Entergy

Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802
Tel 479-858-4888

10CFR50.46(a)(3)(ii)

0CAN050604

May 31, 2006

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Errors or Changes in the Emergency Core Cooling System Evaluation Model: Annual Report for 2005
Arkansas Nuclear One – Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6

Dear Sir or Madam:

10CFR50.46(a)(3)(ii) requires licensees to report annually each change to or error discovered in an acceptable evaluation model or in the application of such model for the emergency core cooling system (ECCS) that affects the peak cladding temperature. Included in this submittal is the estimated effect the changes or errors identified during the reporting period from January 1 through December 31, 2005, have on the limiting ECCS analysis.

This report fulfills the reporting requirements referenced above.

This submittal contains no commitments. If you have any questions regarding the data, please contact Mr. Richard Scheide at (479) 858-4618.

Sincerely,

Dale E. James
Manager, Licensing

DEJ/rhs

Attachments

A001

cc: Dr. Bruce S. Mallett
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

U. S. Nuclear Regulatory Commission
Attn: Mr. Drew Holland
Mail Stop 0-7 D1
Washington, DC 20555-0001

Attachment 1

0CAN050604

ANO-1 Emergency Core Cooling System Report

1.0 AREVA Generic Model Changes and Error Corrections

This section describes the generic Evaluation Model (EM) error corrections or changes that were made in 2005.

1.1 CRAFT2 Evaluation Model Error Corrections or Changes

No errors or changes were reported in the CRAFT2-based B&W ECCS EM, BAW-10104P-A, Rev. 5 for LBLOCA (Reference 1.1) and BAW-10154-A, Rev. 0 for SBLOCA (Reference 1.2), during 2005. Currently, all B&W plants rely on the BWNT LOCA EM to support the cycle-specific LOCA LHR limits. However, certain plants may rely on evaluations and analyses performed with the CRAFT2-based EM to support evaluation of older fuel designs that may be reinserted into a core design, plant operational guidance, or equipment qualification.

- No changes or errors

1.2 BWNT LOCA Evaluation Model Error Correction or Changes

This evaluation model (EM) is applicable to all B&W-designed pressurized water reactors for large and small break LOCA analyses for zircaloy or M5 cladding. The NRC-approved topical report for this EM is BAW-10192P-A Rev 0 (Reference 1.3).

The large break LOCA Evaluation Model consists of four computer codes:

1. BAW-10164P-A, RELAP5/MOD2-B&W to compute the system, core, and hot rod response during blowdown (Reference 1.4),

2. BAW-10171P-A, REFLOD3B to calculate the time for refill of the lower plenum and core reflood rate (Reference 1.5),

3. BAW-10095-A, CONTEMPT to compute the containment pressure response (Reference 1.7), and

4. BAW-10166P-A, BEACH (the RELAP5/MOD2-B&W reflood heat transfer package) to determine the hot pin thermal response during refill and reflood phases (Reference 1.6).

The small break LOCA Evaluation Model consists of two codes:

1. BAW-10164P-A, RELAP5/MOD2-B&W to compute the system, core, and hot rod response during the transient (Reference 1.4), and

2. BAW-10095-A, CONTEMPT to compute the containment pressure response (Reference 1.7), if needed.

An NRC-approved fuel code (currently BAW-10162P-A, TACO3 (Reference 1.9) or BAW-10184P-A, GDTACO (Reference 1.10)) is used to supply the fuel rod steady-state conditions at the beginning of the small or large break LOCA. These codes are approved for use with M5 cladding as discussed in BAW-10227P-A (Reference 1.8).

1.2.1 EM Change for BHTP CHF Correlation Implementation for SBLOCA

The BHTP CHF correlation was conservatively implemented in the RELAP5/MOD2-B&W code as dictated by Section 4.3.4.8 of Volume 1 of the EM for use in LOCA applications. This EM change was previously reported via 50.46 as part of the 2003 annual report (Reference 1.13). As originally implemented, the flow-direction dependent terms of the BHTP correlation were excluded from the calculation of the CHF for LBLOCA applications. This causes a conservative reduction in the BHTP CHF prediction, which was specifically intended only for LBLOCA applications. The EM is changed such that for SBLOCA applications, the BHTP CHF correlation is adjusted to specifically account for these flow-dependent terms since the flow direction does not change for these smaller break sizes and the conservatism in the implementation is not necessary. The SBLOCA EM has been generically modified to include the impact of these terms for analysis and evaluation of the Mark-B-HTP fuel.

