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Standard Guide for Laboratory Evaluation of Automatic Pedestrian SNM Monitor Performance[1]

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1. Scope

1.1 The requirement to search pedestrians for special nuclear material (SNM) to prevent its theft has long been a part of both United States Department of Energy and United States Nuclear Regulatory Commission rules for the physical protection of SNM. Information on the application of SNM monitors to perform such searches is provided in Guide C 1112. This guide establishes a means to compare the performance of different SNM pedestrian monitors operating in a specific laboratory environment.[2] The goal is to provide relative information on the capability of monitors to search pedestrians for small quantities of concealed SNM under characterized conditions. The outcome of testing assigns a sensitivity category to a monitor related to its SNM mass-detection probability; the monitor's corresponding nuisance-alarm probability for that sensitivity category is also determined and reported.

1.2 The evaluation uses a practical set of worst-case environmental, radiation emission, and radiation response factors so that a monitor's lowest level of performance in a practical operating environment for detecting small quantities of SNM is evaluated. As a result, when that monitor is moved from laboratory to routine operation, its performance will likely improve. This worst-case procedure leads to unclassified evaluation results that understate rather than overstate the performance of a properly used SNM monitor in operational use.

1.3 The evaluation applies to two types of SNM monitors that are used to detect small quantities of SNM. Both are automatic monitors; one monitors pedestrians as they walk through a portal formed by the monitor's radiation detectors (walkthrough or portal monitor), and the other monitors pedestrians who are stationary for a short period of time while they are monitored (wait-in monitor). The latter can be a portal monitor with a delay mechanism to halt a pedestrian for a few seconds or it can be an access-control booth or room that contains radiation detectors to monitor a pedestrian waiting for clearance to pass.

1.4 The values stated in SI units are to be regarded as standard.

1.5 *This standard does not purport to address 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:*

C 859 Terminology Relating to Nuclear Materials[3]

C 993 Guide for In-Plant Performance Evaluation of Automatic Pedestrian SNM Monitors[3]

C 1112 Guide for Application of Radiation Monitors to the Control and Physical Security of Special Nuclear Material[3]

C 1189 Guide to Procedures for Calibrating Automatic Pedestrian SNM Monitors[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *confidence coefficient*—the theoretical proportion of confidence intervals from an infinite number of repetitions of an evaluation that would contain the true result.

3.1.1.1 *Discussion*—In a demonstration, if the true result were known the theoretical confidence coefficient would be the approximate proportion of confidence intervals, from a large number of repetitions of an evaluation, that contain the true result. Typical confidence coefficients are 0.90, 0.95 and 0.99.

3.1.2 *Confidence Interval for a Detection Probability*—An interval, based on an actual evaluation situation, so constructed that it contains the (true) detection probability with a stated confidence.

3.1.2.1 *Discussion*—Confidence is often expressed as 100*the confidence coefficient. Thus, typical confidence levels are 90, 95 and 99 %.

[1] This guide is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.12 on Safeguard Applications.

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[2] Note that this is a laboratory evaluation and is not designed for routine in-plant use. A separate guide, C 993, is available for verifying routine in-plant performance.

[3] *Annual Book of ASTM Standards*, Vol 12.01.

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