Cont'd)
INITIAL LIST OF CANDIDATE IMPROVEMENTS
FOR THE TURKEY POINT UNITS 3 & 4 SAMA ANALYSIS

SAMA Number	Potential Improvement	Discussion	Source[a]	Screening Criterion[b]	Evaluation
165	Man safe shutdown facility (SSF) continuously to align coolant makeup system for RCP seal cooling.	At Turkey Point a dedicated operator for seals or for the highest value operator action could be considered.	(19)	N	Not initially screened. Considered further in the final (cost-benefit) screening.
166	Prevent tornado from causing failure of power and upper surge tanks.	Consider protection for tanks or switchgear in Turbine Building. Surge tanks are suction for emergency feedwater pumps.	(19)	B	Turkey Point Units 3 & 4 have redundant CSTs. The switchgear rooms in the Turbine Building are designed for adequate tornado protection. Modifications to increase resistance to tornado-induced damage would be extremely costly. Intent met or implemented.
167	Replace reactor vessel with stronger vessel.	Reduce core damage contribution due to vessel failure.	(19)	N	Not initially screened. Considered further in the final (cost-benefit) screening.

a. The Source numbers correspond to the last portion of the reference numbers for References F.2-1 – F.2-19.

b. Screening Criteria:
A = Not Applicable
B = Intent Met or Implemented
N = Not Screened. Considered in cost-benefit evaluation.

