NEW YORK POWER AUTHORITY
NUCLEAR SAFETY EVALUATION
NO. JAF-SE-92-238 REV. 0

_____ IP3 __X__ JAF

_____ MOD _____ TEST

_____ EXPERIMENT

__X__ OTHER

_____
NUMBER

TITLE: ALTERNATE ELECTRICAL SEPARATION CRITERIA

A. The proposed Modification, Test or Experiment:

1. ( ) Does (X) Does Not — Increase the probability of occurrence or consequences of an accident or malfunction of structures, systems, or components important to safety previously evaluated in the FSAR.

2. ( ) Does (X) Does Not — Create the possibility of an accident or malfunction of safety-related structures, systems, or components of a different type than any evaluated previously in the FSAR.

3. ( ) Does (X) Does Not — Reduce the margin of safety as defined in the basis for Technical Specification.

4. ( ) Does (X) Does Not — Involve an unreviewed safety question, based on 1, 2 and 3 above.

5. ( ) Does (X) Does Not — Involve a change in the Technical Specification (Section(s) _____.)

6. ( ) Does (X) Does Not — Require pre-implementation review by the NRC.

7. ( ) Does (X) Does Not — Degrade the Security Plan, Quality Assurance Program or the Fire Protection System.

8. ( ) Does (X) Does Not — Affect the environmental impact of the plant or involve an unreviewed environmental question.

9. The following items require action tracking:

TENERA, L.P. 12/17/82
Prepared By/Date

Review _____
Designated Individual/Date

Approved _____ 12/22/92
DPEX/SEM/TSM/DNED/Date

Reviewed 92-177 22 dec 1992
PORC/Date

Distribution:
PORC Chairman
Q.A. Superintendent
SRC Chairman
Licensing (WPO)

NYPA FORM MCM-4, ATTACHMENT 4.1 (SEPTEMBER 1992)

I. PURPOSE

This Safety Evaluation addresses utilizing horizontal and vertical cable separation distances of 1 foot-1 foot, respectively, and 1 inch-1 inch between conduits, respectively, as alternate separation criteria on an interim basis to assess cable separation anomalies. The alternate separation criteria is an interim exception to the criteria stated in the JAF FSAR and is based on cable separation testing conducted for other plants. The apparent deviations addressed in this NSE are evaluated using the guidance contained in NRC Generic Letter No. 91-18.

II. DESCRIPTION

The adequacy of the physical separation of electrical cables was identified as a potential issue at the James A. FitzPatrick (JAF) plant in October, 1992. Inspection by Engineering personnel revealed that a number of cable installations appear to differ from the electrical separation criteria specified in the FSAR. Based upon this, a systematic walkdown of a number of plant areas was initiated to further assess the field conditions.

The design philosophy for JAF was established during the time frame of the development of industry criteria for independence of Class 1E equipment and circuits. It is evident that a conservative design philosophy was employed for JAF with respect to the physical separation of redundant safeguards equipment.

The JAF design employs two redundant trains of safeguards equipment which are physically and electrically independent of each other. Physical separation is provided, where practical, through utilization of train-oriented, seismically designed structures or rooms. Examples of such features include:

- redundant, train-oriented, cable tunnels;
- redundant, train-oriented, electric bays;
- redundant, train-oriented, emergency switchgear rooms; and
- redundant, train-oriented, emergency diesel generator rooms.

Physical separation in the above areas limits and localizes the potential for, and consequences of, postulated cable faults and mechanical accidents, e.g., missiles generated by catastrophic failure of rotating equipment.

Areas of the facility where redundant trains could not be routed in separate rooms include:

- the control complex consisting of the main control room, the relay room, and the cable spreading room;
- the battery room corridor;
- "crossover" points at the ends of the cable tunnels; and
- the reactor building.

In such plant areas, protection against common mode failures due to electrical faults and mechanical accidents is provided by a combination of features (not all of which apply to every area):

- physical separation of redundant equipment to the extent feasible and commensurate with the potential hazard;
- segregation of cables based on function and power level;
- installation of area wide fire suppression systems;
- installation of water curtain systems to provide (separation) protection equivalent to a three-hour rated barrier; and
- use of flame retardant cable jacketing materials.

The FSAR addresses electrical separation of safety related circuits from the standpoint of voltage class segregation, physical separation and circuit isolation. The criteria for physical separation of cables for redundant safety-related functions established in the FSAR require that a minimum horizontal distance of 3 ft and/or a minimum vertical distance of 7 ft be maintained between cable trays, conduits, and armored cables not in trays. These criteria apply to all areas of the plant unless a reinforced concrete wall or floor slab exists between the raceways. Specific deviations from these criteria are listed in the FSAR for certain situations and plant areas.

