NEXTera ENERGY DUANE ARNOLD

September 30, 2009

NG-09-0709
10 CFR 54.21(b)

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

Duane Arnold Energy Center
Docket 50-331
License No. DPR-49

First Annual Amendment to the Duane Arnold Energy Center License Renewal Application

References:

1. Letter, Richard L. Anderson (FPL Energy Duane Arnold, LLC) to Document Control Desk (USNRC), "Duane Arnold Energy Center Application for Renewed Operating License (TSCR-109)," dated September 30, 2008, NG-08-0713 (ML082980623)
2. Letter, Richard L. Anderson (FPL Energy Duane Arnold, LLC) to Document Control Desk (USNRC), "License Renewal Application, Supplement 1: Changes Resulting from Issues Raised in the Review Status of the License Renewal Application for the Duane Arnold Energy Center," dated January 23, 2009, NG-09-0059 (ML090280418)
3. Letter, Richard L. Anderson (NextEra Energy Duane Arnold, LLC) to Document Control Desk (USNRC), "Response to Request for Additional Information Regarding Severe Accident Mitigation Alternatives for Duane Arnold Energy Center," dated July 9, 2009, NG-09-0514 (ML091960050)
4. Letter, Christopher Costanzo (NextEra Energy Duane Arnold, LLC) to Document Control Desk (USNRC), "Clarification of Response to Request for Additional Information Regarding Severe Accident Mitigation Alternatives for Duane Arnold Energy Center," dated September 23, 2009, NG-09-0716.

In accordance with the requirements of 10 CFR 50, 51, and 54, FPL Energy Duane Arnold, LLC requested the renewal of the operating licenses for the Duane Arnold Energy Center in Reference 1 and supplemented that request in Reference 2.

A137
NRR

The License Renewal Rule, 10 CFR 54.21(b), requires that each year following submittal of a license renewal application (LRA), and at least 3 months before scheduled completion of the NRC review, an amendment to the renewal application must be submitted that identifies any change to the current licensing basis (CLB) of the facility that materially affects the content of the LRA including the FSAR supplement.

In accordance with this requirement, NextEra Energy Duane Arnold, LLC performed a review of CLB changes since the submittal of Reference 2, to determine whether any sections of the LRA were affected by these changes. The results of the review are reported in Enclosure 1.

In Reference 4, a commitment was made to submit conforming changes to the Environmental Report that reflect the information provided in References 3 and 4. The required Environmental Report changes are included as Enclosure 2. This completes the NextEra Energy Duane Arnold action for this commitment.

If you have any questions, please contact Mr. Kenneth Putnam at (319) 851-7238.

I declare, under penalty of perjury, that the foregoing is true and correct.

Executed on September 30, 2009.

Christopher R. Costanzo
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosures
1) First Annual Amendment to the Duane Arnold License Renewal Application
2) Replacement pages for the Environmental Report per References 3 and 4

cc: Administrator, Region III, USNRC
Project Manager, DAEC, USNRC
Senior Resident Inspector, DAEC, USNRC
License Renewal Project Manager, USNRC
License Renewal Inspection Team lead, Region III, USNRC
M. Rasmusson (State of Iowa)

Enclosure 1

First Annual Amendment to the Duane Arnold License Renewal Application

Changes to Licensee's Legal Name and Principal Officers

- The legal name of the licensee changed from FPL Energy Duane Arnold, LLC to NextEra Energy Duane Arnold, LLC (Letter L-2009-066 dated March 24, 2009, Mano K. Nazar to U.S. Nuclear Regulatory Commission, Notice of Legal Name Change)

  In all places in the LRA where FPL Energy Duane Arnold, LLC appears, it should be interpreted as NextEra Energy Duane Arnold, LLC where appropriate.

- In Section 1.1.4, the list of officers for FPL Energy Duane Arnold is changed to the following list of officers for NextEra Energy Duane Arnold:

NextEra Energy Duane Arnold – Principal Officers

T. J. Tuscai
President
700 Universe Boulevard
Juno Beach, FL 33408-0420

Michael O'Sullivan
Senior Vice President
700 Universe Boulevard
Juno Beach, FL 33408-0420

Manoochehr K. Nazar
Senior Vice President and Chief Nuclear Officer
700 Universe Boulevard
Juno Beach, FL 33408-0420

Mark R. Sorensen
Treasurer
700 Universe Boulevard
Juno Beach, FL 33408-0420

Charles S. Schultz
Secretary
700 Universe Boulevard
Juno Beach, FL 33408-0420

Rita W. Costantino
Assistant Secretary
700 Universe Boulevard
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Judith J. Kahn
Assistant Treasurer

700 Universe Boulevard
Juno Beach, FL 33408-0420

Michael D. Bryce
Assistant Secretary
700 Universe Boulevard
Juno Beach, FL 33408-0420

- In LRA Section 2.5, Mr. Richard Anderson Vice President Duane Arnold Energy Center is changed to Mr. Christopher R. Costanzo Vice President Duane Arnold Energy Center.

Changes to Current Licensing Basis

There are no changes to the Current Licensing Basis of the facility that materially affect the contents of the license renewal application, including the FSAR supplement.

