American Nuclear Society

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criteria for the handling and initial evaluation of records from nuclear power plant seismic instrumentation

an American National Standard

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American National Standard Criteria for the Handling and Initial Evaluation of Records from Nuclear Power Plant Seismic Instrumentation

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American Nuclear Society

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American National Standard

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Foreword

(This Foreword is not a part of American National Standard "Criteria for the Handling and Initial Evaluation of Records from Nuclear Power Plant Seismic Instrumentation," ANSI/ANS-2.10-2003.)

The purpose of this standard[1)] is to specify criteria for light-water-cooled nuclear power plants for the treatment of records obtained from seismic instrumentation specified in the American National Standard "Earthquake Instrumentation Criteria for Nuclear Power Plants," ANSI/ANS-2.2-2002.

This standard sets forth criteria on how the records obtained from such instrumentation should be retrieved, evaluated, and stored after an earthquake. This standard provides criteria and guidelines for a timely determination for whether the operating-basis earthquake ground motion (OBE) was exceeded.

Criteria for the plant owner or its agents are provided in connection with the following activities:

(1) retrieval of recorded data from seismic instrumentation in the event that an earthquake occurs with sufficient ground-shaking motion to activate the seismic instrumentation;

(2) correction of the recorded data to minimize erroneous signals;

(3) initial evaluation of the recorded data to estimate the degree of earthquake excitation to be compared with earthquake excitation values used for the plant design-basis calculations and established absolute values that are defined in this standard;

(4) storage and maintenance of recorded data and calculations.

Currently, this standard applies to land-based, light-water-cooled nuclear power plants. This standard will be reviewed for its applicability to nuclear power plants that are based on different technologies from current light-water-cooled nuclear power plants when these technologies become available. The writing group will also review, from time to time, the standard's applicability to new light-water-cooled power plant installations to verify that the purposes of this standard are preserved.

This standard does not address operator actions necessary to accomplish plant shutdown due to seismic activity, restart of the plant after shutdown due to seismic activity, or other supplemental power plant operator actions.

When an earthquake occurs, seismic data are recorded by the seismic instrumentation. Evaluations based on the recorded data are used to make an early determination of whether earthquake ground surface motion exceeded OBE levels of severity or the minimum damage threshold. Using this information, the guidelines in this standard can be used to determine whether the OBE was exceeded. In the case that the OBE has been exceeded, the licensee makes the decision whether to shut down the nuclear power plant. In some cases shutdown is part of the licensing basis (e.g., condition of license, Final Safety Analysis Report commitment, or Technical Specification requirement). If on the basis of

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[1)]The current standard, ANSI/ANS-2.10-2003, is herein referred to as "this standard."

this initial evaluation, and a plant walkdown (see ANSI/ANS 2.23-2002, "Nuclear Plant Response to an Earthquake"), it is concluded that the OBE seismic design has not been exceeded, it is presumed that the plant will not be shut down or be obligated to remain shut down. However, additional studies will often be undertaken to evaluate possible long-term effects of the seismic activity and to document the recorded response and the calculated results. These studies may be minimal depending on the initial evaluation and may take place while the facility is in operation.

This standard was prepared by ANS-2.10 Working Group of Subcommittee ANS-21, Nuclear Facility Design Criteria and Operations, of the American Nuclear Society Nuclear Facilities Standards Committee (NFSC).

The standard was initially approved in 1979. It was withdrawn as an American National Standard in April 1990. This newly revised standard incorporates changes in technology that have occurred since the 1979 standard was developed.

Two major changes were incorporated since the 1979 standard:

(1) this standard covers initial free-field surface record evaluation only. Evaluation of the records taken from other instruments is discussed in ANSI/ANS 2.23-2002;

(2) free-field surface motion is compared in two ways. The recorded motion response spectrum is compared with the OBE design response spectrum (or equivalent) and spectral acceleration and velocity limits. In addition, the cumulative absolute velocity of the motion is calculated and compared against a limiting damage value.

The ANS-2.10 Working Group had the following membership at the time of approval of the standard:

D. K. Ostrom, Chair, *Consultant*
C. Angstadt, *Cleveland Electric Illuminating Company*
M. L. Crumb, *TERRA Technology Corporation*
J. Diel, *Agbabian and Associates*
P. D. Engdahl, *Engdahl Enterprises*
R. P. Kassawara, *Electric Power Research Institute*
R. M. Kenneally, *U.S. Nuclear Regulatory Commission*
J. McCumber, *Yankee Atomic Electric Company*
T. O'Hara, *Yankee Atomic Electric Company*
R. Srinivasan, *Structural Integrity Associates*
J. Stevenson, *Stevenson and Associates*
A. Y. C. Wong, *Stone and Webster Engineering Corporation*

Contents

Criteria for the Handling and Initial Evaluation of Records from Nuclear Power Plant Seismic Instrumentation

1 Scope

This standard provides criteria for the timely retrieval and the subsequent processing, handling, and storage of data obtained from seismic instrumentation specified in ANSI/ANS-2.2-2002 [1].[1)] Also included are initial evaluation criteria to determine whether earthquake motion at the site has exceeded the plant's operating-basis earthquake ground motion (OBE).

This standard does not address procedures for plant walkdowns immediately (within 8 hours) after an earthquake, for ensuring a safe and orderly shutdown, for long-term evaluations of the building and equipment response data, and for subsequently returning the plant to operation. These topics are addressed in ANSI/ANS-2.23-2002 [2].

2 Purpose

This standard defines activities related to the handling of data from seismic instrumentation in the event of an earthquake. These activities include the retrieval, initial evaluation, processing, storage, and maintenance of the data.

This standard is intended for use at light-water-cooled, land-based nuclear power plants. It can be used for guidance at other types of nuclear facilities.

3 Definitions

acceleration sensor: An instrument capable of sensing absolute acceleration and producing a signal that can be transmitted to a recorder.

accelerogram: The record of acceleration versus time for a single component of motion.

cumulative absolute velocity (CAV): The time integral of absolute acceleration over the duration of the strong shaking associated with an earthquake. This quantity has been shown to be a good indicator of the damage potential of an earthquake time history.

design-bases response spectra (DBRS): Response spectra used to design Seismic Category I structures, systems, and components.

first-order correction: An analytical process that removes a linearly accumulating error from an accelerogram.

free-field: A ground surface location for an earthquake motion sensor where the motion will be only of the ground surface and where the effects that are associated with certain surface features, buildings, and components will be insignificant.

operating-basis earthquake ground motion (OBE): The vibratory ground motion for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public will remain functional. The OBE is only associated with plant shutdown and inspection after an earthquake unless specifically selected by the applicant as a design input. For the purposes of this standard, if an OBE analysis is not part of the licensing basis, the OBE is defined as one-third safe shutdown earthquake ground motion (SSE) or lower.

recorded data: The registered output from a time-history accelerograph (T/A).

seismic data retrieval: The process of collection, identification, and preservation of all re-

[1)] Numbers in brackets refer to corresponding numbers in Section 6, "References."