The FSAR cable separation criteria for JAF are very conservative when compared to many other plants that received Construction Permits in the 1970 timeframe. This conservative approach was taken to address uncertainties regarding separation requirements at the time of construction.

In 1974 the industry produced a draft standard which provided specific guidance for physical separation of safety related circuits and those circuits which were not safety related but, due to their physical or electrical relationships, could affect the safety function. The distances that were given for separation between redundant Class 1E cable trays located in areas having limited hazards potential are conservatively based on practices which have been considered to provide an adequate degree of separation. Lesser separation distances can be established by the testing of the cable types being used to determine the degree of damage propagation.

In recent years, extensive cable separation testing was conducted by some plants(see refs. 4, 5,& 6). The latest testing provides for the reduction of separation criteria for configurations that exist at JAF. Specifically, cable testing was done for configurations, cable types, and voltage levels that bound the JAF configurations and provide acceptable results for separation distances that are less than the 1 foot-1 foot and 1 inch-1 inch(for conduits) JAF alternate criteria. Therefore, the JAF alternate criteria has separation margin to the distances used in the tests and is conservative.

III. REVIEW AND ANALYSIS

Adequate separation is maintained by the separation criteria reflected in the FSAR and those criteria established by testing and/or analysis. The FSAR criteria were based on prudent engineering judgment at the time but not actual test data of any kind. In some 23 other plants, industry and NRC have allowed the establishment of lesser separation distances by analysis of proposed cable installations and tests.

Extensive industry cable separation testing programs were conducted over the past decade to justify lesser separation distances. Several test reports applicable to JAF cables are contained in references 4, 5, and 6. Tested cables were qualified in accordance with IEEE 383. Cables at JAF used in plant systems (except lighting cables) are either qualified to IEEE 383 or have been evaluated to be equivalent. This evaluation is contained in Report RVR-92-11R. Also, the cable configurations of concern at JAF, with one exception, are low voltage, where separation distances may be reduced in accordance with testing and/or analyses. The JAF alternate separation criteria applies to JAF cable sizes of 2/0 and less in limited hazard areas in service classes L, K, C and X. The exception involves 350 MCM neutral color cables routed in the Cable Spreading Room in a blue color tray. The blue tray contains armored blue color cables which are inherently protected in their own enclosures. The 350 MCM cable will be eliminated as a source of concern prior to startup either by modification (installation of tray covers or

rerouting), deenergization of the cable, or analysis (verification of double electrical isolation).

The industry raceway and cable configuration tests were designed to duplicate plant conditions as closely as possible, using actual materials (cable, tray, and conduit) supplied by utilities and arranging them in configurations which simulate actual plant installations typical and, based on a review of the Deviation reports, bounding of those at JAF. The JAF configurations bounded by the referenced industry testing are tray to tray, tray to free air cable, tray to conduit, conduit to conduit, conduit to free air cable, and free air cable to free air cable. Table 1 of this NSE contains a listing of the Deviation reports corresponding to the tested configurations. Low voltage and/or instrument cables were selected as target cables in the tests due to their susceptibility to damage. Having selected the fault cables and currents, and the target cables, the configurations were tested in a two-step sequence.

First, current was applied to the fault cable to establish its worst-case operating condition. Second, fault current was applied to the fault cable until the conductors open-circuited or until the cable temperatures stabilized. Evaluative tools such as visual inspections, video evidence, insulation resistance testing, high potential testing, continuity testing, and thermal data gathering were used to determine the condition of the target cable.

The referenced industry tests simulate and bound the actual plant configurations, the cables tested are equivalent to those used in JAF, the cable service (voltage levels) tested bound those being assessed in the walkdowns and the conservative nature of the original raceway design has no unusual characteristics from that tested. Therefore, the reduced separation distances may be utilized since they are based on testing of typical cable installations at JAF. The reductions in separation distances are based on reviews of the test data which indicate that reduced separation distances would still result in adequate separation and a conservative design.

In summary, the use of alternate separation criteria on an interim basis for assessing cable separation anomalies in JAF:

1. Does not increase the probability of occurrence or consequences of an accident or malfunction of structures, systems, or components important to safety previously evaluated in the FSAR because use of the alternate criteria results in the of adequate separation between redundant safety function circuits, as demonstrated by test.

2. Does not create the possibility of an accident or malfunction of a different type than any evaluated previously in the FSAR because adequate separation is still maintained between redundant safety function circuits, as demonstrated by test.
3. Does not reduce the margin of safety as defined in the basis for any Technical Specification. The separation distances are addressed in the FSAR with certain noted exceptions. Therefore, the bases for any Technical Specification is not involved.