Enclosure 2

Replacement Pages to the Duane Arnold License Renewal Application Environmental Report Appendix F

The following pages have been updated to reflect information submitted in References 3 and 4, and replace the corresponding pages in the Environmental Report as originally submitted.

Table 3.1.1.1-1 Dominant Contributors to Risk Reduction

Contributor	RRW	Description
B-OPSLCE---U	1.099	Operator Fails to Inject SBLC Early (Within 4 Minutes)
FTPE-Q4--Q4-	1.059	Operator Fails to Bypass MSIV Isolation Interlocks (ATWS)
V-OPTORVENTU	1.053	Operator Fails to Vent Containment Per EOPs
FTPE-L---L--	1.053	Operator Fails to Prevent Overfilling RPV
L2OPNOREC--U	1.049	Operator Fails to Recover Torus Cooling
FTPE-L1--L1-	1.042	Operator Fails to Lower RPV Level to TAF for ATWS Pwr Cntrl
E/P4914	1.033	Control Air Supply E/P converter for CV4914
CB8490	1.033	This term represents failure of Switchyard Control Breaker "M". SAMAs 11, 14, 15, 17, 20, 24, and 26 evaluate improvements in the AC power system that would reduce the risk of loss of power to/from the switchyard.
FTPE-X---X--	1.031	Operator Fails to Inhibit ADS (ATWS with High Press Inj)
FTPE-L2--L2-	1.030	Operator Fails to Restore RPV Level Post ED (ATWS)
C-OPNOREP--U	1.029	Operator Fails to Recover Main Condenser
1G031	1.029	This represents failure of the Div 1 Standby Diesel Generator. SAMAs 11, 14, 15, 17, 20, 24, and 26 evaluate improvements in the AC power system that would reduce the risk of loss of power to/from the switchyard.
E/P4915	1.028	Control Air Supply E/P converter for CV4915
1G021	1.028	This represents failure of the Div 2 Standby Diesel Generator. SAMAs 11, 14, 15, 17, 20, 24, and 26 evaluate improvements in the AC power system that would reduce the risk of loss of power to/from the switchyard.
1P216	1.025	This represents failure of the HPCI Pump/Turbine. SAMAs 27, 28, 29, 31, 33, 34 evaluate improvements that would reduce the risk of high pressure injection failures.
O-OPMANDEP-U	1.023	Operator Fails to Manually Initiate ADS (Non-Med LOCA)
FTPE-LA--LA-	1.023	Operator Fails to Prevent Overfilling RPV
FTPE-TR--TR-	1.018	Operator Fails to Bypass HPCI/RCIC Low RPV Press Trip
L-OPCHRTRNSY	1.017	Operator Fails to Follow EOPs for Cont. Ht. Removal
V-OPVENTTRNY	1.017	Operator Fails to Vent Torus (Transients/LOCA)
C-OPCD03---U	1.017	Operator Fails to Open an MSIV and/or Bypass Valve
B-OPSLCLAT3U	1.016	Operator Fails to Inject SBLC Early (Within 14 Minutes)
PS4529	1.016	RPV Low Pressure Permissive for LPCI/CS
PS4545	1.016	RPV Low Pressure Permissive for LPCI/CS
FTPE-Q3--Q3-	1.014	Operator Fails to Bypass MSIV Isolation Interlocks (ATWS)
1A311	1.013	This represents failure of the SBDG 1G031 to Bus 1A3 Circuit Breaker. SAMAs 11, 14, 15, 17, 20, 24, and 26 evaluate improvements in the AC power system that would reduce the risk of loss of power to/from the switchyard. SAMA 23 evaluates the risk due to breaker failures.
1A411	1.013	Failure of the SBDG 1G021 to Bus 1A4 Circuit Breaker. SAMAs 11, 14, 15, 17, 20, 24, and 26 evaluate improvements in the AC power system that would reduce the risk of loss of power to/from the switchyard. SAMA 23 evaluates the risk due to breaker failures.
C-OPALTINJ-U	1.013	Operator Fails to Initiate Condensate for Alt Inj

Table 3.1.1.1-1 Dominant Contributors to Risk Reduction (Cont.)

