UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

May 15, 1973

MEMO TO ATTENDEES

SUMMARY OF MEETING WITH ERICO PRODUCTS, INC. ON MAY 8, 1973

A meeting was held in Bethesda on May 8, 1973, between representatives of Erico Products, Inc., Regulatory Standards, Licensing, and Regulatory Operations. A series of questions had been raised by Erico in a letter of April 25, 1973, regarding the interpretation and application of Regulatory Guide 1.10, Revision 1 of 1/2/73, "Mechanical (Cadweld) Splices in Reinforcing Bars of Category I Concrete Structures." The following responses were given to Erico by the representatives of RS, L, and RO. Responses are numbered to match the questions of the Erico letter, which is attached.

1. It is not necessary to qualify splices in all positions at the time of initial qualification — only those positions which will actually be used at that time. (C.I.)*

2. It is acceptable to prepare the qualification splices for each of the splice positions using the largest bar size to be used in that position. (C.I.)

3. The qualification for each splice position can be postponed until that position becomes necessary for production. (C.I.)

4. It is necessary to requalify a splicer if the specific splice position has not been used for a period of 3 months or more even though his splices will pass visual inspection and his production samples pass the tensile test requirements. (C.I.)

5. Requalification of a splicer is not necessary if based on a single visual reject. Statistical sampling procedures permit a discard sample. However, consistent visual rejects by the inspector should be cause for requalification. (C.I.)

6. The same concept of a statistical discard sample is reflected in Section C.5. If 1 of 15 consecutive test samples fails, the sampling program can be started anew without requalifying the crew. If the failure rate exceeds 1 in 15, then the provisions of C.5. should be followed and the crew requalified. (C.5.)

7. The splicer should be requalified for all positions being used at that time. (C.1.)

8. It is intended that an inspector check the mechanical splice preparations prior to casting of the splice, but that it not be necessary for each mechanical splice to be so inspected. It is intended that the inspector would cover the work of more than one crew and that periodic preparation checks would be made. However, each completed mechanical splice should be visually inspected. The next revision of Regulatory Guide 1.10 will clarify this point. (C.2.)

9. Manufacturer's specifications are presumed to be incorporated as minimum requirements in the A/E specs. Supplementary requirements in excess of manufacturer's specs are a matter between the manufacturer and the A/E. Tolerances for the items enumerated in C.2. for inclusion in the specs are deferred by the AEC to the A/E or manufacturer's specs. (C.2.)

10. Delecte by Erico.

11. Shop-welded splices are not covered by this guide and therefore are a matter to be taken by on a case-by-case basis with Licensing. It is to be noted that the arc welding of the mechanical splice sleeves to structural steel shapes is not covered by this guide, but the installation of the reinforcing bar into the sleeve is covered.

    The next revision of Regulatory Guide 1.10 will carry an insert in the 3rd paragraph of Section 3 such as: "In testing such a connection, consideration should be given to the design requirements and limitations of the entire anchorage." (C.3.)

12. Splice locations should be indicated such that a record search can locate the splices and where the samples were taken, as well as whether it was a production or sister sample. The method of accomplishing this end is left to the applicant. Test results should also be available. (C.3.b.)

*Refers to paragraph in Regulatory Guide 1.10

13. If they are available, referral to the proper detailed placing drawings would satisfy the splice location requirement. (C.3.b.)

14. This item will be taken up separately at a later date.

15. "Each 15 consecutive test samples" pertains to the total output of all splicers, for the practical reasons illustrated in questions 16 and 17. (C.5.a.)

16. To be handled in the most practical manner possible on a case-by-case basis with Licensing and Operations being advised of the steps taken.

17. Answered in 15.

A copy of the April 25, 1973, Erico letter is attached.

E. Gunter Arndt

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April 8, 1980

Gentlemen:

We are pleased to submit our comments on American National Standard "Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete, Structural Steel, Soils, and Foundations During the Construction Phase of Nuclear Power Plants," ANSI/ASME N45.2.5-1978.

1. Page 11, Section 6.12.3. The second paragraph needs clarification. The second sentence states, "Straight sister splice samples shall be made for each of the required curved reinforcing bar production splices." This implies that, for every production splice on curved bars, it is necessary to make a sister splice. This statement is not true. It should be rewritten to state, "Straight sister splice samples shall be made for each of the curved reinforcing bar production splices selected for testing, in accordance with the frequency specified in Section 6.12.4."

