



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

AEOD/E116

JUL 14 1981

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50-339

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.

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 aluminium 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).

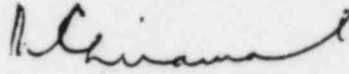
Conclusions

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.

Carlyle Michelson

- 3 -

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
Office for Analysis and Evaluation
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Enclosures:
As Stated

cc w/enclosures:
TNovak
RMattson
GLainas
EJordan
LEngle
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RFerguson
J0lshinski



UNITED STATES
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WASHINGTON, D. C. 20555

JUL 06 1981

MEMORANDUM FOR: Thomas M. Novak, Assistant Director for
Operating Reactors, DL

THRU: Robert A. Clark, Chief *Robert A. Clark*
Operating Reactors Branch #3, DL

FROM: Leon B. Engle, Project Manager
Operating Reactors Branch #3, DL

SUBJECT: UPDATE ON TRANSFORMER FIRE AT NORTH ANNA POWER STATION,
JULY 3, 1981

At 7:22 AM, Friday (July 3, 1981) a fire in the main-phase B transformer which was carrying power from Unit No. 2 initiated an automatic shutdown of Unit 2.

The cause of the fire was an electrical fault in the B transformer. The fire ruptured the transformer and spread to cooling oil (269,000 gal. rated capacity) which spilled through the rupture. Heat from the oil-fire caused nitrogen bottles serving the transformer to explode.

The loss of load (B transformer) initiated a turbine-reactor trip, at approximately 7:22 AM for Unit 2. As a precautionary measure, plant operators tripped two Reactor Coolant Pumps (Unit-2) to reduce net-load on Unit 2.

At about 7:40 AM, the fire melted open bus bars that receive power from the reserve C transformer. These open bus bars were physically located over B transformer in their connection from C transformer to the turbine building. These bus bars supply emergency power to both Units and the melting of the bus bars caused reserve transformer C to relay out and the initiation of diesel generator power.

Because of the already occurred reactor trip at Unit 2 and cutoff of the two reactor coolant pumps, a low-low TAV signal was locked in on the ESFAS. At the time reserve C transformer relayed out, a spurious high steam flow signal registered on the ESFAS logic which when combined with the already present low-low TAV signal initiated Safety Injection. Safety Injection was terminated within 2 minutes by operator action.

Prior to initiation of these events, Unit No. 2 was at about 8% power and Unit No. 1 at 100% power. Unit No. 1 was reduced to 30% power as a precautionary measure and placed in a 72-hour Limiting-Condition-Of-Operation regarding two independent off site power sources. Unit No. 1 was later (about 3:00 PM) removed from the LCO and began increasing power for 100%.

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Because this fire held the potential for degradation of station safety levels, the station emergency director declared a station alert in accordance with VEPCO's Corporate Emergency Response Plan. State and Federal agencies were notified by the station emergency director in accordance with the Emergency Response Plan. VEPCO's emergency response managers monitored the alert from VEPCO's emergency response center in the Richmond headquarters.

The fire was extinguished at about 8:25 AM and the station alert was terminated at about 9:20 AM. The fire was contained on-site by the station fire brigade and was extinguished with the help of fire crews from Louisa County, Spotsylvania County and the town of Mineral.

The event occurred at a fortunate time since the day shift was just arriving to relieve the mid-shift still at stations. The Station Superintendent and Assistant Superintendent were both on site during the event.

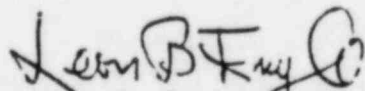
Two NRC inspectors from Surry and another two I&E inspectors (Region 2) arrived on site about noon and 3:00 PM, respectively.

Citizen concern was caused to a great extent by the copious, black smoke rising over the plant site. Numerous calls were received by VEPCO indicating concern.

It is presently estimated Unit No. 2 will be shutdown for three weeks until a spare-modified transformer arrives from the Surry Station.

I&E (Reg. 2) is presently preparing a Preliminary Notification of these events.

