

**DG-1145: Combined License Applications for
Nuclear Power Plants (LWR Edition)**



**Office of Nuclear Reactor Regulation
July 11, 2006**

**Section C.I.9, Auxiliary Systems
OVERVIEW**

- Section rationale and basis
- Section references
- Chapter 9 highlights
- Selected Technical Branch insights
- What if DC or DC&ESP are referenced?
- Pre-Workshop Comments
- Q&A, Additional Discussion

Section C.I.9, Auxiliary Systems Rationale & Basis

- **Rationale:**
 - Provide guidance for 10 CFR Part 52 applicants.
- **Technical basis/input from:**
 - Regulatory Guide 1.70 REV 3 NOV 1978
 - Standard Review Plan (NUREG-0800) & draft updates
 - NEI 04-01E input
 - AP-1000 COL Action items list

Section C.I.9, Auxiliary Systems References

- 10 CFR Parts 50, 52
- 10 CFR Part 21
- Regulatory Guides
- NUREGS
- Generic Letters
- Commission Papers
- Branch Technical Positions
- ANS/ANSI/IEEE/ASME/DEMA Standards

Section C.I.9, Auxiliary Systems Highlights

- Section numbering tracks with SRP sections
- Seven Technical Branches provided input:
 - AFPB--S.Weerakody/R. Radlinski (fire prot systems & program)
 - EEEB—G. Wilson (lighting systems)
 - EICB—A. Howe (comms systems)
 - CSGB—A. Hiser/T. Bloomer (chemistry inputs)
 - SBPB—Li/Young/Jones/Shum (many balance of plant systems)
 - SCVB—R. Dennig/E. Forrest (containment & ventilation systems)
 - SBWB—G. Cranston/G. Thomas (standby liquid control-bwr's)

Section C.I.9, Auxiliary Systems Highlights, overview guidance

- Ch 9 of the FSAR: provide information about the auxiliary systems in the facility
- ID systems essential for safe S/D or protection of public health and safety
- Describe each of these systems & its design bases. Include:
 - for critical components, a safety evaluation
 - testing and inspection to verify system capability and reliability
 - required instrumentation and controls
- Systems with little or no relationship to protection of the public against exposure to radiation: Provide enough information to allow understanding of design and operation and their effect on reactor safety
- The capability of the system to function without compromising safe operation of the plant under both normal operating or transient situations
- State seismic design classifications; refer to details in Chapter 3
- Summarize radiological considerations for system ops under normal and accident conditions; and refer to detailed info in Chapters 11 or 12 as appropriate.

Section C.I.9, Auxiliary Systems

Section 9.5.1, Fire Protection

- Current fire regulations and guidance will apply – enhanced per SECY-93-087/90-016
- Review will focus on separation of redundant trains – design, certification, installation, and maintenance
- It is expected that with enhanced FP design, issues such as spurious actuations and operator manual actions will be minimized outside of the main control room. Likewise for alternative/dedicated shutdown.
- NFPA 804 is acceptable industry standard (deterministic)
- Guidance for a risk-informed, performance-based FPP for new reactors (new SRP section) is in preparation

Section C.I.9, Auxiliary Systems

What if DC, DC/ESP is referenced?

- Provide a description of each system *not included* in the certified design, and include:
 - the design bases for the system and for critical components,
 - a safety evaluation demonstrating how the system satisfies the design bases,
 - the testing and inspection to be performed to verify system capability and reliability, and the required instrumentation and controls.
- Systems with little or no relationship to protection of the public against exposure to radiation: provide enough information to
 - allow understanding of design and operation
 - show effect on reactor safety, the reactor and its safety features or
 - address contribution to the control of radioactivity.

Section C.I.9, Auxiliary Systems What if DC, DC/ESP is referenced?

- Describe capability of systems not included in the certified design to function without compromising safe plant operation during normal operating or transient situations.
- Seismic design classifications for systems not part of the DC: details in Ch 3
- Summarize radiological considerations for operation of each system under normal and accident conditions—details in Ch 11 or 12

Section C.I.9, Auxiliary Systems What if DC, DC/ESP is referenced?

- Information to be submitted that is not necessarily addressed in DCD:
 - Design parameters, materials of construction, and analytical methods associated with new and spent fuel storage rack criticality and structural analyses, spent fuel rack thermal-hydraulic analyses
 - Spent fuel storage neutron absorber design basis for subcriticality, including assumptions used & material compatibility reqts
 - Spent fuel pool make-up water sources
 - Operational program for maintaining spent fuel decay heat load within SFP system heat removal capacity during refueling, including analytical methods used in associated calculations

Section C.I.9, Auxiliary Systems What if DC, DC/ESP is referenced?

