

April 10, 2017

EA-17-024

Mr. Tracy Bolt, Director of Quality
AZZ Nuclear | NLI
7410 Pebble Drive
Fort Worth, TX 76118

SUBJECT: RESPONSE TO TWO DISPUTED NOTICES OF NONCONFORMANCE
CONTAINED IN NUCLEAR REGULATORY COMMISSION INSPECTION
REPORT 99901471/2016-201

Dear Mr. Bolt:

I am responding to your letter dated January 13, 2017, in which you disputed Nonconformances 99901471/2016-201-03 and 99901383/2016-201-04 as identified in the Notice of Nonconformance (NON) attached to the Nuclear Regulatory Commission (NRC) Inspection Report 99901471/2016-201 dated December 14, 2016 (ADAMS Accession No. ML16305A097). The NRC staff identified these NONs during an inspection conducted from September 19 through 22, 2016, at your facility in Fort Worth, TX. The NONs described examples where AZZ NUCLEAR | NLI (hereafter referred to as AZZ) was not fully implementing its Quality Assurance program in the areas of design control and commercial-grade item dedication.

In your letter, you disputed NON 99901471/2016-201-03, which concerned the use of Masterpact circuit breakers as motor starters with overcurrent trip devices that are powered from the load side of the breakers supplied to Public Service Enterprise Group for use at the Hope Creek Nuclear Station. The NRC identified that AZZ had not verified the adequacy of this aspect of the design as part of their design verification or commercial-grade dedication processes. The AZZ reply stated that the design of the Masterpact circuit breaker was verified extensively by review, qualification testing and dedication testing activities, in addition to review of operating history. You also stated that although this unexplained phenomenon has occurred at the Public Service Enterprise Group facility, the technical evaluations and dedication activities you performed were adequate to ensure with reasonable assurance that the breaker would perform the intended safety function in the design application.

You also disputed NON 99901471/2016-201-04 regarding two examples of inadequate commercial-grade dedication. In the first example AZZ failed to verify the critical characteristic of total harmonic distortion and power quality on the output of a repaired Exeltec inverter supplied to Entergy and in the second example AZZ failed to identify and verify the critical characteristic of current interrupting rating for Masterpact circuit breakers supplied to Tennessee Valley Authority. For the first example the AZZ reply stated that the inverter was returned to AZZ from the client to have refurbishment activities performed on the unit and that this unit had been previously dedicated by AZZ using the dedication plan that had been approved by the client for the specific application. The dedication plan was revised to include a reference to the

generic technical evaluation for inverters. With respect to the second example, AZZ's position is that the interrupting rating of a circuit breaker is not considered a critical characteristic because there is no credible failure mechanism associated with this design characteristic and that the AZZ technical evaluations covering circuit breakers identify the critical characteristic to be verified partly on information contained in UL489, "Standard for Molded Case Circuit Breakers, Molded-Case Switches, and Circuit Breakers Enclosures," and guidance in NRC Bulletin 88-10, "Nonconforming Molded Case Circuit Breakers."

The NRC staff has independently reviewed the information provided in your letter of January 13, 2017, and has concluded that NON 99901471/2016-03 and NON 99901471/2016-04 occurred as stated in the NONs of September 22, 2016. The bases for the NRC conclusions regarding this matter are provided in the enclosure to this letter.

Please provide a written statement or explanation within 30 days from the date of this letter in accordance with the instructions specified in the Notice of Nonconformance described in the December 14, 2016, inspection report. We will consider extending the response time if you show good cause for us to do so.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public inspections, exemptions, requests for withholding," of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any additional questions, please contact Richard McIntyre of my staff at 301-415-3215.

Sincerely,

/RA/

Paul G. Krohn, Deputy Director
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99901471

Enclosure:
NRC Evaluation and Conclusions for
NON 99901471/2016-03 and NON
99901471/2016-04

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REPORT 99901471/2016-201

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NUCLEAR REGULATORY COMMISSION'S EVALUATION AND CONCLUSION

Statement of Nonconformance 99901471/2016-201-03

Criterion III, "Design Control," of Appendix B "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," states, in part, that, "The design control measures shall provide for verifying the adequacy of the design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program."