TABLE F.2-2
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
7	Increase charging pump lube oil capacity.	Would lengthen time before charging pump failure due to lube oil overheating in loss of CCW sequences.	<$31K	>2 x Benefit	Screen out	Charging pumps have connection for cooling by SW; unavailability is dominated by pump failures. Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCAs to be <$31K. In order to implement this alternative, plant hardware modifications would be needed. The cost of this would be greater than the benefit obtained.
8	Eliminate RCP thermal barrier dependence on CCW, such that loss of CCW does not result directly in core damage.	Would prevent loss of RCP seal integrity after a loss of CCW. Watts Bar IPE stated they could do this with ERCW connection to charging pump seals.	<$31K	>2 x Benefit	Screen out	Charging pumps have connection for cooling by SW; unavailability is dominated by pump failures. Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCAs to be <$31K. In order to implement this alternative, plant hardware modifications would be needed. The cost of this would be greater than the benefit obtained.
9	Provide additional SW pump.	Providing another pump would decrease core damage frequency due to a loss of SW.	<$31K	>2 x Benefit	Screen out	CCW cooled by ICW; can cross-tie to opposite unit CCW if ICW lost. Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCA to be <$31K. In order to implement this alternative, additional hardware would need to be installed (plant modification). The cost of this would be greater than the benefit obtained.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
10	Create an independent RCP seal injection system, with dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of CCW or SW, or SBO.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCA, to be < $31K. In order to implement this alternative, additional hardware would need to be installed (plant modification). The cost of this would be greater than the benefit obtained.
11	Create an independent RCP seal injection system, without dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of CCW or SW or SBO.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP Seal LOCA to be < $31K. In order to implement this alternative, additional hardware would need to be installed (plant modification). The cost of this would be greater than the benefit obtained.
12	Use existing hydro test pump for RCP seal injection.	Independent seal injection source, without cost of a new system.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCAs to be < $31K. In order to implement this alternative, plant hardware modifications would be needed to allow timely connection of the hydro pump for seal injection. The cost of this would be greater than the benefit obtained.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
13	Replace ECCS pump motors with air cooled motors.	Remove dependency on CCW.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCAs to be < $31K. In order to implement this alternative, plant hardware modifications would be needed to allow timely connection of the hydro pump for seal injection. The cost of this would be greater than the benefit obtained.
15	Add a third CCW pump.	Reduce chance of loss of CCW leading to RCP seal LOCA.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCA to be < $31K. In order to implement this alternative, additional hardware would need to be installed (plant modification). The cost of this would be greater than the benefit obtained.
16	Prevent charging pump flow diversion from the relief valves.	If relief valve opening causes a flow diversion large enough to prevent RCP seal injection, then modification can reduce frequency of loss of RCP seal cooling.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCAs to be < $31K. The actual benefit would be much less, since the failure rate for relief valve premature opening is only 0.000004/hour (IEEE Std 500). In order to implement this alternative, plant hardware modifications would be needed to direct relief valve flow back to system. The cost of this would be greater than the benefit obtained.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
25	Develop procedures for temporary HVAC.	Provides for improved credit to be taken for loss-of-HVAC sequences.	<$15.3K	>2 x Benefit	Screen out	Procedure describes using portable fans and blocking doors open for DC Equipment Room. Reactor auxiliaries building (RAB) ventilation not expected to be required except for RHR rooms. The RHR pumps must have room cooling when pumping hot water (as opposed to pumping RWST water); the RHR pumps would survive without HVAC if temporary measures are taken within 1/2 hour of commencing to pump hot water. Opening the doors to the rooms would provide adequate room cooling. Analysis case RABCSF determined the benefit from eliminating all contribution from failure of RAB ventilation to be <$15.3K. However, another analysis was run using a more realistic Level 3 model [RABCSF(L3)] and the resulting benefit was <$10.7K; therefore, this SAMA will screen out. In order to implement this alternative, plant procedure modifications would be needed. The cost of this would be greater than the benefit obtained.
31	Develop an enhanced drywell spray system.	Would provide a redundant source of water to the Containment to control containment pressure, when used in conjunction with containment heat removal.	<$177K	>2 x Benefit	Screen out	Analysis case SGCRVLP2 determined the benefit from eliminating all contribution from containment spray failure to be less than $177K. In order to implement this alternative, substantial plant hardware modifications would be needed. The cost of this would be greater than the benefit obtained.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
32	Provide a dedicated existing drywell spray system.	Identical to the previous concept, except that one of the existing spray loops would be used instead of developing a new spray system.	< $177K	> 2 x Benefit	Screen out	Analysis case SGCRVLP2 determined the benefit from eliminating all contribution from containment spray failure to be less than $162K. In order to implement this alternative, substantial plant hardware modifications would be needed. The cost of this would be greater than the benefit obtained.
33	Install a containment vent large enough to remove ATWS decay heat.	Assuming injection is available, would provide alternative decay heat removal in an ATWS.	< $802K [maximum attainable benefit (MAB)]	> 2 x Benefit	Screen out	Turkey Point Units 3 & 4 containment design has 2-inch Instrument Air bleed line; purge valve to vent for small venting demand should be very costly (unfiltered version of SAMA Number 34) The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.