- Information to be submitted that is not necessarily addressed in DCD:
 - Fuel handling operational program, including procedures and admin controls
 - Various heavy load handling program items: maintenance documents, inspection and test plans, personnel qualifications, training and controls, associated QA programs
 - Safety evaluations for heavy loads outside the bounds of the certified design
 - Station service water system—section 9.2.1
 - Station ultimate heat sink—section 9.2.5
 - Portions of Condensate Storage facilities—section 9.2.6

Section C.I.9, Auxiliary Systems What if DC, DC/ESP is referenced?

- Information to be submitted that is not necessarily addressed in DCD:
 - Portions of Process Auxiliaries—section 9.3, including compressed air, process and post-accident sampling, equipment and floor drainage, drywell sump sizing
 - Portions/aspects of Fire Protection Program—section 9.5.1
 - Normal, emergency and supplementary lighting systems & lighting capabilities during total loss of all AC power
 - Various Diesel Generator support systems—sections 9.5.4 through 9.5.xx

Section C.I.9, Auxiliary Systems Pre-Workshop Comments

- Section C.I.9.1.2, “Spent Fuel Storage”, last sentence. This sentence requires a description of the “design features and or controls for density of spent fuel assembly storage to address the potential for zircaloy cladding ignition of recently discharged fuel in the case of a spent fuel pool draining event. This event is not a design basis event for any of the designs currently anticipated to be referenced in COLAs. What is the regulatory basis for including this requirement in a COL application?
- Sections 9.5.4, 9.5.5, 9.5.6, 9.5.7, and 9.5.8, Diesel Generator Auxiliary Systems. This section of the guidance should address the case for designs that do not rely on diesel generators for safety-related functions. An introductory sentence that states that the sections are only applicable for designs that incorporate safety-related diesel generators would clarify the guidance.

Section C.I.9, Auxiliary Systems Pre-Workshop Comments

- Section C.I.9.5.1.3, “Safety Evaluation”. The last sentence before the two bullets states that the analyses described in the two bullets should be provided, *as a minimum*. (emphasis added). The second bullet states, “When provided, a summary description of the design specific fire probabilistic risk assessment (PRA) that uses ----”. The effect of the two sentences makes it unclear as to whether a fire PRA is required. The risk information required to address fire hazards is not yet resolved. It is recommended that the information requirements related to fire risk be addressed in Section C.II.1 of the guidance and that the second bullet be deleted.
- Sections C.I.9.5.2.1 and C.I.9.5.2.2. These sections require information to be provided related to the Security Communications System. Since much of this information may be treated as Safeguards information, it is recommended that it be addressed as part of the Security Program in Section C.I.13.

Section C.I.9, Auxiliary Systems

- **Q&A, Additional Discussion**

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

- C.I.19 FSAR Chapter 19 Format and Content
- C.II.1 PRA Submittal Information Format/Content for COL application WITHOUT certified design
- C.III.1 Submittal Information Format/Content for COL application WITH certified design
- C.III.2 Submittal Information Format/Content for COL application WITH certified design & ESP

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

FSAR CHAPTER 19

- **Addresses two analysis topics:**
 - Plant-specific PRA
 - Severe accident evaluation
- **Information should enable NRC to conclude:**
 - Analyses are sufficiently complete and scrutable
 - Results and insights show plant meets objectives
(cf. DG-1145 Section C.II.1.2)
- **FSAR should contain qualitative, descriptive information
(not quantitative results)**

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

FSAR CHAPTER 19 FORMAT

- **To support timely NRC review of COL application,
applicant should adhere to recommended format and
content:**
 - 19.1 INTRODUCTION
 - 19.2 PRA RESULTS AND INSIGHTS
 - 19.3 SEVERE ACCIDENTS EVALUATIONS
 - 19.4 PRA MAINTENANCE
 - 19.5 ITAACS, ACTION ITEMS, & OTHER COMMITMENTS
 - 19.6 CONCLUSIONS

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.1 INTRODUCTION

- Describe purpose and objectives of plant-specific PRA and severe accident evaluations and specifically address related:
 - 10 CFR Part 52 requirements
 - Commission policies and positions
 - Objectives identified in DG-1145 Section C.II.1.2
- Identify structure of Chapter 19
- Identify what specific PRA information is docketed and what PRA information is retained by the applicant, but available for NRC review and audits

