

July 25, 2003

NG-03-0527  
10 CFR 50  
Appendix R

Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
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DUANE ARNOLD ENERGY CENTER  
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RESPONSE TO NRC UNRESOLVED ITEM 50-331/03-02-03(DRS): EPOXY FLOOR COATINGS

REFERENCE: NRC INSPECTION REPORT 50-331/03-02(DRS), DATED MAY 22, 2003, JULIO LARA (NRC) TO MARK PEIFER (NMC)

In the referenced Inspection Report, the NRC identified Unresolved Item (URI) 50-331/03-02-03(DRS) regarding the acceptable use of epoxy floor coatings at Duane Arnold Energy Center (DAEC). The item was identified during the NRC Triennial Fire Protection Inspection at DAEC.

The Inspection Report included a request for additional information, within sixty days, to support resolution of the URI. Specifically, in enclosure 2 of the referenced Inspection Report, a request was made to provide an evaluation or an action plan to justify acceptability of epoxy floor coverings which qualify as interior coatings (i.e., having thicknesses which exceed 0.9 millimeters and a flame spread rating which exceeds 25). It was also stated that the evaluation or action plan should address:

- 1) contribution to combustible fire loading for fire areas,
- 2) impact on areas required to be free of combustibles (such as separation zones required to support an exemption or to meet 10 CFR Part 50, Appendix R), and
- 3) potential for fire propagation from one fire area to another. If testing is used to support an evaluation, such testing should bound actual plant configurations (i.e., thickness and material composition).

Our response to this request is included in the Attachment.

This letter contains no new commitments.

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Sincerely,

A handwritten signature in black ink, appearing to read 'Mark A. Peifer', with a stylized flourish extending to the right.

Mark A. Peifer  
Site Vice President, Duane Arnold Energy Center

Attachment : Evaluation to Support Resolution of NRC Unresolved Item 50-331/03-02-03(DRS)

cc: Regional Administrator, USNRC, Region III  
Director, Office of Enforcement  
Project Manager  
NRC Resident Inspector-DAEC

**Attachment to NG-03-0527**  
**Evaluation to Support Resolution of**  
**NRC Unresolved Item 50-331/03-02-03(DRS)**

Request

Provide an evaluation or an action plan to justify acceptability of epoxy floor coverings which qualify as interior coatings (i.e., having thicknesses which exceed 0.9 millimeters and a flame spread rating which exceeds 25). The evaluation or action plan should address 1) contribution to combustible fire loading for fire areas, 2) impact on areas required to be free of combustibles (such as separation zones required to support an exemption or to meet 10 CFR Part 50, Appendix R), and 3) potential for fire propagation from one fire area to another. If testing is used to support an evaluation, such testing should bound actual plant configurations (i.e., thickness and material composition). We request that the evaluation or action plan be provided to the NRC within 60 days.

Response

Epoxy coatings have been applied to various concrete floors throughout the DAEC facility since the time of the DAEC's commitment to Appendix A of BTP APCS 9.5-1. Coating samples taken from areas containing safety related equipment range in thickness from 0.003 inches to 0.071 inches (90 percent of samples) with a few outliers having thicknesses up to 0.182 inches.

A review of fire protection literature suggests that the presence of epoxy based floor coatings at the DAEC constitutes a very low hazard. The Branch Technical Position to which the DAEC is committed does not differentiate between interior finishes applied to walls and ceilings and those applied to floors. Fire behavior of materials in floor configurations, however, is recognized as less severe than fire behavior of the same materials in wall and ceiling configurations. The National Fire Protection Association (NFPA) Fire Protection Handbook, Nineteenth Edition, chapter entitled "Interior Finish" states:

Experience has shown that traditional floor coverings, such as wood, vinyl tile, and linoleum, are not likely to affect early fire growth. In most instances, there will be little gain in safety achieved by regulating traditional floor coverings.

A representative from Nuclear Electric Insurance Limited (NEIL) was contacted and asked whether they regard epoxy based floor coatings, in general, to be suitable for application in nuclear power plants. The representative stated that "the fire hazard from epoxy coatings is reasonably low. The material is technically a combustible product and will burn, but it does not sustain combustion and it self extinguishes." NEIL has accepted the use of epoxy floor coatings at other nuclear facilities and the representative was not concerned by its use at the DAEC.

