FPL

10 CFR § 50.73
L-2004-274
December 7, 2004

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

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Reportable Event: 2004-003-00
Date of Event: October 8, 2004
Single Failure Vulnerability in Dousing Function Can Cause Emergency Containment Filters to be Inoperable

The attached Licensee Event Report 250/2004-003-00 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(ii)(B), and 10 CFR 50.73(a)(2)(v)(C) and (D) to provide notification of the subject event.

If there are any questions, please call Mr. Walter Parker at (305) 246-6632.

Very truly yours,

Terry O. Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

IE22

NRC FORM 366 (6-2004)	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104	EXPIRES: 06/30/2007

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Turkey Point Unit 3	05000250	1 OF 10

4. TITLE
Single Failure Vulnerability in Dousing Function Can Cause Emergency Containment Filters to be Inoperable

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME: Turkey Point Unit 4	DOCKET NUMBER: 05000251
10	8	2004	2004	- 003 -	00	12	7	2004	FACILITY NAME:	DOCKET NUMBER: 05000

9. OPERATING MODE: 6

10. POWER LEVEL: 0

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☒ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Paul F. Czaya – Licensing Engineer	305-246-7150

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)*	☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

During a Unit 3 clearance review, a single failure vulnerability was identified in the dousing function of the Emergency Containment Filters (ECF). The loss of power to certain power panel breakers could inadvertently douse all three ECFs for Unit 3. A similar condition applies to Unit 4. Three ECFs are provided in each reactor containment building to remove radioactive iodine so that offsite radiation dose is maintained within regulatory guideline values during a maximum hypothetical accident. The ECF system is required to perform its safety-related function of radioiodine removal, assuming a single active failure. The impact of the reduced capability of the doused ECF charcoal adsorbers to remove methyl iodide is an increase in offsite and control room dose to the thyroid. The increase in control room dose is greater than the increase in offsite dose; however, a realistic dose evaluation shows that the regulatory guideline value would not be exceeded in either case. The cause of the design deficiency is human error both in the original redesign of the dousing initiation system and in subsequent reviews of the single failure vulnerability. A modification to correct the design deficiency has been performed for both Units 3 and 4. Since no actual event occurred which relied on the ECFs to perform their safety function nor would the degraded performance of the ECFs result in doses above regulatory limits, it was concluded that the health and safety of the public were not affected by the ECF design deficiency.

DESCRIPTION OF THE EVENT

On October 2, 2004, during a Unit 3 clearance review by Operations personnel, a single failure vulnerability was identified in the dousing function of the Emergency Containment Filters (ECF) [EIIC: FLT] that applies to both Turkey Point units. Specifically, the loss of power to power panel [EIIC: PL] 3P22 breaker [EIIC: BKR] 12 or power panel 3P21 breaker 12 could inadvertently douse all three ECFs for Unit 3. Similarly, all three ECFs for Unit 4 could be inadvertently doused by loss of power to power panel 4P22 breaker 12 or power panel 4P21 breaker 12.

After evaluation, this condition was determined to be reportable on October 8, 2004 in accordance with 10 CFR 50.73(a)(2)(ii)(B), and 10 CFR 50.73(a)(2)(v)(C) and (D).

At the time of discovery Unit 3 was shutdown in Mode 6 for a refueling outage and Unit 4 was in operation in Mode 1 at 100 percent power.

BACKGROUND

Three Emergency Containment Filters are provided in each reactor containment building [EIIS: NH] to remove radioactive iodine so that offsite radiation dose is maintained within the guidelines in 10 CFR 100 and control room [EIIS: NA] radiation dose is maintained within the guidelines in 10 CFR 50, Appendix A, General Design Criterion 19, during a maximum hypothetical accident (MHA).

A dousing system is installed to dissipate excessive decay heat on the charcoal filters [EIIC: ADS] due to adsorbed radioiodine in the event that a filter unit fan [EIIC: FAN] fails in service. The dousing water is supplied by the containment spray [EIIS: BE] headers inside containment. Electronic flow switches [EIIC: FS] at the discharge of the filter fans are designed to automatically initiate charcoal filter dousing upon detection of no fan discharge flow. Three pairs of parallel solenoid valves [EIIC: FSV] provide dousing water flow to the three filter units. Two flow switches are provided in each filter unit, each controlling one of the two parallel solenoid valves supplying dousing water to that unit. One vital AC breaker provides power to all three A train flow switches. Another vital AC breaker provides power to all three B train flow switches. In this configuration, a single electrical failure can activate one train of dousing valves on all three ECFs. If containment spray is operating (and the ECFs have been operating for a period longer than the 5-minute circuit activation time), this failure could douse all three filter units simultaneously.

