U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# Vogtle ESP Mandatory Hearing

March 23-25, 2009

# NRC Staff Presentation Topic #8

# Severe Accident Mitigation Design Alternatives

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

Presenter:

J.V. Ramsdell, Jr.

Pacific Northwest National Laboratory

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# SAMDA?

- A severe accident is a low-probability, high consequence accident that is beyond the design basis for a nuclear power plant.
- The Commission Interim Policy Statement “Nuclear Power Plant Accident Considerations Under the National Environmental Policy Act of 1969” (45 FR 40101) and the Commission “Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants” (50 FR 32138) provide for review of severe accidents in environmental impact statements.
- A SAMDA is a Severe Accident Mitigation Design Alternative. It is a change in facility design intended to mitigate consequences of a severe accident.
- The severe accident review that is part of the environmental review of licensing actions includes review of SAMDAs.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# Vogtle ESP Application

- The Vogtle ESP application cites Revision 15 of the AP1000 design.
- Appendix D of 10 CFR Part 52 certifies Revision 15 of the AP1000 design.
- Paragraph VI(B)(7) of Appendix D states that SAMDA issues are resolved "…for plants referencing this appendix whose site parameters are within those specified in the severe accident mitigation design alternatives evaluation."

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# AP1000 SAMDA Evaluation

In FSER (NUREG-1793) Chapter 19 and the Environmental Assessment (SECY-05-0227, Encl. 2) for the AP1000 design certification review, the staff:

- Reviewed the AP1000 probabilistic risk assessment.
- Evaluated 16 (14 Westinghouse+2 staff) design alternatives and cost-benefit comparisons.
- Considered the results of uncertainty analyses that were conducted for the AP600 reactor SAMDA review.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# AP1000 SAMDA Environmental Assessment Conclusions

- Based on its review the staff concluded:
  - "…that none of the potential design modifications evaluated are justified on the basis of cost-benefit considerations."
  - "… it is unlikely that any other design changes would be justified in the future on the basis of person-rem exposure because the CDFs [Core Damage Frequencies] are very low on an absolute scale."

Source: United States Nuclear Regulatory Commission Environmental Assessment and Finding of No Significant Impact Relating to the Certification of the AP1000 Standard Plant Design Docket No. 52-006. (Enclosure 2 to SECY-05-0227, pages 28 and 29)

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# AP1000 SAMDA Finding

- The finding of the generic AP1000 SAMDA review in the design certification review environmental assessment is:

  "…that the evaluation provides reasonable assurance that there are no additional SAMDAs beyond those currently incorporated into the AP1000 design which are cost-beneficial, whether considered at the time of the approval of the AP1000 design certification or in connection with the licensing of a future facility referencing the AP1000 design certification, where the plant referencing this appendix is located on a site whose site parameters are within those specified in Appendix 1B of the AP1000 design control document (DCD). These issues are considered resolved for the AP1000 design." [EA at pg. 4]

- As noted earlier, this resolution of the SAMDA issues for the AP1000 certified design is codified in 10 CFR Part 52, Appendix D, Paragraph VI(B)(7).

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# Vogtle ESP SAMDA Review

- The staff's site-specific SAMDA evaluation for the Vogtle ESP application focused on whether Vogtle site-specific values are within the site parameters specified in Appendix B1 of the AP1000 DCD.
- Site-specific information appears in SAMDA evaluations as population dose risk (person-rem per reactor year) and offsite economic costs ($ per reactor year). These values are combined with other factors that are not site-specific to estimate the maximum attainable benefit (averted cost) for a SAMDA that reduces risk to zero.
- Site-specific information contributing to population dose and economic costs includes meteorology, population distribution, and land use information; together these comprise a large data set. The staff considers it more appropriate to use values that describe impacts to determine whether the site-specific values are bounded by the site parameters than to base the determination on comparison of individual elements of large data sets.
- AP1000 DCD Appendix B1 lists population dose risk (person-rem per reactor year) and maximum benefits of the AP1000 generic SAMDA review. The staff considers probability-weighted, mean population dose risks derived from Table B1-3 in the appendix and the base case and sensitivity case maximum attainable benefits listed in Table B1-4 to be the appropriate measures to determine whether the Vogtle site values are within the site parameters specified in Appendix B1.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# SAMDA Site Parameter Evaluation

| | **Population Dose Risk (first 24 hrs) person-rem/reactor year** | **Population Dose Risk (long term) person-rem/reactor year** |
|---|---|---|
| **DCD Appendix B1 (Internal Events)** | $4.32\times10^{-2}$ | $5.40\times10^{-2}$ |
| **Vogtle Site (Internal and External Events, 2065 population)** | $1.03\times10^{-2}$ | $2.75\times10^{-2}$ |
| **Vogtle Site Risk as Fraction of DCD Risk** | **24%** | **51%** |
| | **Maximum Attainable Benefit (7 % Discount Rate)** | **Maximum Attainable Benefit (3 % Discount Rate)** |
| **DCD Appendix B1 (Internal Events)** | $21,000 | $43,000 |
| **Vogtle Site (Internal and External Events)** | $18,000 | $34,000 |
| **Vogtle Site Benefit as Fraction of DCD Benefit** | **86%** | **79%** |

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# Staff Conclusions

- Based on the comparisons of the population dose risks and the maximum benefits, the staff finds that the Vogtle site-specific values are within the site parameters specified in Appendix B1 of the AP1000 Design Control Document.
- Consequently, the staff did not perform additional site-specific SAMDA review for the Vogtle ESP application because the issue has been resolved by rule.

# U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*