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Development and Evaluation of a Physical Protection Plan for 10 CFR 73.45 Capabilities (c), (d), and (f)

Summary of Design Guidance Compendium and Safeguards Upgrade Rule Evaluation (SURE) Methodology Testing

Prepared by M. T. Olascoaga, H. A. Bennett, J. A. Allensworth

Sandia National Laboratories

Prepared for
U.S. Nuclear Regulatory Commission

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ABSTRACT

Limited testing of the NRC Fixed-Site Physical Protection Upgrade Rule Guidance Compendium and the associated Sandia product, the Safeguards Upgrade Rule Evaluation (SURE) methodology, has been completed. This exercise was aimed at determining the utility of these two products with respect to the NRC Physical Protection Upgrade Rule (10 CFR 73.45) requirements. The test exercise and its results are discussed in this report.

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EXECUTIVE SUMMARY

Under a recent program, Sandia National Laboratories (SNL) provided assistance to the Nuclear Regulatory Commission (NRC) in the development of a Design Guidance Compendium for fixed-site physical protection.[1] The compendium was developed to provide fuel cycle facility licensees with practical guidance in the design and documentation of their physical protection systems (PPSs) relative to the requirements of the NRC <u>Physical Protection Upgrade Rule</u> (10 CFR Parts 73.20, 73.45, and 73.46).[2] In addition, SNL developed the Safeguards Upgrade Rule Evaluation (SURE)[3] methodology to aid in evaluating the performance of these PPSs.

Within the scope of this program, a testing exercise was initiated to provide a preliminary check on the NRC Design Guidance Compendium and the SURE methodology. Allied-General Nuclear Services (AGNS), Barnwell, South Carolina, was contracted to develop and document a partial PPS that would provide "good" performance with respect to the requirements specified in 10 CFR 73.45 paragraph (b): "Prevent unauthorized access of persons and materials into material access areas (MAAs) and vital areas (VAs)." The partial design consisted of an access control system and boundary penetration prevention system for an MAA. This limited test exercise is discussed in Reference 3. Although the test effort was insufficient to assess the total design guidance package, the results were encouraging. Consequently, testing of the compendium and the SURE methodology for three additional performance capabilities was requested by the NRC. These three capabilities, as stated in 10 CFR 73.45 paragraphs (c), (d), and (f), are

- Par. (c) Permit only authorized activities and conditions within protected areas (PAs), material access areas (MAAs) and vital areas (VAs);
- Par. (d) Permit only authorized placement and movement of strategic special nuclear material (SSNM) within MAAs; and
- Par. (f) Provide for authorized access and assure detection of and response to unauthorized penetrations of the PA.

The Design Guidance Compendium test exercise consisted of the design and documentation of a "good" partial PPS which was to exceed the minimal requirements of each of performance capabilities (c), (d), and (f), as stated above. The partial PPS designed by AGNS consisted of a PA containing an MAA with a single vault. The vault was completely enclosed within a VA. Based on the NRC Fixed-Site Physical Protection Upgrade Rule Guidance Compendium[1],* documentation of the design included a general description of the PPS sample security plan with an Information Request Sheet (IRS) completed for each component in the system. Responses to a set of component Effectiveness Test Questionnaires (ETQs) appropriate to the partial system design were provided by AGNS to serve as input to the SURE methodology.

As a result of the PPS design exercise, several notable attributes, as well as deficiences, of the Design Guidance Compendium were identified. The attributes included

1. IRSs which identify technical information to be included in the evaluation of the PPS and the associated security plan, thus providing conformity in the licensing process. By responding to the information solicited in the compendium, the licensee is committed to the submission of security plans which are more cohesive and coordinated. These physical protection plans will contain, and be limited to, only the information necessary to perform a thorough evaluation of the ability of the PPS to achieve the performance capabilities. Additionally, the licensee is relieved of the responsibility of determining the type of information required in the compendium.
2. Functional hierarchies which identify the functions and subfunctions that must be performed to achieve the objective stated in each performance capability. This allows the licensee to review his design for completeness, while enabling him to make performance tradeoffs among components which interact within the same physical protection subsystem.
3. ETQs which address component performance, thus providing the licensee with a continuous self-test capability. These ETQs permit identification of component inadequacies and system incongruities. As each new component or system is added to the total system, the licensee becomes initially exposed to both the beneficial and detrimental characteristics of the component. Subsequently, this exposure broadens and necessitates the licensee's evaluation of the impact of the component on the PPS and the impact of the PPS on the component.

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*This document will subsequently be referred to as the Design Guidance Compendium or just compendium.

The one notable deficiency of the compendium concerns some inconsistencies between the information requested by an IRS and the information evaluated by the associated ETQ. In such cases, either information concerning a specific component or system is requested and then not evaluated, or information is evaluated but never requested. In addition, identical information for similar components or systems is not always requested or evaluated. However, the effects of this deficiency are minimal and could easily be corrected by a revision of these products.

In conclusion, the deficiencies of the Design Guidance Compendium are minimal when compared to its positive attributes. Maximization of its utility occurs when the compendium is implemented during the design phase of the facility, e.g., concurrently with health and safety, operations, and maintenance design considerations. However, confidence in all fixed-site nuclear facility PPSs, whether planned, under construction, or in operation, is sufficiently enhanced by utilizing the compendium to warrant its implementation.

Testing of the SURE methodology included implementation of the SURE computer program to permit a performance evaluation of the AGNS partial PPS design. Responses to the component ETQs provided by AGNS for the design served as input to the program. The results of the performance evaluation for the AGNS design relative to the requirements of each of the three performance capabilities on a scale of 0 to 1 are as follows:

Performance Capability		Score
(c)	Permit only authorized activities and conditions within the MAA	0.33
(d)	Permit only authorized placement and movement of SSNM within MAAs	0.38
(f)	Provide for authorized access and assure detection and response to unauthorized penetration of the PA	0.23

At present, no acceptance level has been established by the NRC that would indicate the significance of these scores. The development of two PPS designs, which a consensus of experts judged as "good" and "minimal" relative to the performance capability requirements, would provide the NRC with some basis for establishing an acceptance level. However, it should be emphasized that the aggregate score which results from application of the SURE methodology to a PPS should not be used as an absolute measure of system performance. It is intended for use by an evaluator only as a guide to making a judgment regarding the adequacy of the PPS.

