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Document Control Branch (Document Control Desk)

SUBJECT: Forwards comments on preliminary accident sequence precurser analysis (LER 251-92-007) delineated in NUREG/CR-4674, "Precursors to Potential Severe Core Damage Accidents:1992,Status Rept," per NRC 930602 request.

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JUN 23 1993

L-93-161

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Review of Accident Sequence Precursor B.6 in the
Draft 1992 NUREG/CR-4674 Report

By letter dated June 2, 1993, the NRC requested comments from Florida Power and Light (FPL) Company on an aspect of the draft version of the annual report for NUREG/CR-4674, "Precursors to Potential Severe Core Damage Accidents: 1992, A Status Report." Specifically, the NRC asked for comments concerning the preliminary accident sequence precursor analysis B.6, Licensee Event Report 251-92-007, Automatic Auxiliary Feedwater Start on Main Feedwater Pump Trip for Turkey Point Unit 4. Enclosed are FPL's comments in response to this request.

In a conference call on June 10, 1993, among FPL, NRC and the staff's consultants at the Oak Ridge National Laboratory, FPL questioned whether the conditional core damage probability for this event meets the criteria used to include an event in NUREG/CR-4674. The conditional core damage probability calculated by FPL in response to this request used the Probabilistic Risk Assessment (PRA) model developed in response to the Individual Plant Examination required by Generic Letter 88-10. FPL questions the use of generic models to analyze plant specific events. While data may differ, the model used by AEOD to analyze plant events should reflect the design of the plant to the maximum extent practical. FPL believes that the model used by AEOD to analyze this LER should be modified to more closely represent the Turkey Point plant configuration.

Should there be any questions, please contact us.

Very truly yours,

T. F. Plunkett by L. W. Pearce

T. F. Plunkett
Vice President
Turkey Point Nuclear

Enclosure

TFP/RJT/rt

cc: S. D. Ebneter, Regional Administrator, Region II, USNRC
R. C. Butcher, Senior Resident Inspector, USNRC, Turkey Point

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FLORIDA POWER & LIGHT COMPANY

REVIEW OF (PRELIMINARY) SECTION B.6 OF
NUREG/CR-4674
"PRECURSORS TO POTENTIAL SEVERE
CORE DAMAGE ACCIDENTS"

REVIEW OF (PRELIMINARY) SECTION B.6 OF NUREG/CR-4674 "PRECURSORS TO POTENTIAL SEVERE CORE DAMAGE ACCIDENTS"

I. GENERAL COMMENTS

In a letter dated June 2, 1993 from the NRC, the staff requested FPL to comment on one section of a draft report generated by the Office for Analysis and Evaluation of Operational Data (AEOD). This report, "Precursors to Potential Severe Core Damage Accidents: 1992, A Status Report", NUREG/CR-4674, contains an analysis of an event which occurred at Turkey Point Unit 4. The event, reported as Licensee Event Report (LER) 251-92-007, involved the loss of main feedwater with the plant in startup (Mode 2) at 2 percent power. At the time of the event, the "B" auxiliary feedwater (AFW) pump was out of service undergoing post-maintenance testing.

FPL has reviewed the analysis of the Turkey Point event contained in the AEOD report. Also a conference call was placed on June 10, 1992 between the NRC, FPL, and NRC contract analysts at Oak Ridge National Laboratory (ORNL) to discuss the AEOD analysis methodology. During this conversation, FPL described the design features unique to Turkey Point which are apparently not included in the AEOD analysis. FPL has performed an analysis of LER 251-92-007 similar to that done by AEOD using the Probabilistic Risk Assessment (PRA) model developed in response to the Individual Plant Examination required by Generic Letter (GL) 88-20. The FPL submittal in response to GL 88-20 has been approved by the NRC as fulfilling the requirements of the generic letter.

FPL recognizes that AEOD uses a generic model to select "precursor events" for inclusion in its annual Accident Sequence Precursor (ASP) Report. We note, however, that the Turkey Point plant design has unique features which, if considered in the AEOD analysis of LER 251-92-007, would show that this event is <u>not</u> a significant ASP for Turkey Point. A discussion of these features, as well as our comments on NUREG/CR-4674 is contained in the following paragraphs. A description of the FPL analyses for this event is also presented.