The Turkey Point maximum hypothetical accident assumes that the total iodine source term is comprised of 91% elemental iodine, 4% methyl iodide, and 5% particulate iodide. Of these chemical species, elemental iodine and methyl iodide are required to be removed by the ECF charcoal adsorber, while particulate iodine is removed by the high-efficiency particulate absorber (HEPA) bank. Inadvertent dousing can adversely impact the iodine removal efficiency of the charcoal filters by filling the charcoal pores, thereby blocking access of the iodine gases to the filter medium.

Operation of the ECF is modeled in the loss of coolant accident (LOCA) and control rod ejection accident (CREA) analyses. In each scenario, the filters are assumed to have 90% removal efficiency for elemental iodine, 30% removal efficiency for methyl iodide, and 95% removal efficiency for particulate iodine.

Although the Turkey Point Preliminary Safety Analysis Report (PSAR) documents previous tests that conclude that waterlogged charcoal would still remove elemental iodine with high enough efficiency to perform its intended safety function, a degraded methyl iodide removal efficiency could still constitute non-compliance with Technical Specification ECF operability requirements. Technical Specification (TS) 3.6.3 requires that the ECFs maintain a methyl iodide penetration of less than or equal to 35% as a condition of operability. This correlates to a required filter removal efficiency of 65%, which is higher than the test results for waterlogged charcoal reported in the Turkey Point PSAR. As such, current industry documentation supports the presumption that wetted charcoal renders a filter inoperable (e.g., Peach Bottom Atomic Power Station – NRC Integrated Inspection Report 05000277/2003-003 and 050000278/2003-003).

The ECF system is required to perform its safety-related function of radioiodine removal, assuming a single active failure. The identified single point vulnerability in the flow switch power supply circuits can impact the performance capability of all three ECF units.

CAUSE OF THE EVENT

As discussed in the analysis of occurrence below, the design deficiency was raised several times. In each case, failure to recognize the impact on ECF function was due to human error as a result of lack of attention to detail.

ANALYSIS OF THE EVENT

The single point vulnerability that has been identified does not render the ECFs inoperable. From a safety function standpoint, the ECFs are capable of performing their design function. The inability to withstand certain postulated single failures is considered a design deficiency, consistent with Generic Letter (GL) 91-18 guidance.

As indicated above, the dousing of all ECFs can only occur if there is loss of power to the filter airflow switch, coincident with a design basis accident that requires containment spray system actuation. Failure modes that could cause a loss of power to the flow switches include:

a) short of the flow switch,
b) inadvertent opening of a supply breaker,
c) failure of a power cable, and
d) failure of the battery bus or vital AC power panel.

It is possible that components in the flow switch circuit could short. The short would have to occur in a portion of the flow switch connected to the 120 volt vital AC power supply. These short circuit locations are limited within the switch. The absence of such shorts is demonstrated on a monthly basis during performance of the ECF operability test. This test operates each filter for a minimum of 15 minutes to verify proper operation of the fan and flow element circuit. It operates the filter units on a staggered basis (essentially one each week). If a short circuit, inadvertent opening of the supply breaker, or cable failure were to occur prior to or during this weekly test, it would be readily detected by the dousing valve position indication lights in the control room. For a failure of the battery bus or vital AC power panel, control room operators would readily detect this failure and would take appropriate corrective action. Hence, these failures are not considered latent failures, but rather, easily detectable on a weekly basis.

Based on the current level of surveillance testing, the ECFs are considered "operable but nonconforming" in accordance with GL 91-18.

TSs do not require that both independent trains of ECF dousing components be operable to support the ECFs. However, consistent with TS Bases, an ECF is considered inoperable in Modes 1, 2, 3, or 4, if one of its associated dousing valves is open (i.e., power is removed only from the flow switch).