The results of the methodology testing, however, did indicate the advantages of a hierarchical evaluation approach. Such an approach permits tracing back through the structure to locate low scores which identify areas of concern to the licensee and/or NRC evaluators. This trace-back capability provides the licensee and the NRC with a valuable tool for discussion and resolution of discrepancies in the perceived performance of the PPS.

In addition, a limited sensitivity analysis was performed using the preceding performance evaluation results as the base case. This analysis included examination of the sensitivity of the overall performance capability score to (1) improvements in component and subsystem performance and (2) selection of alternate aggregation schemes within the methodology.

Recommendations for further development of the Design Guidance Compendium and SURE methodology are as follows:

1. Continued development of system ETQs for systems in which performance is subject to functional and/or dynamic interaction between system elements,
2. Provision for comprehensive testing by both industry and the NRC to determine the utility, completeness, and validity of the Design Guidance Compendium and SURE methodology, and
3. Extension of the methodology to evaluate the performance provided by multiple layers of protection, given an adversary gains access to the PA, MAA, etc.

1. INTRODUCTION

1.1 BACKGROUND

On 28 November 1979, the NRC published revisions to 10 CFR Parts 70 and 73. These revisions, known as the Physical Protection Upgrade Rule, state that certain fuel cycle facility licensees "shall establish and maintain or make arrangements for a physical protection system which will have as its objective to provide high assurance that activities involving special nuclear material are not inimical to the common defense and security and do not constitute an unreasonable risk to the public health and safety" (10 CFR Part 73.20).[2] The purpose of such a general performance requirement is to maximize design flexibility within the constraints of each of the following required performance capabilities found in paragraphs (b) through (f) of 10 CFR 73.45:

- Par. (b) Prevent unauthorized access of persons and materials into material access areas (MAAs) and vital areas (VAs);
- Par. (c) Permit only authorized activities and conditions within protected areas (PAs), MAAs, and VAs;
- Par. (d) Permit only authorized placement and movement of strategic special nuclear materials (SSNM) within MAAs;
- Par. (e) Permit removal of only authorized and confirmed amounts of SSNM from MAAs; and
- Par. (f) Provide for authorized access and assure detection of and response to unauthorized penetrations of the PA.

However, fundamental to the success of performance-oriented regulations is the ability to measure physical protection system (PPS) performance. Toward this end, Sandia National Laboratories (SNL) was requested by the NRC to assist in the development of the following design guidance products:

- Functional hierarchies to link each of the required performance capabilities with low-level system tasks which could be performed directly by components, e.g., equipment, procedures, and design features,
- Component selection matrices to aid in identifying potential components which could be selected to perform a particular task, and
- Questionnaires to comprehensively address the effectiveness of components in performing a particular task.

In addition, a system performance evaluation methodology was developed to provide a practical, as well as defensible, means of measuring PPS performance relative to the Upgrade Rule. The design guidance products were included in the NRC Design Guidance Compendium. The evaluation methodology was published as a separate document (Reference 3).

The evaluation methodology developed for this program is called the Safeguards Upgrade Rule Evaluation (SURE) methodology.[3] It provides a means of arriving at an overall measure of PPS performance relative to the Upgrade Rule requirements. This innovative methodology, unlike most current physical protection performance evaluation techniques, is structured to provide clear traceability to the regulations. It provides a logical, comprehensive view of the entire PPS at all levels, from components through system subfunctions and functions up to performance capabilities. This methodology considers both equipment and procedures in the development of measures for component performance.

Within the scope of the project, a testing program was initiated to provide a preliminary check on the NRC Design Guidance Compendium and the SURE methodology. AGNS was contracted to develop and document a partial PPS that would provide "good" performance with respect to the requirements specified in 10 CFR 73.45 paragraph (b). The partial design consisted of an access control system and boundary penetration prevention system for an MAA. Although the test effort was insufficient to assess the total design guidance package, the results were encouraging. The following statement, taken from the report by AGNS,[4] summarizes the results of the Design Guidance Compendium testing: "Unequivocally, the Design Guidance Compendium possesses invaluable attributes which facilitate and enhance the development of a physical protection system complying with the requirements of the physical protection Upgrade Rule (10 CFR 73.45)."

Encouraged by the initial test effort, NRC decided to test the Design Guidance Compendium and the SURE methodology with regard to additional capabilities required in the Upgrade Rule. To determine the utility of the Design Guidance Compendium and the SURE methodology, a comprehensive testing program was required. However, comprehensive testing of the Design Guidance Compendium and the SURE methodology was not feasible within the scope of the current program. Instead, limited testing of these products was performed by Sandia and AGNS personnel, which provided for testing of the material in the compendium for three more performance capabilities. It also permitted additional testing of the evaluation methodology. This limited testing program for 10 CFR 73.45 capabilities (c), (d), and (f) is described briefly in the following subsection and in more detail in Volumes II, III, and IV, respectively, of this report.

1.2 SCOPE OF TEST PROGRAM

AGNS, under contract to SNL, provided assistance in implementing and testing a portion of the Design Guidance Compendium. Within the current program scope, the following tasks were undertaken by AGNS:

1. Based on the NRC Fixed-Site Physical Protection Upgrade Rule Guidance Compendium, a "good" partial PPS which complies with the requirements of each of the performance capabilities specified in 10 CFR 73.45 paragraphs (c), (d), and (f) was designed and documented, and
2. Responses to component ETQs appropriate to the partial PPS design were provided to serve as input to the evaluation methodology.

In addition, SNL was able to partially test the SURE methodology using the ETQ responses provided by AGNS in task (2) above. This portion of the testing program includes a limited sensitivity analysis.

1.3 REPORT ORGANIZATION

A brief discussion of the limited testing of both the Design Guidance Compendium and the SURE methodology is provided in Chapter 2. (A more detailed discussion, which includes the documentation of the partial physical protection plan developed by AGNS and of the subsequent performance evaluation of the plan with SURE is provided in Volumes II through IV.) A critique of both the Design Guidance Compendium and the SURE methodology is also presented in Chapter 2. Based upon the experience gained from this portion of the test program, recommendations for further development of the Design Guidance Compendium and the SURE methodology are made in Chapter 3.