The affect of this SBLOCA EM change on the plant-specific evaluations and analyses related to the Mark-B-HTP fuel is reported in the plant-specific submittals. The maximum break size for the SBLOCA spectrum is defined in the BWNT LOCA EM based on the CHF performance, specifically that the heat flux should not exceed the CHF during the first several seconds of the SBLOCA transient. The extent of this EM change is to confirm that the correct EM (transition LBLOCA versus SBLOCA) is utilized to analyze the transient. However, this change does not affect the limiting SBLOCA PCT for any of the B&W plants. Therefore, the PCT change associated with this SBLOCA EM change is (+0 F).

- Generic EM Change – Implementation of BHTP CHF Correlation for SBLOCA
- The PCT change is (+0 F) for the Mark-B-HTP SBLOCA applications.

2.0 BWNT LOCA Evaluation Model Generic Analyses

One generic B&W evaluation was completed in 2005.

2.1 Generic Evaluation of FUELGUARD Inlet Debris Filter on Mark-B-HTP Fuel

AREVA offers the FUELGUARD™ inlet debris filters on the Mark-B-HTP fuel assemblies to help reduce fuel assembly fretting problems. The purpose of the filter is to catch debris before it enters the core. Reference 1.25 establishes the LOCA and safety analysis design basis requirements for these filtering devices. Of primary importance is the demonstration that the use of a fuel filter does not increase the risk to public health and safety versus not using them.

It was concluded that the Mark-B-HTP fuel assemblies used in B&W designed plants are no more nor no less subject to adverse consequences due to trapping debris as a result of incorporating the FUELGUARD™ inlet debris filters into their design. Additionally, there is no safety significance in that long-term cooling is easily provided for both cold leg and hot leg breaks.

- Other – Generic evaluation of debris filter versus no debris filter
- There are no PCT changes associated with this topic.

3.0 Generic EM Information

General information related to the EM topical reports and associated modeling guidance is provided below. These topics do not constitute EM changes or error corrections, and are provided as information.

3.1 Approval of Extended Ranges for BHTP CHF Correlation, BAW-10241P

In 2003, the BHTP CHF correlation from BAW-10241P (BHTP DNB Correlation Applied with LYNXT) was implemented into the RELAP5/MOD2-B&W code for analysis of Mark-B-HTP fuel (Section 2.2.1 of Reference 1.13). Since that time, BAW-10241PA was revised to extend the ranges of application of the correlation. The revision to the topical has been approved, and the BHTP CHF correlation utilized in the BWNT LOCA EM is now referenced to the approved topical report BAW-10241(P)(A), Revision 1 (Reference 1.15).

- Other - Acknowledgement of publication and application of approved topical report
- A PCT change is not applicable.

3.2 Revision to Reload Licensing Methodology, BAW-10179

Revision 6 of the reload licensing methodology described in BAW-10179P-A was approved in 2005 (Reference 1.11). The methodology is applied for licensing of fuel for all of the B&W plants, except for Oconee 1, 2 and 3. The revision added reference to the newly approved revision of the BHTP CHF correlation described in BAW-10241(P)(A), Revision 1 (Reference 1.15).

- Other - Acknowledgement of publication and application of approved topical report
- A PCT change is not applicable.

3.3 Receipt of Revised SER for the Reactor Coolant Pump Degradation Model (PSC 2-00)

In 2003, the NRC approved the use of the M3-modified two-phase reactor coolant pump degradation multiplier in RELAP5/MOD2-B&W for resolution of PSC 2-00 (Section 2.4.2 of Reference 1.13). This approval was contingent upon each licensee establishing that the M3-modified curve is conservative for each licensee's plant. AREVA submitted generic material to justify the use of the M3-modified curve with respect to the plant-specific reactor coolant pumps and requested that the SER be amended to remove the contingency (Reference 1.21 and 1.24). Use of the M3-modified RCP degradation multiplier was previously applied as an EM Change in 2000 (Reference 1.20) and 2001 (Reference 1.19).

A revised SER (Reference 1.16) was received in January 2005 that removed the contingency regarding the use of the M3-modified curve.

- Other – Acknowledgement of receipt of amended SER.
- There are no PCT changes associated with this topic.

3.4 Outline of Evolution of BAW-10192P-A Changes

The general outline for application of the Evaluation Model is described in BAW-10192P-A. The code topical report revisions identified in BAW-10192P-A Rev. 0 for use in LOCA analyses are:

BAW-10164P-A, Revision 3, RELAP5/MOD2-B&W,	Reference 1.23
BAW-10171P-A, Revision 3, REFLOD3B,	Reference 1.5
BAW-10166P-A, Revision 4, BEACH,	Reference 1.22
BAW-10095-A, Revision 1, CONTEMPT, and	Reference 1.7
BAW-10162P-A, Revision 0, TACO3.	Reference 1.9

Since the approval of BAW-10192P-A, the codes and methods have evolved through approved code revisions, identification of specific codes not identified in the EM, and the addition of new methods and error corrections made under 10 CFR 50.46. The following NRC-approved topical reports have been added as part of the EM. However, these revisions are not explicitly identified in BAW-10192P-A Rev. 0.