34	Install a filtered containment vent to remove decay heat.	Assuming injection is available (non-ATWS sequences), would provide alternate decay heat removal with the released fission products being scrubbed.	< $802K (MAB)	Industry estimate $20M	Screen out	TVA estimate $20M (Reference F.2-7); expected to well exceed MAB. The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
35	Install an unfiltered hardened containment vent.	Provides an alternate decay heat removal method (non-ATWS), which is not filtered.	< $802K (MAB)	Industry estimate $20M	Screen out	TVA estimate $20M (Ref. F.2-7); expected to well exceed MAB. The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.
38	Create a giant concrete crucible with heat removal potential under the basemat to contain molten debris.	A molten core escaping from the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a melt through.	< $802K (MAB)	Industry estimate $108M	Screen out	For an existing plant, design and installation of this SAMA are not considered feasible. The costs associated with the plant modifications required to implement this alternative are greater than the benefit. S80 estimate $108M (Ref. F.2-16); expected to well exceed MAB.
39	Create a water-cooled rubble bed on the pedestal.	This rubble bed would contain a molten core dropping onto the pedestal, and would allow the debris to be cooled.	< $802K (MAB)	Industry estimate $18M	Screen out	For an existing plant, design and installation of this SAMA are not considered feasible. The costs associated with the plant modifications required to implement this alternative are greater than the benefit. S80 estimate $18M (Ref. F.2-16); expected to well exceed MAB.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
46	Provide containment inerting capability.	Would prevent combustion of hydrogen and carbon monoxide gases.	< $802K (MAB)	Industry estimate $10.9M	Screen out	Turkey Point Units 3 & 4 do not have hydrogen recombiners (operation of ECCS also mitigates hydrogen levels); but have the provisions to obtain within 7 days post accident (including needed penetrations). Hydrogen concentration or pockets are not likely based on IPE insights. TVA estimate $10.9M (Ref. F.2-7); cost expected to well exceed MAB. The costs associated with the plant modifications required to implement this alternative are greater than the benefit.
47	Use fire water spray pump for containment spray.	Redundant containment spray method without high cost.	< $49K	> 2 x Benefit	Screen out	The RHR pumps can back up the spray pumps when AC is available, thus the primary benefit for FW backup would be during SBO. Analysis case No LOG determined the benefit of eliminating all Loss of Grid events. Based on this analysis, the maximum benefit to be obtained from use of firewater spray during blackout is less than $49K. The costs associated with the plant modifications required to implement this alternative are greater than the benefit.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
48	Install a passive containment spray system.	Containment spray benefits at a very high reliability, and without support systems.	<$177K	>2 x Benefit	Screen out	Analysis case SGCRVLP2 determined the benefit from eliminating all contribution from containment spray failure to be less than $177K. In order to implement this alternative, substantial plant hardware modifications would be needed. The cost of this would be greater than the benefit obtained.
50	Increase containment design pressure.	Reduce chance of containment overpressure.	<$481K	>2 x Benefit	Screen out	If containment failure were eliminated, maximum benefit would be elimination of all offsite dose/loss. Benefit is <$481K. Cost would be expected to be >2 x benefit.
53	Create another building, maintained at a vacuum to be connected to Containment.	In an accident, connecting the new building to Containment would depressurize Containment and reduce any fission product release.	<$802K (MAB)	Industry estimate >$10M	Screen out	For an existing plant, design and installation of this SAMA are not considered feasible. Industry cost estimate >$10M; expected to well exceed MAB
54	Add ribbing to the containment shell.	Would reduce the chance of buckling of Containment under reverse pressure loading.	<$481K	>2 x Benefit	Screen out	For an existing plant, design and installation of this SAMA are not considered feasible (also Turkey Point Units 3 & 4 do not have steel containments). Very costly, extensive reconstruction of Containment; expected to well exceed MAB.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
57	Provide an additional diesel generator.	Would increase onsite emergency AC power reliability and availability (decrease SBO). The ANO-1 IPE reported that ANO committed to install an alternate alternating current power source capable of supplying the LOOP loads of any one of the four safety buses. This source would be available within 10 minutes after determination of SBO conditions.	< $72K	> 2 x Benefit Industry estimate $431K (Ref. F.2-7) to $25M (Ref. F.2-16)	Screen out	Analysis case EDG5 determined the maximum benefit from installation of another diesel generator to be < $72K. The cost of installation of another diesel generator is expected to greatly exceed twice this expected benefit.
59	Use fuel cells instead of lead-acid batteries.	Extend DC power availability in a SBO.	~ $0	> 2 x Benefit	Screen out	Event U3BATDEP for operator failure to recover offsite power prior to battery depletion has CDF RRW = 1. Indicates battery depletion not a large contributor. Based on this contribution to CDF, the maximum benefit to be obtained from fuel cells is nearly zero.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
67	Develop procedures to repair or change out failed 4 kilovolts (kV) breakers.	Offers a recovery path from a failure of breakers that perform transfer of 4.16kV non-emergency buses from unit station service transformers to system station service transformers, leading to loss of emergency AC power (i.e., in conjunction with failures of the diesel generators).	~$0	>2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates that 4kV breaker failure has minimal contribution to CDF (RRW = 1). Based on this contribution to CDF the maximum benefit to be obtained from procedures to change out or repair breakers is nearly zero.