2. The listing of specific test designations for soil in Table B suggests that these are required or preferred test methods and that other test methods are to be excluded. This places an undue limitation on soil testing programs. This limitation should be remedied by identifying the list as "Commonly Used Test Methods." (Insert this identification next to "Requirements" at the head of Table B). A statement that other test methods may be acceptable should also be added.

   a. Specific comments on test methods in Table B are given below:

      Compaction Tests

      On some nuclear power projects, the required field compaction of cohesionless soils has been set as a percentage of the maximum determined by a vibratory table in accordance with ASTM D2049. This test method should be added to Table B. ASTM D2049 is especially appropriate in gravelly soils because

large particle sizes can be tested and because the test eliminates the difficulty of determining the moisture content of materials that drain rapidly during compaction by impact methods.

Grain Size

ASTM D422 requires both a hydrometer analysis and sieve analysis to be performed; it does not state that either a hydrometer or sieve analysis should be performed, depending on soil type. For sandy soils, ASTM C33 is appropriate because it does not require a hydrometer analysis on the fraction passing the No. 200 sieve. Therefore, ASTM D422 or C33 should be selected, as appropriate.

Field Density Test

The proposed standard should include use of the Washington Densometer as a means of determining field density. (See "Suggested Method of Test for Density of Soil in Place Using the Washington Densometer," ASTM STP 479, 1970.) The Washington Densometer is capable of measuring larger hole volumes than those measured by ASTM D1556 and 2167 and may be appropriate in testing soils having a large maximum particle size or where increased accuracy is desirable.

Fines Content

Determination of fines content by ASTM C117 may be appropriate in some cases and should be added.

Borrow Moisture

In Table B, under Borrow Moisture, ASTM designations D1556, 2167, and 2937 should be deleted; these are field density tests. Appropriate methods for determination of moisture content should be added. ASTM D2216 is appropriate where sufficient time is available to dry the samples overnight. For the more normal field situation, where moisture content must be determined rapidly, Table B should include the following:

> AASHTO T217, Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Moisture Tester; and SCS 193-12, Moisture Content of Soil, Field Determination Using Quick Dry Procedure, National Engineering Handbook 19, S-12 (U.S. Soil Conservation Service).

The Plasticity Index may not be applicable, particularly in the case of cohesionless soils such as those used for Category I fill.

b. The required test frequencies in Table B should be revised as follows:

1. Grain size should be determined for each compaction test on cohesionless materials only and in accordance with the owner's specifications. Requiring a grain size determination for fine-grained cohesive soilds would be wasteful because the sample could be adequately described on the basis of its Atterberg limits.

2. Plasticity Index should be determined only in accordance with the owner's specifications and for at least every 10,000 cu yd of clay placed. Volume change characteristics may be questionable, but not important on some jobs; this requirement should be deleted.

3. It may or may not be necessary to specify moisture content at the borrow source. Often, only the in-place moisture content is specified. It would be more appropriate to require testing as specified in the owner's specification and to delete the other requirements.

4. The minimum requirement for field density tests every 10,000 sq ft should be deleted. This requirement is not appropriate for thick fills. The testing frequency should be evaluated on a case-by-case basis. Therefore, testing should be in accordance with the owner's specifications. (Note: On nuclear power projects, the minimum frequency of field density tests is usually specified on a cu-yd basis, rather than a sq-ft basis.)

5. Fines content should be tested only if this characteristic is of importance to the performance of the fill. In some fills, any fines content would be acceptable. Testing should be in accordance with the owner's specifications. The minimum frequency of one test per 100,000 sq ft should be eliminated. (Note: If fines content is of concern, the minimum test frequency is normally specified on a cu-yd basis.)

3. Page 14, Section 7.4.2

The meaning of the word "calibration" is not clear. It is our practice that tension testing three bolts on a bolt tensioning device, such as a Skidmore, constitutes an acceptable method of calibration.

