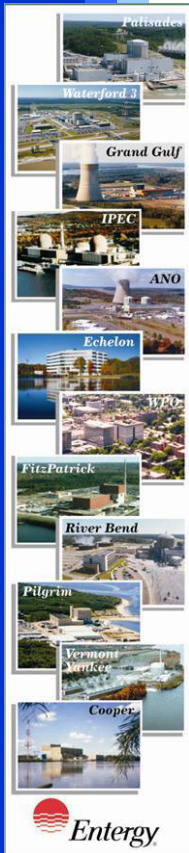




License Amendment Request NFPA 805 Acceptance Review

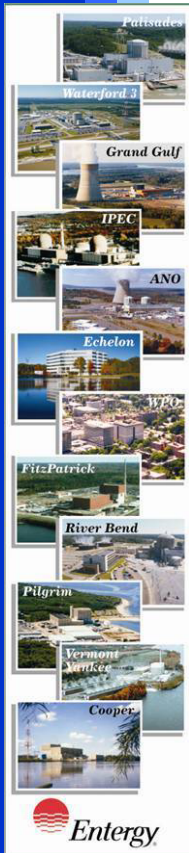
Arkansas Nuclear One Unit 2

June 12, 2012



NRC four areas of concern with the LAR

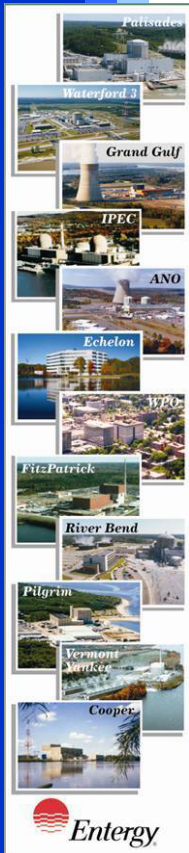
- The modifications for transition need to be described and, as appropriate, modeled in the PRA to properly estimate the change in risk associated with transition. The LAR needs to be supplemented with the descriptions of these modifications and provide adequate information to review the evaluations supporting these modifications.
- About one third of the fire areas in the "Additional Risk of RAs" column of Table W-2 of the LAR do not contain a quantitative risk result. The LAR needs to be supplemented with all of the quantitative Recovery Action risk estimates to demonstrate that the evaluations supporting the transition have been satisfactorily completed.
- Attachment G of the LAR states that ANO-2 has no primary control station, besides the Main Control Room (MCR), yet only eight Recovery Actions are identified for Fire Area G. It is also unclear how both the total change in risk and the additional risk from Recovery Actions is bounded by a risk estimate of "0.0." The LAR needs to be supplemented with additional discussion about the planned modifications and Recovery Actions, and how these are modeled in the PRA in sufficient detail to explain the unexpected results.
- Two sensitivity studies compare the results based on one "unaccepted method" to results based on another "unaccepted method." The LAR needs to be supplemented with the risk results (in relation to the sensitivity analyses for non-suppression probability for long-term fires and adjustment factor for electrical cabinet ignition frequency) calculated using an acceptable analysis method.





Technical Acceptance Issues

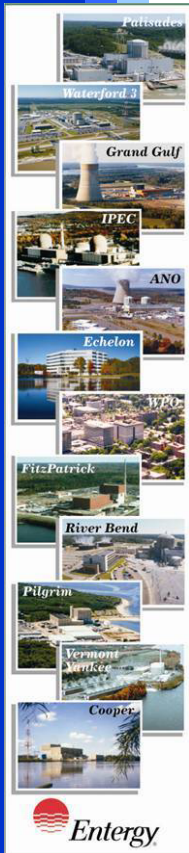
1. ANO has prepared more detailed modification descriptions. Draft changes available for discussion.
2. ANO has prepared a draft analysis to address the risk estimates of the quantitative Recovery Actions (RA). These draft RA risk values are available for discussion.
3. ANO will explain the results in Fire Area G (Control Room) and how the mods and RAs were modeled in the Fire PRA.
4. ANO has drafted a new Sensitivity analysis in compliance with NUREG/CR-6850 for comparison to the current results. Further analysis is needed to accurately reflect the risk and minimize the need for unnecessary plant modifications.