BAW-10164P-A, Revision 4, RELAP5/MOD2-B&W	Reference 1.4
BAW-10166P-A, Revision 5, BEACH	Reference 1.6
BAW-10227P-A, Revision 1, M5 Cladding (Revision 1 is related to non-B&W plant fuel and is not necessary for B&W plant licensing. However, the most recent revision of a topical report is referenced.)	Reference 1.8
BAW-10184P-A, Revision 0, GDTACO	Reference 1.10

The addition of new methods and error corrections made under 10 CFR 50.46 are reported to the utilities at least annually for inclusion in plant-specific 50.46 reports to the NRC.

In the case of new methods, acceptable licensing cases are typically not reanalyzed or reevaluated in order to take advantage of the new methods. (Error corrections are applied to current licensing basis cases as necessary.) Therefore, the last acceptable licensing cases for a specific plant may not have been performed with the most recent EM changes (approved or made via 50.46). In order to assist the utility in identifying which EM and 50.46 changes were utilized in their licensing cases, Table 1-1 was created. The different stages of models available via reference to BAW-10192P-A are identified in Table 1-1 as versions denoted by "RN.n", where "R" stands for revision, "N" represents the revision of BAW-10192P-A (in all cases, 0) and "n" is the subrevision identifier of the modeling change not explicitly described in the NRC-approved Revision of BAW-10192P-A. These informal revision levels are for internal tracking purposes in order to identify those EM and 50.46 changes that are applied in the analyses. The revision level is reported in the plant-specific PCT summary tables alongside the final licensing PCT.

- Other

- No 50.46 changes or corrections are discussed.

Table 1-1: Evolution of Changes to BAW-10192P-A [1]

Date First Introduced	BAW-10192P-A Revision 0	Description of Change		Method of Change and/or Approval
		LBLOCA	SBLOCA	
1993	R0.0	--	--	Original (approved 1997)
1994	R0.1	CFT Inventory (PSC 5-94)	CFT Inventory (PSC 5-94)	50.46 Change (Ref. 1.14)
1999	R0.2	M3-Modified RCP degradation multiplier (PSC 1-99)	*Not Applicable*	50.46 Change (Ref. 1.18)
1999	R0.3	Extension of BEACH acceptable range of application for initial cladding temperature	*Not Applicable*	50.46 Change (Ref. 1.18) Approved BAW-10166P-A Rev. 5 (Ref. 1.6, 2003)
1999	R0.4	M5 Cladding (if used)	M5 Cladding (if used)	Approved Change BAW-10227P-A (Ref. 1.8, 2000)
2000	R0.5	*Not Applicable*	M3-Modified RCP degradation multiplier (via PSC 2-00)	50.46 Change (Ref. 1.20) Approved via Reference 1.16 and 1.17 (2003 and 2005)
		Not Applicable	Void-dependent cross-flow (via PSC 2-00)	50.46 Change (Ref. 1.20) Approved via BAW-10164P-A Rev. 4 (Ref. 1.4, 2002)
2002	R0.6	Appendix K Power Uprate (if applicable)	Appendix K Power Uprate (if applicable)	50.46 Change (Ref. 1.12)
2002	R0.7	Hot pin modeling for LBLOCA	*Not Applicable*	Approved Change BAW-10164P-A Rev. 4 (Ref. 1.4, 2002)
2003	R0.8	BHTP CHF correlation for analysis of Mark-B-HTP fuel (if used)	BHTP CHF correlation for analysis of Mark-B-HTP fuel (if used)	50.46 Change (Ref. 1.13)
2005	R0.9	*Not Applicable*	Application of BHTP CHF correlation for analysis of Mark-B-HTP fuel (if used)	50.46 Change

[1] Higher revision levels implicitly include the changes contained in the previous revisions. Some changes are specific to a fuel assembly design or plant change, and are not applicable to all analyses (marked as "if used" or "if applicable").

4.0 References

1.1 AREVA/FANP Proprietary Topical Report BAW-10104P-A, Rev. 5, "B&W's ECCS Evaluation Model," November 1988.

1.2 AREVA/FANP Proprietary Topical Report BAW-10154-A, Rev. 0, "B&W's Small-Break LOCA ECCS Evaluation Model," July 1985.