II. TURKEY POINT UNIQUE DESIGN FEATURES

The Turkey Point Plant, the site of two fossil and two nuclear units, has a number of unique features providing additional defense in depth for the prevention or mitigation of severe accidents that are in addition to normal nuclear plant required design features. The most important of these relative to the subject AEOD report concerns the availability of feedwater to the steam generators. In addition to the normal sources of Main Feedwater (MFW) and Auxiliary Feedwater (AFW), Turkey Point has a third feedwater system, the Standby Steam Generator Feedwater (SSGFW) System (see Figure 1). While not safety-grade, the system is maintained, operated and tested under the Technical Specifications. SSGFW is supplied from the Demineralized Water Storage Tanks (AFW is supplied from the Condensate Storage Tanks). (The fossil units also provide feedwater to MFW, but this feature is not credited.)

Each SSGFW pump is sized to provide the post-shutdown feedwater requirements for both nuclear units, i.e. each pump has the capacity to handle a dual unit trip with the concurrent loss of both MFW and AFW. The pumps are powered from the Unit 3 and Unit 4 "C" 4160 VAC busses, one pump normally being supplied by each unit's bus. In turn, each "C" bus is powered from off-site power via individual transformers, and each transformer can supply either or both "C" busses (The C-Bus transformers are of the same capacity as, but independent of, the startup transformers). Under station blackout conditions, the "C" busses can be powered by any of the five fossil unit Cranking (Black Start) Diesel Generators (CDG), each of which has approximately the same capacity as each of the Emergency Diesel Generators on the nuclear units. To maximize reliability, the CDG are currently maintained by the Nuclear Maintenance Department. It should also be noted that the blackout cross tie between the Unit 3 and Unit 4 4160V AC system is available prior to considering the use of the black start diesel generators.

Additionally, eight 240kV electrical lines serve the Turkey Point Switchyard, which is a larger number than typically found at power plants (see Figure 3). As this switchyard is shared with the adjacent 400 MW fossil units, the nuclear unit busses can be supplied from the fossil units, if necessary.

Operationally, the SSGFW System is used in place of the AFW System during normal startups and shutdowns. Under the unlikely (and beyond design basis) transient conditions of the total loss of all AFW, Emergency Operating Procedure 3-EOP-FR-H.1 directs the operators to utilize SSGFW, if MFW cannot be recovered. If feedwater could not be recovered, the operators are then directed to feed and bleed for decay heat removal. For station blackout scenarios, FPL has demonstrated to the NRC the capability to power the SSGFW pumps from the CDG and provide SSGFW to the steam generators within 30 minutes. Procedure *-EOP-ECA-0.0, Loss of All AC Power, is used to accomplish this. With offsite power available, the SSGFW pumps can be started immediately from the control room with one manual valve manipulation at the pumps.

III. FPL COMMENTS ON REQUESTED SPECIFIED ITEMS (LER 50-251-92-007)

A. Item 1: The ASP Characterization of possible plant response given the event occurrence.

Comment: *The event tree provided depicts an accurate plant response with the exception of the availability of the Standby Steam Generator Feedwater System. While not safety-related, this system is considered important to safety and is maintained as such under the Technical Specifications.*

B. Item 2: The representation in the analysis of plant safety equipment configuration and capability at the time of the event.

Comment: *The representation of the plant configuration as shown in the event tree is correct, with the exception of the SSGFW System. A review of the Equipment Out-of-Service Log shows, with the exception of the "B" AFW pump, all safety equipment, as well as the SSGFW System, was available at the time of the event.*

With regard to equipment capabilities, the Turkey Point PRA model calculated that the AFW System unavailability used by the AEOD, is higher by a factor of approximately 2. The report is also confusing, as it indicates three trains of AFW (page B-27B of the draft NUREG) and a motor-driven AFW pump (page B-25, Fig. B.5 of the draft NUREG), whereas Turkey Point has two AFW trains supplied by three 100% capacity AFW pumps, all three of which are steam-driven. By procedure, when one pump is to be taken out of service, the AFW System is aligned such that each operable pump supplies a separate train. Figure 2 shows the Turkey Point AFW System.