2. TESTING PROGRAM

2.1 INTRODUCTION

AGNS, under Contract No. 13-7145 with SNL, has prepared a report to assist SNL and NRC in implementing and testing a portion of the Design Guidance Compendium. In addition, SNL exercised the SURE methodology using the results of the AGNS effort as input to the methodology. The principal objective of this testing was to determine the utility of both the Design Guidance Compendium and the SURE methodology with respect to implementation of the Physical Protection Upgrade Rule (10 CFR 73.45) by facility licensees and NRC licensing personnel.

2.2 DESIGN GUIDANCE COMPENDIUM

The primary goal of the design guidance testing was to determine the overall usefulness of the compendium with respect to aiding a fixed-site nuclear facility licensee in the design of a PPS to satisfy the requirements of 10 CFR 73.45. Constraints normally considered in designing a PPS, such as the cost effectiveness of a component or system, were not considered in the hypothetical PPS. The following objectives were addressed:

1. Utilizing the Design Guidance Compendium, "good" partial physical protection plans which comply with the performance capabilities specified in 10 CFR 73.45 paragraphs (c), (d), and (f), have been developed and documented. A "good" plan is defined as one which exceeds the minimal requirements necessary to satisfy the specified performance capability. The facility being protected consists of a PA which encompasses an MAA. The MAA contains a single vault, which is totally enclosed within the confines of a VA. The plan is comprised of two parts. The first part, the sample plan, is a generic description of the PPS which contains information dealing with specific parts of the total PPS, including identification of components incorporated into the system and responses to specific regulatory requirements. The second part is composed of IRSs which support the generic PPS description. These IRS forms provide specific, technically oriented information pertinent to the rationale for selection and utilization of the components in the PPS.
2. ETQs associated with each component identified within the context of the generic description of the PPS have been completed. These answers are utilized by SNL to quantitatively evaluate the degree of compliance exhibited by the "good" partial physical protection plans relative to the requirements of 10 CFR 73.45 paragraphs (c), (d), and (f).

3. Based upon the experience and expertise gained during the completion of the two preceding objectives, a documented critique of the Design Guidance Compendium was provided. The critique is intended to illustrate both the weak and strong points of the compendium with respect to its ability to aid the licensee in designing a PPS and in preparing the associated license documents necessary to satisfy the performance requirements of the NRC.

2.2.1 Design of a Partial Physical Protection Syst ~m (PPS)

The partial system design includes a PA with one MAA which is totally enclosed within a VA. The MAA contains a single vault. A block diagram of this area is shown in Figure 2-1. The security plan for this partial PPS consists of two parts: the AGNS sample plan and IRSs. The AGNS sample plan, a generic description of the PPS, contains information dealing with specific parts of the total PPS, including identification of components incorporated into the system and responses to specific regulatory requirements. The IRSs support the generic PPS description by providing specific, technically oriented information pertinent to the rationale used in selection and utilization of the components in the PPS. The exclusion of the response function from the partial PPS documentation should be noted. In the regulations and

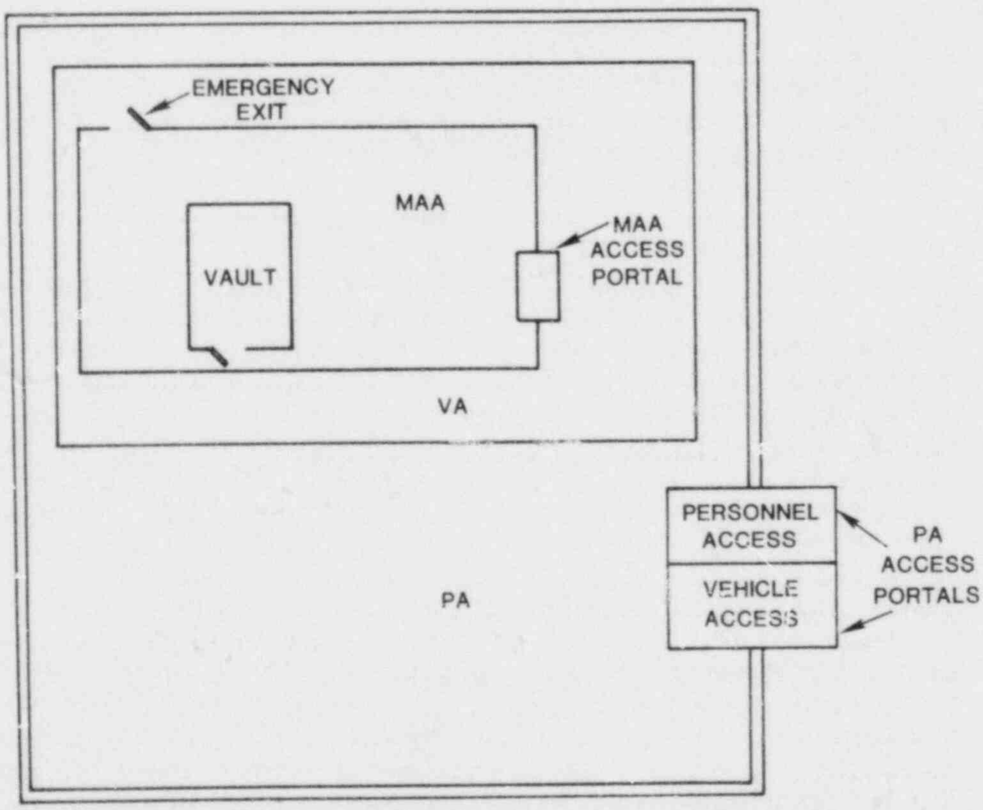


Figure 2-1. Block Diagram of PA, MAA, and VA

the Design Guidance Compendium, response is considered a performance capability, as specified in 10 CFR 73.45 paragraph (g), while in the evaluation structure it is included as an integral part of each capability specified in paragraphs (b) through (f) of 10 CFR 73.45. Because AGNS completed task (1) for only capabilities (c), (d), and (f) using the compendium format, response is not included in the compendium testing. The AGNS sample plans for capabilities (c), (d), and (f) are contained in Volumes II through IV, respectively.

2.2.2 Completion of Effectiveness Test Questionnaires (ETQs)

Responses were provided to ETQs associated with each component identified within the context of the generic description of the partial PPS. These ETQs are included in Volumes II through IV of this report. Note that there are only a limited number of questionnaires for components related to the response function. This is because consideration of this function was not within the scope of the partial design. Therefore, the effectiveness scores for the response function have been assumed in order to complete the aggregation. These responses were utilized by SNL to partially test the SURE methodology. This testing is discussed in Subsection 2.3.