Item No. 1 – Modification Details

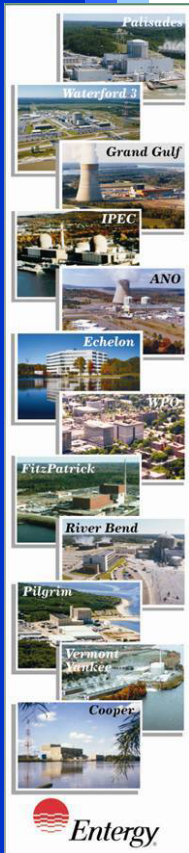
The modifications for transition need to be described and, as appropriate, modeled in the PRA to properly estimate the change in risk associated with transition. The LAR needs to be supplemented with the descriptions of these modifications and provide adequate information to review the evaluations supporting these modifications.





Item No. 1 – Modification Details

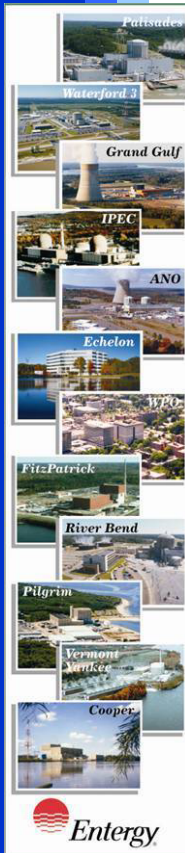
- Detailed final plant configurations have been completed and will be discussed for all 16 modifications identified
- The modifications will be completed in a manner that supports the assumptions of the Fire PRA





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Insert Att. S Excerpt



Att S Proposed Update_060812Rev1.pdf - Adobe Reader

File Edit View Document Tools Window Help

6 / 8 150% Find

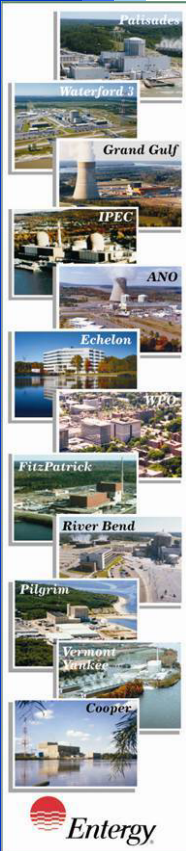
Statement	Proposed Modification	Amended Proposed Modification	In F
ity of feedwater to ntified as an issue	ANO will provide a modification to assure a source of AFW to one of the SGs. The plant change will resolve multiple issues for existing areas where EFW is impacted.	ANO plans to install a new Auxiliary Feedwater Pump (AFW) capable of feeding one of the ANO-2 steam generators, or utilize an existing ANO-2 Auxiliary Feedwater Pump. The modification is planned to ensure that fire impacts to ANO-2 are acceptable.	Y
A was ANO's gh risk and time sh as control of AFW), outside of om.	ANO will provide a modification for a local control panel to perform critical operator actions outside the ANO-2 control room. As a minimum, the panel will permit control of AFW.	A new AFW pump would be designed to meet or exceed the flow requirements of the ANO-2 Emergency Feedwater Pump 2P-7B (380 gpm @ 1100 psig). A new AFW pump would be designed with the capability to be operated from the ANO-2 Control Room and locally at the pump. A new AFW pump and associated motor operated valves would be designed to be powered by diverse non-safety related power sources to prevent a single exposure fire from disabling equipment operation. A new AFW pump modification would be designed to include local controls and monitoring instrumentation to ensure proper water flow from the AFW pump to the steam generator. The local panel would include SG level, SG pressure, and AFW flow instrumentation. The controls and monitoring instrumentation for the AFW pump would be located in a panel installed in the same fire zone as the AFW pump with a backup DC power supply.	

17.00 x 11.00 in



Item No. 2 – Risk Estimates for Recovery Actions

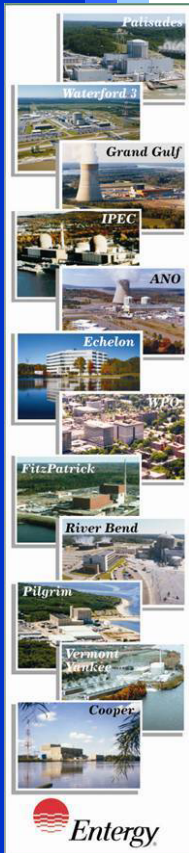
About one third of the fire areas in the "Additional Risk of RAs" column of Table W-2 of the LAR do not contain a quantitative risk result. The LAR needs to be supplemented with all of the quantitative Recovery Action risk estimates to demonstrate that the evaluations supporting the transition have been satisfactorily completed.