We note that the description of the Turkey Point AFW System in Section B.6.3 is correct so far as the number of pumps is concerned. However, as described in Section II of this document, the SSGFW pumps are normally supplied from off-site power, with emergency power being supplied by the non-safety grade diesel generators.

C. Item 3: The analysis assumptions regarding equipment recovery probabilities.

Comment: *For the subject event, the use of the sequence for Loss of Main Feedwater (MFW) - Recoverable, may be inappropriate, as for this event, main feedwater would not be recoverable so long as the diversion path exists. As a conservatism, the FPL analysis of this event assumes that MFW is not recoverable due to the flow diversion. This diversion path would not affect the availability of the SSGFW System.*

In general, the AEOD non-recovery probabilities, and specifically the generic non-recovery probability value of 0.34 used for this event, also seem overly conservative, particularly because this specific recovery action is both routine and procedurally based. Current human reliability analysis techniques common in PRA development today would predict a lower non-recovery probability. Considering the availability of SSGFW, this value would be even lower for Turkey Point.

IV. FPL ANALYSIS OF LER 251-92-007

An analysis of LER 251-92-007 was performed using the Turkey Point PRA model. The event tree used to develop this model differs from that used by AEOD, and a single sequence envelopes the three core damage sequences (15, 16, and 17) contained and discussed in NUREG/CR-4674. Table 1 summarizes the results of this analysis.

As shown in Table 1, the Core Damage Frequency (CDF) calculated for the LER 251-92-007 scenario using the Turkey Point PRA is substantially smaller than that calculated in the three sequences used by AEOD. But, as the Turkey Point model uses a single sequence for this calculation, further analysis was performed. To more closely compare the Turkey Point PRA model to the results of the AEOD study, new top logic was created, generating sequences identical to those in the AEOD event tree (Figure B.6 of the draft NUREG), and the model was rerun. As shown in Table 1, the dominant sequence is

identical to that calculated in the AEOD study, and the sequences show a significantly smaller CDF.

TABLE 1

SEQUENCE	AEOD	FPL	AEOD/FPL	FPL/AEOD	BASELINE
15	4.70E-06	N/A	4.61E-07	5.95E-08	N/A
16	5.20E-07	N/A	1.23E-09	4.43E-11	N/A
17	5.50E-06	N/A	1.38E-10	1.44E-11	N/A
TOTALS	1.07E-05	4.61E-07	4.62E-07	5.96E-08	5.95E-08
360 H AFW	~8.0E-05	N/A	N/A	N/A	6.64E-05
360 H EPS	~8.0E-04	N/A	N/A	N/A	6.75E-05
BASELINE	N/A	N/A	N/A	N/A	6.63E-05

Legend:

AEOD: Conditional Core Damage Probability reported in NUREG/CR-4674 (Preliminary), Section B.6

FPL: Conditional Core Damage Probability for LER 251-92-007 scenario as calculated in current Turkey Point PRA model (single sequence)

AEOD/FPL: Conditional Core Damage Probability with new sequences created in Turkey Point Model equivalent to those in the AEOD model (LER 251-92-007 scenario)

FPL/AEOD: Core Damage Frequencies as calculated using the new sequences and baseline Turkey Point PRA parameters

BASELINE: Baseline Turkey Point PRA Core Damage Frequency for the Loss of Feedwater sequence (Baseline PRA CDF is 6.63E-05/reactor-year)

Additionally, sensitivity runs were made to compare the FPL model with the AEOD model for some of the other scenarios displayed in Figure B.5 (of the draft NUREG). Cases were run by adding 360 hours additional outage time for an auxiliary feedwater (AFW) pump and an emergency diesel generator (EDG) respectively. As can be seen in the last three rows of Table 1 and in Figure 4, the increase in core damage frequency for each case is negligible, being on the order of 0.10 percent for the AFW case, and 0.13 percent for the EDG case. The impact of increased outage time for the AFW case is small due to the availability of the Standby Feedwater Pumps. The impact in the EDG case is minimal due to the availability of the Station Blackout Cross-

Tie to the adjacent nuclear unit. Note that the values reported represent a total annual (reactor-year) core damage frequency for all initiators.

