STATION BLACKOUT

Computer Based Training module

ABSTRACT

This CBT is a detailed, comprehensive, generic overview of station blackout issues and the methods of addressing them. It will help trainees expand their knowledge about the subject and ensure that a detailed evaluation of station blackout is done appropriately. The training will familiarize the trainees with key documents, common problems and solutions, and common analysis techniques. The training is detailed enough to allow trainees to quickly diagnose any station blackout issue that arises, however, it is not intended to be completely comprehensive of station blackouts and its analysis. There are no prerequisite CBTs that need to be completed prior to taking this CBT. It is designed and set up with a 2-tiered approach geared to both the site Subject Matter Expert (SME) and non-expert (generalist) personnel such as engineering supervisors or licensing/regulatory assurance personnel. The "Skip" function in various chapters allows the generalist to skip training material intended for the expert. Generalists are also not required to take the final exam, while the experts are required to take and pass the final exam.

INTENDED AUDIENCE

1. Experienced site engineering SMEs in development, who require an in-depth understanding of station blackout issues
2. Site engineering Managers and Supervisors, who require a high-level understanding of the fundamentals of station blackout

DURATION

2.75 hours

An additional 8-10 hours for reading materials provided within the CBT

TERMINAL LEARNING OBJECTIVES:

1. Describe common station blackout experiences that led to the creation of station blackout programs at commercial nuclear generation stations as defined in 10 CFR 50.63.
2. Examine the applicable regulatory requirements for station blackout at commercial nuclear generation stations as defined in 10 CFR 50.63.
3. Compare NUMARC 87-00 and NRC Reg. Guide 1.155 to assemble a comprehensive understanding of how industry guidance has shaped the NRC's expectations for station blackout.
4. Describe the safety implications of inadequate station blackout coping at a commercial nuclear generation station as described in 10 CFR 50.63 and NRC Reg. Guide 1.155.
5. Identify the scope of responsibility for engineering, systems, maintenance, and operations to identify, manage, and correct the station blackout issue given a station blackout scenario.
6. Identify the factors provided in NRC Reg. Guide 1.155 that are considered in determining the minimum acceptable station blackout duration capability.
7. Evaluate a plant's Offsite Power Design Characteristic Group based on the independence of offsite power groups, the severe weather group, and the severe weather recovery group.
8. Assess a plant's Emergency AC Power Configuration Group based on the redundancy of the onsite emergency AC power system.
9. Determine an allowed Emergency Diesel Generator (EDG) reliability based on the calculated EDG reliability.
10. Select a unit's minimum required station blackout coping duration based on the Emergency AC Power Group, Offsite Power Group, and Allowed EDG Target Reliability.
11. Describe the necessary considerations for determining a plant's capability to cope with a station blackout.
12. Calculate the available and required condensate inventory to maintain adequate reactor coolant system inventory for decay heat removal.
13. Evaluate the capacity of the Class 1E batteries to ensure their adequacy in supporting decay heat removal and monitoring during the station blackout coping duration.
14. Assess that all Air-Operated Valves (AOVs) required for decay heat removal have an adequate supply of reserve air or can be opened manually during a station blackout.
15. Identify the Dominant Areas of Concern (DAC) and acceptance criteria that may be applied for loss of ventilation to those areas.
16. Evaluate the design adequacy and capability of equipment necessary for safe shutdown for increased temperatures due to a loss of ventilation during a station blackout.
17. Analyze the ability of the plant to maintain appropriate containment integrity for the required coping duration during a station blackout event.

18. Describe the requirements for station blackout for an Alternate AC power source based on the guidance of NRC Reg. Guide 1.155 and NUMARC 87-00.
19. Identify potential modifications to the plant that may be necessary to extend the time the plant can cope with a station blackout in case the minimum required coping time is not met.
20. Describe the Extended Loss of AC Power (ELAP) event at Fukushima Daiichi that led to the issuance of EA-12-049 and JLD-ISG-2012-01, requiring mitigating strategies for beyond-design-basis external events.
21. Review the industry guidance provided in NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guidance.
22. Identify the different phases of FLEX and the equipment used to support each phase.
23. Evaluate how FLEX strategies to extend or recover power will mitigate an ELAP event.
24. Define the analyses required to support FLEX strategy development.
25. Describe the difference between station blackout coping and FLEX strategies.
26. Explain the procedural approach used to implement FLEX strategies.

KEY INDUSTRY DOCUMENTS:

Publicly Available Documents

1. 10 CFR 50.63, "Loss of all alternating current power"
2. NRC Regulatory Guide 1.155 (ML003740034), "Station Blackout"
3. NUMARC 87-00 (ML12137A732), "Guidelines and Technical Bases for NUMARC initiatives addressing Station Blackout at Light Water Reactors"
4. NUREG-1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants, Technical Findings Related to Unresolved Safety Issue A-44"
5. NUREG-1410, "Loss of Vital AC Power and the Residual Heat Removal System During Mid-Loop Operations at Vogtle Unit 1 on March 20, 1990"
6. NUREG/CR-5496, "Evaluation of Loss of Offsite Power Events at Nuclear Power Plants: 1980 – 1996"
7. NUREG/CR-6890, "Reevaluation of Station Blackout Risk at Nuclear Power Plants: Analysis of Station Blackout Risk"
8. NUREG-0800, "U.S. Nuclear Regulatory Commission Standard Review Plan"
9. NRC EA-12-049 (ML12054A735), "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events"
10. JLD-ISG-2012-01 (ML17005A188), "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events", Revision 2
11. NUREG-1776, "Regulatory Effectiveness of the Station Blackout Rule"
12. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide"
13. Regulatory Basis Document NRC-2011-0299, "Station Blackout Mitigation Strategies," ADAMS Accession Number ML13171A061
14. Exelon Generation Company, "Report of Full Compliance with March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (order Number EA-12-049)"
15. "Virginia Electric and Power Company (Dominion) Surry Power Station Units 1 and 2 Compliance Letter and Final Integrated Plan in Response to the March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," ADAMS Accession No. ML16033A353

INPO Documents

16. INPO Event Report 13-10, "Nuclear Accident at the Fukushima Daiichi Nuclear Power Station"
17. INPO Event Report 12-78, "Station Blackout and Loss of Shutdown Cooling Event Resulting from Inadequate Risk Assessment"