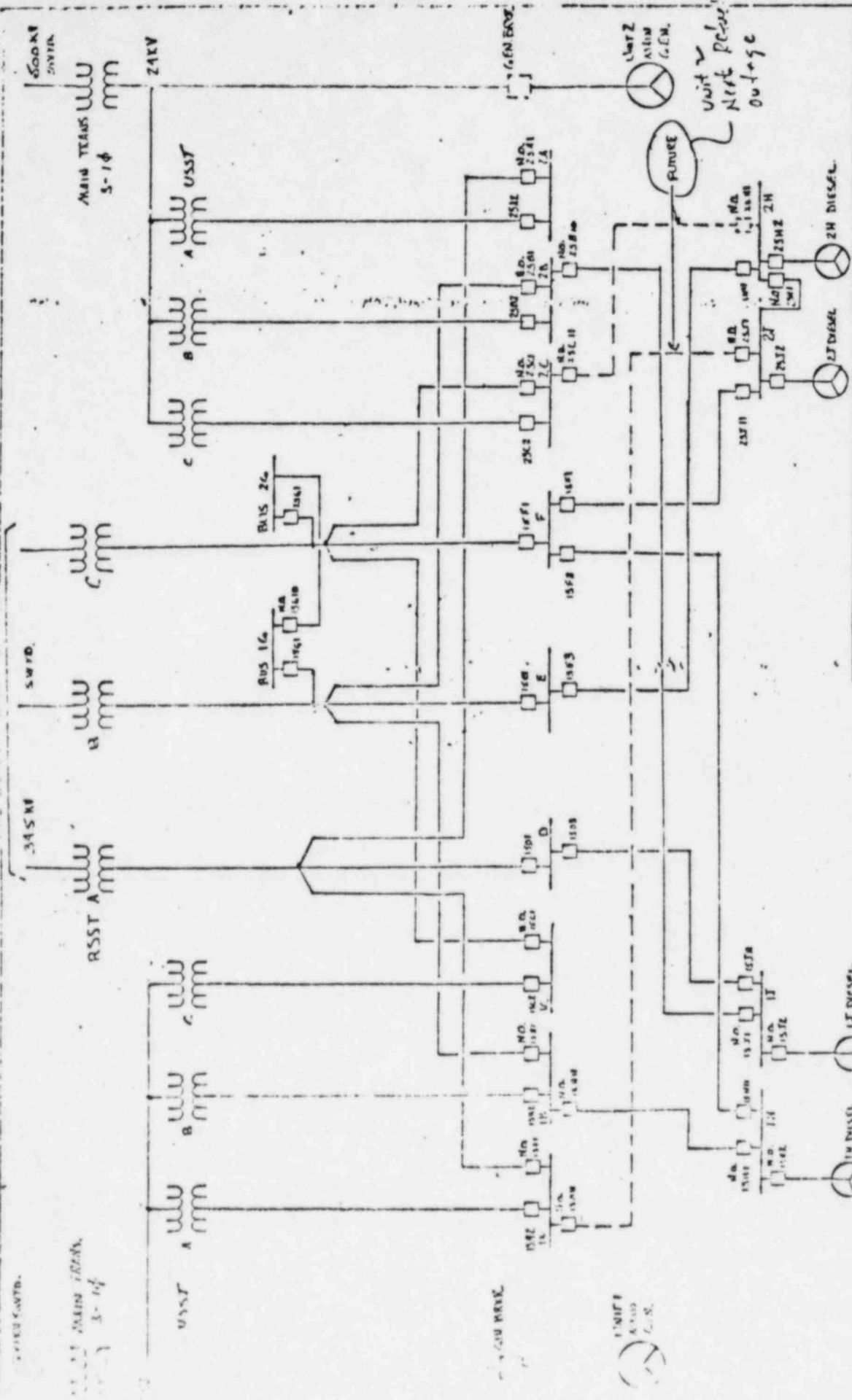
Note: The description of this event as described above may change as further information is received.



Leon B. Engle, Project Manager
Operating Reactors Branch #3, DL

cc: H. Denton
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STONH & WEBSTER ENGINEERING CORPORATION



SCALE:	DATE:	SHEET NUMBER:
CHECKED	CORRECT	APPROVED
POWER INDUSTRY GROUP TITLE		

NORTH ANNA 1, 2 - SIMPLIFIER SINGLE LINE DIAGRAM

REVISIONS

3-14

UNIT 1 DIESEL

UNIT 2 ATOM G.E.M.

Unit 2 power Next phase outage