1.3 AREVA/FANP Proprietary Topical Report BAW-10192P-A, Rev. 0, "BWNT LOCA – BWNT Loss-of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998.

1.4 AREVA/FANP Proprietary Topical Report BAW-10164P-A, Rev. 4, "RELAP5/MOD2-B&W – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis", November 2002.

1.5 AREVA/FANP Proprietary Topical Report BAW-10171P-A, Rev. 3, "REFLOD3B – Model for Multinode Core Reflooding Analysis", December 1995.

1.6 AREVA/FANP Proprietary Topical BAW-10166P-A, Rev. 5, "BEACH – A Computer Program for Reflood Heat Transfer During LOCA", November 2003.

1.7 AREVA/FANP Proprietary Topical Report BAW-10095-A, Rev. 1, "CONTEMPT – Computer Program for Predicting Containment Pressure-Temperature Response to a LOCA", April 1978.

1.8 AREVA/FANP Proprietary Topical Report BAW-10227P-A, Rev. 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel", June 2003.

1.9 AREVA/FANP Proprietary Topical Report BAW-10162P-A, Rev. 0, "TACO3 Fuel Pin Thermal Analysis Code", October 1989.

1.10 AREVA/FANP Proprietary Topical Report BAW-10184P-A, Rev. 0, "GDTACO Urania – Gadolinia Fuel Pin Thermal Analysis Code", February 1995.

1.11 AREVA/FANP Proprietary Topical Report BAW-10179P-A, Revision 6, "Safety Criteria and Methodology for Acceptable Cycle Reload Analyses", August 2005.

1.12 AREVA/FANP Document 47-5026040-00, "2002 Draft Annual BWOG 50.46 Letter", 5/14/03.

1.13 AREVA/FANP Document 47-5039949-00, "2003 Draft Annual BWOG 50.46 Letter", 3/30/04.

1.14 AREVA/FANP Document 47-5022659-00, "Draft 1994 NRC Annual Report", 12/3/2002.

1.15 AREVA/FANP Proprietary Topical Report BAW-10241(P)(A), Revision 1, "BHTP DNB Correlation Applied with LYNXT," July 2005.

1.16 Letter dated April 10, 2003 from H. N. Berkow USNRC to J. Mallay (AREVA), Subject: Evaluation of Framatome ANP Preliminary Safety Concern (PSC) 2-00 Relating to Core Flood Line Break and Operator Action Time (TAC No. MA9973), Project No. 728, ADAMS Accession Number ML031010143.

1.17 Letter dated January 10, 2005 from R. A. Gramm USNRC to J. S. Holm (AREVA), Subject: Request for Amendment of Safety Evaluation for "Report of Preliminary Safety Concern (PSC) 2-00 Related to Core Flood Line Break with 2-Minute Operator Action Time" (TAC No. MA9973), Project No. 693, ADAMS Accession Number ML043550355.

1.18 AREVA/FANP Document 47-5007106-00, "1999 DRAFT ECCS Annual Letter", 2/16/00.

1.19 AREVA/FANP Document 47-5017330-00, "2001 Draft ECCS Annual Report", 4/26/02.

1.20 AREVA/FANP Document 47-5011843-00, "2000 Draft ECCS Annual Letter", 4/19/01.

1.21 Letter NRC:04:051 dated 9/21/04 from James F. Mallay (FANP) to Document Control Desk (USNRC), Subject: Request for Amendment of Safety Evaluation for Preliminary Safety Concern (PSC) 2-00.

1.22 AREVA/FANP Proprietary Topical BAW-10166P-A, Rev. 4, "BEACH – A Computer Program for Reflood Heat Transfer During LOCA", February 1996.

1.23 AREVA/FANP Proprietary Topical Report BAW-10164P-A, Rev. 3, "RELAP5/MOD2-B&W – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis", July 1996.

1.24 AREVA/FANP Document 86-5044228-00, "B&W LOCA – Two-Phase RCP Degradation", 7/21/04.

1.25 EVA/FANP Document 51-9004825-000, "FUELGUARD Debris Filter Evaluation for BWOG Plants", 12/05

5.0 ANO – 1 Specific Information

In addition to the information identified above, the following licensing analyses or evaluations were performed in 2005 and are applicable to ANO-1. Limiting ECCS analyses are tracked for the Mark-B9 and Mark-B-HTP fuel rod designs for the RELAP5-based EM. Each activity and the effect on the limiting ECCS analyses are summarized in Table 2-1.

