



Standard Practice for Prediction of the Long-Term Behavior of Materials, Including Waste Forms, Used in Engineered Barrier Systems (EBS) for Geological Disposal of High-Level Radioactive Waste¹

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1. Scope

1.1 This practice describes test methods and data analyses used to develop models for the prediction of the long-term behavior of materials, such as engineered barrier system (EBS) materials and waste forms, used in the geologic disposal of spent nuclear fuel (SNF) and other high-level nuclear waste in a geologic repository. The alteration behavior of waste form and EBS materials is important because it affects the retention of radionuclides by the disposal system. The waste form and EBS materials provide a barrier to release either directly (as in the case of waste forms in which the radionuclides are initially immobilized), or indirectly (as in the case of containment materials that restrict the ingress of groundwater or the egress of radionuclides that are released as the waste forms and EBS materials degrade).

1.1.1 Steps involved in making such predictions include problem definition, testing, modeling, and model confirmation.

1.1.2 The predictions are based on models derived from theoretical considerations, expert judgment, interpretation of data obtained from tests, and appropriate analogs.

1.1.3 For the purpose of this practice, tests are categorized according to the information they provide and how it is used for model development and use. These tests may include but are not limited to the following:

1.1.3.1 Attribute tests to measure intrinsic materials properties,

1.1.3.2 Characterization tests to measure the effects of material and environmental variables on behavior,

1.1.3.3 Accelerated tests to accelerate alteration and determine important mechanisms and processes that can affect the performance of waste form and EBS materials,

1.1.3.4 Service condition tests to confirm the appropriateness of the model and variables for anticipated disposal conditions,

1.1.3.5 Confirmation tests to verify the predictive capacity of the model, and

1.1.3.6 Tests or analyses performed with analog materials to identify important mechanisms, verify the appropriateness of an accelerated test method, and to confirm long-term model predictions.

1.2 The purpose of this practice is to provide methods for developing models that can be used for the prediction of materials behavior over the long periods of time pertinent to the service life of a geologic repository as part of the basis for performance assessment of the repository.

1.3 This practice also addresses uncertainties in materials behavior models and their impact on the confidence in the performance assessment.

1.4 *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 requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C1285 Test Methods for Determining Chemical Durability of Nuclear, Hazardous, and Mixed Waste Glasses and Multiphase Glass Ceramics: The Product Consistency Test (PCT)

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E178 Practice for Dealing With Outlying Observations

E583 Practice for Systematizing the Development of (ASTM) Voluntary Consensus Standards for the Solution of Nuclear and Other Complex Problems (Withdrawn 1996)³

¹ This practice is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.13 on Spent Fuel and High Level Waste.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.