



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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MEMORANDUM TO: Mark Kowal, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: A. Klein, Acting Chief */RA/*
Fire Protection Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation

SUBJECT: FIRE PROTECTION SAFETY EVALUATION INPUT FOR INDIAN
POINT UNIT NO. 3 REQUEST FOR REVISION OF EXISTING
EXEMPTIONS FROM 10 CFR 50, APPENDIX R, FOR HEMYC
ELECTRICAL RACEWAY FIRE BARRIER SYSTEM
(TAC NO. MD2671)

The Fire Protection Branch (AFPB) reviewed the request for revision of existing exemptions from Title 10 of the *Code of Federal Regulations* (10CFR) 50, Appendix R, for Hemyc electrical raceway fire barrier system submitted by Indian Point Nuclear Generating Plant Unit No. 3, dated July 24, 2006, and subsequent submittals dated April 30, 2007, May 23, 2007 and August 16, 2007, to the U. S. Nuclear Regulatory Commission's request for additional information. The analysis was reviewed in accordance with the fire protection program requirements of, Part 50, Section 48 (10CFR 50.48), "Fire Protection," and General Design Criteria 3, "Fire Protection."

Enclosed is the AFPB safety evaluation input. Should you have any questions, please contact us.

Enclosure:
As stated

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING PLANT, UNIT NO. 3
DOCKET NO. 50-286
REVISION TO EXISTING EXEMPTIONS

1.0 BACKGROUND

The Entergy Nuclear Operations, Inc. (ENO) (the licensee) is the holder of Facility Operating License No. DPR-59. The operating license authorizes the licensee to operate the Indian Point Nuclear Generating Plant, Unit No. 3 (IP3). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of two pressurized-water reactors located in Westchester County, New York.

2.0 REQUEST/ACTION

IP3 was licensed to operate prior to January 1, 1979. As such, the licensee's Fire Protection Program must satisfy the established fire protection features of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix R, per 10 CFR 50.48 (b) regulatory requirements. 10 CFR 50.48(b) requires circuits located within the same fire area to be separated in accordance with 10 CFR 50, Appendix R, Subsection III.G.2. One acceptable method (III.G.2.c) to ensure that one of redundant trains necessary to achieve and maintain hot shutdown conditions, remains free of fire damage in the event of a fire is to provide a 1-hour rated fire barrier, in addition to installed fire detection and

automatic fire suppression in the area, as one means for complying with this fire protection requirement.

In NRC letter and safety evaluation report (SER) dated February 2, 1984, the NRC granted the licensee exemptions from the requirements of Appendix R, Section III.G.2, for Fire Area ETN-4 (Fire Zones 7A, 60A and 73A) to the extent that redundant safe-shutdown trains are not separated by more than 20 feet without intervening combustibles or fire hazards, and that redundant safe-shutdown trains are not separated by 1-hour rated fire barrier in an area protected by automatic fire detection and suppression systems. The exemption was based on the minimum of 12-foot spatial separation between the redundant trains, minimal fire hazards in the area, the use of asbestos-jacketed flame-retardant cables, and the installed automatic fire detection and cable tray suppression systems.

Following a comprehensive reassessment of the IP3 Appendix R compliance basis, the licensee identified the need for additional separation measures and installed 1-hour rated fire wraps on several redundant safe-shutdown raceways in Fire Area ETN-4 (Fire Zones 7A, 60A and 73A). By SER dated January 7, 1987, the NRC accepted the use of 1-hour rated fire barriers in the above fire area and confirmed continued validity of the exemption granted by the February 2, 1984 SER. IP3 used the Hemyc fire barrier system to provide the 1-hour rated fire barriers. In the January 7, 1987 SER, the NRC also approved an exemption from Appendix R, Section III.G.2, separation requirements for Fire Area PAB-2 (Fire Zone 1) to the extent that redundant safe-shutdown trains are not separated by more than 20 feet without intervening combustibles or fire hazards, and that an automatic suppression system has not been provided. The basis for this exemption included the partial spatial separation between the redundant safe-shutdown trains, the low fire loading in the area, and the existing fire protection features including an automatic fire detection system, manual

hose stations and portable extinguishers, a partial-height non-combustible barrier designed to protect redundant equipment against radiant heat from a fire, and a 1-hour rated Hemyc cable wrap around the normal power feed to the redundant Component Cooling Water (CCW) Pump 33.