Item No. 2 – Risk Estimates for Recovery Actions

- The delta risk from recoveries are currently being drafted and preliminary results are available for review
- An example of the information to be provided in the Supplement to the ANO-2 LAR is contained in the next slide





Example of the information to be provided in the Supplement to address the delta risk of recoveries

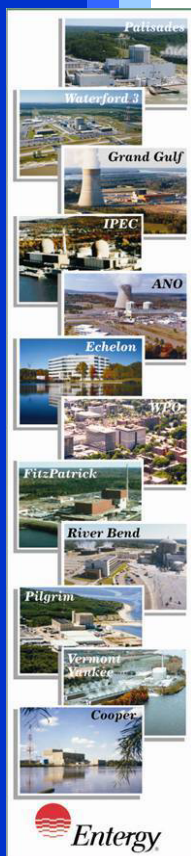
Table W-2 ANO-2 Fire Area Risk Summary

Fire Area	Area Description	NFPA 805 Basis	Fire Area CDF	Fire Area LERF	VFDR (Yes/No)	Recovery Actions	Fire Risk Eval Δ CDF	Fire Risk Eval Δ LERF	Additional Risk of RAs (CDF/LERF)
DD	fire zones 2019-JJ, 2032-JJ, 2040-JJ, and 2068-DD (acid condensate tank room, spent resin storage tank room, corridor, and hot machine shop)							-9.64E-08	n/a
EE-L	fire zones 2055-JJ and 2068-DD (piping penetration rooms)							-2.64E-08	-6.00E-09/1.51E-09
EE-U	fire zone 2111-T (lower south electrical penetration room)	4.2.4.2	2.03E-06	4.81E-08	yes	yes	-5.77E-06	-1.94E-07	2.00E-08/2.70E-09
FF	fire zone 2025-JJ (motor-driven emergency feedwater pump room)	4.2.3.2	1.15E-08	3.66E-10	no	n/a	n/a	n/a	n/a
G	fire zones 2199-G, 2119-H, 2136-I, 2137-I, 2150-C, 2098-C, and 2098-L (control room and other alternate shutdown areas)	4.2.4.2	2.64E-06	3.52E-08	yes	yes	-2.65E-06	-9.78E-08	-2.00E-08/1.60E-09
GG	fire zones 2074-HH and 2081-HH (electrical equipment room and upper north and lower north piping penetration room).	4.2.4.2	1.03E-06	2.17E-08	yes	yes	-1.12E-05	-3.82E-07	-9.27E-06/3.20E-09
HH	fires zones 2063-DD, 2072-R, 2073-DD, 2096-M, 2106-R, and 2107-N (sample room, VCT room, 2B-62 room, 2B-63 room, degasifier vacuum pump room, and corridor)	4.2.4.2	3.11E-06	4.65E-08	yes	yes	-5.80E-07	-2.18E-08	-1.13E-06/1.23E-08
II	fire zone 2101-AA (north switchgear 2A-3 room)	4.2.4.2	2.90E-06	9.31E-08	yes	yes	-1.33E-04	-4.52E-06	-2.70E-07/6.80E-09
JJ	fire zone 2109-U (corridor)	4.2.4.2	2.70E-06	7.97E-08	yes	yes	-3.78E-06	-1.21E-07	-1.50E-07/1.24E-08
K	fire zones 16-Y and 2020-JJ (clean waste receiver tank room and boron holdup tank vault)	4.2.3.2	6.47E-10	1.44E-11	no	n/a	n/a	n/a	n/a

Revised Column for delta risk of Recovery action only



Example of the information to be provided in the Supplement to address the delta risk of recoveries



Zero delta risk removed and actual delta risk incorporated to show negative delta risk