5.1 EM Change for BHTP CHF Correlation Implementation for SBLOCA

The maximum break size for the SBLOCA spectrum is defined in the BWNT LOCA EM based on the CHF performance, specifically that the heat flux should not exceed the CHF during the first several seconds of the SBLOCA transient. For the Mark-B9 fuel with the historical Mark-B grid design and the BWC CHF correlation, the maximum break size for the SBLOCA spectrum is 0.75 ft^2. As discussed above, the SBLOCA EM has been changed to account for the flow-dependent terms in the BHTP CHF correlation. With this EM change, discussed in detail in Reference 2.7, the 0.5-ft^2 break size has been determined to be the maximum SBLOCA break size for the Mark-B-HTP fuel design with the BHTP CHF correlation. The extent of this EM change is to confirm that the correct EM (transition LBLOCA versus SBLOCA) is utilized to analyze the transient. The SBLOCAs with the least margin to CHF are those with break sizes exceeding 0.3 ft^2, and these break sizes are not limiting for the ANO-1 SBLOCA. Therefore, there is a (+0 F) PCT change associated with this EM change. Entergy was previously notified of this EM change and associated PCT change via Reference 2.14.

When the SBLOCA cases do not exceed the CHF during the first several seconds of the transient, there are no differences in the transient results for each fuel type due to the CHF correlation selected. Therefore, the same SBLOCA cases represent the results for all considered fuel designs. The break sizes greater than the maximum SBLOCA break size are part of the transition LOCA methodology, which is bounded by the results of the LBLOCA analyses.

- EM Change – Implementation of BHTP Correlation to SBLOCA.
- There is a (+0 F) PCT change.

5.2 Mark-B-HTP LOCA with EOTSG

New Mark-B-HTP LBLOCA and SBLOCA analyses were performed to support licensing of the new Mark-B-HTP fuel assembly design at ANO-1 with the replacement EOTSG. The analyses consisted of full-core Mark-B-HTP LBLOCA analyses and a set of LBLOCA and SBLOCA analyses that considered the Mark-B-HTP fuel assembly surrounded by Mark-B9 fuel assemblies. Much of the documentation in support of the

analyses was released in 2004, with the final licensing analyses being completed in 2005.

The LBLOCA and SBLOCA analyses utilized EM R0.9, which includes the BHTP CHF correlation necessary for analysis of the Mark-B-HTP design, the approved hot pin modeling for LBLOCA (BAW-10164P-A Rev. 4), and the approved void-dependent cross-flow model for SBLOCA (BAW-10164P-A Rev. 4). These EM changes were previously reported, and should be included in any new submittals if they were not included in past submittals. The new EM change discussed above is also applied to these analyses.

The following documents were completed in 2005.

Reference 2.1, LBLOCA base model revision with EOTSG and Mk-B-HTP

Reference 2.2, LBLOCA analyses for a full core of Mark-B-HTP and mixed core of Mark-B-HTP and Mark-B9

Reference 2.4, SBLOCA analyses to cover Mark-B-HTP and Mark-B9 fuel types

Reference 2.5, Document that reconciles the final EOTSG design versus that modeled in the LOCA analyses

Reference 2.6, LOCA information provided to support an RAI on the licensing amendment for M5 cladding

Reference 2.7, final LOCA summary report

A complete description of the results of the LBLOCA and SBLOCA analyses for the Mark-B-HTP and Mark-B9 fuel assemblies, along with the results of each 50.46 criteria, is provided in Reference 2.7. A summary of the PCT rack-up for the Mark-B-HTP analyses was previously provided in Reference 2.14. The Mark-B-HTP LOCA analyses are separated into three plant changes: 1) replacement EOTSG, 2) introduction of Mark-B-HTP (mixed-core) and 3) transition to full-core of Mark-B-HTP fuel. The transition to a full-core of Mark-B-HTP fuel allows for removal of the mixed-core penalty, which allows for an increase in the LOCA LHR limit when comparing the mixed-core and full-core analysis cases that provide the limiting PCT.

- **Plant Change – Replacement EOTSG.**

- It was determined that the original OTSG evaluations with 20 percent SG tube plugging represented a more conservative plant configuration for evaluation of the LOCA.

- **Plant Change – Introduction of Mark-B-HTP fuel assembly.**

- It was determined that consideration of a full core of Mark-B9 fuel was a more conservative plant configuration than the transition core.

- The limiting LBLOCA mixed-core PCT for the Mark-B-HTP fuel was analyzed to be 1981.4 F.

- The limiting SBLOCA mixed-core PCT was analyzed to be 1179.7 F.

- **Plant Change – Transition to full-core of Mark-B-HTP fuel assemblies.**

- The limiting LBLOCA full-core PCT for the Mark-B-HTP fuel was analyzed to be 2008.1 F.

