

EDO Principal Correspondence Control

FROM: DUE: 06/16/05

EDO CONTROL: G20050360  
DOC DT: 05/03/05  
FINAL REPLY:

Raymond Shadis  
New England Coalition

TO:

Reyes, EDO

FOR SIGNATURE OF :

\*\* GRN \*\*

CRC NO:

Dyer, NRR

DESC:

ROUTING:

2.206 - Degraded Fire Protection Systems at  
Entergy Nuclear Vermont Yankee

Reyes  
Virgilio  
Kane  
Silber  
Dean  
Burns  
Collins, RI  
Cyr, OGC  
Skay, NRR  
Goldberg, OGC

DATE: 05/13/05

ASSIGNED TO:

CONTACT:

NRR

Dyer

SPECIAL INSTRUCTIONS OR REMARKS:

Ref. G20050361.

Template: EDO-001

E-RIDS: EDO-01

# New England Coalition

VT . NH . ME . MA .  
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POST OFFICE BOX 545, BRATTLEBORO, VERMONT 05302

on *Nuclear Pollution*

*by e-mail [lar1@nrc.gov]*

May 3, 2005

Mr. Luis A. Reyes  
Executive Director for Operations  
Mail Stop 016E15  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

**Subject: Request for NRC enforcement action under 10 CFR 2.206  
to address degraded fire protection systems at Entergy Nuclear Vermont Yankee  
Power Station (Docket 50-271)**

Dear Mr. Reyes

New England Coalition, a non-profit membership organization incorporated in the State of Vermont, now requests under provisions set forth in the Code of Federal Regulations (10 CFR 2.206), that the U.S. Nuclear Regulatory Commission act promptly to restore reasonable assurance of adequate protection of public health and safety that is now degraded by the incorporation of substandard fire barriers in Entergy Nuclear Vermont Yankee electrical cable protection systems.

New England Coalition herein notifies NRC that Entergy Nuclear's Vermont Yankee Power Station fire protection system is not operable and cannot at this time pass minimum standards of operability under 10 CFR 50, Appendix R and other applicable regulation.

## **Background**

On April 1, 2005, NRC issued NRC Information Notice 2005-007, Results of Hemyc Electrical Raceway Fire Barrier System Full Scale Fire Testing, which notifies licensees that because of shrinkage Hemyc fire barrier failed one-hour fire tests.

NRC has listed Entergy Nuclear Vermont Yankee Power Station (ENVY) among those NRC licensees who have installed Hemyc to protect electrical cables from fire.

NRC Vermont Yankee Nuclear Power Station Inspection Report 05000271/2001-003, July 27, 2001, [Triennial Fire Inspection], details Raceway Protection on pages 3

through 6. The Report identifies the utilization of Hemyc wrap in "selected raceways" and, in particular, "*...to protect the power supply conduits for residual heat removal (RHR) pump A,*" thus documenting the involvement of at least one critical Vermont Yankee safety system.

The report examines qualification test documentation utilized by ENVY (actually its predecessor, Vermont Yankee Nuclear Power Corporation) as the bases for qualifying the Hemyc system as a one-hour fire barrier for raceways: CTP-1026 [1982] and CTP-1077 [1986].

The report shows these qualification tests to be non-conservative compared to ASTM E-119 and concludes that the tests are not in accordance with NRC Generic Letter-86-10.

Further the inspection team determined that the results of the engineering tests alone were inconclusive for qualifying the fire barrier system (Hemyc) as a one-hour rated fire barrier.

The question of acceptability of the tests was entered as an unresolved issue, URI 05000271/2001-003-01.

It is important to note that interior conduit maximum allowable temperature rise was exceeded in 42 minutes in one test and 38 minutes in another. Thus, even comparatively non-conservative testing demonstrated Appendix R standards might not be met at Vermont Yankee.

Finally, the report notes similar Hemyc test issues had been found at the Shearon Harris Nuclear Power Plant and that as far back as November 23, 1999, NRC Region II has asked assistance in evaluating resolution of the issues.

## **Conclusions**

Substantial evidence indicates that:

1. ENVY is currently operating in violation of 10 CFR 50, Appendix R and that these violations involve safety-related systems and equipment.
2. ENVY has been aware of the defects in its fire barrier qualification tests dating to the conduct of those tests in 1982 and 1986.