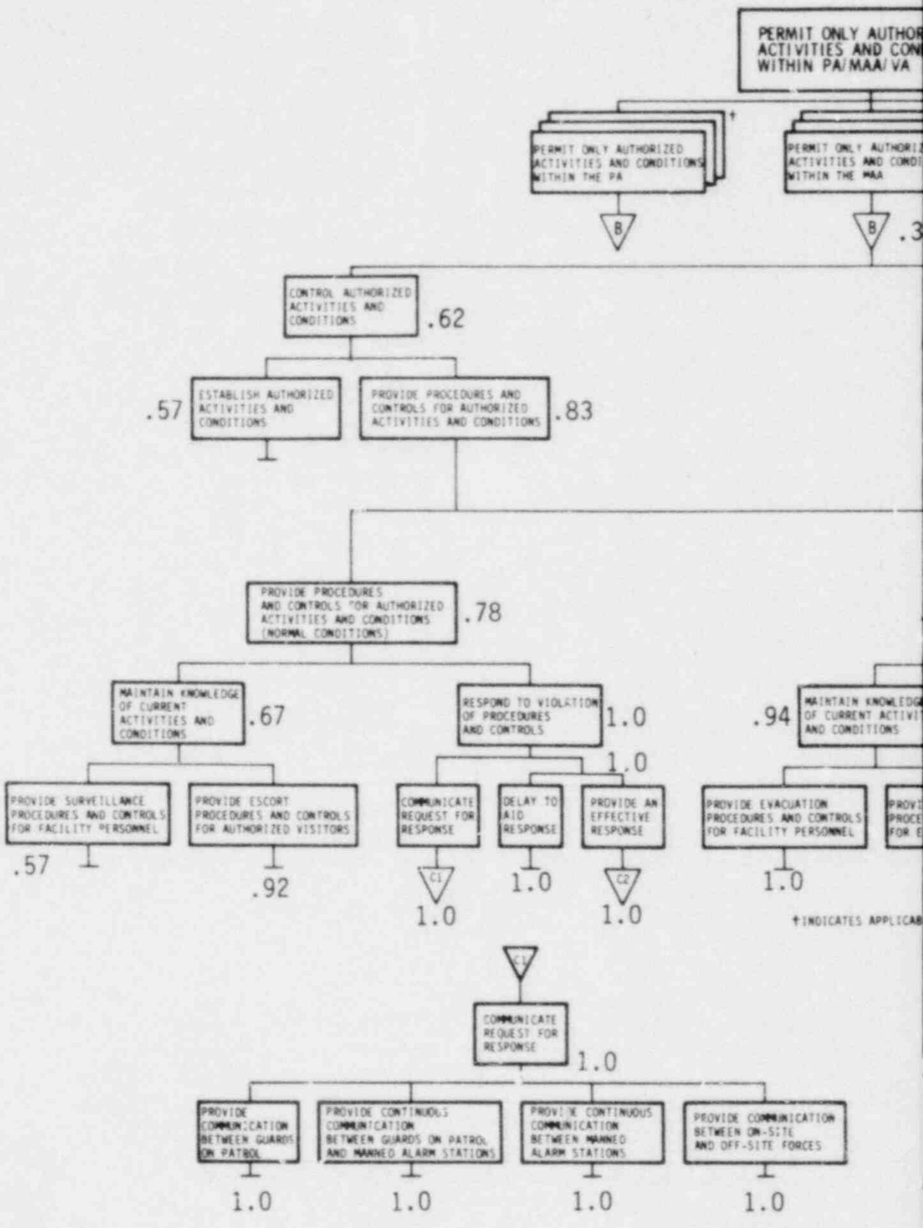
2.3 SAFEGUARDS UPGRADE RULE EVALUATION (SURE) METHODOLOGY TESTING

The responses to the ETQs which were provided by AGNS for the partial PPS design served as input to the SURE methodology. Using a computer program developed as an integral part of SURE, the evaluation methodology was implemented to arrive at a performance measure (score) for the ability of the PPS developed by AGNS to achieve each of the performance capabilities specified in 10 CFR 73.45 paragraphs (c), (d), and (f). A brief sensitivity analysis was also performed for capabilities (c), (d), and (f).

2.3.1 Performance Evaluation Using SURE

The results of the evaluation performed for each of the performance capabilities of 10 CFR 73.45 paragraphs (c), (d), and (f) are shown in Figures 2-2, 2-3, and 2-4, respectively; limited interpretation of these results is provided in Volumes II, III, and IV. In order to illustrate these results more clearly, the computer program output scores have been transferred to the functional hierarchy for each performance capability.

The evaluation procedure begins with the aggregation of individual responses within a questionnaire to arrive at an overall component effectiveness score. At the next level, these individual component scores are aggregated to arrive at a performance measure for the corresponding element of the next level of the hierarchy. This process continues up through the various levels of the hierarchy until an overall score can be determined for the ability of the AGNS sample plan to satisfy the requirements specified in the associated paragraph of 10 CFR 73.45. The need for