- It was determined that consideration of the transition core of Mark-B-HTP and Mark-B9 fuel was a more conservative plant configuration than the full core of Mark-B-HTP fuel.

5.3 Cycle 20 Reload Licensing

Cycle-specific licensing documentation was prepared for ANO-1 Cycle 20. An evaluation of LHR limit applicability to the final plant and fuel design was performed in Reference 2.8. The evaluation included the first application of the Mark-B-HTP LOCA LHR limits to ANO-1 with the EOTSG. The evaluation also considered a change in the reactor vessel head and the CRDMs. The evaluation concluded that the Mark-B-HTP and Mark-B9 LOCA models were bounding and applicable to Cycle 20.

The following additional documents were prepared in support of Cycle 20 operation.

Reference 2.9 and 2.10, Input to the Reload Report

Reference 2.11, Input to the Reload Technical Document (RTD)

Reference 2.12 and 2.13, Cycle-specific hold time for RCP restart after a transient where core exit subcooling margin is lost

Reference 2.3, Input to Mark-B-HTP Fuel Design Report

- Plant Change – New LOCA analysis results were applied and plant changes were considered.

- The evaluations concluded the PCT change for the change in reactor vessel head and CRDM was (+0 F).

6.0 References

2.1 AREVA/FANP Proprietary Document 32-5043782-01, "ANO EOTSG LBLOCA Model with Mark-B-HTP FA", 1/05.

2.2 AREVA/FANP Proprietary Document 32-5052636-02, "ANO-1 EOTSG MK-B-HTP LBLOCA Analyses", 8/05.

2.3 AREVA/FANP Document 51-5071695-00, "LOCA Input to Mark-B-HTP Design Report", 8/05.

2.4 AREVA/FANP Proprietary Document 32-5048086-00, "ANO-1 Mk-B-HTP SBLOCA", 7/05.

2.5 AREVA/FANP Proprietary Document 51-5066300-02, "ANO-1 EOTSG Reconciliation for Safety Analyses", 7/05.

2.6 AREVA/FANP Document 86-5064485-00, "ANO-1 M5 Fuel Transition", 5/05.

2.7 AREVA/FANP Document 86-5064591-01, "ANO-1 Mark-B-HTP & Mark-B9 LOCA Summary Report (EOTSG)", 10/05.

2.8 AREVA/FANP Proprietary Document 51-5059529-02, "ANO-1 CY20 LHR Limits", 11/05.

2.9 AREVA/FANP Document 51-5066354-00, "ANO-1 CY20 Task 4 RR Input", 8/05.

2.10 AREVA/FANP Document 51-9005582-00, "ANO-1 CY20 Task 4 RR Input (SSR Evaluation)", 11/05.

2.11 AREVA/FANP Document 51-5063917-00, "ANO-1 CY20 Task 4 RTD Input", 8/05.

2.12 AREVA/FANP Document 86-5069444-00, "ANO-1 CY20 Inputs to TBD Vol.3 Chapter IV.A (RCP Restart)", 8/05.

2.13 AREVA/FANP Proprietary Document 32-5069435-00, "ANO-1 CY20 Inputs to TBD Vol.3 Chapter IV.A (RCP Restart) - Calculation", 8/05.

2.14 Letter FAB05-652 dated August 22, 2005 from F. X. Masseth (AREVA) to J. H. Willoughby (Entergy), Subject: 10 CFR 50.46 LOCA EM Change and PCT Reporting.

Table 2-1: 2005 LOCA Licensing Activity for ANO Unit 1

Plant Name:		Arkansas Nuclear One – Unit 1	***LOCA Spectrum***		
Utility Name:		Entergy	*Mark-B-HTP LBLOCA*	*Mark-B9 LBLOCA*	*SBLOCA*
Item #	***Reporting Category***	***Description***	***PCT or (PCT Change)***		
Licensing Basis at End of 2004			**N/A**	**2000 F Estimate EM R0.3**	**1068 F Analyzed EM R0.5**
2005 Licensing Activity					
0 and 0	EM Change	Implementation of BHTP CHF correlation for SBLOCA application	N/A	N/A	(+0 F)
0	Plant Change	Replacement EOTSG	N/A	Previous Bounding	Previous Bounding
0	Plant Change	Mixed-Core Mark-B9 and Mark-B-HTP	1981.4 F Analyzed EM R0.9	Previous Bounding	1179.7 F Analyzed EM R0.9
0	Plant Change	Full-Core Mark-B-HTP (w/ LHR increase)	2008.1 F Analyzed EM R0.9	N/A	Previous Bounding
0	Plant Change	Cycle 20, Reactor vessel head and CRDM replacement	(+0 F)	(+0 F)	(+0 F)
Licensing Basis at End of 2005			**2008.1 F [1] Analyzed EM R0.9**	**2000 F Estimate EM R0.3**	**1179.7 F Analyzed EM R0.9**

[1] The mixed-core LHR of 1981.4 F may be reported until a full-core configuration is implemented.

