Revision 2
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REGULATORY GUIDE 1.136

MATERIALS, CONSTRUCTION AND TESTING OF CONCRETE CONTAINMENTS

(Articles CC 1000, 2000 and 4000-7000 of the "Code for Concrete Reactor Vessels and Containments"[1])

A. INTRODUCTION

General Design Criterion 1, "Quality Standards and Records for Nuclear Power plants," to 10 CFR Part 50, "Domestic Lincensing of Production and Utilization Facilities," requires, in part, that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 requires, in part, that measures be established to assure materials control and control of special processes such as welding, and that proper testing be performed.

This guide describes some bases acceptable to the NRC staff for implementing the above requirements with regard to the materials, contruction and testing of concrete containments.

B. DISCUSSION

The American Society of Mechanical Engineers and the American Concrete Institute have jointly published the Code for Concrete Reactor Vessels and

[1]The "Code for Concrete Reactor Vessels and Containments" is also known either as the ASME Boiler and Pressure Vessel Code, Section III, Division 2, 1977 edition or as ACI Standard 359-77. Copies of the Code and addenda thereto may be obtained from the American Society of Mechnical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017 or the American Concrete Institute, Box 19150, Detroit, MI 48219.

Containments,"[1] which is referred to in this guide as the Code. The Code was formally issued for the first time in 1975, was reissued in 1977, and has been undergoing a number of technical and editorial revisions. Consideration will be given to endorsing the Code in the Federal Regulations after sufficient experience has been accumulated with its use. In the interim, the NRC staff will be setting forth its position on the acceptability of the Code for licensing purposes through the regulatory guide process.

This guide, originally issued addressing only Article CC-2000, "Material," of the Code, has been expanded to provide information regarding the staff's position on the acceptability for NRC licensing actions of the following Articles of the "Code for Concrete Reactor Vessels and Containments":

CC-1000, Introduction

CC-2000, Material

CC-4000, Fabrication and Construction

CC-5000, Construction Testing and Examination

CC-6000, Structural Integrity Test of Concrete Containment Structures

CC-7000, Protection Against Overpressure

The NRC staff has evaluated the provisions contained in the articles described above, but no attempt has been made to coordinate all literature (standards, codes, guidelines, regulations, etc.) that may be relevant to the subject of this guide. In those areas where the provisions of the referenced Code are insufficient for licensing purposes, the staff has provided supplementary guidelines it considers to be acceptable. These guidelines are contained in the regulatory position. Brief reasons for recommending them are given below.

1. CC-2232.1(a)[2]

Paragraph CC-2232.1(a) gives no guidance as to how conformance with the concrete strength requirements is to be demonstrated. This is clarified in Regulatory Position C.1.

2. CC-2232.2(a)

The Code lacks tolerance limits for the maximum permitted slump and air content. The limits in Regulatory Position C.2 are taken from Section 4.4.2 of ACI Standard 318-77, "Building Code Requirements for Reinforced Concrete."[3]

3. CC-2243.3

Regulatory Position C.3 substitutes the position of Regulatory Guide 1.107, "Qualification for Cement Grouting for Prestressing Tendons in Containment Structures," for item CC-2243.3 with respect to the limits on deleterious substances and pH. The staff believes that these recommended limits are more conservative and provide better assurance of avoiding unforeseen problems than the limits given in the code.

4. CC-2463.1

Different systems of prestressing may require different numbers of tests for tendon systems to establish their adequacy for use. One static tensile test, as required by the Code, cannot assess the influence of dimensional variations of anchorages on the strength of a prestressing system. Variations within the tolerance limits of the Construction Specification in material properties

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[2]This refers to the article number of the "Code for Concrete Reactor Vessels and Containments."

[3]Copies may be obtained from the American Concrete Institute, Box 19150, Detroit, Michigan 48219.

and in geometry of anchorages and tendons must be realistically and adequately represented in the system testing. Therefore, Regulatory Position C.4 recommends that any system of prestressing be subjected to sufficient tests to establish its adequacy before it is adopted for use.

5. CC-5210

Embedments (including supports, ties, and braces) that are encased or partially encased in concrete will displace concrete. Therefore, to prevent a reduction in structural strength or shielding effectiveness for radiation, precaution must be taken to ensure that no embedments not included in the design are left in the concrete.

6. CC-6214

The second sentence of CC-6214 permits an option of doing nothing even after studies have been made which indicate that the acceptance criteria (c) & (d) of CC-6213 were still not met. The need to select one of the followup options is defined in Regulatory Position C.6.

C. REGULATORY POSITION

The requirements specified in Articles CC-1000, 2000 and 4000 through 7000 of the "Code for Concrete Reactor Vessels and Containments," ASME Boiler & Pressure Vessel Code, Section III, Division 2, 1977, (also known as ACI Standard 359) through its Winter 1978 Addenda are acceptable to the NRC staff for the materials, construction and testing of concrete containments of nuclear power plants subject to the following:

1. CC-2232.1 Introduction

To item CC-2232.1(a), "conformance with the concrete strength requirements" should be added:

"as demonstrated by the strength tests of CC-2232.2."

2. CC-2232.2 Strength Tests

To paragraph CC-2232.2(a), should be added:

"The range of variation allowed for the air content shall be within ±0.5 percent and for the slump within ±0.75 in. of the maximums permitted by the specifications."

3. CC-2243.3 Chemical Requirements

Instead of item CC-2243.3, the recommended limits in Regulatory Position C1.e of Regulatory Guide 1.107 should be used.

4. CC-2463.1 Static Tensile Test

Instead of "CC-2463.1 Static Tensile Test. One static tensile test ...," the following should be used:

"CC-2463.1 Static Tensile Tests. Static tensile tests..."

Any system of prestressing should be subjected to sufficient tests to establish its adequacy. Justification for the sufficiency of tests and a description of the test program should be submitted to the NRC for review and approval.

5. CC-5210 General

The requirements of CC-5210 should be supplemented by an inspection to make sure that only the embedments (including supports, ties and braces) shown on the drawings or covered by documented field changes remain in the form after the concrete is placed.

6. CC-6214 Retest

One or the other of the options permitted by the Code in the phrase in the second sentence of CC-6214 "...remedial measures may be undertaken or a retest may be conducted" should actually be selected if the requirements of CC-6213(c) and (d) are not met.

D. IMPLEMENTATION

This proposed guide has been released to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method to be described in the active guide reflecting public comments will be used in the evaluation of (1) all construction permit applications, (2) standard reference system preliminary design applications (PDA) or Type-2 final design applications (FDA-2), and (3) licenses to manufacture after the implementation date to be specified in the active guide, except those portions of a construction permit application that:

a. Reference an approved standard reference system preliminary or final design (PDA or FDA), or applications for such approval.

b. Reference an approved standard duplicate plant preliminary or final design (PDDA or FDDA).

c. Reference parts of a base plant design qualified and approved for replication.

d. Reference a plant design approved or under review for approval for manufacture under a Manufacturing License.

This implementation data (to be specified in the active guide) will in no case be earlier than April 30, 1980.