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Title: DEVELOPMENT OF AN ASTM STANDARD GUIDE ON PERFORMING VULNERABILITY ASSESSMENTS FOR NUCLEAR FACILITIES

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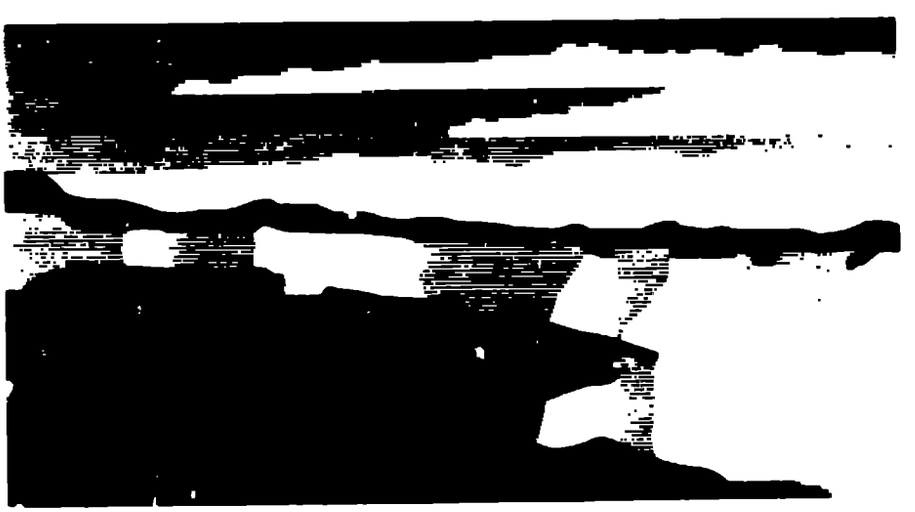

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DEVELOPMENT OF AN ASTM STANDARD GUIDE ON PERFORMING VULNERABILITY ASSESSMENTS FOR NUCLEAR FACILITIES*

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ABSTRACT

This paper describes an effort undertaken by subcommittee C26.12 (Safeguards) of the American Society for Testing and Materials (ASTM) to develop a standard guide for performing vulnerability assessments (VAs). VAs are performed to determine the effectiveness of safeguards and security systems for both domestic and international nuclear facilities. These assessments address a range of threats, including theft of nuclear material and sabotage, and use an array of methods. The approach to performing and documenting VAs is varied and is largely dependent upon the tools used to perform them. This diversity can lead to tools being misused, making validation of VAs more difficult. The development of a standard guide for performing VAs would, if generally accepted, alleviate these concerns. ASTM provides a forum for developing guides that includes a high level of peer review to assure that the result is acceptable to all potential users. Additionally, the ASTM is widely recognized for setting standards, and endorsement by the Society may increase the likelihood of acceptance by the nuclear community. The goal of this work is to develop a guide that is independent of the tools being used to perform the VA and applicable to the spectrum of threats described above.

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INTRODUCTION

This paper is a description and a justification of the need for the subject task and a request for support within the nuclear community. The motivation for the proposal to develop an American Society for Testing and Materials (ASTM) standard guide for performing vulnerability assessments (VAs) is threefold. Standardization could increase the efficiency of performance of VAs and the ease of validation and reduce the dependency of VA procedures on the specific tools used to perform the VA. Additionally, development under the auspices of the ASTM will provide for a high level of peer review and may broaden the user base for the end product.

ASTM Standard Practice: Definitions

ASTM develops a number of different types of standards including guides, test methods, specifications, and practices.[1] A standard is defined as a document developed and established within the consensus principles of the society and that meets the requirements of ASTM procedures and regulations. A practice is a definitive procedure for performing one or more specific operations or functions. The proposed standard practice for

performing VAs would be developed by a task group formed within the ASTM subcommittee C26.12, Nuclear Fuel Cycle, Safeguards.

ASTM Standard Practice - Status

The effort to develop a VA Standard Practice was initiated with a half-day session during the January 1995 ASTM meeting in Phoenix. During this meeting, a scope statement and several basic definitions were developed. Since that meeting, there has been no progress toward development of the standard. This appears to be due, in part, to the lack of explicit support by the Department of Energy (DOE). At the June 1995 ASTM meeting in Denver, it was determined to formally request support of the effort from the DOE Office of Safeguards and Security. As will be discussed later in this paper, a positive response to this request is crucial to the successful development of a standard.

DOE VULNERABILITY ASSESSMENTS

VAs are performed to evaluate the effectiveness of a facility's protection elements. VAs are performed as a part of the process of designing a new facility or to evaluate the effects of changes in physical structure or activities, or both, in existing facilities.