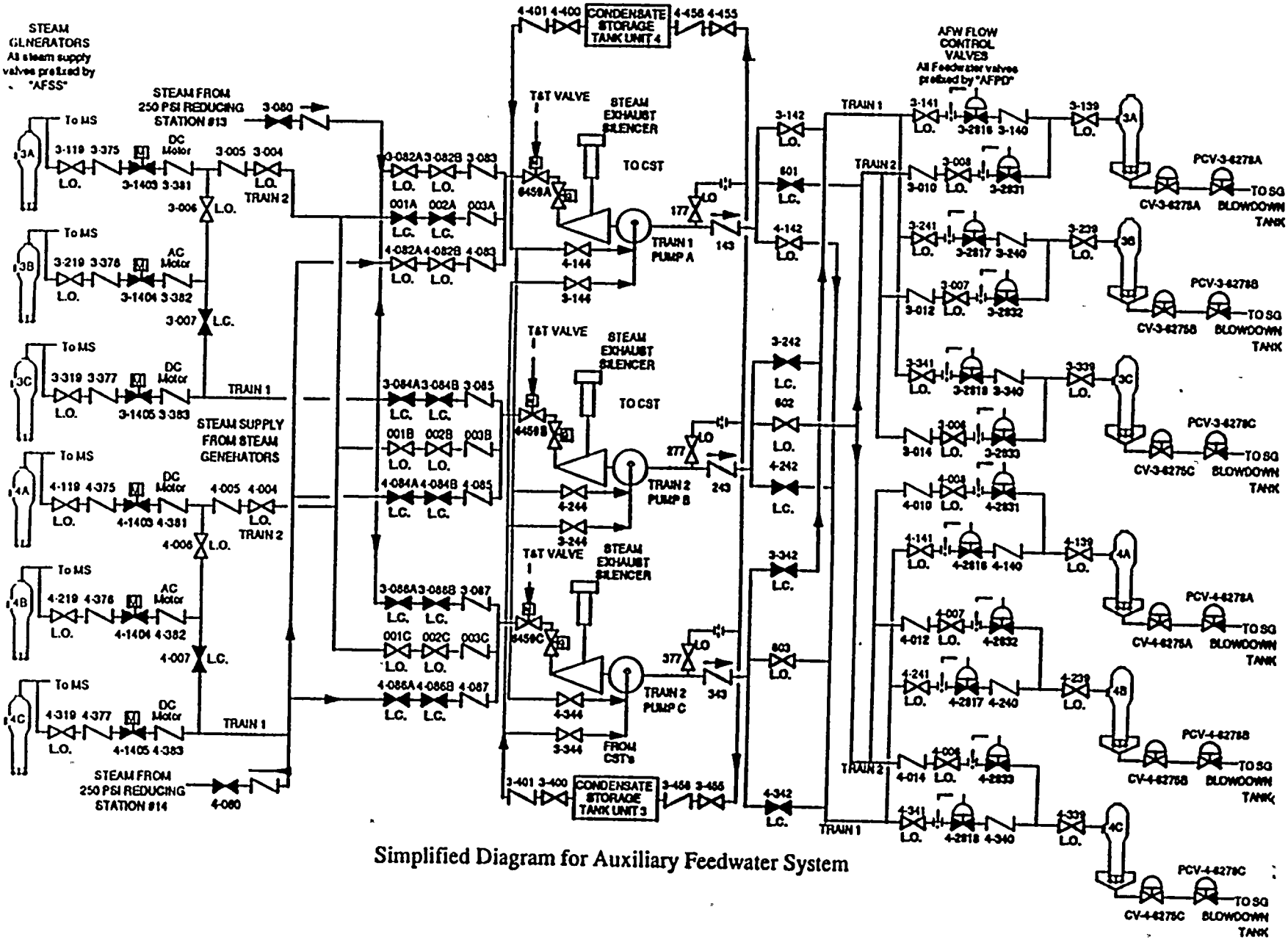
The Loss of Off-Site Power case was not run due to the sensitivity to assumptions and our unfamiliarity with the AEOD model. FPL notes, however, that if a Loss of Grid with no recovery (p = 1.00) is assumed, the Turkey Point PRA calculates a conditional core damage probability of approximately 1.0E-04, essentially the same as the AEOD result for Loss of Off-Site Power (LOOP).