The impact of inadvertent dousing was initially evaluated in Supplement 14 to the Turkey Point Preliminary Safety Analysis Report. This supplement discussed various experimental tests that were performed on nuclear-grade charcoal to ascertain the impact of moisture on its radioiodine removal characteristics. It was concluded that waterlogged charcoal would still remove elemental iodine with high efficiency; however, removal efficiencies as low as 18% were reported for methyl iodide with waterlogged charcoal. This is below the accident analysis efficiency assumption of 30% for methyl iodide.

Although the Turkey Point PSAR states that temporary dousing of an ECF would not preclude it from accomplishing its safety function, a degraded removal efficiency for methyl iodide can impact ECF operability. TS 3.6.3 requires that the ECFs maintain a methyl iodide penetration of less than or equal to 35% as a condition of operability. This correlates to a required filter removal efficiency of 65%, which is greater than some of the test results for waterlogged charcoal (18% efficiency) reported in Supplement 14 of the PSAR.

As indicated above, the single point vulnerability of the ECF flow switch power supply had been previously recognized but its impact on ECF functions had not been assessed. Three of these assessment opportunities included:

1. Development of Plant Change/Modification in 1984 (PC/M) 84-24;

2. Site Emergency Power System Upgrade in 1991;

3. Preparation of a Technical Specification Position Statement (TSPS) 96-003 in 1996.

PC/M 84-24 implemented a change in 1985 to replace the original mechanical flapper-type flow switches with electronic flow switches. These new flow switches use a thermal sensor with an electronic relay to provide the flow (on/off) input function. The thermal sensor functions by using a low-powered heater and two resistive temperature sensors wired into a Wheatstone Bridge circuit. When sufficient airflow exists, the two temperature sensors will be in thermal equilibrium and the bridge circuit will be balanced. Under these equilibrium conditions, the flow switch energizes an internal relay (K2). As long as sufficient airflow across the remote sensor is maintained, the flow switch will continue to energize the K2 relay coil and maintain the dousing system solenoid valve closed.

Under low airflow conditions, the heater will warm the surrounding air, causing an imbalance in the bridge circuit. This will cause the flow switch to de-energize the K2 relay allowing the dousing system solenoid valve to open. If the containment spray pumps are running, the open solenoid valve in turn will douse the charcoal filter.

During the development of PC/M 84-24, questions were raised about the failure modes of the new switches. In response to these questions, a supplemental safety evaluation was prepared to clarify the operating characteristics of the new components to further support the PC/M 10 CFR 50.59 evaluation. That supplemental safety evaluation (1987) stated that a loss of power would not affect the availability of the ECF because of the redundant flow sensor on the same ECF. This statement suggests that the PC/M designers did not completely understand the failure mechanism given a loss of power to the filter flow switches. The supplemental safety evaluation implied that a loss of power to a flow switch would cause the associated dousing system solenoid valves to remain closed and that the redundant train of dousing components would remain available to accomplish the dousing function, if needed.

In 1991, during the Emergency Power Systems Enhancement Project, the single point vulnerability was identified once more. Technical Issue Report Number 110 evaluated the risk associated with the flow switch design deficiency. It also stated that this failure mode (loss of power to a flow switch) existed outside the design basis for the plant, listing the root cause as an incomplete licensing basis issue. This conclusion was erroneous given that loss of a vital instrument bus is part of the plant design basis. As documented in Section 8.2 of the Updated Final Safety Analysis Report (UFSAR):

> "The vital instrumentation load for each unit is distributed on the four buses in such a manner to avoid the complete loss of any particular function with the loss of any one bus."

Since this failure mode was (incorrectly) considered outside the plant design basis, the impact on operability of the ECFs was not addressed at that time in 1991.

A contributing factor to this oversight may have been the specific operability requirement for ECF iodine removal efficiency documented in the TS at the time. In 1991, operability of the ECF charcoal was based solely on the efficiency for removing elemental iodine. However, in response to Generic Letter 99-02, "Laboratory tests of Nuclear Grade Activated Charcoal," the operability requirement for ECF charcoal removal efficiency was changed to methyl iodide removal. Consequently, the potential implications of reduced methyl iodide removal efficiency may have appeared unrelated to ECF operability prior to the 1999 TS change.

