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HILTI®

U.S. Construction Company

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September 16, 1986

U.S. Nuclear Regulatory Commission
Office of Inspection & Enforcement
Washington, D.C. 20555

Attention: Mr. John Fair

Dear Mr. Fair:

Subsequent to our meeting on August 28, 1986, I have reviewed in detail the Kwik-Bolt data and would like to provide you with the following information.

First, on-site Kwik-Bolt testing was conducted at Susquehanna Steam Electric Station/Emergency Diesel Generator Facility during May, 1985, and March/April, 1986 (Attachment 1). These tests indicated some local site-specific deviations from the expected values for the 3/8, 1/2, 5/8, 3/4 and 1-1/4 inch Kwik-Bolts with deep embedments (Attachment 2). A preliminary review at the jobsite did not reveal a cause for the differences.

The Susquehanna Kwik-Bolt data along with other nuclear power plant on-site test data (39 test reports; 1425 data points, Attachment 4) was compared to the published values. This analysis revealed that the on-site average ultimate tensile values met or exceeded the current published ultimate tensile values except for the 1/2 inch diameter Kwik-Bolt with embedments greater than 3-1/2 inches. These values were 7 to 20% below published data.

Next, additional 1/2 inch Kwik-Bolt tests were conducted at the HILTI Test Center (Report WENT #115-86). This test program confirmed the 1/2" ultimate tensile values reported in the nuclear power plant on-site test report data analysis.

In addition, tensile tests were conducted in a hard river gravel (Moh's hardness #9) to determine the influence of aggregate hardness on the 1/2 inch Kwik-Bolt. For comparison, the limestone aggregate normally used in our testing has a Moh's hardness equal to 4 or 5. The test results in the river gravel concrete met or exceeded the published data by 0 to 16%. As the aggregate hardness increases, the ultimate tensile values increase until the bolt or wedge material strength is exceeded. Thus, we have concluded that the 1/2 inch Kwik-Bolt tensile values are influenced by the coarse aggregate hardness.

September 16, 1986

We believe that aggregates commonly used in concrete mix designs more closely match the limestone aggregate used in our laboratory vs. a hard river gravel. Therefore, after review of all the test data, we have elected to revise the 1/2 inch diameter Kwik-Bolt tensile values, (Attachment 10). All other Kwik-Bolt values will remain as currently published.

For your review, I have calculated the factor of safety using the revised ultimate values vs. the current working load. As you can see, even for the worst case, there remains at least a 2.9:1 factor of safety. Practically, there would probably be at least a 3.6 to 1 factor of safety since most designs are based on a 4000 psi concrete and an embedment of less than six (6) inches.

In summary, the Kwik-Bolt values currently published are substantiated by the on-site field test reports. The only exception is the 1/2 inch diameter Kwik-Bolt, which is influenced by aggregate hardness at deep embedments.

Any NRC notice deemed appropriate could be developed with the text being specific and narrow in scope. Working together, HILTI can be supportive to you and to the utility owners in effectively and efficiently resolving application questions that need attention. I am available to meet with you as required.

Sincerely,

HILTI U.S. CONSTRUCTION

Charles J. Poparad

Charles J. Poparad, P.E.
Director
Technical Marketing Services

CJP:bc
Attachments

cc: M. Hilti - HILTI/Tulsa
E. Hoelker - HILTI/Tulsa
R. L. Zink - HILTI/Tulsa

ATTACHMENTS

1. Susquehanna Test Reports - March 1985 March/April 1986
2. Susquehanna Test Data Analysis
3. Nuclear Power Plant On-Site Test Data Analysis Index
4. Nuclear Power Plant On-Site Test Data Analysis
5. Hilti Test Report WENT #115-86
6. 1/2" Kwik Bolt Detailed Data Analysis
7. 1/2" Diameter Kwik Bolt Data Analysis Excluding Susquehanna Test Reports
8. Susquehanna Kwik Bolt Material/Dimension Analysis
9. Concrete Mix Design
10. Revised 1/2" Kwik Bolt Tension Values
11. Factor of Safety Analysis
12. Nuclear Power Plant On-Site Test Index

Attachment 1

SUSQUEHANNA TEST REPORTS

March 1985
March/April 1986