The last two columns of Table 1 show the calculated CDF using the Turkey Point baseline data and PRA model for both the new sequences generated for this analysis and the existing sequence in the baseline model. As can be seen, there is no change in the result, i.e. the new sequences calculate the same result as the existing sequence in the baseline PRA model.

V. SUMMARY AND CONCLUSIONS

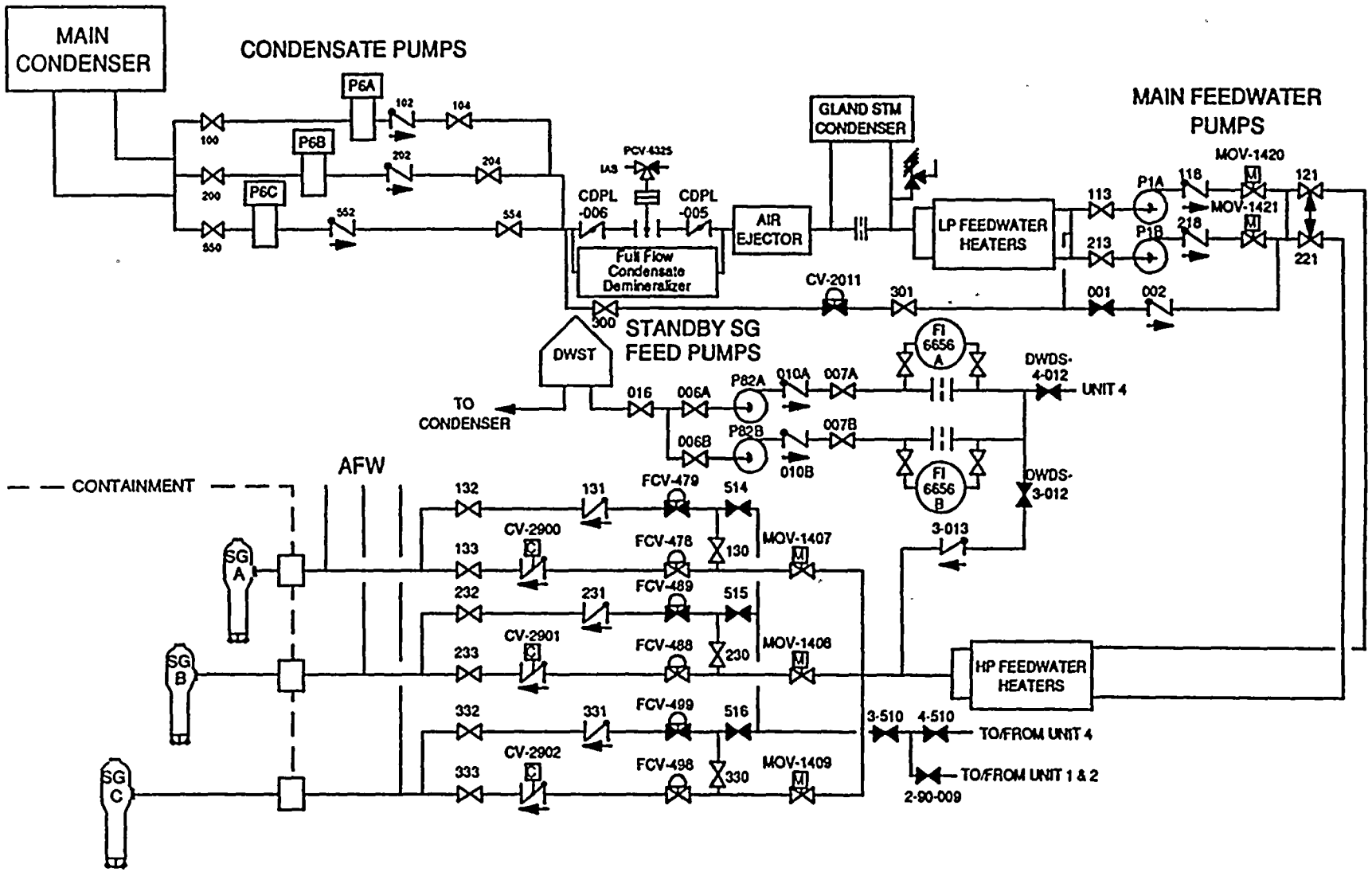
The Turkey Point plant design is unique, and incorporates additional redundancies to required safety systems that are not typically found at other nuclear units. The Turkey Point PRA model, which reflects these features and has been approved by the NRC as meeting the IPE requirements of GL 88-20, calculates significantly lower core damage frequencies than those calculated by AEOD for identical scenarios. The FPL analysis of LER 251-92-007 shows that this event was <u>not</u> a precursor to a potential severe core damage accident for the Turkey Point Plant. Specifically, the FPL analysis for this event yields a CDF of 4.6E-07 per reactor-year, which is well below the AEOD ASP threshold value of 1.0E-06 per reactor-year and, therefore, should not be included in the 1992 edition of NUREG/CR-4674.