71	Install gas turbine generators.	Improve onsite AC power reliability.	<$49K	Industry estimate $10M	Screen out	Analysis case No LOG determined the benefit of eliminating all Loss of Grid events. Based on this analysis, the maximum benefit to be obtained from a gas turbine generator is less than $49K. The costs associated with the plant modifications required to implement this alternative are greater than the benefit.
75	Provide a connection to alternate offsite power source.	Increase offsite power redundancy.	<$49K	>2 x Benefit (assuming distance >2 miles) Industry estimate $1M/mile	Screen out	Analysis case No LOG determined the benefit of eliminating all Loss of Grid events. Based on this analysis, the maximum benefit to be obtained from an additional offsite power source connection is less than $49K. In 1994 at CCNPP, BGE installed a 500kV line at a cost of $1M/mile. This would exceed FPL benefit.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
76	Implement underground offsite power lines.	Could improve offsite power reliability, particularly during severe weather.	< $49K	> 2 x Benefit	Screen out	Analysis case No LOG determined the benefit of eliminating all Loss of Grid events. Based on this analysis, the maximum benefit to be obtained from underground offsite power lines is less than $49K. The distance that would be necessary to bury cabling would be significant given that the severe weather to which the plant is susceptible (primarily hurricanes) typically affects a broad area.
79	Install a redundant spray system to depressurize the primary system during a SGTR.	Enhanced depressurization ability during SGTR.	< $1K	> 2 x Benefit	Screen out	Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
80	Improved SGTR coping abilities.	Improved instrumentation to detect SGTR, or additional systems to scrub fission product releases.	< $1K	> 2 x Benefit	Screen out	Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
81	Add other SGTR coping features.	(a)A highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources, (b) A system which returns the discharge from the steam generator relief valve back to the primary Containment, (c) An increased pressure capability on the steam generator shell side with corresponding increase in the safety valve setpoints.	< $1K	> 2 x Benefit	Screen out	Per System 80 + (Ref. F.2-16), relief valve return to Containment requires major redesign. Increasing secondary pressure capacity requires new secondary system. Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
82	Increase secondary-side pressure capacity such that a SGTR would not cause the relief valves to lift.	SGTR sequences would not have a direct release pathway.	< $1K	> 2 x Benefit	Screen out	Per System 80 + (Ref. F.2-16) relief valve return to Containment requires major redesign. Increasing secondary pressure capacity requires new secondary system. Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
83	Replace steam generators with new design.	Lower frequency of SGTR.	< $1K	> 2 x Benefit	Screen out	Original Turkey Point Units 3 & 4 steam generators replaced with newer design. Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
84	Direct steam generator flooding after a SGTR, prior to core damage.	Would provide for improved scrubbing of SGTR releases.	< $1K	> 2 x Benefit	Screen out	Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
85	Implement a maintenance practice that inspects 100 percent of the tubes in a steam generator.	Reduce chances of tube rupture.	< $1K	> 2 x Benefit	Screen out	Analysis case NO-SGTR determined the benefit from eliminating all contribution from SGTR to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
87	Locate RHR inside of Containment.	Would prevent ISLOCA out the RHR pathway.	< $802K (MAB)	> 2 x Benefit	Screen out	For an existing plant, relocating the RHR inside the Containment is not feasible, as it would require an entirely new RHR system.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
88	Self-actuating containment isolation valves.	For plants that don't have this, it would reduce the frequency of isolation failure.	< $1K	> 2 x Benefit	Screen out	Except for 4 valves, Turkey Point Units 3 & 4 Containment Isolation System valves fail safe on loss of electric/air, and require only Engineered Safety Features Actuation System containment isolation signal Analysis case CI-OK determined the benefit from eliminating all contribution from early Containment failure (including containment isolation failure) to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification).
89	Install additional instrumentation for ISLOCA sequences.	Pressure or leak monitoring instruments installed between the first two pressure isolation valves on low-pressure injection lines, RHR suction lines, and high-pressure injection lines would decrease ISLOCA frequency.	< $16K	> 2 x Benefit	Screen out	Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
90	Increase frequency of valve leak testing.	Decrease ISLOCA frequency.	< $16K	> 2 x Benefit	Screen out	Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
91	Improve operator training on ISLOCA coping.	Decrease ISLOCA effects.	< $16K	> 2 x Benefit	Screen out	Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.
92	Install relief valves in the Component Cooling Water System.	Would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	< $16K	> 2 x Benefit	Screen out	This mechanism not identified as a contributor to ISLOCA at Turkey Point Units 3 & 4. Even so, case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification).
95	Ensure all ISLOCA releases are scrubbed.	Would scrub ISLOCA releases. One suggestion was to plug drains in the break area so the break point would cover with water.	< $16K	> 2 x Benefit	Screen out	Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification) and procedure modifications written to provide additional direction.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
96	Add redundant and diverse limit switch to each containment isolation valve.	Enhanced isolation valve position indication, which would reduce frequency of containment isolation failure and ISLOCAs.	< $17K	> 2 x Benefit	Screen out	Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. Analysis case CI-OK determined the benefit from eliminating all contribution from early Containment failure (including containment isolation failure) to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification).
97	Modify swing direction of doors separating Turbine Building basement from areas containing safeguards equipment.	For a plant where internal flooding from the Turbine Building to safeguards areas is a concern, this modification can prevent flood propagation.	~ $0	> 2 x Benefit	Screen out	This SAMA is clearly not applicable to Turkey Point Units 3 & 4 Turbine Building designs. The IPE indicates, for the two internal flooding scenarios that were considered credible by the analysis, both have CDFs of < 0.0000005; improvement would yield no measurable benefit.