3. ENVY has been aware that its fire barrier qualification tests were not the equivalent of tests in ASTM E-119 and therefore the tests were not in accordance with standards set forth in GL-86-10.
4. ENVY, though having ample notice (many years), provided no justification for deviation from 10 CFR 50, Appendix R and other applicable standards.
5. Since the effectiveness, distribution, and quantity of installed HEMYC fire barriers at Vermont Yankee have not been verified, Vermont Yankee is operating in an unanalyzed condition.
6. Since the Hemyc installation at Vermont Yankee was done in the early 1980's, it is reasonable to assume that the installed Hemyc is not pre-shrunk and therefore it is susceptible to shrinkage and failure during a fire.
7. Since safety-related systems, for example residual heat removal pump power feed, are involved, it is reasonable to conclude that, absent the addition of mitigating measures, assurance of public health and safety is degraded.

#### **Request for Enforcement Action**

In consideration of the forgoing, New England Coalition now requests prompt NRC enforcement action under 10 CFR 2.206; to wit, that:

1. NRC will promptly conduct a review at ENVY to determine extent of condition; including a full inventory of the type, amount, application, and placement of Hemyc; and an assessment of the safety significance of each application,
2. NRC will require ENVY to promptly provide justification for operation in non-conformance with 10 CFR 50, Appendix R.
3. Upon finding that Vermont Yankee is operating in an unanalyzed condition and/or that assurance of public health and safety is degraded, NRC will promptly order a power reduction (derate) of Vermont Yankee until such time as it can be demonstrated that ENVY is operating in conformance with 10 CFR50, Appendix R and all other applicable regulation.

Of primary interest, is that US NRC takes prompt and decisive action to resolve uncertainties regarding the ENVY fire barrier/fire protection system and to restore

reasonable assurance of public health and safety. If in the opinion of NRC, prompt action cannot be taken through the 10 CFR 2.206 process, then New England Coalition urges that the NRC exercise its statutory discretion to order a derate of Vermont Yankee until such time as the operability of fire barrier/fire protection systems can be assured and to do so prior to screening New England Coalition's letter for acceptance into the 2.206 process.

New England Coalition respectfully reminds the NRC that ENVY is also operating Vermont Yankee in non conformance with emergency response/ emergency notification minimum standards of operability as set forth in 10 CFR 50, Appendix E, § (D)<sup>1</sup>, (E), and other applicable regulation (See NEC 2.206, December 7, 2004). Public confidence is not served when a licensee is permitted to operate outside the bounds of both safety and emergency response regulations.

New England Coalition now eagerly awaits a response. Please address all correspondence on this matter to my address below.

Thank you for your prompt attention,

Raymond Shadis  
Staff Technical Advisor  
New England Coalition  
Post Office Box 98  
Edgecomb, Maine 04556  
shadis@prexar.com

Cc: Chairman Nils J. Diaz, US NRC  
US Senator Patrick Leahy  
US Senator James Jeffords  
US Representative Bernie Sanders  
Governor James Douglas

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**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON D.C. 20555-0001**

April 1, 2005

**INFORMATION NOTICE 2005-07: RESULTS OF HEMYC ELECTRICAL RACEWAY FIRE  
BARRIER SYSTEM FULL SCALE FIRE TESTING**

**ADDRESSEES**

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel, and fuel facilities licensees.

**PURPOSE**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of the results of Hemyc electrical raceway fire barrier system (ERFBS) full-scale fire tests. The Hemyc ERFBS did not perform for one hour as designed because shrinkage of the Hemyc ERFBS occurred during the testing. It is expected that recipients will review the information for applicability to their facilities and consider actions as appropriate to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

**BACKGROUND**

The Hemyc ERFBS, manufactured by Promatec, Inc., has been installed at nuclear power plants (NPPs) to protect circuits in accordance with regulatory requirements (Reference 1) and plant-specific commitments.

As a result of fire protection inspections, unresolved items (URIs) were opened at some nuclear power stations due to questions raised regarding the fire resistance capability of the Hemyc ERFBS (Reference 2). The Office of Nuclear Reactor Regulation (NRR) performed a review of the Hemyc ERFBS (Reference 3) and requested the NRC's Office of Nuclear Regulatory Research (RES) to perform confirmatory testing of this ERFBS. RES performed the testing at the Omega Point Laboratories in Elmendorf, Texas.

**DISCUSSION**

This information notice describes the results of the investigation of the fire resistance capability of the Hemyc ERFBS (Attachment 1). The NRC performed two ASTM E 119 furnace tests on a number of cable raceway types that are protected by the Hemyc ERFBS (with and without air gaps) in accordance with the Hemyc ERFBS test plan (see ADAMS Accession No. ML043210141 for a preliminary version of the test plan). The test plan provides

**ML050890089**

a detailed discussion of the assemblies and the thermocouple positions. The Hemyc ERFBS tests were performed for a period of 60-minutes each, followed by a hose stream test and post-test visual inspection of the ERFBS.