FPL is concerned about the adequacy of the current generic model used to analyze and publish reports regarding events at Turkey Point. While data may differ, the model used by AEOD to analyze plant events should reflect the design of the plant to the maximum extent feasible. FPL believes it is important that the model used by AEOD to analyze LER 251-92-007 and other LER events should be modified to more closely represent the Turkey Point design, and we offer any additional assistance in accomplishing this goal.



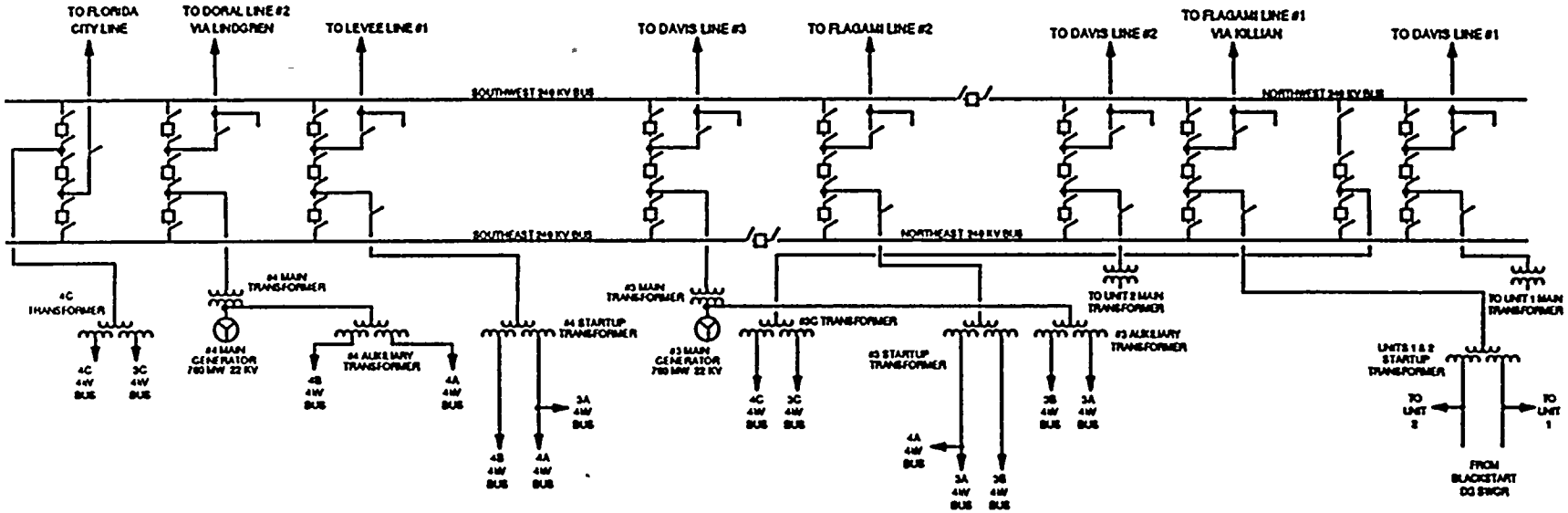
Simplified Diagram for Auxiliary Feedwater System