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PERMIT ONLY AUTHORIZED ACTIVITIES AND CONDITIONS WITHIN THE PA
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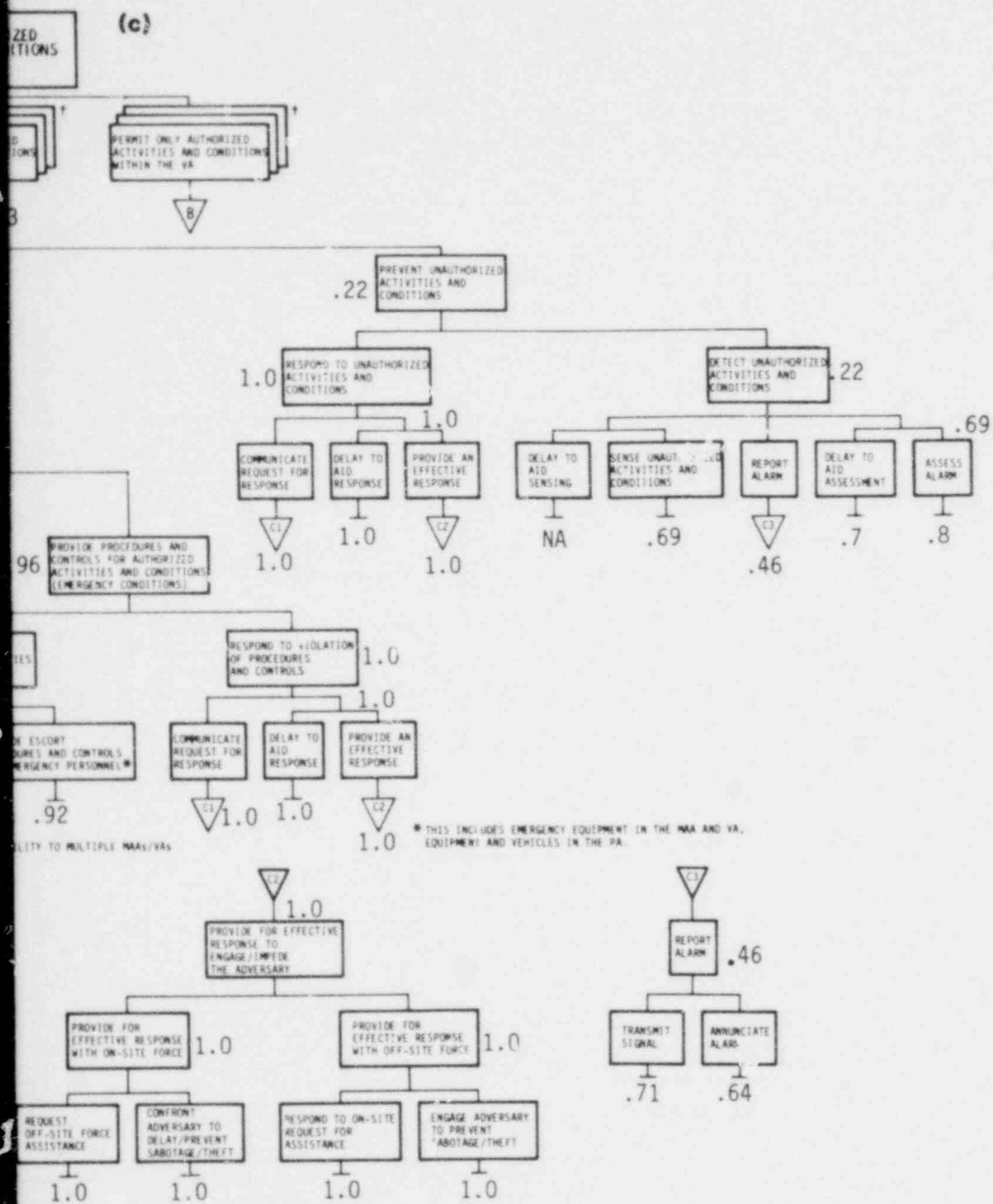
CONTROL AUTHORIZED ACTIVITIES AND CONDITIONS
.62
.57
ESTABLISH AUTHORIZED ACTIVITIES AND CONDITIONS
PROVIDE PROCEDURES AND CONTROLS FOR AUTHORIZED ACTIVITIES AND CONDITIONS
.83
PROVIDE PROCEDURES AND CONTROLS FOR AUTHORIZED ACTIVITIES AND CONDITIONS (NORMAL CONDITIONS)
.78
MAINTAIN KNOWLEDGE OF CURRENT ACTIVITIES AND CONDITIONS
.67
RESPOND TO VIOLATION OF PROCEDURES AND CONTROLS
1.0
1.0
.94
MAINTAIN KNOWLEDGE
OF CURRENT ACTIVIT
AND CONDITIONS
PROVIDE SURVEILLANCE PROCEDURES AND CONTROLS FOR FACILITY PERSONNEL
.57
PROVIDE ESCORT PROCEDURES AND CONTROLS FOR AUTHORIZED VISITORS
.92
COMMUNICATE REQUEST FOR RESPONSE
C1
1.0
DELAY TO AID RESPONSE
1.0
PROVIDE AN EFFECTIVE RESPONSE
C2
1.0
PROVIDE EVACUATION PROCEDURES AND CONTROLS FOR FACILITY PERSONNEL
1.0
†INDICATES APPLICAB
C1
COMMUNICATE REQUEST FOR RESPONSE
1.0
PROVIDE COMMUNICATION BETWEEN GUARDS ON PATROL
1.0
PROVIDE CONTINUOUS COMMUNICATION BETWEEN GUARDS ON PATROL AND MANNED ALARM STATIONS
1.0
PROVIDE CONTINUOUS COMMUNICATION BETWEEN MANNED ALARM STATIONS
1.0
PROVIDE COMMUNICATION BETWEEN ON-SITE AND OFF-SITE FORCES
1.0