In addition to the perspective indicated by both NFPA and NEIL, epoxy floor coatings have, on occasion at DAEC, been subjected to dropped heated material from welding operations. These occurrences have created burn spots on the floor consistent with the size of the welding/cutting byproducts. Experience has shown that these scorched areas self-extinguish within a short period of time. This anecdotal evidence supports the position held by NEIL that epoxy coated concrete floors are unlikely to propagate flame.

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DAEC Engineering staff has evaluated the contribution that epoxy floor coatings may have to combustible loads in safety related areas of the plant, using conservative estimates for coating volume and caloric content. The resulting total combustible loads did not present a challenge to the plant's fire barriers. In addition, application to concrete floors distinguishes the expected fire behavior of these coatings from that of electrical cables, hydraulic fluids and miscellaneous ordinary transient combustibles, materials that commonly exist throughout the plant and are accounted for in combustible inventories. Application of epoxy to concrete floors serves to minimize the likelihood of ignition and flame spread in these floor coatings. For these reasons, the contribution of epoxy floor coatings to area fire hazards was determined to be negligible and, therefore, does not warrant their inclusion in the inventories of plant combustible materials.

The potential for fire spread via floor coatings has been evaluated for the following fire zone configurations:

- those on the same building elevation for which no physical fire barrier separation exists, but which credit spatial separation and no intervening combustibles with providing the necessary fire area separation, and
- those on the same building elevation which credit a single door with providing the necessary fire area separation

The region between the north and south portions of the torus room does not have a physical fire barrier to separate these two fire areas. An exemption from the III.G.2. separation requirements of Appendix R to 10CFR50 has been granted for this area. The exemption credits 50 foot-wide areas of spatial separation with no intervening combustibles and the large, non-combustible torus and drywell between redundant divisions of safe shutdown equipment, in addition to a low combustible load throughout the torus room. Epoxy floor coatings do not represent an intervening combustible in the torus room due to the difficulty in igniting and sustaining a flame capable of propagating the distances referenced in the exemption. Therefore, the presence of an epoxy coating on the torus room floor is acceptable.

A second plant area that lacks a physical fire barrier to provide the necessary separation is the 747 foot elevation in the pump house. Here, the necessary separation between redundant divisions of safe shutdown credited electrical cables is provided by a 20 foot-wide area of spatial separation with no intervening combustibles, in addition to fire detection and suppression systems installed in the area in accordance with the requirements of Appendix R to 10CFR50. As with the torus room, epoxy floor coatings do not represent an intervening combustible in this area of the pump house due to the difficulty in igniting and sustaining a flame capable of propagating the 20 foot distance mentioned. Therefore, the presence of an epoxy coating in this area of the pump house is also acceptable.

Fire areas that credit a single door with providing the necessary separation contain either rated or evaluated fire doors. In addition, there also exists a non-combustible threshold beneath these doors, which would further reduce the likelihood of flame propagation between fire areas. Therefore, in these plant locations, the presence of epoxy floor coatings does not provide a credible means of spreading fire between multiple fire areas.

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The presence of epoxy floor coatings, as currently applied at the DAEC, is judged to be acceptable. Epoxy floor coatings applied to concrete substrates are not expected by the fire protection community to present an unusual hazard in industrial applications. It is appropriate for epoxy floor coatings to be added to the list of plant combustible materials excluded from consideration in combustible inventories given that they are unlikely to contribute significantly to the existing fire hazard. The impact on fire spread in designated areas of the plant, required to be free of combustibles, has been found to be acceptable due to the difficulty for its epoxy floor coating to ignite and sustain a flame capable of propagating across the region required to be free of intervening combustibles. The potential for fire propagation between fire areas that credit a single door with providing separation is not increased by application of epoxy coatings on their floors. Since the doors are either rated or evaluated fire doors, and since non-combustible thresholds are present beneath the doors, flame propagation between the fire areas is not credible. For these reasons, it is appropriate to identify the existing epoxy floor coatings as an exception to the DAEC's commitment to Position D.1.(d) of BTP APCSB 9.5-1, which establishes flame spread rating criteria for "interior finishes."