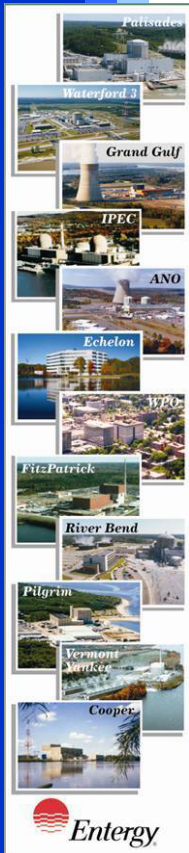
Table W-2 ANO 2 Fire Area Risk Summary

Fire Area	Area	Fire Risk Eval Δ CDF	Fire Risk Eval Δ LERF	Additional Risk of RAs (CDF/LERF)
DD	fire zone 2040-I, acid storage room	-2.85E-06	-9.64E-08	n/a
EE-L	fire zone DD	-7.89E-07	-2.64E-08	-6.00E-09/1.51E-09
EE-U	fire zone electrical penetration room)	-5.77E-06	-1.94E-07	2.00E-08/2.70E-09
FF	fire zone 2025-JJ (motor-driven emergency feedwater pump room)	n/a	n/a	n/a
G	fire zones 2199-G, 2119-H, 2136-I, 2137-I, 2150-C, 2098-C, and 2098-L (control room and other alternate shutdown areas)	-2.65E-06	-9.78E-08	-2.00E-08/1.60E-09
GG	fire zones 2074-HH and 2081-HH (electrical equipment room and upper north and lower north piping penetration room).	-1.12E-05	-3.82E-07	-9.27E-06/3.20E-09
HH	fires zones 2063-DD, 2072-R, 2073-DD, 2096-M, 2106-R, and 2107-N (sample room, VCT room, 2B-62 room, 2B-63 room, degasifier vacuum pump room, and corridor)	-5.80E-07	-2.18E-08	-1.13E-06/1.23E-08
II	fire zone 2101-AA (north switchgear 2A-3 room)	-1.33E-04	-4.52E-06	-2.70E-07/6.80E-09
JJ	fire zone 2109-U (corridor)	-3.78E-06	-1.21E-07	-1.50E-07/1.24E-08
K	fire zones 16-Y and 2020-JJ (clean waste receiver tank room and boron holdup tank vault)	n/a	n/a	n/a



Item No. 3 – Recovery Actions Credited for Control Room Abandonment

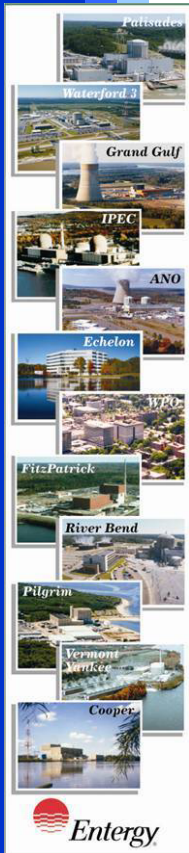
Attachment G of the LAR states that ANO-2 has no primary control station, besides the Main Control Room (MCR), yet only eight Recovery Actions are identified for Fire Area G. It is also unclear how both the total change in risk and the additional risk from Recovery Actions is bounded by a risk estimate of "0.0." The LAR needs to be supplemented with additional discussion about the planned modifications and Recovery Actions, and how these are modeled in the PRA in sufficient detail to explain the unexpected results.





Item No. 3 – Recovery Actions Credited for Control Room Abandonment

- Fire Area G contains several zones including the Control Room
- A fire in Fire Area G may result in control room abandonment
- Mods and operator actions outside the Control Room have been credited for Core Damage Mitigation

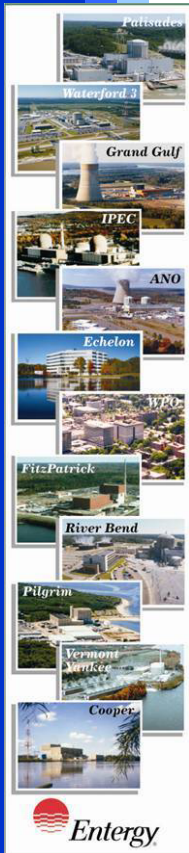




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Proposed Control Room Modifications for Transition to NFPA-805

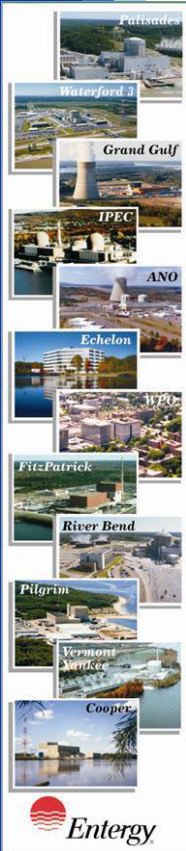
- Modification to eliminate potential spurious operation
 - 2CV-1002 ADV Block valve
 - 2CV-1052 ADV Block valve
 - 2CV-4698-1 ECCS Vent Valve
- AFW Modification





