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Standard Test Method for Evaluating Coatings Used in Light-Water Nuclear Power Plants at Simulated Design Basis Accident (DBA) Conditions¹

This standard is issued under the fixed designation D 3911; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

During a design basis accident (DBA) in nuclear power plants, conditions in the reactor containment will be characterized by elevated temperature and pressure, as well as the presence of a radiation environment. Water sprays, with or without chemical additives, may be used in the primary containment to suppress the consequences of the incident, to scavenge radioactive products, and to return the containment to near-ambient conditions.

1. Scope

1.1 This test method establishes procedures for evaluating protective coating systems test specimens under simulated DBA conditions. Included are a description of conditions and apparatus for temperature-pressure testing, conditions for radiation testing, and procedures for preparing, examining, and evaluating the samples.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 714 Test Method for Evaluating Degree of Blistering of Paints²

D 4082 Test Method for Effects of Radiation on Coatings Used in Light-Water Nuclear Power Plants³

D 5139 Specification for Sample Preparation for Qualification Testing of Coatings to be Used in Nuclear Power Plants³

3. Terminology

3.1 Definitions:

¹ This method is under the jurisdiction of ASTM Committee D-33 on Protective Coating and Lining Work for Power Generation Facilities and is the direct responsibility of Subcommittee D33.02 on Service and Material Parameters.

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² Annual Book of ASTM Standards, Vol 06.01.

³ Annual Book of ASTM Standards, Vol 06.02.

3.1.1 *blistering*—the formation of bubbles in a coating (paint) film.

3.1.2 *boiling water reactor (BWR)*—a reactor in which the water moderator-coolant is boiled directly within the reactor core. The pressure in the reactor vessel is only slightly greater than the steam turbine pressure.

3.1.3 *chemical spray*—a solution of chemicals, such as those contained in Table 1, which could be used during a loss of coolant accident (LOCA) to suppress the incident, to scavenge fission products, and to return the facility to near-ambient conditions.

3.1.4 *coating (paint) system*—a polymeric protective film consisting of one or more coats applied in a predetermined order by prescribed methods to a defined substrate.

3.1.5 *cracking*—a break or a split in the coating (paint) system extending through the film or to the substrate.

3.1.6 *curing*—the transformation of a coating or other material into a solid phase or film.

3.1.7 *DBA*—a generic term for any one of a family of accident conditions which can result from postulated events. These conditions are generally associated with the rupture of high energy piping. The more commonly recognized accident conditions used to evaluate coating systems for primary containment are the LOCA or main steam pipe break.

3.1.8 *deionized water*—water prepared by an ion exchange process meeting the requirements of Specification D 1193, Types II and III.

3.1.9 *delamination*—separation of one coat or layer from another coat or layer, or from the substrate.

3.1.10 *engineered safety system*—a system designed to mitigate the effects of a design basis accident.

3.1.11 *irradiation*—exposure to ionizing radiation.

3.1.12 *light-water nuclear reactor*—an apparatus, using light water as a moderator, in which fissionable material is arrayed so that controlled nuclear fission may be sustained in a