Contributor	RRW	Description
W-OPWS04---U	1.013	Operator Fails to Open CV4914
W-OPWS02---U	1.012	Operator Fails to Open CV4915
FTPE-XA--XA-	1.012	Operator Fails to Inhibit ADS (ATWS with No High Press Inj)
I-OPLRESPERX	1.011	Miscalibration of Low Press Permiss Instrumentation
H-OP14-----U	1.011	Operator Fails to Shutoff HPCI or RCIC
1T218	1.011	Failure of the SBLC Storage Tank. SAMAs 118, 119 evaluate alternate means of boron injection in ATWS.
1P226	1.010	Failure of the RCIC Turbine/Pump. SAMAs 27, 28, 29, 31, 33, 34 evaluate improvements that would reduce the risk of high pressure injection failures.
PS4530	1.010	RPV Low Pressure Permissive for LPCI/CS
PS4548	1.010	RPV Low Pressure Permissive for LPCI/CS
Q-OPLEVEL-TT	1.009	Operator Fails to Cntrl Rx Level Following Scram
Z-OPWELLWTRU	1.009	Operator Fails to Maximize Well Water to Circ Pit
FTPE-X1--X1-	1.008	Operator Fails to Manually Depressurize RPV (ATWS)
L-OPCHRATWSY	1.008	Operator Fails to Follow EOPs for Cont. Ht. Removal
Q-OPFW99--LU	1.008	Operator Fails to Initiate Feedwater (Large LOCA/ATWS)
P-OPBCREC--Y	1.007	Operator Fails to Recover Battery Charger
O-OPMNDPML-U	1.006	Operator Fails to Manually Initiate ADS (Medium LOCA)
U-OP2NOREPRS	1.006	Operator Fails to Repressurize RPV for HPCI
W-OPFFWS03--	1.005	Operator Fails to Open CV4910B
W-OPFFWS04--	1.005	Operator Fails to Open CV4910A
G-OPLOCSTRTU	1.005	Operator Fails to Close Breaker to Start GSW Pump
HS4914	1.005	Failure of the RWS Loop 'B' Makeup Hand Switch
PDI2046	1.005	Failure of the RHRSW Loop 'A' HX Diff Press Indicator
PDI1947	1.005	This represents failure of the RHRSW Loop 'B' HX Diff Press Indicator

3.1.1.2 Level 1 PRA Model Changes since IPE Submittal

The major Level 1 changes incorporated into the updated DAEC model since the 1992 IPE Submittal are described as follows:

Revisions 3 (aka 3A) and 3B, March 1995 and January 1996, respectively

- Incorporation of Design and Procedural changes since the IPE freeze date through January 1994,
- Inclusion of control building flood event trees,
- Revision to HPCI/RCIC battery life estimates,
- Reclassification of DAEC offsite power independence group from L1 to L2,
- Re-evaluation of the LOOP initiator,
- Incorporation of the Manual Shutdown event tree,
- Incorporation of the LOCA Outside of Containment event tree,
- Revision of the RPV water level and pressure instrumentation to reflect the correct mission time for transmitters failure probabilities,
- Incorporation of changes resulting from the PSA QA program,
- Addition of house events and flag settings to facilitate batch file capability and automation of fault tree quantification,
- Modification of fault tree and event tree culling limits to reduce quantification of less significant cut sets,
- Incorporation of a revised control building HVAC assessment,
- Incorporation of sole dependence of DC power on 125 VDC batteries given a LOOP or LOCA initiator,
- Modification of success criteria for SORV cases,
- Addition of maintenance basic events.

Revision 4 (aka 4A), March 1998

- Essential Switchgear rooms' ventilation requirement relaxed,
- ADS Suppression added as a means for vapor suppression,
- Allowance for failure of DHR upon success of HPCI / RCIC in small LOCA event tree sequences,
- Addition of credit for River Water Supply Recovery,
- Sequences for Loss of Offsite Power events with subsequent failure to re-close SRVs categorized as LOOP to IORV,
- Added Credit for Drywell Venting,
- Revision of event trees for Human Error Probabilities or Containment heat removal,
- Added credit for procedures dealing with total loss of 125VDC,
- Incorporated initiating event frequencies for transients and manual shutdown,
- Addition of Several Maintenance Unavailability Terms,
- Inclusion of modification to the Well Water System Design,
- Inclusion of Common Cause Failure for SRVs,

- Updated maintenance unavailability rates from the Maintenance Rule database,
- Added an explicit model of the important transformers, control breakers, and power source lines.

Revision 4B, March 1998

- Conversion from REBECA to CAFTA.

Revision 5 (aka 5A), October 2003

- Updated several Human Error Probabilities (HEPs) as a result of the plant's power uprate,
- Numerous basic event nomenclature and failure probability changes were made in order to make the failure rates more traceable and make the nomenclature more self-consistent,
- Loss of offsite power initiator frequency was updated to reflect plant operating experience since the last PRA update,
- Added a fault tree for the instrument air system,
- Modification to the modeling of the CV4909 River Water radwaste dilution isolation valve,
- Incorporated changes with smaller impacts on CDF as a result of BWROG PSA Certification team comments.

Revision 5B, February 2005

- ESW/RHRSW pumphouse ventilation dependency added to ESW fault tree,
- Explicit fault tree modeling of Recirculation Pump Trip failure rather than a single point estimate value,
- Basic event nomenclature and failure probability changes were made,
- Loss of offsite power initiator frequency was updated to be consistent with the plant station blackout (SBO) analysis.

Revision 5C, July 2007

- Eliminated the use of quantification flag setting from the Base Rev 5B Level 1 internal events model to correct a quantification error.