Figure 2-2. .er



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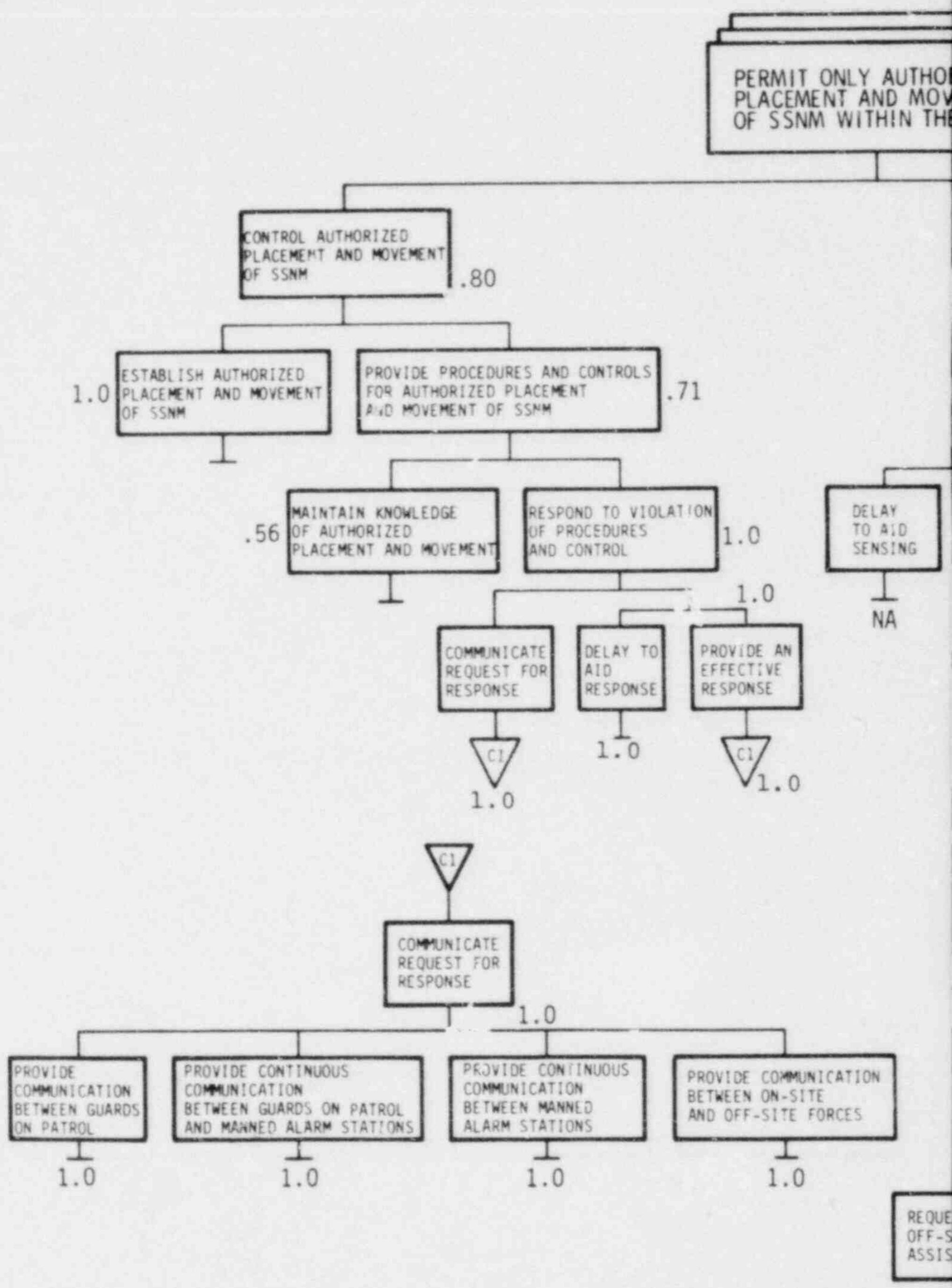

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MAINTAIN KNOWLEDGE OF AUTHORIZED PLACEMENT AND MOVEMENT
.56
RESPOND TO VIOLATION OF PROCEDURES AND CONTROL
1.0
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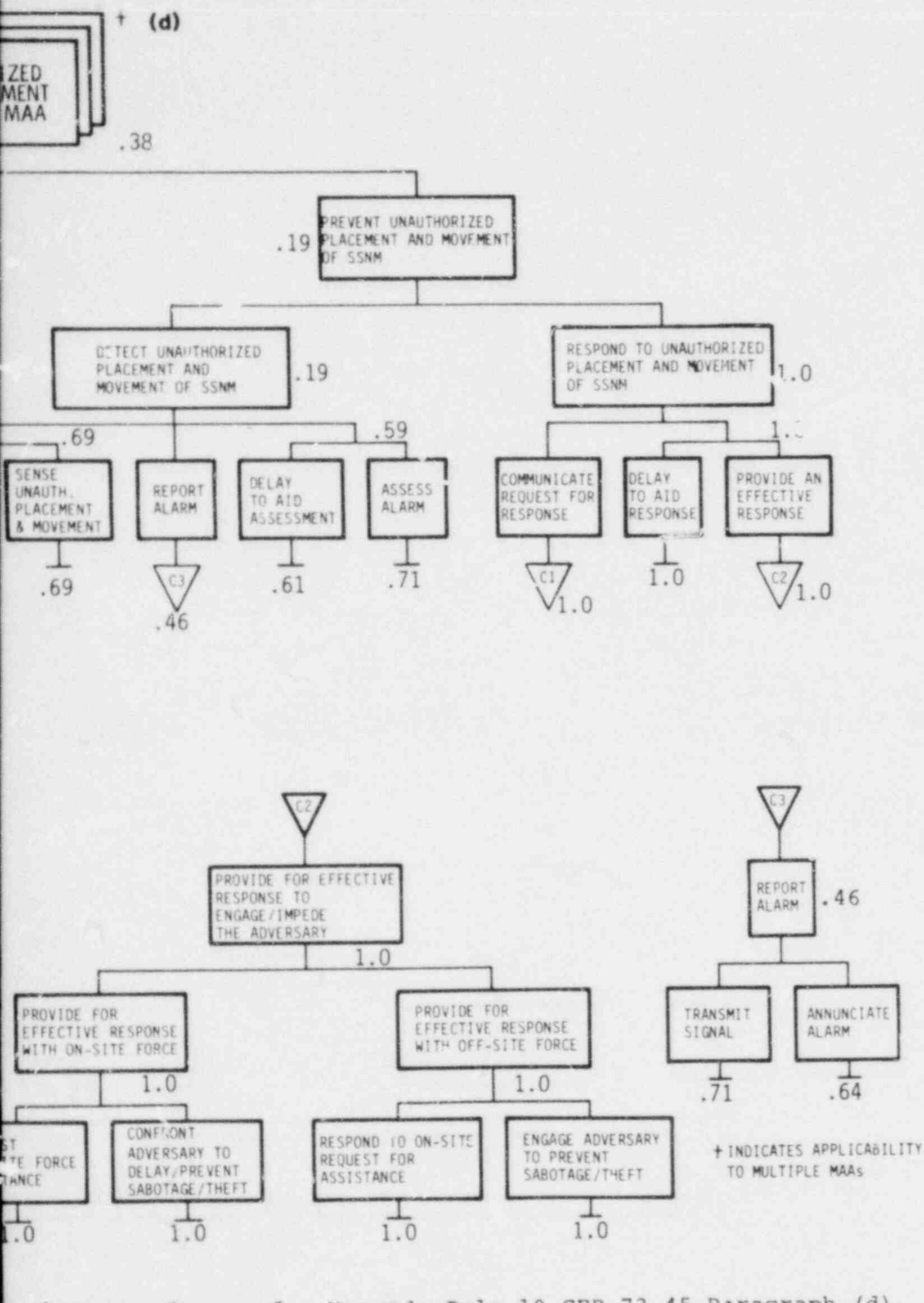
Figure 2-3. F



erformance Scores for Upgrade Rule 10 CFR 73.45 Paragraph (d)

