



# **Station Blackout and Advanced Accident Mitigation (B.5.b) Overview**

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# **Station Blackout Background**

- **WASH-1400, “Reactor Safety Study,” issued 1975, indicated that station blackout (SBO) could be an important contributor to the total risk from nuclear power plant accidents**
- **In 1980, the Commission designated the issue of station SBO as Unresolved Safety Issue (USI) A-44, “Station Blackout”**
- **NRC issued the final SBO Rule (10 CFR 50.63) on June 21, 1988**
- **SBO Rule requires each plant to be able to cope and recover from an SBO event**

# **Station Blackout Staff Evaluations**

- **NRC issued Regulatory Guide (RG) 1.155, “Station Blackout,” on August 1988 and endorsed NUMARC 87-00 industry guidance to implement the SBO Rule**
- **All 104 plants met the SBO rule requirements at the time of the staff’s review**
  - **Safety Evaluations**
  - **Pilot Inspections**
- **License Renewal Application reviews - Staff verifies the scoping and aging management of systems, structures, and components required for SBO in accordance with 10 CFR 54.4(a)(3) and 10 CFR 54.21**

# **Station Blackout - New Reactors**

- **All new standard reactor designs must include an alternate ac (AAC) power source with diverse design to cope with an SBO for 8-hours**
- **New reactors with passive designs cope with an SBO with battery power for 72-hours**

## **B.5.b Requirements**

### **NRC Imposed Requirements after the events of September 11, 2001**

- **Interim Compensatory Measures Order EA-02-026**
- **License Condition**
- **10 CFR 50.54(hh)(2)**

# **10 CFR 50.54(hh)(2)**

**“Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire ....”**



# **Station Blackout Preparedness and Coping**

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# **SBO Rule**

- **Rule in Federal Register 10CFR50.63  
“Loss of all alternating current power”**
- **SBO Rule requires each plant to be able to cope and recover from an SBO event of specified duration**
- **NRC issued Regulatory Guide (RG) 1.155, “Station Blackout,” on August 1988 and endorsed NUMARC 87-00 industry guidance to implement the SBO Rule**



# **SBO Coping**

- **Rule provided guidance on how to calculate the plant specific SBO duration.**
- **The coping duration based on following factors:**
  - **The redundancy of the onsite emergency ac power sources**
  - **The reliability of the onsite emergency ac power sources**
  - **The expected frequency of loss of offsite power**
  - **The probable time needed to restore offsite power**
- **SBO event ends when either offsite or onsite power is restored**

# **Coping Methods**

- **AC independent**
  - **44 plants rely on batteries only**
  - **Maximum duration 4 hours**
- **Alternate AC**
  - **60 plants in this category**
  - **Emergency Diesel Generators from adjacent unit with excess capacity**
  - **Gas turbine generators, diesel generators and hydro units**
  - **Appendix R Diesel generators**

# **Staff Review of SBO Rule Implementation**

- **NRC staff reviewed and approved by safety evaluations all 104 plants SBO submittals.**
- **NRC staff conducted pilot inspections at 8 sites (2 per region) using NRC Temporary Instruction 2515/120**
- **Inspection results revealed that the licensees were implementing the SBO Rule consistent with NRC requirements and staff's safety evaluations**

# Design Overview

- **Battery coping plants - maximum coping duration is 4 hours**
- **Battery life may be extended to required duration by load shedding**
- **Effects of loss of ventilation.**
- **Condensate, compressed air and RCS inventories verified for adequacy**
- **Procedures developed for SBO**
- **Operator training**

# **SBO Procedures**

- 1. Specific actions for restoration of AC power**
- 2. Ensure support equipment functional without AC**
- 3. High priority on steam driven pumps**
- 4. Identify RCS leakage paths**

# **Grid Interface**

- **Grid Interface Enhancements**
  - **Grid operator evaluates network on daily basis**
  - **Plant procedures for degraded grid conditions**
  - **Plant controlled work in switchyard**
  - **High priority for TSO to restore power**
  - **New guidelines from NERC**

# Summary

- **Only one U.S plant has had an SBO, it was in 1990 (App. 1 hour)**
- **SBO compliance evaluated for**
  - **License renewal**
  - **Power uprates**
  - **License amendment requests**
  - **New Reactors**
- **Staff interfacing with FERC to maintain reliability with future changes in generation mix and transmission system upgrades.**



# **Extensive Damage Mitigating Guidelines (B.5.b)**

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## **B.5.b Strategies**

- **Details Designated Official Use Only - Security Related Information**
- **Flexible, Deployable Strategies Providing Alternate Means to Accomplish Key Safety Functions**

# **Phased Approach**

- **Phase 1 – Readily Available Materials and Personnel**
- **Phase 2 – Spent Fuel Pools**
- **Phase 3 – Core Cooling and Containment**

# **Phase 1 – Readily Available**

- **Existing Programs & Equipment**
- **Best Practices from Initial Response**
- **Lessons Learned from Analyses**

# **Phase 1 Strategies**

- **Memoranda of Understanding**
- **Fire Fighting Enhancements**
- **Passive Measures**

# **Phase 2 - Spent Fuel Pool Cooling**

- **Make-up Water**
- **Cooling Spray**
- **Power Independence**

# **Phase 3 - Core Cooling and Containment**

- **Key Safety Functions Based on Plant Specifics**

## **Boundary Conditions:**

- **Loss of All Internal Power Distribution**
- **Minimum Staffing**

# **Utility of B.5.b Strategies in SBO**

- **Entry Conditions More Conservative than SBO**
- **Use of Strategies Has Potential to Extend Duration for Supplying Key Safety Functions**

# Acronyms

- **B.5.b – Mitigating Strategies Requirements from Order EA-02-026, Section B.5.b, the Subsequent License Conditions, and 10 CFR 50.54(hh)(2)**
- **SBO – Station Blackout**