Figure 1



Main and Standby Feedwater Systems

Figure 2



Turkey Point Power Distribution System Switchyard

Figure 3

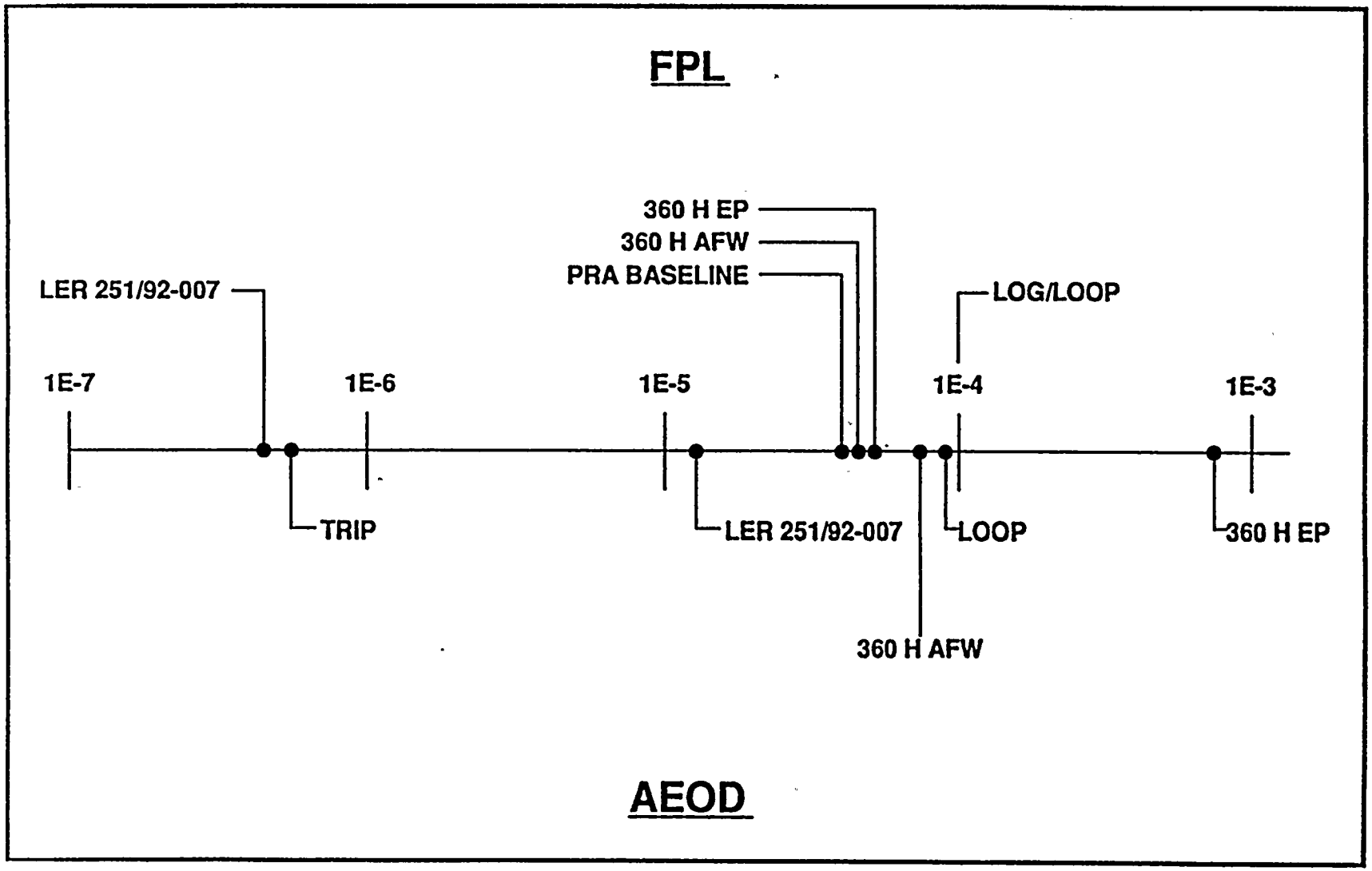


Figure 4

Relative Event Significance as Calculated by FPL and AEOD