Testing by the NRC in 2005, identified Hemyc electrical raceway fire barrier system (ERFBS) as a potential nonconforming barrier, potentially not capable of providing one hour fire rating, and Information Notice (IN) 2005-07, "Results of HEMYC Electrical Raceway Fire Barrier System Full Scale Fire Testing," and Generic Letter (GL) 2006-03, "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations," were issued to licensees to inform them of the issue and to collect information regarding Hemyc fire barrier installations. In the response to GL 2006-03, ENO informed the NRC that they had declared the Hemyc ERFBS at IP3 inoperable and implemented temporary compensatory measures including an hourly fire watch and verification that fire detection systems are operable in the affected fire areas until compliance is restored for the Hemyc ERFBS. ENO asserted that in light of the minimal fire hazards and existing fire protection features in the affected fire areas, and the proposed modifications to the Hemyc ERFBS installed at IP3, which are expected to provide at least a 24-minute rated fire barrier for cable tray configurations, and 30-minute rating for conduit and box configurations, between redundant trains of safe-shutdown equipment and cables, continue to satisfy the underlying intent of 10 CFR 50, Appendix R, Subsection III.G.2.c.

In summary, by letter dated July 24, 2006, and supplemental letters dated April 30, 2007, May 23, 2007, and August 16, 2007, responding to the NRC staff's request for additional information, ENO submitted a request for revision of existing exemptions for the Upper and Lower Electrical Tunnels (Fire Area ETN-4, Fire Zones 7A and 60A, respectively), and the Upper Penetration Area (Fire Area ETN-4, Fire Zone 73A), to the extent that 24-minute rated fire barriers are used to protect redundant safe-shutdown

trains located in the above fire areas in lieu of the previously approved 1-hour rated fire barriers per the January 7, 1987 SER. For the 41' Elevation Component Cooling Water (CCW) Pump Area (Fire Area PAB-2, Fire Zone 1) ENO is requesting a revision of the existing exemptions to the extent that a 30-minute rated fire barrier is provided to protect redundant safe shutdown trains located in the same fire area.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. These circumstances include the special circumstances that (1) compliance is not necessary to achieve the underlying purpose of the rule (i.e., Subsection III.G.2 of 10 CFR 50, Appendix R), and (2) compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted.

The underlying purpose of Subsection III.G.2 of 10 CFR 50, Appendix R, is to ensure that one of the redundant trains necessary to achieve and maintain hot shutdown conditions remains free of fire damage in the event of a fire. III.G.2.c through the use of a 1-hour fire barrier, with fire detection and automatic suppression, is one acceptable way to comply with this fire protection requirement.

The staff reviewed the licensee's evaluation in support of the subject exemption revision request for a 24-minute rated fire barrier for ETN-4, and 30-minute rated fire barrier for **PAB-2**, in lieu of a 1-hour rated barrier, and concluded that given the existing fire protection features in the affected fire zones, ENO continues to meet the underlying purpose of 10 CFR 50, Appendix R, Subsection III.G.2 for the cable tray, conduit and junction box configurations. The following technical evaluation provides the basis for this conclusion.

3.1 Fire Hazards

The licensee stated that the fire hazards and ignition sources in both Fire Areas ETN-4 and PAB-2 remain materially unchanged from those described in the SERs dated February 2, 1984 and January 7, 1987. For Fire Area ETN-4, the ignition sources consist of limited transient combustibles (in all fire zones), and several instrument cabinets and a 3kVA 480V/120V instrument power transformer in Fire Zone 73A. The current IP3 Fire Hazard Analysis calculated the fire severity in Fire Area ETN-4 to be less than 60 minutes, with asbestos-jacketed flame-retardant cable insulation being the predominant combustible. The licensee states that the asbestos-jacketed cable would not constitute a significant component of the fuel source due to the flame-retardant nature of the cable. Therefore the predominant combustible would be the incidental combustibles located in the area which constitute less than one minute of fire severity.