4. Page 15, Section 8.2.2(1)

There appears to be two sets of criteria dealing with what actions are to be performed when substandard tensile test results are obtained with individual splice samples. The criteria is summarized as follows:

Single Splice Sample Failure - Failure Not in Bar

a. ANSI N45.2.5-1978 allows the failure of a single splice sample without corrective action provided the observed rate of failure does not exceed 1 for each 15 consecutive splice samples tested. When the observed rate of failure exceeds the 1 in 15 criteria then the following must be performed:

- o All splicing must be stopped.
- o The adjacent production splices on each side of the last failed splice shall be tested.
- o Four other splices distributed uniformly throughout the balance of 100 splices under investigation shall be tested.
- o An analysis shall be performed based on the results of the additional tests to identify the cause of all failures. Failure of two of the additional six splices tested requires the balance of the 100 production splices to be evaluated.

b. ASME III Division 2 requires the following corrective action to be performed when any splice sample failure occurs.

- o The adjacent production splices on each side of a failed production splice or two additional sister splices for a failed sister splice shall be tested.
- o If either of these retests fail, then splicing must be halted and the cause of failure determined and corrected prior to resumption of splicing.

It is suggested that the above criteria for failure of single splice samples be reviewed and a criteria acceptable for both ANSI N45.2.5 and ASME III, Division 2 be established. Since the ASME III, Division 2 criteria does not rely on statistical criteria necessitating the testing of six additonal production splices prior to acceptance of a 100 splice lot but instead requires resolving each sample splice failure by testing two additional splices for compliance, the ASME III, Division 2

approach is preferred. This approach also enables evaluations to be performed to determine whether failures are limited to particular Cadwelders or Cadweld crews in which case corrective action could be performed without stopping all Cadwelding.

5. It is our belief that when ANSI N45.2.5-1978 was revised, it was done to include a qualification added by the Nuclear Regulatory Commission (NRC) in Regulatory Guide (RG) 1.94, Revision 1, Item C.4 in its endorsement of ANSI N45.2.5-1974. In reviewing the revision made against the added qualification of the NRC it is apparent that the change actually goes beyond what we believe the NRC actually intended. Since the subsquent proposed Revision 2 to RG 1.94 endorses ANSI N45.2.5-1978, we have called this matter to the attention of the NRC. It is our recommendation that ASME revise the specific section in question to reflect the original intent of the NRC's qualifying statement.

Specifically, Section 4.10 of ANSI N45.2.5-1974 stated that welding of reinforcing bar splices shall be subject to the provisions of Section 5.5, except that AWS D12.1 shall apply. Revision 1 to RG 1.94 (April 1976) paragraph C4 additionally required that "...the provisions of articles C-4334 an C-4330 of...(ASME, Section III, Division 2 ... testing of welded reinforcing bar splices should be used as guidance pending endorsement of that code by the NRC staff."

The proposed Revision 2 to RG 1.94 no longer addresses this matter, apparently because ANSI N45.2.5-1978, Section 6.13 has been revised. It now reads, "Welded reinforcing bar splices shall be subject to the requirements of Section 7.5 of this Standard except that provisions of Subsection CC-4334 of ASME Code Section III, Division 2 shall apply."

The wording of Revision 1 to RG 1.94 invoked CC-4334 with regard to testing welded splices, whereas ANSI N45.2.5-1978 invokes all of CC-4334, which is a significant change. Because of the new wording, certain aspects of CC-4334 appear to apply now which did not before. Some of the more significant of these are:

a. (CC-4334.1) Requirements for controlled chemistry reinforcing bars and a limitation on the maximum carbon equivalent in order to be able to weld reinforcing bars.

b. (CC-4334.2) The allowable end preparation for details of welded reinforcing joints restricts welding to only a few of the end preparation details that are allowed by AWS D12.1.

c. (CC-4334.6.1) Nondestructive examination (radiography) is required for welded reinforcing bar splices but is not required by AWS D12.1 unless specifically addressed in contract documents.

We do not believe that the NRC intended to adopt this revised section in its entirety. We have recommended to NRC that RG 1.94 (Revision 2) be revised to invoke only the tensile testing portion of CC-4334.

Stone & Webster Engineering Corporation appreciates this opportunity to contribute to the improvement of this Standard.

Very truly yours,

S. B. Jacobs
Chief Licensing Engineer

DWR: jmm