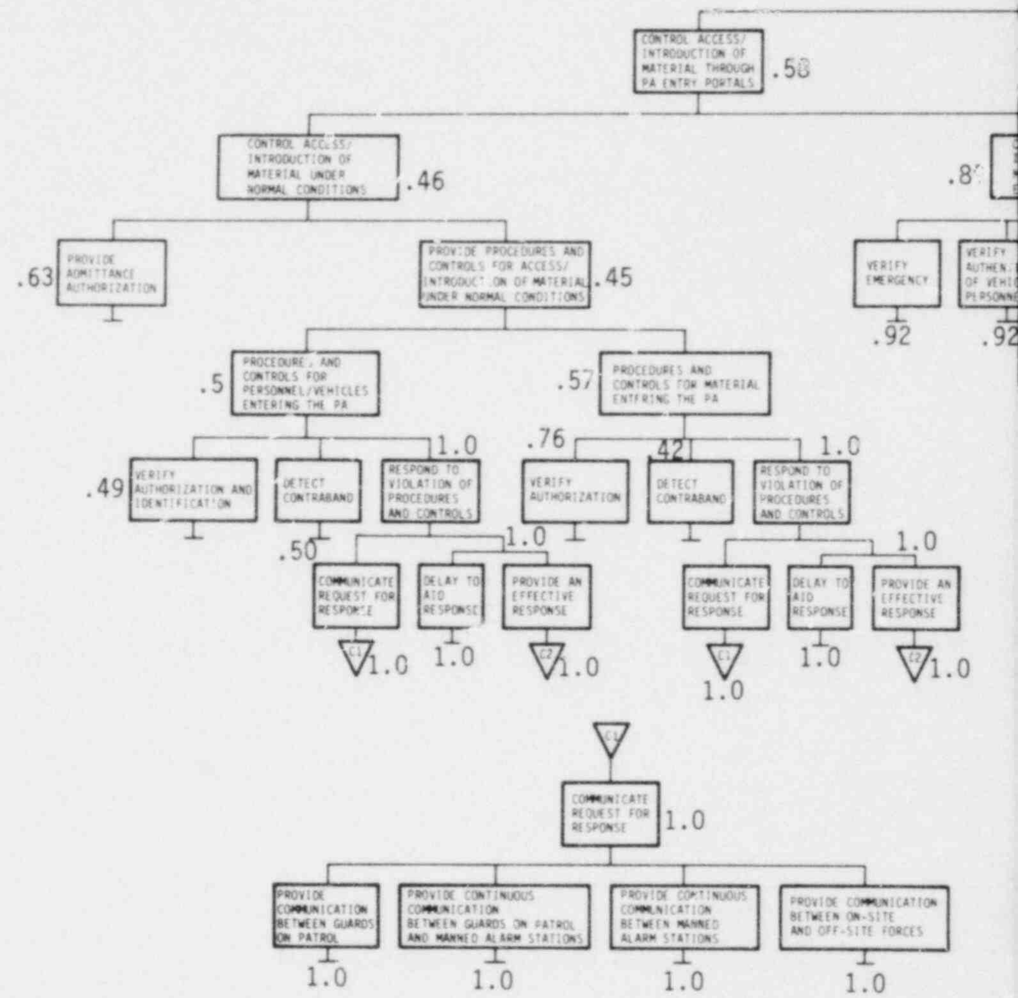
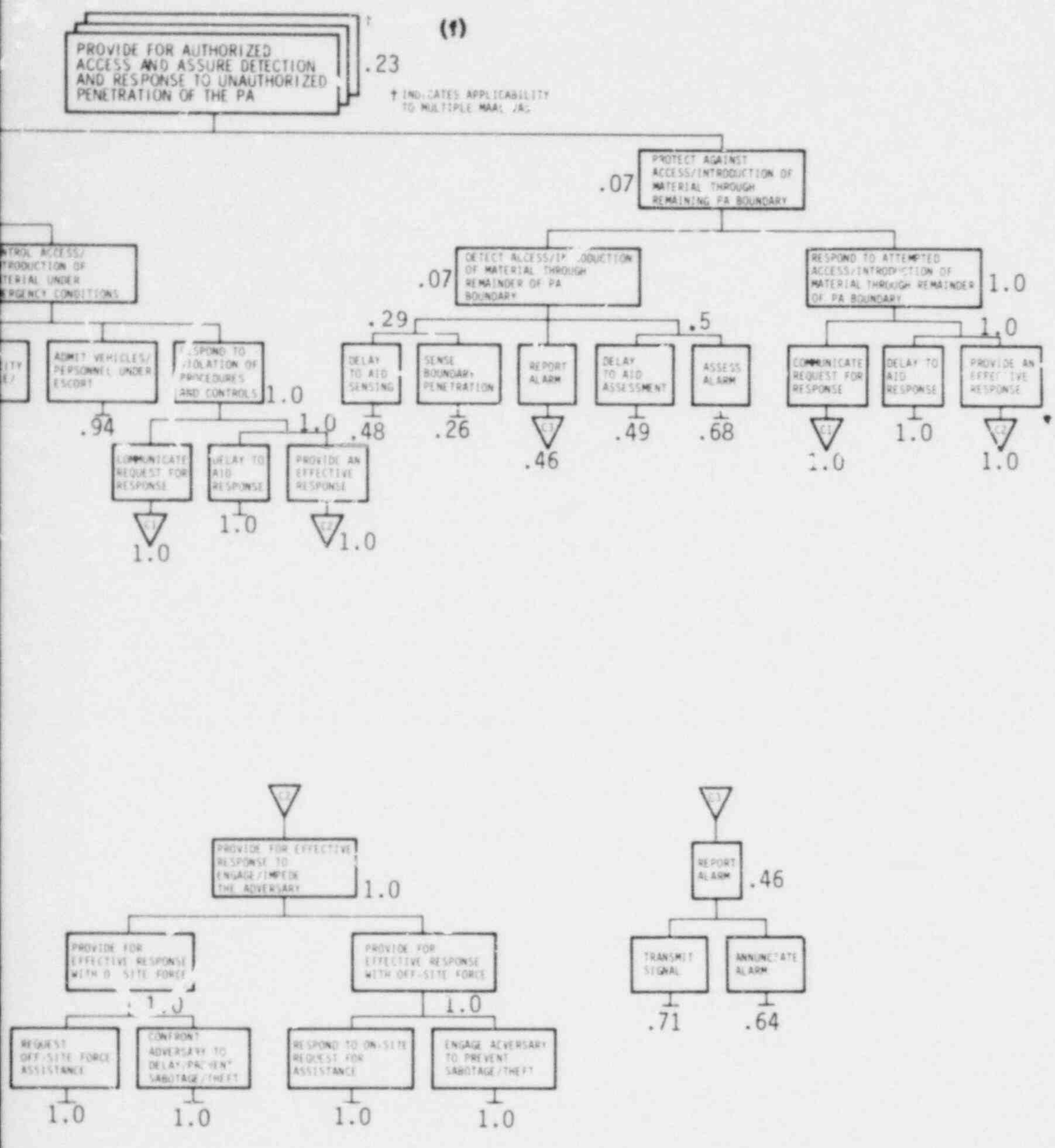