Based on a November 22, 1982, letter that included results of testing of asbestos-jacketed cable, NRC staff concludes that the ignition sources in the area are unlikely to cause fire propagation along the cables to a significant degree, and therefore, it is reasonable to exclude the asbestos-jacketed cable from being considered a hazard within the area.

For the 41' Elevation CCW Pump Area (PAB-2, Fire Zone 1), the current IP3 Fire Hazard Analysis indicated a fire severity of less than 10 minutes. Combustibles are predominantly attributed to the CCW pump lubricating oil and transient materials.

3.2 Rated Fire Wraps

The licensee has performed an engineering evaluation to compare the details of the NRC-sponsored Hemyc fire test configurations as reported in NRC IN 2005-07, "Results of Hemyc Electrical Raceway Fire Barrier System Full Scale Fire Testing," with the details of the installed Hemyc ERFBS at IP3. The evaluation established that the configurations are comparable in most cases. Where differences were noted, minor enhancements to the ERFBS supports and installation of additional over-banding on certain enclosures will be performed to upgrade the configurations. Based on these upgrades, the licensee expected the Hemyc ERFBS at IP3 to provide at least 24 minutes of protection for cable tray configuration, and 30 minutes for conduit and box-type configurations, as demonstrated by comparison to relevant NRC-tested configurations. The following are comparisons between the IP3 Hemyc installations and NRC-sponsored test configurations:

4-Inch Conduit Configuration

The Hemyc-wrapped 4-Inch Conduit Configuration installed in Fire Area ETN-4 (Fire Zones 60A and 73A) and Fire Area PAB-2 (Fire Zone 1) is comparable to Configuration 1A in NRC Test 1. These are 4" conduits protected by a direct-attached 2" thick Hemyc blanket wrap. Tests performed by both NRC and industry indicated that this configuration provides at least 30 minutes of protection from an exposed fire using the American Society for Testing and Materials (ASTM) E-119 time-temperature profile.

Box-Type Configuration

The Hemyc-wrapped Box-Type Configuration installed in Fire Area ETN-4 (Fire Zone 73A) is comparable to Configuration 2G in NRC Test 2, except for the lack of the stainless steel over-banding. These enclosures are protected by a direct-attached 2” thick Hemyc blanket wrap. Both NRC and industry-sponsored tests indicated that box-type configurations provided at least 30 minutes of thermal protection when tested in accordance with ASTM E-119. However, to more closely reflect Configuration 2G, the licensee has committed to install over-banding on the Box-Type Configuration at IP3.

Cable Tray Configuration

The Hemyc-wrapped Cable Tray Configuration installed in Fire Area ETN-4 (Fire Zones 7A and 73A) is comparable to Configuration 2B and 2D of NRC Test 2. The licensee’s cable trays are protected by a 1-1/2” thick Hemyc blanket wrap with a nominal 2” air gap between the protected cable tray and the blanket. Fire tests conducted by both NRC and industry indicated that these Hemyc-wrapped cable tray configurations will provide at least 24 minutes of thermal protection in accordance with the ASTM E-119 time-temperature profile.

Based on the above, the NRC staff concluded that the licensee has adequately demonstrated a 30-minute rated fire wrap for the 4-Inch Conduit Configuration and Box-Type Configuration. The Cable Tray Configuration has been adequately demonstrated to provide a 24-minute rated fire wrap.

3.3 Existing Fire Protection Features

Fire Area ETN-4 contains the Upper and Lower Electrical Tunnels (Fire Zones 7A and 60A, respectively) and the Upper Penetration Area (Fire Zone 73A). This area is separated from other plant areas by 3-hour rated fire barriers. Automatic fire detection

systems and automatic cable tray fire suppression systems are installed in the area. Manual fire suppression features including accessible fire hose stations and portable fire extinguishers are also provided.