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.2 PRA RESULTS AND INSIGHTS

- 19.2.1 Introduction
 - Provide summary description of scope and process used to develop plant-specific PRA
 - Cross-reference Section 19.4 for how PRA is maintained and ensure is adequate for applications
- 19.2.2 Uses of the PRA
 - Describe uses and specific risk-informed applications of the PRA for the various phases
 - Design, COL Application, Construction, Operational
 - Section 19.2.2 should expand if new risk-informed applications are proposed and implemented

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.2 PRA RESULTS AND INSIGHTS (continued)

- 19.2.3 Evaluation of Full Power Operations
 - Focus is to provide qualitative results and risk insights for internal and external event PRAs addressing full power operations
 - Identify events evaluated and any screening, group, or bounding of events
 - Address significant contributors/sequences related to:
 - Core Damage
 - Large Release
 - Offsite Consequences
 - Summarize Important Results and Insights

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.2 PRA RESULTS AND INSIGHTS (continued)

- 19.2.4 Evaluation of Other Modes of Operations
 - Focus is to provide qualitative results and risk insights for internal and external event PRAs addressing other, non-full power, modes of operations (e.g., shutdown)
 - Identify events and modes evaluated and any screening, grouping, or bounding of events/modes
 - Address significant contributors/sequences related to:
 - Core Damage
 - Large Release
 - Offsite Consequences
 - Summary of Important Results and Insights

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.2 PRA RESULTS AND INSIGHTS (continued)

- 19.2.5 Summary of Overall Plant Risk Results and Insights
 - Provide overall PRA results and insights
 - Identify plant features and operator actions that are important to reducing risk
 - Confirm expectation stated in 10 CFR 52.79(a)(2) is met
 - Extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products
 - Provide table that identifies PRA-based insights that ensure assumptions and plant operational features addressed in the PRA will remain valid in as-built, as-to-be-operated plant

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.3 SEVERE ACCIDENT EVALUATIONS

- Section addresses following requirements:
 - 10 CFR 52.79(a)(38) - Description and analysis of design features for the prevention and mitigation of severe accidents (cf. SECY-93-087) e.g.,
 - ATWS, mid-loop operations, station blackout, fire protection, ISLOCA
 - Hydrogen generation/control, core debris coolability, high-pressure core melt ejection, containment performance, dedicated containment vent penetration
 - 10 CFR 52.79(a)(17) - Perform plant-specific PRA to seek improvements in reliability of core and containment heat removal systems

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.4 PRA MAINTENANCE

- Describe the PRA maintenance/update program that ensures the PRA reasonably reflects the as- designed, as-built, as-operated plant, including:
 - Frequency of PRA updates
 - Screening process/criteria allowing insignificant changes to be deferred (i.e., not included in scheduled update)
 - Criteria for immediate PRA update (prior to scheduled update)
 - How PRA scope, level of detail, and technical adequacy is ensured adequate and maintained consistent with prevailing standards, guidance, and good practices, as needed to support PRA uses
- Section 19.4.2 should expand following each update phase to describe significant changes that affect PRA results/insights

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.5 ITAACS, ACTION ITEMS, AND OTHER COMMITMENTS

- Describe the PRA-related ITAACs, COL Action Items and the actions taken to address them
- If item cannot be addressed at COL application phase, describe commitment identifying how/when the item will be resolved

Section C.I.19, Probabilistic Risk Assessment & Severe Accident Evaluation

19.6 CONCLUSIONS

- Summarize how each objective identified in FSAR Section 19.1, including objectives identified in DG-1145 Section C.II.1.2, have been met
- Explicitly identify any commitments associated with unresolved action items

Sections C.III.1 & C.III.2, Probabilistic Risk Assessment

Sections C.III.1 & C.III.2:

- PRA-related portions of C.III.1 & C.III.2 are identical
- The applicant's plant-specific PRA submittal should adhere to the guidance provided in DG-1145 Section C.II.1
 - Acceptable to state "No change from the certified design PRA" for specific sections, as appropriate
 - Include updated insights, identify changes in insights, and explain cause of significant changes
 - Describe "significance" screening criteria
 - Prior to fuel load, PRA should be updated to reflect all changes so plant reasonably reflects as-built, as-to-be-operated plant
- FSAR Chapter 19 should adhere to format and content guidance provided in DG-1145 Section C.I.19

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS

- C.II.1-1: Use of “needs to” in regulatory guide is not clear, believe it means “should”
 - Staff agrees. Change of “needs to” to “should” already reflected in website version
- C.II.1-2: Do not expect COL review to result in identifying interface requirements or COL action items - delete terms
 - Staff disagrees. For COL application not referencing certified design, staff expects items will be identified that may not be able to be resolved at the COL application phase, but will be resolved prior to startup (e.g., fire and seismic walkdowns)