Since the 1992 IPE submittal, the CDF has changed in the following manner:

Changes in Internal CDF / Year Since 1992 IPE Submittal

	1992 IPE Submittal	Rev 3A (3/95)	Rev 3B (1/96)	Rev 4A (3/98)	Rev 4B (12/01)	Rev 5A (10/03)	Rev 5B (2/05)	Rev 5C (7/07)
Total	7.84E-06	3.30E-05	1.50E-05	1.11E-05	1.19E-05	1.02E-05	1.07E-05	1.08E-05
LOOP (SBO)	2.93E-06	2.53E-05	7.27E-06	5.90E-06	6.37E-06	3.71E-06	3.75E-06	3.82E-06
ATWS	1.91E-06	3.30E-06	3.30E-06	2.02E-06	1.97E-06	3.11E-06	3.15E-06	3.15E-06

3.1.2 External Events

The current DAEC External Events PRA explicitly models internal fire and seismic initiated core damage accidents. These models are based on the original DAEC IPEEE

3.2.2 Level 2 PRA Model Changes Since IPE Submittal

The changes to the Level 2 release frequencies for the twelve categories are presented below. Note that the total does not match the Level 1 CDF because events resulting in no release or releases below Technical Specifications were not included.

Table 3.2.2-1 Changes to Level 2 CDF by Release Category

Category	1992 Submittal	Rev 3A (3/95)	Rev 3B (8/95)	Rev 4A (3/98)	Rev 4B (12/01)	Rev 5A (10/03)	Rev 5B (2/05)	Rev 5C (7/07)
LL/E	1.78E-07	2.28E-07	1.66E-07	1.07E-07	1.12E-07	1.47E-07	1.50E-07	1.51E-07
LL/I	2.60E-09	1.52E-08	1.51E-08	1.40E-08	2.00E-08	1.51E-08	1.53E-08	1.52E-08
LL/L	3.26E-07	2.08E-07	1.73E-07	7.30E-08	9.48E-08	7.74E-08	8.04E-08	1.45E-07
L/E	1.37E-06	8.11E-07	8.04E-07	4.93E-07	4.95E-07	7.47E-07	7.55E-07	7.67E-07
L/I	2.27E-08	9.03E-08	5.32E-08	5.94E-08	4.07E-07	5.70E-07	5.79E-07	6.71E-07
L/L	8.62E-07	1.11E-06	9.84E-07	4.14E-07	5.36E-07	4.34E-07	4.51E-07	4.85E-07
M/E	1.61E-06	1.39E-05	4.24E-06	2.56E-06	3.81E-06	3.71E-06	3.88E-06	4.27E-06
M/I	4.51E-07	1.94E-06	1.92E-06	1.75E-06	1.92E-06	1.06E-06	1.08E-06	1.09E-06
M/L	2.20E-07	1.50E-07	1.25E-07	4.76E-08	7.50E-08	6.95E-08	7.25E-08	7.54E-08
H/E	5.02E-07	3.63E-06	1.32E-06	8.55E-07	1.14E-06	1.15E-06	1.23E-06	1.39E-06
H/I	1.07E-07	2.99E-07	2.98E-07	3.31E-07	3.74E-07	2.30E-07	2.34E-07	2.37E-07
H/L	5.00E-07	3.70E-07	3.27E-07	1.41E-07	1.99E-07	1.77E-07	1.88E-07	2.18E-07
Total Release	6.15E-06	2.28E-05	1.04E-05	6.85E-06	9.18E-06	8.39E-06	8.72E-06	9.52E-06

No changes to major modeling assumptions, containment event tree structure, accident progression / source term calculations, or binning of end states in the Level 2 PRA model have been made since the IPE submittal

3.3 MODEL REVIEW SUMMARY

DAEC was the first non-pilot plant to have a PSA Peer Certification (BWROG 1997). The PSA Certification process used a team of experienced PSA and system analysts to provide both an objective review of the PSA technical elements and a subjective assessment based on their PSA experience regarding the acceptability of the PSA elements.

The review team consisted of participants with significant expertise in both PSA development and PSA applications. The team was knowledgeable of PSA methodology and applications, nuclear plant design, and operational practices. The team utilized checklists to evaluate the scope, comprehensiveness, completeness, and fidelity of the DAEC PSA products available.

4.1 OFF-SITE EXPOSURE COST

Accident-Related Off-Site Dose Costs

Offsite doses were determined using the MACCS2 model developed for DAEC. Costs associated with these doses were calculated using the following equation:

$$APE = \left(F_S D_{P_S} - F_A D_{P_A}\right) R \frac{1 - e^{-rt_f}}{r} \qquad (1)$$

where:

APE = monetary value of accident risk avoided due to population doses, after discounting

R = monetary equivalent of unit dose, ($/person-rem)

F = accident frequency (events/yr)

D_P = population dose factor (person-rem/event)

S = status quo (current conditions)

A = after implementation of proposed action

r = real discount rate

t_f = years remaining until end of facility life

The values used are:

R = $2000/person-rem

r = 0.07

$$APE = (\$2.15E+4)\left(F_S D_{P_S} - F_A D_{P_A}\right)$$

4.2 OFF-SITE ECONOMIC COST

Accident-Related Off-Site Property Damage Costs

$$AOC = \left(F_S P_{D_S} - F_A P_{D_A}\right) \frac{1 - e^{-rt_f}}{r}$$

AOC = monetary value of accident risk avoided due to offsite property damage, after discounting

P_D = offsite property loss factor (dollars/event)