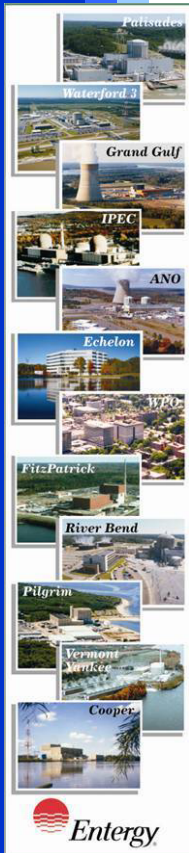
Human Recovery Actions Credited for Control Room Abandonment Scenario

- Operator action to Isolate blowdown
- Operator action to Isolate Letdown Flow
- Operator action to trip RCPs at the switchgear
- Operator action to start and align AFW
- Operator action to stop Charging Pumps
- A specific location is used by the Shift Manager to monitor process instrumentation and coordinate operations activities





Entergy Control Room Analysis Discussion



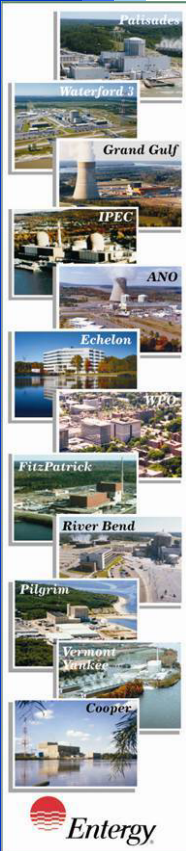
- RCS integrity and primary to secondary heat removal are evaluated crediting the proposed mods and recoveries
- Additional Defense in Depth actions will enhance plant control and reduce the likelihood of equipment damage
- CDF = $\sim 2.6E-06$ (Crediting mods and recovery actions)



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Control Room Analysis Discussion (Cont'd)

- Spurious Operation of equipment has been considered in the Fire PRA analysis.
 - Pump start with no suction
 - HPSI – mini-recirc capability
 - LPSI – spurious pump start
 - EDG and support systems assumed failed



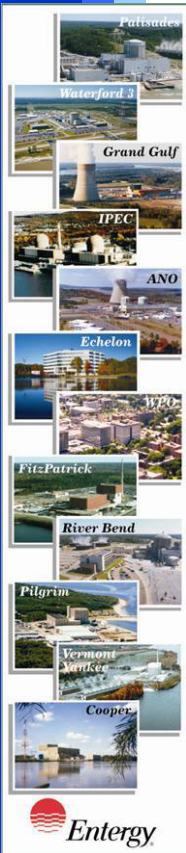


Control Room Analysis Discussion (Cont'd)

Compliant Case Analysis Methodology

- Control Room Variance from Deterministic Requirements (VFDR)

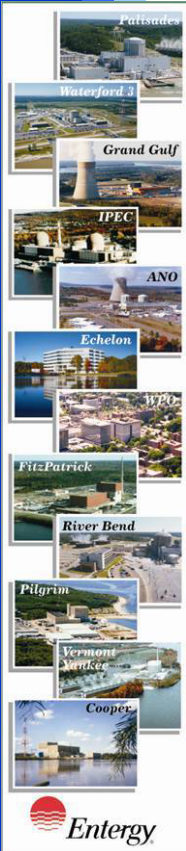
<u>Performance Goal</u>	<u>Current Method Of Accomplishment</u>	<u>Comments</u>
Reactivity Control	Manual reactor trip from the Control Room.	VFDR – FRE is required
Inventory Control	Letdown isolated and RCPs secured to maintain seal integrity.	VFDR – FRE is required
Pressure Control	RCS vent paths are secured.	VFDR – FRE is required
Decay Heat Removal	Main steam isolated, normal feedwater secured, and steam release using MSSVs, if atmospheric dump valves are not immediately available. EFW pump 2P-7A feeding SG-B	VFDR – FRE is required
Vital Auxiliaries (Electrical)	ESF 4.16KV 2A-4 aligned to onsite EDG.	VFDR – FRE is required
Vital Auxiliaries (SW)	SW pump 2P-4C or 2P-4B feeding SW header 2	VFDR – FRE is required