Contrary to the above, as of September 22, 2016, AZZ failed to take adequate actions to verify the adequacy of the design for Masterpact breakers supplied to Public Service Enterprise Group, for use at the Hope Creek Nuclear Station, and that are used as motor starters with overcurrent trip devices that are powered from the load side of the breakers. Since the overcurrent trip devices for these breakers only receive power once the breakers are shut (upon starting of a motor), there is an undefined startup time before the breaker can accurately process load current data. When used as a motor starter, this startup time could potentially cause erroneous data to be acquired or make them more susceptible to noise interference. AZZ had not verified the adequacy of this aspect of the design as part of their design verification or commercial-grade dedication processes.

Basis for Disputing the Nonconformance

In its response to the NRC, AZZ stated that the technical evaluations and dedication activities performed were adequate to ensure with reasonable assurance that the breaker would perform the intended safety function in the design application. The AZZ reply stated that the design of the Masterpact circuit breaker was verified extensively by review, qualification testing and dedication testing activities, in addition to review of operating history. You also stated that although this unexplained phenomenon has occurred at the Public Service Enterprise Group facility, the technical evaluations and dedication activities you performed were adequate to ensure with reasonable assurance that the breaker would perform the intended safety function in the design application.

AZZ stated that the application of closing the breaker to start a fan motor was not considered a credible failure mode when the technical evaluation was performed. During the original dedication and qualification of the equipment, the trip unit was evaluated and verified to ensure that it would perform its intended safety function and critical characteristics were identified based on the intended safety function with the overcurrent trip devices powered from the supply (or line) side of the breaker.

NRC Evaluation of Vendor's Response to the Nonconformance

An independent reviewer from the NRC staff has evaluated AZZ response and has concluded that Nonconformance 99901471/2016-201-03 occurred as stated in our letter dated December 14, 2016. The independent reviewer's basis for this determination is as follows:

While AZZ has stated that more than 1000 breakers have been supplied to the nuclear industry and the failures to date have been limited to a select set of breakers at one facility, this alone does not provide reasonable assurance that the breakers will be able to fulfill their safety

functions under all design basis conditions. Specifically, AZZ has not evaluated the suitability of the subject circuit breakers for use as motor starters when the overcurrent trip devices are powered from the load side of the breakers, such as is with the case for those supplied to the Hope Creek Nuclear Station. In addition, AZZ has not communicated to its purchasers any limitations on the use of these breakers in such applications. As discussed in the subject inspection report, when the overcurrent trip devices are powered from the load side of the breakers, there is likely some finite time period before the overcurrent trip circuitry is stabilized and can accurately process actual data associated with the current being delivered through the breakers. AZZ has not performed an analysis of the acceptability of this overcurrent trip circuitry when used in this application, nor has AZZ performed testing sufficient to bound the use of these breakers in this application. Specifically, AZZ has not evaluated the accuracy of the overcurrent trip devices during their startup/initialization period, nor has AZZ evaluated whether or not the overcurrent trip devices would be more susceptible to externally generated electromagnetic interference during the startup period. These concerns are specifically applicable to applications where the circuit breakers are being utilized as motor starters.

The fact that the failure rates to date at the Hope Creek Nuclear Plant have been low is not reason alone to justify their suitability for the specific application, as it is unknown whether these breakers would be able to perform under all design basis conditions, some of which may not have been experienced to date. As discussed in the inspection report, the use of the breakers in this application is contrary to the recommendations made by the original equipment manufacturer (OEM) who has stated for such applications the overcurrent trip devices should be powered from the line side of the breakers or from an external power supply. AZZ's decision to deviate from the OEMs recommendations in this case is not supported by either testing or analysis.

Statement of Nonconformance 99901471/2016-201-04

Criterion III, "Design Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," states in part that, "Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions for the structures, systems and components."

Contrary to the above, as of September 22, 2016, AZZ failed to ensure the suitability of equipment that is essential to the safety-related functions for certain components supplied to the nuclear industry on two occasions. First, AZZ failed to verify the critical characteristic of total harmonic distortion and power quality on the output of a repaired Exeltec inverter supplied to Entergy under purchase order (PO) 10454062. In the second instance, AZZ failed to identify and verify the critical characteristic of current interrupting rating for Masterpact circuit breakers supplied to Tennessee Valley Authority under PO 758798.

Basis for Disputing the Nonconformance

In its response to the NRC, AZZ stated that for the first example, the inverter was returned to AZZ from the client to have refurbishment activities performed on the unit. This unit had been previously dedicated by AZZ using the dedication plan that had been approved by the client for the application. The dedication plan was revised to include a reference to the generic technical evaluation for inverters (TE-E-5). There was no reference or explanation made on the dedication plan as to why the harmonic distortion was not required to be verified for the unit

being tested following the required activities that were being performed on the unit. The unit was tested utilizing the critical characteristics that had been approved by the client.