Table 5.5-1 List of SAMA Candidates (Cont)

DAEC SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source
162	Install concrete barriers around the auxiliary boiler propane tank.	Eliminate the risk of propane tank damage and subsequent fire/explosion caused by vehicle impacts on the propane tank.	IPEEE	DAEC IPEEE (IES 1995)
163	Improve the reliability of the RWS system control valves CV4914 and CV4915.	Decreased risk due to failures of the RWS system. (High PRA importance list.)	PRA	DAEC PRA Rev 5C (FPL 2007b)
164	Improve the reliability of the RWS control system.	Decreased risk due to failures of the RWS system. (High PRA importance list - HS- 4914.)	PRA	DAEC PRA Rev 5C (FPL 2007b)
165	Improve the reliability of the RHRSW loop differential pressure indicators.	Decreased risk due to failures of the RHRSW system. (High PRA importance list.)	PRA	DAEC PRA Rev 5C (FPL 2007b)
166	Increase the reliability of the low pressure ECCS RPV low pressure permissive circuitry. Install manual bypass of low pressure permissive.	Decreased risk due to failures of the low pressure ECCS systems. (High PRA importance list.)	PRA	DAEC PRA Rev 5C (FPL 2007b)
167	Enhance the support of the Turbine Lube Oil Tank	Decreased risk of fire post seismic event.	IPEEE	May 2009 RAI

Table 6-1 DAEC Phase I SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	Screened Out Ph 1?	Screening Criterion	Phase I Disposition
99	Construct a building to be connected to primary/secondary containment and maintained at a vacuum.	Reduced probability of containment over-pressurization.	Yes	D - Excess Cost	Excess Cost.
104	Erect a barrier that would provide enhanced protection of the containment walls (shell) from ejected core debris following a core melt scenario at high pressure.	Reduced probability of containment failure.	Yes	D - Excess Cost	Excess Cost.
106	Add redundant and diverse limit switches to each containment isolation valve.	Reduced frequency of containment isolation failure and ISLOCAs.	Yes	D - Excess Cost	Cost would exceed MAB.
109	Install self-actuating containment isolation valves.	Reduced frequency of isolation failure.	Yes	D - Excess Cost	Modification cost would exceed maximum benefit.
118	Add an independent boron injection system.	Improved availability of boron injection during ATWS.	Yes	D - Excess Cost	Cost would exceed MAB
167	Enhance the support of the Turbine Lube Oil Tank	Decreased risk of fire post seismic event.	Yes	D - Excess Cost	Cost would be more than four times the benefit.
10	Provide an additional diesel generator.	Increased availability of on-site emergency AC power.	No		Retain for Phase II analysis. Could conceivably use TSC Diesel. However, there are no plans to do so.
12	Improve 4.16-kV bus cross-tie ability.	Increased availability of on-site AC power.	No		Retain for Phase II analysis.
15	Install a gas turbine generator.	Increased availability of on-site AC power.	No		Retain for Phase II analysis.
17	Install a steam-driven turbine generator that uses reactor steam and exhausts to the suppression pool.	Increased availability of on-site AC power.	No		Retain for Phase II analysis.
27	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	No		Retain for Phase II analysis.
28	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	No		Retain for Phase II analysis.

Table 6-1 DAEC Phase I SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	Screened Out Ph 1?	Screening Criterion	Phase I Disposition
35	Add signals to open safety relief valves automatically in an MSIV closure transient.	Reduced likelihood of SRV failure to open in an MSIV closure transient reduces the probability of a medium LOCA.	No		Retain for Phase II analysis. Open reliably now.
39	Increase flow rate of suppression pool cooling.	Improved suppression pool cooling.	No		Retain for Phase II analysis. Do not need more flow, backup is better solution. See item 75.
41	Provide capability for alternate injection via reactor water cleanup (RWCU).	Improved injection capability.	No		Retain for Phase II analysis. No connections.
49	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high-and low-pressure safety injection systems.	No		Retain for Phase II analysis.
52	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	No		Retain for Phase II analysis. Core spray now cooled by ESW.
55	Implement modifications to allow manual alignment of the fire water system to RHR heat exchangers.	Improved ability to cool RHR heat exchangers.	No		Retain for Phase II analysis.
56	Add a service water pump.	Increased availability of cooling water.	No		Retain for Phase II analysis.
75	Install an independent method of suppression pool cooling.	Increased availability of containment heat removal.	No		Retain for Phase II analysis.
78	Enable flooding of the drywell head seal.	Reduced probability of leakage through the drywell head seal.	No		Retain for Phase II analysis.
107	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	No		Retain for Phase II analysis.
117	Increase boron concentration or enrichment in the SLC system.	Reduced time required to achieve shutdown concentration provides increased margin in the accident timeline for successful initiation of SLC.	No		Retain for Phase II analysis.
120	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	No		Retain for Phase II analysis.