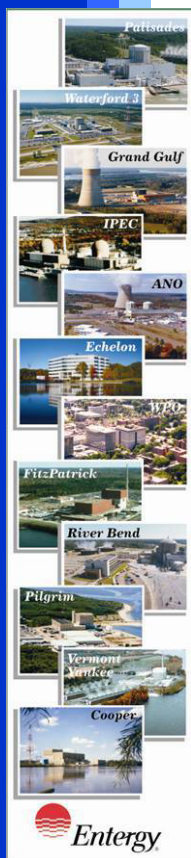
Compliant Case Analysis Methodology

- Single success train for plant control and mitigation
- RG 1.205: “The “deterministically compliant plant” has been referred to as “an ideal plant” that may not exist or be feasible in practice.”
- Modeling configuration assumed
 - EFW Train A to SG B
 - RCS remains intact





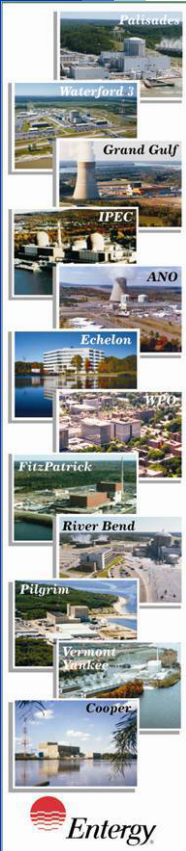
Delta Risk Analysis



Zone	Scenario Description	IGF (/rx-yr)	NSP	SF	CCDP	CDF (/rx-yr)	CLERP	LERF (/rx-yr)
2199-G	Compliant Case	3.79E-05	1.0	1.0	1.40E-01	5.29E-06	3.50E-03	1.33E-07
2199-G	Post Transition Case	3.79E-05	1.0	1.0	6.97E-02	2.64E-06	9.29E-04	3.52E-08
Results					Delta CDF		Delta LERF	
					-2.65E-06		-9.78E-08	

Item No. 4 – Sensitivity Study

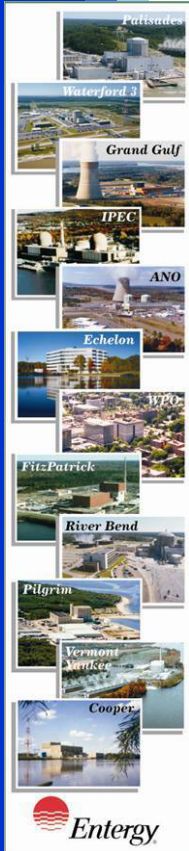
Two sensitivity studies compare the results based on one "unaccepted method" to results based on another "unaccepted method." The LAR needs to be supplemented with the risk results (in relation to the sensitivity analyses for non-suppression probability for long-term fires and adjustment factor for electrical cabinet ignition frequency) calculated using an acceptable analysis method.





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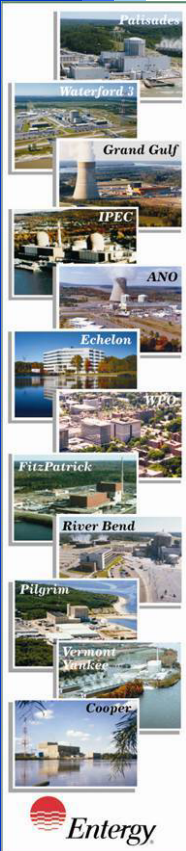
Item No. 4 – Sensitivity Study



- Electrical Panel Propagation Factors are removed from the original analysis to comply with 6850 methodology.
 - CDF Analysis
 - Multi-compartment/Hot Gas Layer (MCA/HGL) screening
- This will meet the NRC expectation for 6850 compliance

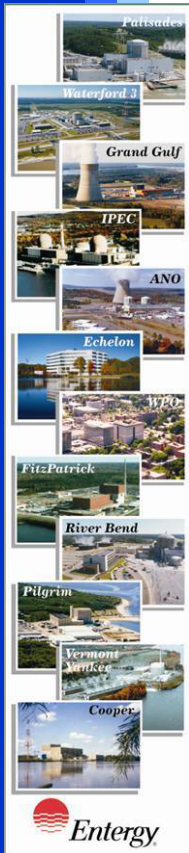
Core Damage Frequency

- Draft results show an increase in risk from that reported in Attachment W of the LAR
 - CDF increased from $4.3\text{E-}05/\text{yr}$ to $\sim 6.0\text{E-}05/\text{yr}$
 - LERF increased from $8.3\text{E-}07/\text{yr}$ to $\sim 1.3\text{E-}06/\text{yr}$
- Results will be provided in the LAR Supplement