Fire Area PAB-2 contains the 41' Elevation CCW Pump Area (Fire Zone 1). This fire area is separated from other fire areas by 3-hour rated fire barriers. There is a portion of open grating from this area to the 55' elevation above. However, the open grating is located approximately 9 feet to the east of the CCW pumps; therefore, there is no potential for combustible liquids to drip directly onto the CCW pump area. Furthermore, the area on the 55' elevation only houses components such as the CCW heat exchangers, boric acid transfer pump, air receivers, and various compressed air and gas tanks that normally contain minimal combustible liquids. Automatic fire detection systems and manual fire suppression features in the form of accessible fire hose stations and portable fire extinguishers are provided in this fire zone. In addition, a 7-foot partial height, noncombustible barrier is installed around the redundant 33 CCW Pump to shield this pump from radiant heat in the event of a fire in the other CCW pump area.

3.4 Enhanced Administrative Controls of Hot Work and Transient Combustibles

The licensee stated that administrative controls of hot work and transient combustibles have improved since the previous exemptions. IP3 administrative procedures now designate Fire Areas ETN-4 and PAB-2 as "Level 2" combustible control areas, which constrain transient combustibles to "moderate" quantities as follows:

- 100 pounds of fire retardant treated lumber, or
- 25 pounds of loose ordinary combustibles or plastics, or
- 5 gallons of combustible liquids stored in approved containers, or

- One pint of flammable liquids stored in approved containers, or
- One 20 ounce flammable aerosol can

Any planned introduction of transient combustibles that is more than the allowable amount will require prior review and approval by a Fire Protection Engineer. In addition, any planned hot work in Fire Areas ETN-4 and PAB-2 will also require prior review and approval by a Fire Protection Engineer. The review will determine if additional protective or compensatory measures are required.

3.5 Evaluation

10 CFR 50, Appendix R, section II states that a licensee's fire protection program shall extend the concept of defense-in-depth (DID) to fire protection with the following objectives:

- To prevent fires from starting,
- To detect rapidly, control, and extinguish promptly those fires that do occur, and
- To provide protection for structures, systems and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant.

Regulatory Guide 1.174 also identifies factors to be considered when evaluating defense-in-depth for a risk-informed change.

The NRC staff has evaluated the elements of DID used for fire protection at IP3, applicable to the fire zones under review. The staff was concerned about the introduction of additional ignition sources and transient combustibles into the affected areas. However, the concern is addressed by existing administrative controls at IP3 which effectively limit transient combustibles to a level that would not significantly

challenge the existing fire protection features in the affected areas. The administrative control procedures at IP3 ensure that transient combustibles, which may exceed the allowable limit, will not be introduced into the affected fire zones without prior evaluation by a qualified Fire Protection Engineer, and without appropriate additional compensatory measures. The three CCW pumps make up the ignition sources in the 41' Elevation CCW Pump Area (Fire Zone 1). Each of these pumps contains a small amount of lubricating oil, with a combined fire severity of less than 10 minutes. As such, a significant fire is not expected to develop in this fire zone. The Upper Electrical Tunnel, Fire Zone 60A, contains no fixed ignition sources, and the combustible load consists of primarily asbestos-jacketed cables. Therefore, based upon consideration of the limited fire ignition sources and fire hazards in the affected areas, and the existing administrative controls of hot work and transient combustibles at IP3, the staff concludes that objective one of DID is adequately met.