Table 6-1 DAEC Phase I SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	Screened Out Ph 1?	Screening Criterion	Phase I Disposition
123	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	No		Retain for Phase II analysis.
139	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	No		Retain for Phase II analysis.
156	Provide an alternate source of water for the RHRSW/ESW pit.	Decrease the contribution to risk due to failure of the RWS system.	No		Retain for Phase II analysis.
163	Improve the reliability of the RWS system control valves CV4914 and CV4915.	Decreased risk due to failures of the RWS system. (High PRA importance list.)	No		Retain for Phase II analysis.
164	Improve the reliability of the RWS control system.	Decreased risk due to failures of the RWS system. (High PRA importance list - HS-4914.)	No		Retain for Phase II analysis.
166	Increase the reliability of the low pressure ECCS RPV low pressure permissive circuitry. Install manual bypass of low pressure permissive.	Decreased risk due to failures of the low pressure ECCS systems. (High PRA importance list.)	No		Retain for Phase II analysis.

Table 7.1.3-1 DAEC Phase II SAMA Analysis

DAEC SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
10	Provide an additional diesel generator.	Increased availability of on-site emergency AC power.	37.79%	41.43%	NOSBO	This case determines the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purposes of the analysis, a single bounding analysis is performed which assumes the standby diesel generators do not fail.	$954k	$10M	Expert Panel.	Not Cost-Beneficial	Cost exceeds MAB.
12	Improve 4.16-kV bus cross-tie ability.	Increased availability of on-site AC power.	12.38%	18.18%	NOSBO2A	This case was used to determine the benefit of installing a cross-tie between the two 4160V busses. For the purposes of the analysis, a single bounding analysis was performed which assumed the Div. I diesel generator does not fail. The Div. I diesel generator was chosen since it has higher risk reduction worth than the Div. II diesel generator	$399k	$1.6M	Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit.
15	Install a gas turbine generator.	Increased availability of on-site AC power.	37.79%	41.43%	NOSBO	This case determines the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purposes of the analysis, a single bounding analysis is performed which assumes the standby diesel generators do not fail.	$954k	$5M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB

Table 7.1.3-1 DAEC Phase II SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
17	Install a steam-driven turbine generator that uses reactor steam and exhausts to the suppression pool.	Increased availability of on-site AC power.	37.79%	41.43%	NOSBO	This case determines the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purposes of the analysis, a single bounding analysis is performed which assumes the standby diesel generators do not fail.	$954k	$20M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
27	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	26.16%	26.08%	LOCA03	This case determines the impact of eliminating the small, medium, and large LOCA initiators, the break outside of containment initiator, the inadvertent open relief valve initiator, and stuck open relief valve sequences in the quantification of the PRA model.	$570k	$20M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
28	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	37.21%	35.99%	LOCA01	This case determines the benefit of the HPCI system operating without failure. For the purposes of the analysis, a single bounding analysis is performed which assumes the HPCI system does not fail.	$814k	$10M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
35	Add signals to open safety relief valves automatically in an MSIV closure transient.	Reduced likelihood of SRV failure to open in an MSIV closure transient reduces the probability of a medium LOCA.	15.12%	7.64%	SRV01	This case determines the benefit of safety/relief valves successfully opening without failure. For the purposes of the analysis, a single bounding analysis is performed which assumes the safety/relief valves do not fail to open when demanded.	$185k	$1M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit.

Table 7.1.3-1 DAEC Phase II SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
39	Increase flow rate of suppression pool cooling.	Improved suppression pool cooling.	8.14%	8.36%	CONT01	This case determines the benefit of eliminating all containment heat removal failures. For the purpose of the analysis, a single bounding analysis is performed which assumes the event tree node representing torus cooling is always successful.	$167k	$2.3M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
41	Provide capability for alternate injection via reactor water cleanup (RWCU).	Improved injection capability.	16.28%	15.96%	LOCA04	Eliminate all steam line breaks and stuck open SRVs. This will be used to evaluate using RWCU for vessel injection. RWCU injection will only be effective for LOCAs that represent a steam break.	$345k	$4.0M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
49	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high- and low-pressure safety injection systems.	26.16%	26.08%	LOCA03	This case determines the impact of eliminating the small, medium, and large LOCA initiators, the break outside of containment initiator, the inadvertent open relief valve initiator, and stuck open relief valve sequences in the quantification of the PRA model.	$570k	$20M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
52	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	26.16%	26.08%	LOCA03	This case determines the impact of eliminating the small, medium, and large LOCA initiators, the break outside of containment initiator, the inadvertent open relief valve initiator, and stuck open relief valve sequences in the quantification of the PRA model.	$570k	$1.5M	Per Expert Panel. $700k per motor x 2, engineering costs, plus installation	Not Cost-Beneficial	Cost Exceeds Benefit.

