NSIC Accession Number: 130111

Date: September 28, 1977

Title: Blackout Condition Occurs After Reactor Trip at Cook 1

The failure sequence was:

- 1. With the reactor at 100% power and during an extreme thunderstorm, a lightning strike on a transmission circuit resulted in the opening of transformer breakers and the de-energization of the "normal reserve" transformer.
- 2. A subsequent lightning strike resulted in a momentary 36% voltage dip that was sensed by the reactor coolant pump bus undervoltage relays, which prematurely initiated a reactor trip and subsequent turbine and generator trips. This resulted in a loss of station electric power.
- 3. The two diesel generators started and provided power to essential loads.
- 4. One hour and 13 minutes after reactor trip, the decision was made to transfer the emergency buses to the "emergency reserve" offsite source (which had been available throughout the incident). Three of the four buses successfully transferred, the fourth bus did not transfer (reason unspecified) and was supplied power from its diesel generators.

Corrective action:

- 1. The reactor coolant pump bus undervoltage relays were reset to their correct delay times.
- The reason for the failure of one emergency bus to transfer to the "emergency reserve" source was not specified.

Design purpose of failed system or component:

Offsite power provides the preferred source of power to plant loads when the unit generator is not operating.

Unavailability of system per WASH 1400:\* Offsite power:  $2 \times 10^{-5}$ /hr (following trip:  $1 \times 10^{-3}$ /D)

Unavailability of component per WASH 1400:\* -

<sup>\*</sup>Unavailabilities are in units of per demand  $D^{-1}$ . Failure rates are in units of per hour  $HR^{-1}$ .



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NSIC 130111 - Actual Occurrence for "Blackout" Condition Occurs After Reactor Trip at Cook 1

House Loads	Loss of Offsite Power	Turbine En Generator g Runs Back Pa and Assumes House Loads	Emer- Auxiliary gency Feedwater and Power Secondary Heat Removal	PORV Demanded	PORV or PORV Isola- tion Valve Closure	High Pressure Injection	Long Term Core Cooling	Potential Severe Core Damage	Sequ No.	ience
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NSIC 130111 - Sequence of Interest for "Blackout" Condition Occurs After Reactor Trip at Cook 1 \* success requires manual transfer to an emergency reserve power source.

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not included in mitigation procedures.

## CATEGORIZATION OF ACCIDENT SEQUENCE PRECURSORS

NSIC ACCESSION NUMBER: 130111 DATE OF LER: September 28, 1977 DATE OF EVENT: September 1, 1977 SYSTEM INVOLVED: Offsite power, on-site power COMPONENT INVOLVED: reserve power transformer breakers reactor coolant pump bus undervoltage relays The breakers opened to clear a fault, the undervoltage relays operated CAUSE: prematurely. SEQUENCE OF INTEREST: Loss of offsite power ACTUAL OCCURRENCE: Reactor trip and loss of offsite power REACTOR NAME: Cook 1 DOCKET NUMBER: 50-315 REACTOR TYPE: PWR DESIGN ELECTRICAL RATING: 1054 MWe REACTOR AGE: 2.6 yr VENDOR: Westinghouse ARCHITECT-ENGINEERS: American Electric Power OPERATORS: Indiana & Michigan Power Co. (American Electric Power) LOCATION: 11 mi. South of Benton Harbor, Michigan DURATION: N/A 100% power PLANT OPERATING CONDITION: SAFETY FEATURE TYPE OF FAILURE: ((a))inadequate performance; (b) failed to start; (c) made inoperable; (d) DISCOVERY METHOD: Operational event COMMENT: -