UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 14 1981

Note disclaimer ↑

MEMORANDUM FOR: Carlyle Michelson, Director
Office for Analysis and Evaluation
of Operational Data

FROM: Matthew Chiramal
Office for Analysis and Evaluation of
Operational Data

SUBJECT: TRIP REPORT TO NORTH ANNA-2 - FAILURE OF B PHASE MAIN TRANSFORMER AND SUBSEQUENT FIRE IN THE TRANSFORMER AREA

On July 9, 1981, I joined NRR staff members on a visit to North Anna-2 to view the extent of damage caused by the failure of B phase main transformer and subsequent fire. The failure of the transformer had occurred on July 3, 1981, while Unit 2 was at 17% power and Unit 1 was at full load (see enclosed memorandum from L. Engle to T. Novak for details of the event).

A fault in the transformer 500 KV bushing inside the transformer casing is suspected to be the cause of the failure (the manufacturer, Westinghouse, is investigating the failure). The short circuit in the transformer caused ruptures in the casing and the spilled oil (~9000 gallons) in the B phase transformer bay and the adjacent spare transformer bay caught on fire.

Observations

1. The 3 single phase transformers are located in a common bay separated from each other by concrete walls. The spare transformer bay is also part of the common bay. The spilled oil spread mainly in the B phase transformer bay and the spare transformer bay.

2. The B phase transformer suffered extensive damage. The casing was ruptured in several places and the shell was distorted. Most of the bushings, lightning arrestors, and auxiliaries were damaged.

3. The fire damage in the B phase transformer bay was not as severe as in the spare bay. This apparently is due to the fire protection sprinkler system actuation in the transformer bay.

(3)

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3. The fire damage in the B phase transformer bay was not as severe as in the spare bay. This apparently is due to the fire protection sprinkler system actuation in the transformer bay.

4. No damage was apparent in the A and C phase transformer sections (again apparently due to the sprinkler systems there).

5. Severe fire damage was seen in the spare transformer bay (which was empty at the time of the event). The spare transformer bay is not fitted with a fire protection system.

6. The fire in the spare bay caused severe damage to the turbine building wall and to overhead alumnium buses of the C Reserve Station Service Transformer (RSST-C). The cables associated with these buses, that were mounted on vertical cable trays on the turbine building wall, were also burnt. (RSST-C provides part of offsite power from the 34.5 KV switchyard to the onsite distribution system - see enclosed single line diagram).

Conclusions

1. Transformer casings apparently are not designed to withstand severe electrical short circuits inside the transformer. Such short circuits can split the transformer casing and cause spillage of transformer fluid in the vicinity of the unit.

2. Fire protection deluge systems can effectively reduce damages due to oil fires.

3. At North Anna 1 and 2, the three reserve station transformers (RSST-A, B, and C) are located adjacent to each other away from the main and station service transformers. However, these transformers are not protected by deluge systems. An oil fire in the area could conceivably damage all three transformers and thus affect offsite power availability to both North Anna units.

4. Several operating nuclear plants have liquid filled transformers located inside the plant building (load center transformers for safety-related and nonsafety-related buses). These plants are not designed to contain or protect against ruptures of these transformers and consequent spillage and fires.

5. In view of the number of transformer failures at operating reactors, we should review the surveillance and preventive maintenance programs being practiced by the utilities to see how failures can be reduced and thus reduce challenges to the onsite power distribution systems.

6. In implementing GDC 17 requirements regarding physical and electrical separation of the preferred power source connections to the plant onsite distribution system, effects of transformer oil fires should be considered.

Matthew Chiramal
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Enclosures:
As Stated

cc w/enclosures:
TNovak
RMattson
GLainas
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