98	Improve inspection of rubber expansion joints on main condenser.	For a plant where internal flooding due to failure of circulating water expansion joint is a concern, this can help reduce the frequency.	~ $0	> 2 x Benefit	Screen out	Benefit would be very small since there were no significant internal flooding issues in the IPE analysis of internal flooding. The IPE indicates that the CDF for this event is < 0.0000005; improvement would yield no measurable benefit.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
99	Deploy internal flood prevention and mitigation enhancements.	1) Use of submersible MOV operators. 2) Back flow prevention in drain lines.	~ $0	> 2 x Benefit	Screen out	Benefit would be very small since there were no significant internal flooding issues in the IPE analysis of internal flooding. The IPE indicates, for the two internal flooding scenarios that were considered credible by the analysis, both have CDFs of < 0.0000005; improvement would yield no measurable benefit.
101	Implement digital feedwater upgrade.	Reduces chance of loss of Main Feedwater following a plant trip.	< $68.2K	~ $580k	Screen out	The Turkey Point Units 3 & 4 PRA indicates that loss of feedwater events have an 8.5 percent contribution to CDF. Based on this contribution to CDF, the maximum benefit to be obtained from a digital feedwater upgrade is less than $68.2K.
111	Use firewater as a backup for steam generator inventory.	Would create a backup to Main and Auxiliary Feedwater for steam generator water supply.	< $8.1K	> 2 x Benefit	Screen out	Turkey Point Units 3 & 4 have many sources of secondary makeup, including a diesel-driven SSGFP. The Turkey Point Units 3 & 4 CFR indicates that this pump has less than a 1 percent contribution to CDF (RRW = 1.009). The benefit of another diesel driven source would be less than the value of the first. Based on this contribution to CDF, the maximum benefit to be obtained from use of firewater as a backup source is less than $8.1K.
115	Create passive secondary-side coolers.	Provide a passive heat removal loop with a condenser and heat sink. Would reduce CDF from the loss of feedwater.	< $802K (MAB)	> 2 x Benefit	Screen out	For an existing plant, design and installation of this SAMA are not considered feasible, as it would involve major changes in plant structures.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
116	Provide capability for diesel-driven, low- pressure vessel makeup.	Extra water source in sequences in which the reactor is depressurized and all other injection is unavailable (e.g., firewater). .	NA	NA	Screen out	Unborated water for safety injection implies applicability to BWR, not PWR. Diesel-driven HHSI is evaluated separately for SAMA Numbers 117, 118, and 124.
117	Provide an additional high-pressure injection pump with independent diesel.	Reduce frequency of core melt from small LOCA sequences, and from SBO sequences.	< $131K	> 2 x Benefit	Screen out	Analysis case HHDDPCSF determined the benefit from addition of a diesel-driven HHSI pump and elimination of HHSI common-cause failure to be less than $131K. In order to implement this alternative, plant hardware modifications would be needed. See also SAMA Numbers 118, 124.
118	Install independent AC high-pressure injection system.	Would allow makeup and feed and bleed capabilities during a SBO.	< $131K	> 2 x Benefit	Screen out	Analysis case HHDDPCSF determined the benefit from addition of a diesel-driven HHSI pump and elimination of HHSI common-cause failure to be less than $131K. In order to implement this alternative, plant hardware modifications would be needed. See also SAMA Numbers 117, 124.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
121	Stop low pressure injection pumps earlier in medium or large LOCAs.	Would give more time to perform recirculation swapover.	< $67K	> 2 x Benefit	Screen out	Analysis case OPERCSF determined the benefit from stopping the LHSI pumps earlier to be less than $67K. In order to implement this alternative, procedure modifications would be needed. The cost of this may be less than the total benefit obtained. However, there is a risk trade-off made when changing the time at which to stop the pumps. Stopping the pumps earlier in the sequence would introduce a risk due to error of commission (stopping pump too soon). Because the current procedures for recirculation swapover are reasonable and operators are well-trained, this potential risk trade-off is considered to be greater than any benefit that may be gained.
123	Upgrade CVCS to mitigate small LOCAs.	For a plant like the AP600, where CVCS can't mitigate small LOCA, an upgrade would decrease CDF from small LOCA.	< $8.1K	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates that HHSI pump independent failure has less than a 1 percent contribution to CDF (RRW = 1.008). Based on this contribution to CDF, the maximum benefit to be obtained from use of CVCS to mitigate small LOCAs is less than $8.1K.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
124	Install an active high- pressure SI system.	For a plant like the AP600, where an active high-pressure safety injection system does not exist, would add redundancy in high-pressure injection.	< $131K	> 2 x Benefit	Screen out	Although there is already an active SI system, system analysis case HHDDPCSF was used to consider additional redundancy by determining the benefit from the addition of a diesel-driven HHSI pump and elimination of HHSI common-cause failure to be less than $131K. In order to implement this alternative, plant hardware modifications would be needed. See also SAMA Numbers 117, 118.
126	Replace two of the four safety injection pumps with diesel pumps.	Intended for System 80+, which has four trains of SI. This would reduce common cause failure probability.	< $131K	> $890k	Screen out	Analysis case HHDDPCSF determined the benefit from addition of a diesel-driven HHSI pump and elimination of HHSI common-cause failure to be less than $131K. In order to implement this alternative, plant hardware modifications would be needed.
129	Improve the reliability of the Automatic Depressurization System.	Reduce frequency of high-pressure core damage sequences.	< $16.4K	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates that PORV failure-to-open events have less than a 2 percent contribution to CDF. Based on this contribution to CDF, the maximum benefit to be obtained from a digital feedwater upgrade is less than $16.4K.