A bare No. 8 stranded copper conductor, instrumented with thermocouples every 6 inches along its length, was routed through each of the conduit and cable tray test specimens. Additional thermocouples were mechanically attached to the outer surfaces of the conduit test specimens and along the length of both side rails of the cable tray test specimens at 6-inch intervals. All results in Attachment 1 refer to the additional thermocouples attached to the outer surfaces of the conduits and cable trays unless otherwise stated.

#### Shrinkage of the Outer Covering

The Hemyc ERFBS is constructed of Hemyc mats consisting of Kaowool insulation inside an outer covering of Siltemp high-temperature fabric. The mats are machine-stitched at the factory to fit each electrical raceway installation. Hemyc mats that are directly wrapped around the electrical raceway use 2-inch-thick Kaowool. Hemyc mats that are installed over spaced frames to provide a 2-inch air gap between the Hemyc and the electrical raceway (for cable tray protection) use 1½-inch-thick Kaowool.

While Siltemp is a frequently used descriptor for the outer covering, and thus is used generically in this information notice, the material originally known as Siltemp is not now available commercially. The Promatec vendor manual references either Siltemp, Refrasil, or Alpha 600 as equivalent materials for the outer covering of the Hemyc ERFBS mats. This testing used the Refrasil brand fabric. The term "Siltemp" is most commonly used in the nuclear industry to describe the outer covering fabric of the Hemyc ERFBS mats. The NRC's preliminary testing indicates that the material density, thickness, and fabric weave are identical for both Siltemp and Refrasil.

During the fire testing, the outer layer of Siltemp consistently showed thermal shrinkage and change of color from tan to white. This shrinkage led to some gaps opening between the Hemyc ERFBS mats. NRC's preliminary findings indicate that the color change and shrinkage of both Siltemp and Refrasil materials are spatially uniform. Based on preliminary testing both Siltemp and Refrasil shrink approximately 8 percent during the ASTM E 119 furnace exposure.

#### Opening of the Joints

This testing examined the four most common methods of joining the Hemyc material into a complete ERFBS: (1) using stitched joints, (2) using minimum 6-inch collars over a joint, (3) using minimum 2-inch overlapping of the mats, and (4) using through bolts with fender washers. The Siltemp shrinkage led to the opening of each of the joint systems, which exposed the assembly (conduit, cable tray, junction box, air drop cable) to the furnace environment. For method (1), the shrinkage led to the seams being torn open. For method (2), the mats also experienced shrinkage, causing openings in the Hemyc ERFBS. It appeared that the 6-inch collar contracted and moved with one side of the material. For method (3), the 2-inch overlapping joints also opened. For method (4), the through-bolting of the Hemyc mats on the cable tray designs using the 2-inch air gap appeared to provide the most robust resistance to Siltemp shrinkage. However, due to this rigid fixed mounting of the Hemyc mats, the Siltemp

experienced tearing of the machine sewn seams and tearing of the Siltemp fabric. All but one assembly (conduit or cable tray) experienced temperatures capable of damaging plant cables (Reference 4).

#### Supports and Intervening Item Protection

With only the 3-inch thick Kaowool protection on supports as required by the vendor manual, the single point temperature rise of 325 °F was exceeded in 13 to 32 minutes. To prevent corruption of the thermal measurement data for the raceways because of potential thermal short-circuiting from structural supports, this program did not test the raceway and the structural supports together. Intervening metallic items would also be expected to permit the same temperature rise.

#### Significance of Results

The significance of the test results is that the Hemyc ERFBS did not perform for one hour as designed. Observations made during the testing, such as mat shrinkage and thermal shorts through the support protection, were not identified during previous testing of the material. Consequently, the Hemyc ERFBS does not provide the level of protection expected for a rated 1-hour fire barrier.

#### **CONTACT**

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contact(s) listed below or the appropriate NRR project manager.

**/RA/**  
Patrick L. Hiland, Chief  
Reactor Operations Branch  
Division of Inspection Program Management  
Office of Nuclear Reactor Regulation

Technical Contact: Daniel Frumkin, NRR/DSSA  
301-415-2280  
E-mail: [dx1@nrc.gov](mailto:dx1@nrc.gov)

Attachment 1: Hemyc 1-Hour Fire-Rated Test Results

Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.