Attachment 2

0CAN050604

ANO-2 Emergency Core Cooling System Report

1.0 Evaluation Model Generic Information

Four evaluation models (EM) for ECCS performance analysis of Combustion Engineering (CE) designed PWRs are described in topical reports, are licensed by the NRC, and are covered by the provisions of 10CFR50.46. The evaluation models for large break LOCA (LBLOCA) are the 1985 EM and the 1999 EM. For the small break LOCA, the evaluation model is the S2M EM. Post-LOCA long term cooling (LTC) analyses use the LTC evaluation model.

Several digital computer codes are used to do ECCS performance analyses of PWRs for the evaluation models described above that are covered by the provisions of 10CFR50.46. Those for LBLOCA calculations are CEFLASH-4A, COMPERC-II, HCROSS, PARCH, STRIKIN-II, and COMZIRC. CEFLASH-4AS is used in conjunction with COMPERC-II, STRIKIN-II, and PARCH for SBLOCA calculations. The codes for post-LOCA LTC analyses are BORON, CEPAC, NATFLOW, and CELDA.

2.0 Westinghouse Generic Model Changes and Error Corrections

2.1 Appendix K Large Break – 1999 EM Related Items

- **LBLOCA STEAM COOLING MODEL ERROR CORRECTION**
  (Non-Discretionary Change)

  Background

  The LBLOCA Evaluation Model, 1999 EM, has an NRC imposed Safety Evaluation Report (SER) constraint. The constraint stipulates that the steam cooling model in the PARCH module of the STRIKIN-II program can be used for calculating the hot rod PCT provided the resulting heat transfer coefficients are no better than those calculated using the FLECHT heat transfer correlation. An error in the implementation of this constraint in the 1999 EM was discovered in calendar year 2005 and was corrected. The error pertains to the STRIKIN-II main program not providing the correct limiting FLECHT heat transfer coefficient value to the PARCH module for use in checking the SER constraint. It was determined that the STRIKIN-II program was providing the steam cooling model heat transfer coefficient value from the previous time step for this check.

  Estimated Effect

  The error in the STRIKIN-II program was corrected by a coding change to ensure the use of the FLECHT heat transfer coefficient for

confirming that the SER constraint was met. The maximum plant specific impact on PCT due to correcting the steam cooling model was an increase of 2 °F. The impact of the correction on PCT for each applicable CE fleet plant is shown in the plant specific text of this report.

- **COMPONENT MODEL IMPROVEMENT TO INCLUDE EFFECT OF SPACER GRIDS FOR LBLOCA ANALYSIS**
(Discretionary Change)

Background

The implementation of an Advanced Automated/Integrated Code System (AAICS) was previously identified as a change in the implementation of the 1999 EM LOCA Evaluation Model in the Annual 10 CFR 50.46 Report for calendar year 2004. A change to the 1999 EM has been implemented since last year's report. This change pertains to the PARCH module of the STRIKIN-II program and was implemented via a component model improvement to include the effects of spacer grids. The improved component model is the 1999 EM steam cooling model for less than 1 in/sec core reflood flow rate. This improvement to the existing 1999 EM component model is intended to be an optional feature of the LBLOCA 1999 EM that is applicable to the CE 16x16 Next Generation Fuel (NGF) design as well as to any other CE fuel design for future applications. The improved model has been submitted to the NRC for review and approval.

Estimated Effect

There is no change in PCT with regard to the current analyses of record for the CE fleet plants since the component model improvement mentioned above is not used in these analyses.

- **ADDITIONAL AUTOMATION OF LOCA ANALYSIS METHODS**
(Discretionary Change)

Background

Automation of the LBLOCA and SBLOCA analysis methods using AAICS had been previously reported in last year's 10 CFR 50.46 report. Additional automation of methods was implemented for both the LBLOCA and SBLOCA analyses. For both analyses, the case inputs for various computer case runs were automatically generated using case matrix generation programs. The case inputs refer to input values for simulating a specific LOCA scenario for a specific plant using the EM. The case matrix refers to a set of parametric cases with differing break sizes and/or plant operating conditions. The utility program CMG99A was used for LBLOCA 1999 EM case matrix generation,

while program CMGS2M was used to create the case matrix for the SBLOCA S2M EM. These programs eliminated much of the manual effort required in setting up LOCA case runs and reduced the potential for errors.