Table 7.1.3-1 DAEC Phase II SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
55	Implement modifications to allow manual alignment of the fire water system to RHR heat exchangers.	Improved ability to cool RHR heat exchangers.	4.65%	8.65%	SW01	This case determines the benefit of the RHR Service Water system operating without failure. For the purposes of the analysis, a single bounding analysis is performed which assumes the RHR Service Water system does not fail.	$156k	$500k	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
56	Add a service water pump.	Increased availability of cooling water.	4.65%	8.65%	SW01	This case determines the benefit of the RHR Service Water system operating without failure. For the purposes of the analysis, a single bounding analysis is performed which assumes the RHR Service Water system does not fail.	$156k	$1M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
75	Install an independent method of suppression pool cooling.	Increased availability of containment heat removal.	8.14%	8.36%	CONT01	This case determines the benefit of eliminating all containment heat removal failures. For the purpose of the analysis, a single bounding analysis is performed which assumes the event tree node representing torus cooling is always successful.	$167k	$1M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
78	Enable flooding of the drywell head seal.	Reduced probability of leakage through the drywell head seal.	0.00%	1.77%	CONT02B	Eliminate all failures of the drywell head flange seal.	$26k	$100k	Expert Panel Procedure, does not consider ability to access area.	Not Cost-Beneficial	Cost Exceeds Benefit
107	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	0.58%	0.52%	ISLOCA	This case determines the impact of eliminating all Interfacing System LOCA initiated sequences in the quantification of the PRA model.	$10.5k	$2.3M	Per Expert Panel. Plant must be shutdown in order to test.	Not Cost-Beneficial	Cost Exceeds MAB. All ISLOCA paths have pressure monitoring instrumentation.

Table 7.1.3-1 DAEC Phase II SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
117	Increase boron concentration or enrichment in the SLC system.	Reduced time required to achieve shutdown concentration provides increased margin in the accident timeline for successful initiation of SLC.	6.60%	6.00%	ATWS02	Eliminate all failures of SLC to inject. In other words, successful boron injection in ATWS scenarios.	137k	$400k	Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
120	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	29.65%	25.63%	NOATWS	This case determines the benefit of eliminating all ATWS events. For the purposes of the analysis, a single bounding analysis is performed which assumes that ATWS events do not occur.	$590k	$5M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
123	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	29.65%	25.63%	NOATWS	This case determines the benefit of eliminating all ATWS events. For the purposes of the analysis, a single bounding analysis is performed which assumes that ATWS events do not occur.	$590k	$3M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
139	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	26.16%	26.08%	LOCA03	This case determines the impact of eliminating the small, medium, and large LOCA initiators, the break outside of containment initiator, the inadvertent open relief valve initiator, and stuck open relief valve sequences in the quantification of the PRA model.	$570k	$13M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB

Table 7.1.3-1 DAEC Phase II SAMA Analysis (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
156	Provide an alternate source of water for the RHRSW/ESW pit.	Decrease the contribution to risk due to failure of the RWS system.	12.79%	14.62%	RWS01	Eliminate all failures of the RWS system.	$320k	$250k	Per Expert Panel. Add a T-connection and valve to the pipe connecting the RHRSW/ESW pit to the Circ Water pit to allow for backflow from the Circ Water pit to the RHRSW/ESW pit.	Potentially Cost-Beneficial	Potentially Cost-Beneficial
163	Improve the reliability of the RWS system control valves CV4914 and CV4915.	Decreased risk due to failures of the RWS system. (High PRA importance list.)	12.79%	14.62%	RWS01	Eliminate all failures of the RWS system.	$320k	$1M	Per Expert Panel. Add a parallel path with piping and valve to each loop.	Not Cost-Beneficial	Cost Exceeds Benefit
164	Improve the reliability of the RWS control system.	Decreased risk due to failures of the RWS system. (High PRA importance list - HS- 4914.)	0.37%	0.49%	RWS02 Vs BASE02	Eliminate all failures of RWS handswitch HS-4914 and the corresponding switch in the opposite loop.	$10k	$100k	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit.
166	Increase the reliability of the low pressure ECCS RPV low pressure permissive circuitry. Install manual bypass of low pressure permissive.	Decreased risk due to failures of the low pressure ECCS systems. (High PRA importance list.)	6.40%	13.20%	LOCA05	Eliminate all failures of the low pressure ECCS low reactor pressure permissive pressure switches.	$276k	$250k	Per Expert Panel, for jumpers in control panel covered by procedure.	Potentially Cost-Beneficial	Potentially Cost Beneficial.