In 1996, Technical Specification Position Statement (TSPS) 96-003 clarified the function of the ECF flow switches and solenoid dousing valves. This position statement also recognized that removing power from a flow switch would inadvertently cause all three solenoid dousing valves to open rendering all ECFs inoperable relative to the ECF safety function. To maintain ECF operability while performing maintenance on an ECF flow switch, the TSPS stated that the fuses for the affected dousing valves had to be pulled prior to de-energizing the flow switch for maintenance. This would maintain the affected dousing valves closed during the maintenance activity. Note that all TSPSs have been cancelled and are no longer used at Turkey Point.

As discussed above, the design deficiency was raised several times but the impact on methyl iodide removal efficiency and ECF operability was not evaluated. In each case, failure to recognize the impact on ECF function was due to human error: 1) Failure to understand all aspects of the flow switch circuit design was a human error by the cognizant engineering design organization. This created the single point vulnerability. 2) Failure to recognize that loss of a vital instrument bus is part of the plant design basis was a human error. 3) Failure to recognize that the single point vulnerability identified in TSPS 96-003 represented a design deficiency that needed correction was also a human error.

Reportability

A review of the reporting requirements of 10 CFR 50.72 and 10 CFR 50.73 and NRC guidance provided in NUREG-1022, Revision 2, Event Reporting Guidelines 10 CFR 50.72 and 10 CFR 50.73, was performed for the subject condition. As a result of this review, the condition is reportable as described below.

The guidance in NUREG-1022 states that "... an unanalyzed condition that significantly degraded plant safety would be the discovery that a system required to meet the single failure criterion does not do so." Since the ECF system design basis includes compliance with the single failure criterion, the identified single failure vulnerability is reportable in accordance with 10 CFR 50.73(a)(2)(ii)(B) for both Turkey Point units.

Since the single failure vulnerability could have prevented the fulfillment of the safety function of the ECFs to control the release of radioactive material and mitigate the consequences of an accident, the condition is also reportable in accordance with 10 CFR 50.73(a)(2)(v)(C) and (D) for both Turkey Point units.

In addition, an 8-hour Emergency Notification System report, in accordance with 10 CFR 50.72(b)(3)(ii) and 10 CFR 50.72(b)(3)(v)(C) and (D), was made to the NRC Operations Center on October 8, 2004 for Unit 4, since that unit was in operation at the time of discovery.

ANALYSIS OF SAFETY SIGNIFICANCE

A calculation has been performed to quantify the safety significance of the identified single point vulnerability. This calculation evaluated three cases:

- Base Case – analysis consistent with current UFSAR assumptions and input
- Scenario 1 – analysis with 2 ECFs running with 15% organic iodine removal efficiency
- Scenario 2 – analysis with 3 ECFs running with 15% organic iodine removal efficiency
- Scenario 3 – analysis with 2 ECFs running with 0% organic iodine removal efficiency with best estimate inputs

The base case was run to benchmark the analysis inputs to reaffirm the current UFSAR results for a LOCA. The three scenarios were established to characterize the safety significance of the ECFs with reduced methyl iodide removal efficiency. The analysis input for the base case and Scenarios 1 and 2 was consistent with the UFSAR LOCA analysis, except for reduced methyl iodide efficiency input. Experiments on wet charcoal documented in PSAR Supplement 14 Appendix A reported methyl iodide removal efficiencies as low as 18% with waterlogged charcoal. To remain conservative, Scenarios 1 and 2 used an organic iodine removal efficiency of 15% instead of the FSAR described efficiency (30%) to calculate the expected doses following the MHA with waterlogged charcoal in all three ECFs.

To understand the methyl iodide removal efficiency sensitivity to dose, Scenario 3 assumes the charcoal removes no methyl iodide after the flow switch loses power, five minutes into the accident when the circuit is activated. This case uses realistic parameters according to the actual Turkey Point design:

1. The ECFs are assumed to operate for 8 hours during the accident rather than the 2 hours assumed in the UFSAR LOCA dose analysis since current operating procedures do not direct the operator to turn off any ECFs. The current design basis requires that the ECFs run for at least 72 hours to remove decay heat generated by the adsorbed radioiodine.

2. The flow rate of each ECF was increased to the design flow rate of 37,500 cfm (nominal TS value) rather than 33,750 cfm (minimum TS value), based on actual surveillance testing results. The operation of two ECFs is assumed in this analysis.