131	Create automatic swapover to recirculation on RWST depletion.	Would remove human error contribution from recirculation failure.	< $56K	~ $450K	Screen out	Analysis case OperCSI estimated the benefit of an automatic swapover system to be < $56K.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
134	Install nitrogen bottles as backup gas supply for SRVs..	Extend operation of safety relief valves during SBO and loss of air events (BWRs).	< $13K	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates that loss of all instrument air and compressor failures have less than a 2 percent total contribution to CDF (RRW = 1.016). Based on this contribution to CDF, the maximum benefit to be obtained from nitrogen bottles is less than $13K.
135	Install motor generator set trip breakers in Control Room.	Provides trip breakers for the motor generator sets in the CONTROL ROOM. Currently, at Watts Bar, an ATWS would require an immediate action outside the control room to trip the motor generator sets. Would reduce ATWS CDF.	< $4.1K	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates failure to manually trip the breakers has less than a 1 percent contribution to CDF (X3OPKMT RRW = 1.005). Based on this contribution to CDF, the maximum benefit to be obtained from relocating the motor generator set trip breakers is less than $4.1K. In addition, Turkey Point Units 3 & 4 have capability to remove power from control rods.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
140	Install a system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	Would improve equipment availability after an ATWS.	< $4.1K	> 2 x Benefit	Screen out	For moderator temperature coefficient (MTC) > -7pcm/degree F, pressure relief is not possible and would exceed Stress Level C (Ref. 4.20-2, Section 1.0, pg. 125 & 146); so this SAMA would have no effect. For MTC > -20 percent milli (pcm)/degree F pressure relief is needed and provided by 3 SRVs or 2 SRVs + 2 PORVs (Ref. 4.20-2, pg. 125 & 146). The Turkey Point Units 3 & 4 PRA indicates unfavorable MTC and SRV/PORV failures have less than a 3 percent contribution to CDF (event ZZMTCUNFAV RRW = 1.001, SRVs RRW = 1.0, PORV fail to open RRW = 1.01 each). Based on this contribution to CDF, the maximum benefit to be obtained from an ATWS pressure relief system is less than $4.1K.
144	Create/enhance Reactor Coolant System depressurization ability.	Either with a new depressurization system, or with existing PORVs, head vents, and secondary-side valve, RCS depressurization would allow low-pressure ECCS injection. Even if core damage occurs, low RCS pressure alleviates some concerns about high-pressure melt ejection.	~ $0	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates depressurization failures have insignificant contribution to CDF (RRW = 1). Based on this contribution to CDF, the maximum benefit to be obtained enhancing depressurization capability is nearly zero.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
146	Defeat 100 percent load rejection capability. INTERPRET AS "PROVIDE 100 percent…"	Eliminates the possibility of a stuck open PORV after a LOP, since PORV opening wouldn't be needed.	$41K	> 2 x Benefit	Screen out	ADVs and CDVs open on reactor trip. The Turkey Point Units 3 & 4 PRA indicates failure of secondary steam relief is assumed negligible (Ref. 4.20-2, pg. 96), and only T2 initiators (transient with PORV demand) are assumed to result in PORV demand (Ref. 4.20-2, pg. 91). T2 initiators and stuck open PORVs have approximately a 5 percent contribution to CDF. Based on this contribution to CDF, the maximum benefit to be obtained from 100 percent load rejection is less than $41K.
148	Install a secondary side guard pipes up to the MSIVs.	Would prevent secondary side depressurization should a steam line break occur upstream of the MSIVs. Would also guard against or prevent consequential multiple SGTR following a main steam line break event.	~ $0	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates steam line break initiators (upstream or downstream of MSIVs) are insignificant to CDF (RRW = 1). Based on this contribution to CDF, the maximum benefit to be obtained from secondary-side guard pipes is nearly zero.
149	Install a digital large break LOCA protection.	Upgrade plant instrumentation and logic to improve the capability to identify symptoms/precursors of a large break LOCA (a leak before break).	< $16.2K	> 2 x Benefit	Screen out	Turkey Point Units 3 & 4 installed a new Reactor Protective System, in 1992, that is partly computer based. The Turkey Point Units 3 & 4 PRA indicates large break LOCA has less than a 2 percent contribution to CDF. Based on this contribution to CDF, the maximum benefit to be obtained from digital large break LOCA protection is less than $16.2K.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA
FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
151	Provide self-cooled ECCS seals.	ECCS pump seals are CCW cooled.	~ $0	> 2 x Benefit	Screen out	CCW is also required for pump motor cooling; thus, elimination of seal cooling would not prevent pump failure. Benefit is $0.
152	Separate non-vital buses from vital buses.	Some non-vital loads mixed with vital loads on load centers causing load shedding difficulties.	< $4.1K	> 2 x Benefit	Screen out	This SAMA would help prevent breaker failures associated with the 480V buses. The Turkey Point Units 3 & 4 PRA indicates 480V breaker failures have less than a 0.5 percent contribution to CDF. Based on this contribution to CDF, the maximum benefit to be obtained from separating vital and non-vital buses is less than $4.1K.
155	Provide a centrifugal charging pump.	Currently charging pumps are positive displacement pumps.	< $20.1K	> 2 x Benefit	Screen out	The Turkey Point Units 3 & 4 PRA indicates charging pump failures have less than a 2.5 percent contribution to CDF. Based on this contribution to CDF, the maximum benefit to be obtained from a centrifugal charging pump is less than $20.1K.
156	Provide a motor operated AFW pump.	Currently AFW pumps are both turbine driven.	~ $0	> 2 x Benefit	Screen out	Turkey Point Units 3 & 4 have many sources of secondary makeup, including a motor-driven SSGFP. The Turkey Point Units 3 & 4 PRA indicates that this pump has an insignificant contribution to CDF (RRW = 1). The benefit of another motor-driven source would be less than the value of the first. Based on this contribution to CDF, the maximum benefit to be obtained from a motor-driven AFW pump is nearly zero.