4. Does not involve an unreviewed safety question based on 1, 2, or 3 above.

5. Does not involve a change to the Technical Specifications (nuclear or environmental). The separation distances are addressed in the FSAR with certain noted exceptions. Therefore, no change to the Technical Specifications is involved.

6. Does not require pre-implementation review by the NRC because no unreviewed safety question exists and no change to the Technical Specification is required.

7. Does not degrade the Security Plan, Quality Assurance Program, or the Fire Protection System because these programs are not affected by use of these separation criteria.

8. Does not affect the environmental impact of the plant or involve an unreviewed environmental question.

IV. SUMMARY

The alternate separation criteria of 1-foot horizontal and 1-foot vertical separation and 1 inch-1 inch for conduits will be utilized on an interim basis to assess cable separation anomalies discovered at JAF during recent plant walkdowns. Based on review of the walkdown documentation (deviation reports) and the cable types, sizes and configurations at JAF, industry testing at lower separation distances is applicable and is used as the basis of the JAF alternate criteria. Use of this separation criteria will maintain adequate separation between redundant safety function circuits at JAF, as demonstrated by test, and therefore does not result in an unreviewed safety question.

V. REFERENCES

1. FSAR Sections 7.1.9, 8.5.4.

2. JAF Technical Specifications.

3. Report RVR-92-11R; Evaluation Of The Flame Retardant Characteristics of Cables Installed at James A. FitzPatrick Nuclear Power Plant.

4. Wyle Test Report No. 47879-06.

5. Wyle Test Report No. 48422-01

6. Wyle Test Report No. 17769-01.

NUCLEAR SAFETY EVALUATION
JAF-SE-92-238,REV.0
TABLE 1

CONFIGURATION CODE

I CONDUIT TO CONDUIT (Reference 4)

W-5 W-7 W-8 E-7 E-10 T-030 T-032 T-034 T-035
E-17 T-05 T-07 T-014 T-010 T-036 T-037 T-038 RX-2
T-012 T-013 T-015 T-016 T-018 RX-8 RX-9 RX-11 RX-26
T-020 T-021 T-022 T-023 T-024 RX-33 RX-38 RX-47 RX-49
T-025 SC-3 SC-5 SC-6 SC-10 RX-60 RX-70 SC-11 SC-12
E-13 T-06 T-08 T-026 T-028 SC-4 T-027

II TRAY TO CONDUIT (Reference 4)

BR-4 RX-1 RX-8 RX-9 RX-11 RX-19 RX-21 RX-24
RX-32 RX-36 RX-39 RX-78

III CABLE TO CONDUIT (Reference 4)

RX-62 RX-63

IV CABLE TO CABLE (Reference 5, 6)

R-11 R-22 R-26 R-66 R-71 R-75 CR-3

V TRAY TO TRAY (Reference 5, 6)

C-15 C-25 C-37 C-44 C-53 C-69 C-83 C-114 C-125 C-138 C-143
R-24 R-33 R-35 R-50 CT-8

VI CABLE TO TRAY (Reference 5, 6)

C-8 C-43 C-87 C-105 C-107 C-109 C-115 C-122 C-123 C-124
C-140 C-141 C-145 C-149 C-150 C-154 C-155 C-158 R-1 R-2
R-3 R-5 R-12 R-13 R-16 R-17 R-18 R-19 R-20 R-21
R-25 R-27 R-28 R-29 R-32 R-34 R-47 R-48 R-52 R-53
R-58 R-59 R-60 R-62 R-72 R-73 R-74 BR-4

WYLE LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP

12-23-92

Mr. Ken Vehstedt
New York Power Authority
123 Main Street
White Plains, NY 10601

Dear Ken,

Per our discussions of 12-23-92, the following clarifications are noted. In Wyle reports 17769-01, 47879-06, 47906-02, and 48422-1, Wyle has certified (typically in Section 8) that all work was performed under Wyle's 10 CFR 50 Appendix B, Nuclear Quality Assurance Program. This signifies that each report and the activities documented in the reports were performed by Wyle, utilizing Wyle's nuclear Quality Assurance Program. Wyle's nuclear QA program meets the eighteen point criteria of 10 CFR 50 Appendix B and ANSI N45.2. Wyle has been regularly audited by the NRC and the nuclear industry. The latest NRC audit of Wyle was in May 1992.

A copy of the first five pages of the current Wyle Nuclear QA Manual are provided for your information.

Best regards,

James F. Gleason, P.E.
Director, Nuclear Engineering