VAs can be designed to address threats ranging from theft of property or information to vandalism and sabotage. In the nuclear community, VAs generally focus on theft/diversion of special nuclear material (SNM) and sabotage and consider both insider and outsider adversaries. DOE requires VAs for all facilities with Category I or II quantities of SNM on inventory as defined in DOE Order 5633.3B.[2] The results of VAs for DOE facilities are used to determine a quantitative relative risk value for each target and threat combination.

VULNERABILITY ASSESSMENT PROCESS

The VA process can be generally described as a sequence of steps, as follows:

1. Target/Threat/Adversary

   (a) Identification of the potential target(s) to be protected. Targets may be repositories for classified information, tanks of hazardous chemicals, or material access areas containing Category I quantities of SNM, for example.

   (b) Definition of the threat(s) to the identified target(s). Threats include theft/diversion of SNM; unauthorized access to or distribution of classified information; and radiological, toxicological, or industrial sabotage.

   (c) Characterization of the adversaries that might attempt to carry out the threat activity. Characterization includes determining whether the adversaries are insiders, outsiders, or both; defining the size of the adversary force; and defining their capabilities.

2. Modeling the Facility

   (a) A physical model of the facility must be developed including the locations of buildings, targets, and access points, for example.

(b) Physical protection system elements are then added to the model. Locations of all barriers, alarms, and protective force positions are identified.

(c) Pertinent elements of the material control and accountability system are also added to the model. These may include SNM monitors, tamper-indicating-devices, and a variety of material surveillance methods.

3. Evaluating of the Effectiveness of the Protection System

Each target is usually evaluated separately. First the effectiveness of individual system elements is determined, usually based on manufacturer's specifications or expert judgment and validated by some form of limited-scope performance testing. Then the overall system effectiveness is determined. System effectiveness may be determined by using an algorithm to combine the effectiveness of the individual elements into an overall value. Such algorithms are generally the central element of the various tools developed to assist in performance of VAs. Frequently, the calculated results are verified by using force-on-force exercises that challenge the system.

CONCERNS WITH THE CURRENT VA PROCESS

Many DOE facilities have successfully performed VAs and used the results to support the Site Safeguards and Security Plan. However, there are two areas of concern in the performance of VAs at various DOE facilities: inconsistency in the approach and scope of VAs from one site to another, and the dependency of VA procedures on the tool being used.

The scope of VAs varies considerably across the DOE nuclear facilities. The spectrum of threats and adversaries is not addressed consistently, and the content and detail of documentation differs greatly from one site to another. These inconsistencies make it difficult to assure that the VA is complete, and increase the effort required for validation.

The use of computerized tools to perform VAs has been an effective approach to performance of VAs at many DOE facilities. However, there has been a concern that the process of using these tools is more complex than necessary for simpler facilities, and this may result in unnecessary expenditure of resources. Additionally, each tool has a procedure for performing the VA (that is, the procedure and the tool are essentially synonymous). This can lead to inconsistencies in the process. It should be possible to develop a procedure for performing VAs that can be used in conjunction with the computerized tools but can also be used for table-top exercises.

PROPOSED APPROACH FOR ASTM STANDARD PRACTICE

The proposed ASTM standard practice should be a generic procedure for performing VAs. The standard practice should not be tied to any tool developed to perform VAs; however, it should be sufficiently generic to be consistent with the use of those tools. The standard should be written so that VAs that are consistent with it can be performed with computerized tools or as a table-top exercise. The standard should also be applicable to the entire range of threats. If the standard could be sufficiently generic to be transparent to the threat being addressed, it might be used outside of the nuclear community. However, it should not become so generic that it fails to

provide adequate assistance in performing VAs.

To complete the task, it will be necessary to draw on the broad range of expertise available in the nuclear community. If the standard is to be accepted and used, it must result from participation by individuals from all parts of the community to obtain a consensus.

CONCLUSIONS

Development of an ASTM standard practice for performing VAs would be worthwhile. The product, if accepted and used, will provide improved consistency in the VA process and may decrease the cost and effort required for validation. Potential customers include DOE and foreign country's state systems of nuclear material control and accountability. As described above, if an effective standard practice that is transparent to the threat being addressed can be written, the customer base would be much broader.

DOE support and participation in the proposed effort is essential. DOE is the primary customer for the end product. Expending the effort to develop the standard would be of questionable value unless it is accepted by DOE. Additionally, DOE and its contractors have the expertise needed to complete the task. Without their participation it is unlikely that a useful product would result from the effort.

REFERENCES

1. "Regulations Governing ASTM Technical Committees," American Society for Testing and Materials (September 1994).

2. "Control and Accountability of Nuclear Material," DOE Order 5633.3B, (September 7, 1994).