For the second example AZZ described that a review of the generic circuit breaker technical evaluations TE-E-2 and TE-E-6 had been performed for completeness and that the breaker interrupt rating is not considered a critical characteristic because there is no credible failure mechanism associated with this design characteristic. Additionally, UL489, "Standard for Molded Case Circuit Breakers, Molded-Case Switches, and Circuit Breakers Enclosures," and NRC Bulletin 88-10, "Nonconforming Molded Case Circuit Breakers," were reviewed by AZZ to determine the applicability of circuit breaker interrupt rating as a critical characteristic. AZZ stated that they do not consider all design characteristics as critical characteristic and thus do they do not all require verification. Finally, AZZ stated they utilized industry documents including: UL489; NRC Bulletin 88-10; OEM documentation; and the 2014 EPRI Technical Report 3002002982, Revision 1 to NP-5652 and TR-102260 as supporting basis to the AZZ technical evaluation, for their determination of what critical characteristics need to be verified during dedication testing of circuit breakers.

NRC Evaluation of Vendor's Response to the Nonconformance

An independent reviewer from the NRC staff has evaluated AZZ's response and has concluded that Nonconformance 99901471/2016-201-04, occurred as stated in our letter dated December 14, 2016. The independent reviewer's basis for this determination is as follows:

With respect to Nonconformance 99901471/2016-201-04, example one, the NRC disagrees with AZZ's position that revising the dedication plan to include a reference to the general technical evaluation for inverters without an explanation made on the dedication plan as to why harmonic distortion was not required to be verified for the unit being tested following the required activities that were being performed on the unit, is acceptable. Verifying that the total harmonic distortion of the inverter is below specified levels is important as excessive distortion in the output of the inverter could impact the proper operation of connected equipment. The NRC understands the unit was tested utilizing the critical characteristics that had been approved by the client, however the critical characteristic of harmonic distortion and power quality on the output of the repaired Exeltec inverter, that was identified in the generic Technical Evaluation for inverters (TE-E-5), was never included in the AZZ generated Verification Plan (VP-0770131-1, Revision 2) and was never verified.

With respect to the second example, the NRC disagrees with AZZ's position that the interrupting rating of a circuit breaker is not a critical characteristic. Generic technical evaluation, TE-E-2, for low and medium voltage circuit breakers, did identify a number of breaker functions as critical characteristics, however, it did not identify verification of the breakers current interrupt rating as a critical characteristic. While it is true that not all design characteristics need to be considered critical characteristics, EPRI 3002002982 clearly states in Section 6.2 that "Selected design characteristics that are essential for the item's safety related functional performance would be included in the critical characteristics." Since a circuit breaker's interrupting rating is essential to ensuring that the breaker can safely interrupt design basis faults, the interrupting rating would need to be considered a critical characteristic. Verifying interrupting capacity of fault protection devices is important due to the failure of this breaker to function could result in loss of power and/or damage to associated equipment should a short circuit occur. Furthermore, verification of the other critical characteristics of the breaker provides little assurance that the interrupting rating has been met. Likewise, operating experience in this case would not be applicable, as the events in question that would challenge a breaker's interrupting rating are infrequent in nature.

With regard to UL 489, while it is true that this standard requires destructive interrupting testing to be performed on a sample of the commercially manufactured breakers, this testing, like any other commercially performed testing for which a dedicating entity would like to credit as part of a commercial-grade dedication process, needs to be verified. Such verification could include a review of the actual testing performed as part of a commercial-grade survey of the breaker manufacturer. Among the items that would need to be considered would be a review of any relevant test data, control of testing, etc., that is applicable to the type of breakers being supplied. Alternatively, a dedicating entity could chose to perform independent testing.

With regard to NRC Bulletin 88-10, the testing protocol contained in Attachment 1 was provided as a means to address a specific issue associated with fraudulent molded case circuit breakers. While performing the tests referenced in the bulletin was considered by the NRC as adequate at the time to address the specific issue identified, it was not intended to be utilized as a basis for establishing a commercial-grade dedication program for the procurement of all subsequent circuit breakers, and in particular larger circuit breakers such as those being supplied by AZZ for which the interrupting rating is more critical.