Based on the evaluation of fire detection and suppression systems provided in the affected fire zones, the NRC staff determined that any postulated fire is expected to be promptly detected by the available automatic fire detection systems in Fire Area ETN-4 (Fire Zone 60A) and Fire Area PAB-2 (Fire Zone 1). Fire Zone 60A is provided with an automatic cable tray fire suppression system, as well as manual suppression equipment. Fire Zone 1 is provided with manual fire suppression only. The available fire detection and suppression equipment in these fire zones ensure that a postulated fire will not be left unchallenged. In addition, since Fire Zone 1 and 60A contain low combustible loading, the NRC staff concluded that the reduction in the level of DID due to the lack of an area wide automatic fire suppression system in these fire zones does not affect the prompt detection and suppression capability of DID objective 2.

With the proposed additional protection of electrical raceway supports and installation of over-banding on Hemyc box configurations, the modified fire barrier

configurations are expected to afford at least 24 minutes for cable tray configurations and 30 minutes of protection for conduit and box configurations. Since the Hemyc ERFBS is expected to provide only 24 or 30-minutes of protection for redundant components and cables in the event of a fire, the NRC staff was concerned about the fire loading in Fire Area ETN-4 (Fire Zone 60A). However, in light of the unlikely fire prorogation along the asbestos-jacketed cables and the installed fire detection and automatic and manual suppression systems in the area, the staff determined that a credible fire in Fire Zone 60A will be limited in severity and would not challenge the 24 or 30-minute barriers. For Fire Area PAB-2 (Fire Zone 1), the NRC staff also concluded that the 30-minute fire barrier rating is adequate in protecting the redundant safe shutdown equipment due to the lack of significant combustible loading in the area, the partial fire wall which localizes a postulated fire from affecting redundant equipment, and the available fire detection and manual suppression systems.

Based on the limited ignition sources and administrative controls satisfying DID objective 1, in conjunction with installed fire detection and suppression features which adequately satisfy DID objective 2, the NRC staff concluded that the minimal combustibles in the areas and existing active/passive fire protection features can compensate for the reduction in DID of objectives 3 and would not impact IP3 post-fire safe-shutdown capability.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. In addition, a special circumstance is present such that the application of the regulation in these particular circumstances is not necessary to achieve the underlying purpose of the rule.

Therefore, the Commission hereby grants ENO an exemption from the requirement of Section III.G.2.c of 10 CFR Part 50, Appendix R, for Fire Area ETN-4 (Fire Zone 7A, 60A, and 73A) and Fire Area PAB-2 (Fire Zone 1) at IP3, provided that the existing Hemyc ERFBS in these areas are modified to achieve at least a 24-minute fire resistance rating for cable tray configuration and 30-minute fire resistance rating for conduits and box configurations, consistent with the licensee's comparison to the NRC's tested configurations as documented in Entergy Engineering Report IP-RPT-06-00062, Revision 0, "Comparison of IP3 Hemyc Electrical Raceway Fire Barrier System to NRC Hemyc Fire Test Results," which meet ASTM-E-119 temperature rise acceptance criteria. The modifications, as committed in Entergy Letter NL-07-061, dated May 23, 2007, will include:

"Complete modification (including supporting engineering evaluation) to install stainless steel over-banding (as described), additional protection of the electrical raceway supports, and protection of certain metallic penetration items, associated with the existing Hemyc ERFBS located outside containment at Indian Point 3. [This is a clarification of commitment 3 (licensee reference number COM-07-00034) made in Entergy Letter NL-06-060 dated June 8, 2006]"

The licensee is also committed to keep fire protection compensatory measures in place at IP3 until the aforementioned modifications are completed. The scheduled completion date of these modifications is December 01, 2008.

The acceptance of this exemption is also based on the licensee's stated availability of administrative control procedures that control hot work and limit transient combustibles in the affected areas, the installed fire detection and suppression systems, limited combustibles in the locations and the 24 and 30 minute fire ratings provided by the Hemyc fire barriers.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment [enter the Federal Register citation for the Environmental Assessment in the parentheses] (XX FR XXXX).

This exemption is effective upon issuance [or state appropriate period].

Dated at Rockville, Maryland, this [date] day of [Month Year].

FOR THE NUCLEAR REGULATORY COMMISSION

, Director

Division of Licensing Project Management

Office of Nuclear Reactor Regulation