Estimated Effect

The use of these utility programs did not result in any changes to the EM or any of its components including those controlled by Appendix K. The use of the case matrix generation programs, CMG99A and CMGS2M, for automating the LOCA analyses has no impact on the analysis results, including the PCT.

2.2 Appendix K Small Break – S2M Related Items

- **ADDITIONAL AUTOMATION OF LOCA ANALYSIS METHODS**
(Discretionary Change)

Background

Automation of the LBLOCA and SBLOCA analysis methods using AAICS had been previously reported in last year's 10 CFR 50.46 report. Additional automation of methods was implemented for both the LBLOCA and SBLOCA analyses. For both analyses, the case inputs for various computer case runs were automatically generated using case matrix generation programs. The case inputs refer to input values for simulating a specific LOCA scenario for a specific plant using the EM. The case matrix refers to a set of parametric cases with differing break sizes and/or plant operating conditions. The utility program CMG99A was used for LBLOCA 1999 EM case matrix generation, while program CMGS2M was used to create the case matrix for the SBLOCA S2M EM. These programs eliminated much of the manual effort required in setting up LOCA case runs and reduced the potential for errors.

Estimated Effect

The use of these utility programs did not result in any changes to the EM or any of its components including those controlled by Appendix K. The use of the case matrix generation programs, CMG99A and CMGS2M, for automating the LOCA analyses has no impact on the analysis results, including the PCT.

3.0 Conclusions

The correction of errors in LOCA analysis models and/or changes to LOCA analysis methods during CY 2005 had the following impact on LOCA analysis results.

1. The correction of the steam cooling model in the STRIKIN-II program of the 1999 EM for LBLOCA results in a maximum plant specific impact on PCT of 2 °F.

2. The component model improvement to include the effects of spacer grid has no impact on the current analyses of record for CE fleet plants since this improvement is not used in these analyses.

3. The automation of the LBLOCA and SBLOCA analysis methods for the 1999 EM and S2M EM using the case matrix generation programs, CMG99A and CMGS2M, respectively, has no impact on analysis results, including the PCT.

The sum of the absolute magnitude of the changes in PCT calculated using the 1985 EM for LBLOCA, including those from previous annual reports remains less than 1°F. The maximum generic impact on PCT calculated with the 1999 EM is less than 3°F. There are no additional generic PCT changes for the Year 2005 for the 1985 EM and the 1999 EM models.

There is no previous generic accumulated change in cladding temperature for the S2M EM. There are no additional PCT changes for calendar year 2005 for the S2M evaluation model.

There is no PCT effect for the post-LOCA long term cooling evaluation model.

4.0 ANO-2 Specific Information

The plant specific effect for 1999 EM LBLOCA analysis of Cycle 18 operating with ZrB_2 Integral Fuel Burnable Absorber (IFBA) fuel is less than 1.4 °F due to use of the AAICS for this analysis consistent with the PCT effect reported in 2004 (Letter 0CAN050504, dated May 31, 2004). In addition, the steam cooling model error correction in the STRIKIN-II program results in an increase in the PCT of less than 0.1 °F. Therefore, the total PCT impact of changes/corrections for LBLOCA analysis is less than 1.5 °F.

There is no plant specific SBLOCA effect for Cycle 18 operating with ZrB_2 IFBA fuel since the corrected version of CEFLASH-4AS was used with the S2M.

The following information discusses a change in the maximum cladding oxidation (MCO) value for SBLOCA. While the PCT is not impacted by the information below and is therefore not reportable, it is included for completeness.

As part of the ZrB_2 IFBA implementation analysis, a change to the S2M cladding rupture strain model was investigated. The change that was considered was to limit the maximum cladding rupture strain for both Zircaloy-4 and ZIRLO cladding to the value equal to the "touching strain" of two adjacent fuel rods. This limit has been part of the cladding rupture strain model used in the Westinghouse SBLOCA evaluation model for Westinghouse PWRs for several years. Using this revised model, the MCO was determined to be 12.4%, well within the 10CFR50.46 acceptance criterion.

When this change was noted, the SBLOCA analysis was reperformed with the S2M EM and the MCO increased from 12.4% to 16.5%. This new value conforms to the 10CFR50.46 acceptance criterion.

The PCT of the ANO ZrB_2 IFBA implementation analysis was not impacted because it was calculated separately from the MCO and its calculation did not implement the change to the cladding rupture strain model. Likewise, the result for core-wide cladding oxidation is not impacted because the reported value bounds the results obtained with both the modified and unmodified cladding rupture strain model.