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1-3: Bullet implies COL application would need to address issues resolved in design certification or include additional design details - delete phrases or clarify
 - Staff agrees. Intent will be clarified so that it does not imply issues resolved in design certification need to be re-addressed or that additional detail is required
- C.II.1.1-1: Text refers to 10 CFR 52.47, but §52.47 does not specify requirements for COL applicants - clarify
 - Staff agrees. Text will be clarified that 10 CFR 52.47 applies to design certifications and clarified that COL applications NOT referencing a certified design, should ensure the 10 CFR 52.47 requirements are also satisfied

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.2-1: Text regarding “vulnerability” is inconsistent with staff workshop response
 - Staff agrees. Text will be clarified that vulnerabilities in this context are failures/combinations of failures that could cause design not to meet stated objectives
- C.II.1.2-2 & C.II.1.6-1: What is regulatory basis for the COL application showing that design represents reduction in risk over existing plants? This comparison is not possible since information not publically available
 - Staff disagrees. Expectation stated in August 8, 1985 Commission severe accident policy statement
 - Clarify text that a qualitative comparison is acceptable

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.2-3 & C.II.1.2-4: QHOs can be demonstrated being met by CDF and LERF, do not need LRF or CCFP goal - cite QHOs and subsidiary goals (i.e., replace LRF goal with LERF goal and delete CCFP goal)
 - Staff disagrees. LRF and CCFP goals established by Commission in June 26, 1990 SRM (SECY-90-016). LRF goal understood to include all large release contributors, not just early (as in LERF).
 - Staff will clarify that while the applicant should address these goals, they are not performance requirements, and clarify the role of the CPGs in properly balancing preventive and mitigative features

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.2-5: Since DG-1145 is focused on COL application, the discussion on construction and operational phases is not appropriate - move text to a background section
 - Staff agrees. The discussion will be incorporated into a more appropriate section
- C.II.1.2-6: Text implies all changes need to be submitted for NRC review and approval and reflected in updates to PRA - clarify text
 - Staff agrees. Text will be clarified to ensure those changes that significantly impact the PRA results/insights are reflected in updates to the PRA as addressed by FSAR Section 19.4

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.3-1: Request confirmation that the potential need to expand the risk evaluation is when PRA is used for optional risk-informed programs and not to further evaluate referenced certified design
 - Staff agrees. A certified design PRA may need to be expanded if it is used to support a risk-informed program that the applicant seeks to voluntarily implement
- C.II.1.4-1: Recommend changing “realistically reflect” to “reasonably reflect” to be consistent with current practices and available information at COL phase
 - Staff agrees. Wording will be changed to “reasonably reflect”

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.5-1: It is not appropriate to apply 10 CFR 50 Appendix B requirements to the PRA and it is not reasonable to expect COL PRAs to meet the ASME/ANS standards that are endorsed at the time of the COL application
 - Staff agrees that a direct reference to Appendix B is not needed and will replace the text consistent with other risk-informed regulatory guidance (e.g., RG 1.174 Section 2.5 and 3.2)
 - Staff agrees that the guidance needs to recognize a time lag in the ability of an applicant to meet endorsed standards and will revise the discussion appropriately

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.6-2a: Does last sentence apply to both bullets?
 - Last sentence applies to last bullet only
- C.II.1.6-2b: How does applicant assure assumptions remain valid for future plants
 - Will revise “future plant” to “as-built, as-operated plant”
- C.II.1.6-2c: Not clear tie between PRA and other program requirements
 - Will clarify text that PRA is not only means used to identify these requirements, but specific requirements may be identified that ensure that important assumptions in PRA remain valid and significant uncertainties are addressed

Section C.II.1 Probabilistic Risk Assessment

Section C.II.1: RESPONSES TO PUBLIC WORKSHOP QUESTIONS (continued)

- C.II.1.7-1: The format and content is not consistent with the proposed 10 CFR 52.80(a) requirement
 - Staff disagrees. §52.80(a) requires applicant referencing a certified design to use the design certification PRA, updated to reflect site information and design changes, but does not require the PRA information submitted for COL application to be in exactly the same format
- C.II.1.7-2: Documentation retention should be to prevailing good practices - revise text
 - Staff disagrees. Text will be clarified to be more consistent with existing risk-informed guidance (e.g., RG 1.174 Section 2.5 and 3.2)