3. The iodine removal efficiencies of the ECFs were increased to 99% for both particulate and elemental iodine, from 95% and 90% respectively, based on actual surveillance testing results. However, the removal efficiency for methyl iodide was not changed from the UFSAR value of 30% for the first 5 minutes. For the first five minutes of ECF operation, loss of power to the flow switches will not initiate dousing. Thus, the ECFs will operate at the design basis efficiency for methyl iodide removal. After the first five minutes has elapsed, the removal efficiency for methyl iodide was assumed to be 0% due to inadvertent operation of the dousing system.

4. The containment leak rate was reduced to 0.15%/day for the first 24 hours and 0.075% thereafter. This is less than the TS allowable value of 0.25%/day with a reduction to 0.125%/day after 24 hours. A leak rate of 0.15%/day bounds the highest containment leak rate test surveillance result of 0.139%/day.

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

The ECFs are utilized to mitigate the consequences of a large-break LOCA as described in UFSAR Section 14.3.5. UFSAR Table 14.3.5-1 and the calculation of record assume that during a LOCA, two ECFs start after a delay of 90 seconds and operate for two hours. The realistic "best-estimate" calculation still assumes two ECFs start after a delay of 90 seconds but continue to operate for eight hours. UFSAR Section 6.3 states that "the equipment [ECF equipment from context] design will permit subsequent operation in an air-steam atmosphere at 5 psig, 152°F for an indefinite period." UFSAR Figures 14.3.4.3-2 (containment temperature) and 14.3.4-5 (containment pressure) show that these conditions are reached in approximately 1x10E6 seconds (11.6 days) following the initiation of the accident. The design basis document (DBD) for the ECF fans provides a required operating time of 72 hours (post-accident). This time was based on a minimum time that the fans needed to be operational to prevent the charcoal from re-releasing the adsorbed iodine in the event there is a loss of forced air flow. In addition, a sensitivity study concluded that running the filters longer than the UFSAR assumption of two hours eventually removed all of the iodine with little change beyond eight hours. This demonstrates that the ECF filters are designed to operate for at least eight hours.

A review of the Turkey Point Emergency Operating Procedures did not find any specific instruction to turn the ECFs off in a post-LOCA situation.

The "best-estimate" ECF flow rate used is the design value of 37,500 cfm per fan (UFSAR Table 6.3-1). Procedures 3/4-OSP-056.2, "Emergency Containment Filter System Performance Test," measure the ECF filter flow rates during the system performance tests. Section 4.8 of the procedure states that the test shall be performed between 33,750 cfm and 41,250 cfm. A review of past surveillance test data (e.g., October 15, 2001) shows that the selection of the design value of 37,500 cfm per fan is both appropriate and realistic.

The "best-estimate" ECF filter efficiencies used for particulate (99%) and elemental (99%) are based on the design characteristics listed in Table 6.3-1 of the UFSAR and are conservative with respect to expected efficiencies based on testing as discussed below. The charcoal removal efficiency for methyl iodide of 30% used in the UFSAR LOCA analysis (Table 14.3.5-1) is retained for this evaluation for ECF performance prior to inadvertent dousing.

The ECF DBD states that the HEPA filters were designed to remove 99.97% of 0.3 micron particles. Procedures 3/4-OSP-056.2 state that the HEPA acceptance criterion is removal of greater than or equal to 99% of dioctyl phthalate (DOP) smoke. The DOP test measures particulate removal efficiency. DOP test results for the Unit 3 containment HEPA filters performed on October 24, 2001 demonstrate that the average percent removal for ECF HEPA 3A, 3B, and 3C are 99.941%, 99.446%, and 99.728% respectively. These test values are greater than the 99% assumed in this evaluation and demonstrate that the selection of particulate iodine removal efficiency of 99% is both appropriate and realistic.

Iodine-131 removal efficiency testing was performed on ECF charcoal that had been stored in the Turkey Point central receiving facility (CRF) in 1998. A test using elemental iodine (I_2), performed on September 9, 1998, resulted in a measured charcoal efficiency of 99.989%. This is greater than the 99% elemental iodine removal efficiency assumed in this evaluation and demonstrates that the selection of elemental iodine removal efficiency of 99% is both appropriate and realistic.

ECF iodine loading was addressed as part of the thermal power uprate project in calculation CN-CRA-95-64. The reduction in the assumed containment leakage has no impact on the charcoal bed loading. The loading was based on the total iodine released from the core and was not reduced because of containment leakage.