**References:**

- 1. Title 10 of the Code of Federal Regulations, Part 50, Appendix R, Section III.G.2**
- 2. NRC Inspection Report 50-400/1999-13 (ADAMS Accession No. ML003685341); NRC Inspection Reports 50-369/2000-09 and 50-370/2000-09 (ADAMS Accession No. ML003778709)**
- 3. NRR Response to Task Interface Agreement (TIA) 99-028, "Shearon Harris Nuclear Power Plant, Unit 1 - Resolution of Pilot Fire Protection Inspection Fire Barrier Qualification Issues," dated August 1, 2000 (ADAMS Accession No. ML003736721)**
- 4. Inspection Manual Chapter 0609, Appendix F, Fire Protection Significance Determination Process, Attachment 7, page F7-2**

**Hemyc 1-Hour Fire-Rated Test Results  
Conduit , Supports & Junction Box**

Raceway	Time to $\Delta T_{ave} \geq 250^{\circ}\text{F}$ (minutes)	Time to Single Point $\Delta T > 325^{\circ}\text{F}$ (minutes)	Max. Temp. Bare #8 @ 1 hour <sup>1</sup> (°F)	Joint Opening <sup>2</sup>  Yes/No
1" Conduit (1E) (Empty)	46	42	1013	Yes
1" Conduit (1F) 1.02 lb./linear foot (lin.ft.) Cable Fill	44	34	1177	Yes
2 ½ " Conduit (1C) (Empty)	48	41	709	Yes
2 ½ " Conduit (1D) 5.85 lb./lin.ft. Cable Fill	51	38	446	Yes
4" Conduit (1A) (Empty)	49	33	865	Yes
4" Conduit (1B) 14.84 lb./lin.ft. Cable Fill	57	43	199	Yes
Junction Box 18" x 24" x 8"	17	15	NA	Yes
Unistrut Support <sup>3</sup>	NA	22 - 32	NA	NA
2" Tube Steel Support <sup>3</sup>	NA	13 - 25	NA	NA

**Hemyc 1-Hour Fire-Rated Test Results  
Cable Tray, Junction Box, & Airdrop**

Raceway	Right Side Tray Rail $\Delta T_{ave} \geq$ 250°F (minutes)	Right Side Tray Rail Single Point $\Delta T > 325^\circ\text{F}$ (minutes)	Left Side Tray Rail $\Delta T_{ave} \geq$ 250°F (minutes)	Left Side Tray Rail Single Point $\Delta T > 325^\circ\text{F}$ (minutes)	Bare #8 $\Delta T_{ave} \geq$ 250°F (minutes)	Bare #8 Single Point $\Delta T > 325^\circ\text{F}$ (minutes)	Bare #8 Max. Temp. @ 1 hour (°F)	Joint Opening <sup>2</sup> Yes/No
12" Cable Tray Empty, (2A) Direct Attachment	36	34	27	18	32	32	1260	Yes
12" Cable Tray Empty, (2B) 2" Air Gap	37	35	38	35	33	34	1002	Yes
36" Cable Tray Empty, (2C) Direct Attachment	41	39	34	33	35	35	1330	Yes
36" Cable Tray Empty, (2D) 2" Air Gap	32	31	33	32	28	27	1117	Yes
Air Drop, (2E) Direct Attachment	NA	NA	NA	NA	35	32	1712	Yes
Air Drop, (2F) 2" Air Gap	NA	NA	NA	NA	32	28	1411	Yes
18" x24" x 8" Junction Box, (2G) Direct Attachment with Bands <sup>4</sup>	31	32	NA	NA	NA	NA	NA	Yes

Notes:

1. The temperatures recorded on the Bare No. 8 conductor may not be indicative of the actual temperature inside the assembly for two reasons. First, to insure the integrity of the thermocouple's jacket and insulation during installation, the instrumented Bare No. 8 conductor was located in the center of the cable; therefore it may not have been exposed to the highest temperature within the conduit. The second reason was that the joints opened during the testing, producing local hot spots on the interior of the raceway that may or may not have been picked up by the Bare No. 8 conductor.
2. All Hemyc ERFBSs experienced some thermal shrinkage of the outer Siltemp covering. As a result, some joints opened and exposed the conduits or cable trays to the furnace environment at various points during the test.
3. The time provided for the structural supports was determined to be the time when the single point temperature rise ( $\Delta T$ ) exceeded 325 °F at a distance 3 inches into the Hemyc insulation protecting the structural steel. Three inches is the minimum structural support protection recommended in the vendor manual.
4. The junction box average temperature is the average across all thermocouples mounted on the outside of the box's surface. The single-point temperature is also measured on the external surface of the junction box.