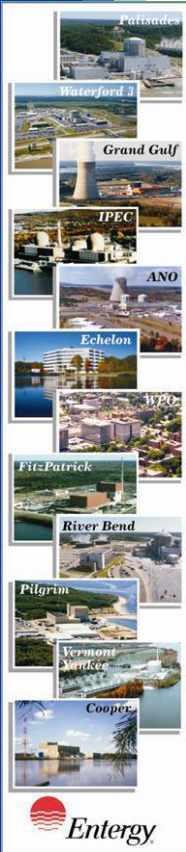
Multi-compartment/Hot Gas Layer

- Draft results show that less than 2% of 1955 previously screened scenarios will no longer screen
- The list of unscreened fire scenarios will be provided in the LAR Supplement



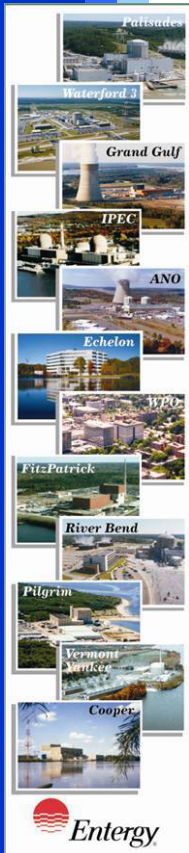
Additional Level of Effort

- Efforts have begun to perform fire modeling.
- This effort is expected to more accurately calculate the risk of a MCA/HGL as well as reduce the increase in CDF
- The refined results will be provided once this additional level of effort is completed



Example Case

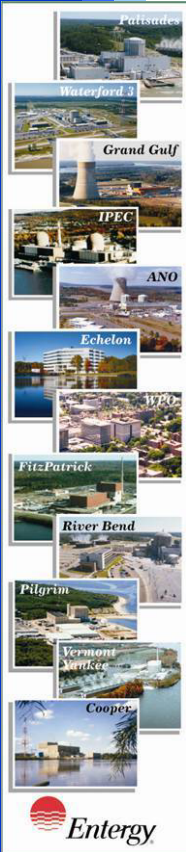
- Scenario (2098-C) was chosen to analyze the impact of additional walkdowns and fire modeling
- 2098-C is the Core Protection Calculator Room
 - This room uses Halon for fire suppression
 - Low voltage electrical panels are contained within this room
 - Current analysis assumes full room burnup
- The new fire modeling shows that a fire in this room will not generate a hot gas layer.
- This new information will be used to refine the risk results for fires in this zone





Impact on ANO-1 LAR

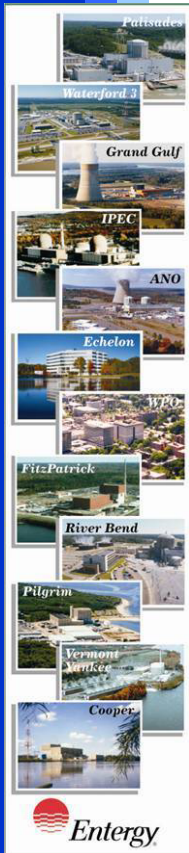
- Additional work to supplement the ANO-2 LAR challenges completion of the ANO-1 LAR
- ANO-1 has similar issues identified for ANO-2
- The ANO-1 LAR submittal is scheduled for August 31, 2012

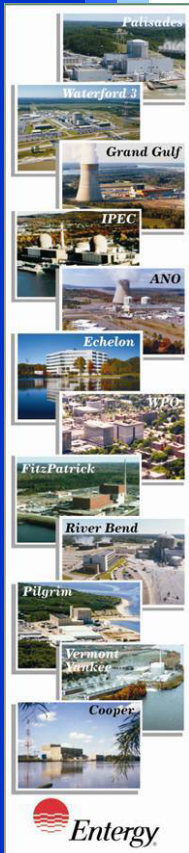




Summary

ANO-2 supplemental response will be provided by the July 11 deadline





Questions ??