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
157	Provide containment isolation design per General Design Criteria and Standard Review Plan.	Enhance containment isolation capability.	< $1K	> 2 x Benefit	Screen out	Analysis case CI-OK determined the benefit from eliminating all contribution from early Containment failure (including containment isolation failure) to be < $1K. In order to implement this alternative, additional hardware would need to be installed (plant modification).
159	Provide Auxiliary Building vent/seal structure.	Enhance ventilation in Auxiliary Building.	< $16K	> 2 x Benefit	Screen out	The intent is to reduce leakage from the Auxiliary Building after an ISLOCA. Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification).
160	Add charcoal filters on Auxiliary Building exhaust.	Enhance fission product removal after ISLOCA.	< $16K	> 2 x Benefit	Screen out	Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification).

TABLE F.2-2 (Cont'd)
SUMMARY OF TURKEY POINT UNITS 3 & 4 SAMA FINAL SCREENING/COST-BENEFIT ANALYSIS

SAMA Number	Potential Improvement	Discussion	Total Benefit (Bounding)	Estimated Cost	Conclusion	Basis for Conclusion
161	Add Penetration valve leakage control system.	Enhance capability to detect/control leakage from penetration valves.	< $17K	> 2 x Benefit	Screen out	Analysis case CI-OK determined the benefit from eliminating all contribution from early Containment failure (including containment isolation failure) to be < $1K. Analysis case NO-ISLOCA determined the benefit from eliminating all contribution from ISLOCA to be < $16K. In order to implement this alternative, additional hardware would need to be installed (plant modification).
165	Man SSF continuously to align Coolant Makeup system for RCP seal cooling.	At Turkey Point a dedicated operator for seals or for the highest value operator action could be considered.	< $31K	> 2 x Benefit	Screen out	Analysis case SEALCSF determined the benefit from eliminating all contribution from RCP seal LOCAs to be < $31K. The Oconee SAMA evaluation estimated the cost of continuously manning the SSF to have a present value of $5 million; therefore, is expected to greatly exceed twice the benefit for Turkey Point Units 3 & 4.
167	Replace reactor vessel with stronger vessel.	Reduce core damage contribution due to vessel failure.	< $802K (MAB)	> 2 x Benefit	Screen out	For an existing plant, design and installation of this SAMA is expected to greatly exceed 2MAB.

The PSA results used in this analysis are calculated using internal event results only. An external events PSA model has not been developed for Turkey Point Units 3 & 4. Therefore, to account for the potential impact of external events on the results of these SAMA evaluations, it is assumed that the benefits of each SAMA are doubled for purposes of comparing with its cost.

F.2.4 REFERENCES

Ref. F.2-1 "Turkey Point Units 3 & 4 Probabilistic Risk Assessment Individual Plant Examination; Final Report," Florida Power & Light Company, June 1991.

Ref. F.2-2 Letter from Mr. M. O. Medford (TVA) to NRC Document Control Desk, dated September 1, 1992. "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Generic Letter (GL) 88-20 – Individual Plant Examination (IPE) for Severe Accident Vulnerabilities – Response – (TAC M74488)."

Ref. F.2-3 "Cost Estimate for Severe Accident Mitigation Design Alternatives. Limerick Generating Station for Philadelphia Electric Company," Bechtel Power Corporation, June 22, 1989.

Ref. F.2-4 NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.35, "Listing of SAMDAs considered for the Limerick Generating Station," NRC, May 1996.

Ref. F.2-5 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. F.2-6 Letter from Mr. W. J. Museler (TVA) to NRC Document Control Desk, dated June 5, 1993. "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA) - (TAC Nos. M77222 and M77223)."

Ref. F.2-7 Letter from Mr. D. E. Nunn (TVA) 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) - (TAC Nos. M77222 and M77223)."

Ref. F.2-8 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."