Table 8.2-1 DAEC Sensitivity Evaluation

DAEC SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit	Benefit at 3% Disc Rate	Benefit at BE Disc Rate	Benefit at 27yrs	Benefit at UB	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
10	Provide an additional diesel generator.	Increased availability of on-site emergency AC power.	NOSBO	$954k	$1,376k	$850k	$1,093k	$2,386k	$10M	Expert Panel.	Not Cost-Beneficial	Cost Exceeds Benefit
12	Improve 4.16-kV bus cross-tie ability.	Increased availability of on-site AC power.	NOSBO2A	$399k	$572k	$354k	$456k	$998k	$1.6M	Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
15	Install a gas turbine generator.	Increased availability of on-site AC power.	NOSBO	$954k	$1,376k	$805k	$1,093k	$2,386k	$5M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB
17	Install a steam-driven turbine generator that uses reactor steam and exhausts to the suppression pool.	Increased availability of on-site AC power.	NOSBO	$954k	$1,376k	$850k	$1,093k	$2,386k	$20M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
27	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	LOCA03	$570k	$826k	$508k	$655k	$1,426k	$20M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
28	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	LOCA01	$814k	$1,179k	$725k	$935k	$2,035k	$10M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
35	Add signals to open safety relief valves automatically in an MSIV closure transient.	Reduced likelihood of SRV failure to open in an MSIV closure transient reduces the probability of a medium LOCA.	SRV01	$185k	$275k	$164k	$215k	$462k	$1M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
39	Increase flow rate of suppression pool cooling.	Improved suppression pool cooling.	CONT01	$167k	$242k	$149k	$192k	$418k	$2.3M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
41	Provide capability for alternate injection via reactor water cleanup (RWCU).	Improved injection capability.	LOCA04	$345k	$499k	$307k	$396k	$861k	$4.0M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
49	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high-and low-pressure safety injection systems.	LOCA03	$570k	$826k	$508k	$655k	$1,426k	$20M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
52	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	LOCA03	$570k	$826k	$508k	$655k	$1,426k	$1.5M	Per Expert Panel. $700k per motor x 2, engineering costs, plus installation	Not Cost-Beneficial	Cost Exceeds Benefit
55	Implement modifications to allow manual alignment of the fire water system to RHR heat exchangers.	Improved ability to cool RHR heat exchangers.	SW01	$156k	$224k	$139k	$178k	$391k	$500k	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
56	Add a service water pump.	Increased availability of cooling water.	SW01	$156k	$224k	$139k	$178k	$391k	$1M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
75	Install an independent method of suppression pool cooling.	Increased availability of containment heat removal.	CONT01	$167k	$242k	$149k	$192k	$418k	$1M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
78	Enable flooding of the drywell head seal.	Reduced probability of leakage through the drywell head seal.	CONT02B	$26k	$36k	$23k	$29k	$65k	$100k	Expert Panel, for procedure, does not consider abiliity to access area.	Not Cost-Beneficial	Cost exceeds benefit.
107	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	ISLOCA	$10.5k	$14.9k	$9.3k	$11.9k	$26.1k	$2.3M	Per Expert Panel. Plant must be shutdown in order to test.	Not Cost-Beneficial	Cost Exceeds MAB. All ISLOCA paths have pressure monitoring instrumentation.

Table 8.2-1 DAEC Sensitivity Evaluation (Cont.)

DAEC SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit	Benefit at 3% Disc Rate	Benefit at BE Disc Rate	Benefit at 27yrs	Benefit at UB	Minimum Cost	Cost Basis	Evaluation	Basis for Evaluation
117	Increase boron concentration or enrichment in the SLC system.	Reduced time required to achieve shutdown concentration provides increased margin in the accident timeline for successful initiation of SLC.	ATWS02	$137k	$198k	$122k	$157k	$342k	$400k	Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
120	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	NOATWS	$590k	$857k	$525k	$678k	$1,474k	$5M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
123	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	NOATWS	$590k	$857k	$525k	$678k	$1,474k	$3M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
139	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	LOCA03	$570k	$826k	$508k	$655k	$1,426k	$13M	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds MAB.
156.	Provide an alternate source of water for the RHRSW/ESW pit.	Decrease the contribution to risk due to failure of the RWS system.	RWS01	$320k	$461k	$285k	$366k	$800k	$250k	Per Expert Panel. Add a T-connection and valve to the pipe connecting the RHRSW/ESW pit to the Circ Water pit to allow for backflow from the Circ Water pit to the RHRSW/ESW pit.	Potentially Cost-Beneficial	Potentially Cost-Beneficial
163	Improve the reliability of the RWS system control valves CV4914 and CV4915.	Decreased risk due to failures of the RWS system. (High PRA importance list.)	RWS01 Vs BASE02	$320k	$461k	$285k	$366k	$800k	$1M	Per Expert Panel. Add a parallel path with piping and valve to each loop.	Not Cost-Beneficial	Cost Exceeds Benefit
164	Improve the reliability of the RWS control system.	Decreased risk due to failures of the RWS system. (High PRA importance list - HS-4914.)	RWS02b2	$10.0k	$14.4k	$8.9k	$11.5k	$25.1k	$100k	Per Expert Panel	Not Cost-Beneficial	Cost Exceeds Benefit
166	Increase the reliability of the low pressure ECCS RPV low pressure permissive circuitry. Install manual bypass of low pressure permissive.	Decreased risk due to failures of the low pressure ECCS systems. (High PRA importance list.)	LOCA05	$276k	$393k	$246k	$314k	$690k	$250k	Per Expert Panel, for jumpers in control panel covered by procedure.	Potentially Cost-Beneficial	Potentially Cost Beneficial.

Note: The benefits in this table are provided for 5 cases: (1) "Benefit" – Baseline benefit calculated using nominal values for all parameters; (2) "Benefit at 3% Disc Rate" – Benefit calculated using 3% discount rate rather than the nominal 7%; (3) "Benefit at BE Disc Rate" – Benefit calculated using the best estimate discount rate of 8.5% provided by DAEC rather than the nominal 7%; (4) "Benefit at 27yrs" – Benefit using a 27-year calculation period rather than the nominal 20 years; and (4) "Benefit at UB" – Benefit calculated using the upperbound of CDF as defined by DAEC rather than the point estimate for CDF.