The containment leakage rate currently assumed for the LOCA in the UFSAR is 0.25%/day for the first 24 hours and 0.125%/day thereafter for the duration of the accident (UFSAR Table 14.3.5-1). The results of past integrated leak rate test (ILRT) tests for each unit were reviewed to determine a realistic best-estimate value for containment leakage to use in this evaluation. The Unit 3 ILRT performed November 14, 1992 resulted in a containment as-found leak rate of 0.139%/day using BN-TOP-1 analysis method and 0.113%/day using the mass point analysis method. The Unit 4 ILRT performed October 20, 1991 resulted in a containment as-found leak rate of 0.057%/day using the mass point analysis method. Recent Type B and C local leak rate test (LLRT) results for Unit 3 and Unit 4 also support this selection. The values from both the ILRT and LLRT tests are lower than the selected initial leakage value of 0.15%/day used in the "best-estimate" calculation. Therefore, the assumption of 0.15%/day conservatively bounds the actual containment leakage. The value of 0.15%/day is used for the first 24 hours and the value is halved to 0.075%/day thereafter. This is consistent with the current licensing basis 50% reduction after 24 hours.

The results of this analysis, documented in calculation NAI-1101-048, showed the total thyroid doses within the guidelines of 10 CFR 100 for the Low Population Zone (LPZ) and Exclusion Area Boundary (EAB), and 10 CFR 50, Appendix A, General Design Criterion 19 for control room operator doses. Table 1 displays the results of the dose calculation and compares them to the regulatory guidelines and analysis of record (UFSAR) values. The doses in bold are those that are greater than the UFSAR benchmark. These doses, less than federally regulated limits however, are, with the exception of LPZ thyroid dose for Scenarios 2 and 3, greater than current licensed values.

Table 1: Calculation Results.

Case	EAB Thyroid Total Dose (Rem)	LPZ Thyroid Total Dose (Rem)	Control Room Thyroid Total Dose (Rem)
Federal Regulation Dose Limit	300	300	30
Current UFSAR Results	23.59	2.79	14.97
Base Case: UFSAR Benchmark	23.50	2.77	15.05
Scenario 1: 2 ECF @ 15% CH_3I	**25.39**	**3.48**	**25.45**
Scenario 2: 3 ECF @ 15% CH_3I	21.70	**2.78**	**18.00**
Scenario 3: Best Estimate @ 0% CH_3I	16.16	**2.78**	**26.88**

As indicated above, the maximum control room thyroid dose increased by less than a factor of 2 for the LOCA with 0% ECF filter efficiency for organic iodine. The offsite thyroid dose for the LOCA with 0% ECF filter efficiency for organic iodine is bounded by the analysis of record. The current UFSAR results for the CREA give a maximum offsite thyroid dose of 0.59 Rem. The thyroid dose limit for a CREA is 75 Rem; therefore, based on the results of the LOCA analysis, the thyroid dose limit for the rod ejection analysis will not be challenged by the reduction in the ECF filter efficiency that accompanies inadvertent dousing. Note that there are currently no control room doses reported for the CREA in the UFSAR. Therefore, since no actual event occurred which relied on the ECFs to perform their safety function nor would the degraded performance of the ECFs result in doses above regulatory limits, it was concluded that the health and safety of the public were not affected by the ECF design deficiency.

CORRECTIVE ACTIONS

To address this design deficiency, a design modification package was issued to modify the current design to prevent unintentional solenoid valve actuation on a loss of flow switch power. Following the loss of any single vital AC supply to the flow switches, one train of dousing solenoids associated with the three ECFs will be disabled. A different vital AC supply provides power to the flow switches associated with the redundant train of solenoid valves. This train will remain operable to respond to a valid low flow condition and provide the dousing function to a potentially overheated ECF, without prematurely actuating its train of dousing valves. This design modification has been completed for both Turkey Point Units 3 and 4.

The ECF Design Basis Document was revised to identify that the flow switches have a safety related function to not impact more than one ECF in the event of a switch malfunction.

ADDITIONAL INFORMATION

EIIS Codes are shown in the format [EIIS SYSTEM: IEEE system identifier, component function identifier, second component function identifier (if appropriate)].

FAILED COMPONENTS IDENTIFIED: NONE

SIMILAR EVENTS

No similar events have occurred at Turkey Point. An industry operating experience (OE) report was submitted to the INPO Nuclear Network and assigned OE#19378.