Ref. F.2-9 Brookhaven National Laboratory, Department of Advanced Technology, Technical Report FIN W-6449, "NRC – IPE Workshop Summary/ Held in Austin Texas; April 7-9 1997," dated July 17, 1997/Appendix F – Industry Presentation Material, Contribution by Swedish Nuclear Power Inspectorate (SKI) and Safety Assessment Consulting (SAC): "Insights from PSAs for European Nuclear Power Plants," presented by Wolfgang Werner, SAC.

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Ref. F.2-11 NUREG 0498, "Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2," Supplement No. 1, NRC, April 1995.

Ref. F.2-12 NUREG/CR-5567, "PWR Dry Containment Issue Characterization," NRC, August 1990.

Ref. F.2-13 NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," Volume 2, NRC, December 1997.

Ref. F.2-14 NUREG/CR-5630, "PWR Dry Containment Parametric Studies," NRC, April 1991.

Ref. F.2-15 NUREG/CR-5575, "Quantitative Analysis of Potential Performance Improvements for the Dry PWR Containment," NRC, August 1990.

Ref. F.2-16 "CESSAR Design Certification, "Appendix U, Section 19.15.5, "Use of PRA in the Design Process," December 31, 1993.

Ref. F.2-17 NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," NRC, August 1994.

Ref. F.2-18 Forsberg, C. W., E. C., Beahm, and G. W. Parker, "Core-Melt Source Reduction System (COMSORS) to Terminate LWR Core-Melt Accidents," Second International Conference on Nuclear Engineering (ICONE-2), San Francisco, California, March 21-24, 1993.

Ref. F.2-19 Oconee Nuclear Station, "Applicant's Environmental Report-Operating License Renewal Stage, "Attachment K, "Oconee Nuclear Station Severe Accident Mitigation Alternatives (SAMAs) Analysis," Rev. 0, June 1998.

Ref. F.2-20 NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," NRC, January 1997.

F.3 ACRONYMS USED IN APPENDIX F

AC	Alternating Current
ADV	Automatic Depressurization Valve
AFW	Auxiliary Feedwater
AMSAC	ATWS Mitigating System Actuation Circuitry
ANO-1	Arkansas Nuclear One Unit 1
AOV	Air operated valve
ATWS	Anticipated Transient Without Scram
BGE	Baltimore Gas and Electric Company
BWR	Boiling Water Reactor
CCNPP	Calvert Cliffs Nuclear Power Plant
CCW	Component Cooling Water
CDF	Core Damage Frequency
CDV	Condensate Dump Valves
COMSORS	Core-Melt Source Reduction System
CST	Condensate Storage Tank
CVCS	Chemical Volume Control System
DC	Direct Current
DHR	Decay Heat Removal
DWST	Demineralized Water Storage Tank
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedure
ERCW	Emergency Raw Cooling Water
FPL	Florida Power & Light
FW	Feedwater
GL	Generic Letter
HHSI	High Head Safety Injection
HPCI	High Pressure Coolant Injection
HPCS	High Pressure Core Spray
HPSI	High Pressure Safety Injection
HVAC	Heating, Ventilation and Air Conditioning
ICONE	International Conference on Nuclear Engineering
ICW	Intermediate Cooling Water
IEEE	Institute of Electrical and Electronic Engineers
IPE	Individual Plant Examination
ISLOCA	Interfacing System LOCA
K	Thousand
KV	Kilovolts
LC	Load Center

LHSI	Low Head Safety Injection
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
LOP	Loss of Power
LPCI	Low-Pressure Coolant Injection
LWR	Light Water Reactor
MAB	Maximum Attainable Benefit
MACCS2	Melcor Accident Consequences Code System
MOV	Motor-Operated Valve
MSIV	Main Steam Isolation Valve
MTC	Moderator Temperature Coefficient
NRC	U. S. Nuclear Regulatory Commission
pcm	percent milli
PORV	Power Operated Relief Valve
PRA	Probabilistic Risk Analysis
PSA	Probabilistic Safety Assessment
PWR	Pressurized Water Reactor
RAI	Request for Additional Information
RAB	Reactor Auxiliaries Building
RCIC	Reactor Core Isolation Cooling
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RRW	Risk Reduction Worth
RWST	Refueling Water Storage Tank
SAC	Safety Assessment Consulting
SAMA	Severe Accident Mitigation Alternative
SAMDA	Severe Accident Mitigation Design Alternative
SBO	Station Blackout
SGTR	Steam Generator Tube Rupture
SI	Safety Injection
SKI	Swedish Nuclear Power Inspectorate
SLC	Standby Liquid Control
SRV	Safety Relief Valve
SSF	Safe Shutdown Facility
SSGFP	Standby Steam Generator Feed Pump
SW	Service Water
SWGR	Switchgear
TVA	Tennessee Valley Authority
V	Volt(s)
WBN	Watts Bar Nuclear Plant
>	Greater than

<	Less than
~	Approximately