CONTROL ACCESS/ INTRODUCTION OF MATERIAL THROUGH PA ENTRY PORTALS
.58
CONTROL ACCESS/ INTRODUCTION OF MATERIAL UNDER NORMAL CONDITIONS
.46
PROVIDE ADMITTANCE AUTHORIZATION
.63
PROVIDE PROCEDURES AND CONTROLS FOR ACCESS/ INTRODUCTION OF MATERIAL UNDER NORMAL CONDITIONS
.45
PROCEDURES AND CONTROLS FOR PERSONNEL/VEHICLES ENTERING THE PA
.5
PROCEDURES AND CONTROLS FOR MATERIAL ENTERING THE PA
.57
VERIFY AUTHORIZATION AND IDENTIFICATION
.49
DETECT CONTRABAND
.50
RESPOND TO VIOLATION OF PROCEDURES AND CONTROLS
1.0
VERIFY AUTHORIZATION
.76
DETECT CONTRABAND
.42
RESPOND TO VIOLATION OF PROCEDURES AND CONTROLS
1.0
COMMUNICATE REQUEST FOR RESPONSE
DELAY TO AID RESPONSE
PROVIDE AN EFFECTIVE RESPONSE
1.0
VERIFY EMERGENCY
.92
.92
COMMUNICATE REQUEST FOR RESPONSE
1.0
PROVIDE COMMUNICATION BETWEEN GUARDS ON PATROL
PROVIDE CONTINUOUS COMMUNICATION BETWEEN GUARDS ON PATROL AND MANNED ALARM STATIONS
PROVIDE CONTINUOUS COMMUNICATION BETWEEN MANNED ALARM STATIONS
PROVIDE COMMUNICATION BETWEEN ON-SITE AND OFF-SITE FORCES

Figure 2-4.



Performance Scores for Upgrade Rule 10 CFR 73.45 Paragraph (f) system ETQs to address the functional and dynamic interactions of various system functions and subfunctions has been discussed in a previous report.[3] In this evaluation, the choice of aggregation rule, e.g., SOFT AND, which reflects these interactions was tentatively made by the authors.

The results of the performance evaluation for the partial PPS designed by AGNS are given in Table 2-1. These scores are defined on a scale of 0 to 1.

Table 2-1

Performance Scores for Partial PPS

Performance Capability	Score
(c) Permit only authorized activities and conditions within the MAA	0.33
(d) Permit only authorized placement and movement of SSNM within MAAs	0.38
(f) Provide for authorized access and assure detection and response to unauthorized penetration of the PA	0.23

At this time, no acceptance level has been established by the NRC which would indicate the significance of these scores. The development of two PPS designs which a consensus of experts judged as "good" and "minimal," relative to the performance capability requirements, would provide the NRC with some basis for establishing an acceptance level. However, it should be emphasized that the aggregate score which results from application of the SURE methodology to a PPS should not be used as an absolute measure of system performance. It is intended to be used by an evaluator only as a guide to making a relative judgment regarding the adequacy of a PPS.

In the absence of an acceptance level, no judgments are made here regarding the significance of these scores. Instead, the results of the evaluation are examined with the initial goal in mind, i.e., testing of the methodology to provide a critique. Given the scores for the various hierarchy elements (boxes) shown in Figures 2-2, 2-3, and 2-4, a limited analysis of the test results with regard to 10 CFR 73.45 capabilities (c), (d), and (f) is presented in Volumes II through IV, respectively. This analysis includes tracing back through the functional hierarchies and identifying the lowest score at each level. This process permits easy identification of problem components or areas of concern. Discussions between NRC evaluators and licensees, based on isolation of problem areas using this trace-back process should result in either revised component, subfunction, or function scores based on additional design information not reflected in the methodology or system design modifications to correct the deficiencies.

2.3.2 Sensitivity Analysis

A brief sensitivity analysis was performed for each performance capability evaluation. This included an analysis of the sensitivity of the overall performance capability score to the following:

1. Improvement in component and subsystem performance, and
2. Selection of alternate aggregation schemes within the methodology.

The results of this analysis for each of the three performance capabilities in 10 CFR 73.45 (c), (d), and (f) are discussed in Volumes II, III, and IV, respectively. In general, the results indicate the importance of individual component performance as well as system integration. This was especially true where improvements were made in components contributing to the performance of a vital function, e.g., detection. It is also evident that the proper selection of aggregation rules throughout the hierarchy is very important to obtaining a valid measure of performance. It is considered essential for situations in which it is not possible to simply select an aggregation rule, e.g., SOFT AND, independent of the specific components in the system and/or site conditions involved. Furthermore, it may not be desirable to allow rule selection to be performed by the licensee or evaluator under such circumstances. Rather, rule selection should be made on the basis of responses to a series of questions. Since an acceptance level has not been established by the NRC, the significance of the sensitivity analysis results is difficult to ascertain. Another observation which can be made as a result of this exercise is the ease of performing a sensitivity analysis.

2.4 TEST RESULTS

2.4.1 Critique of the Design Guidance Compendium

Following the design and documentation of the "good" partial PPS and completion of the corresponding ETQs, AGNS provided a critique of the compendium. This critique was intended to illustrate both the strengths and weaknesses of the compendium with respect to its utility to the licensee in designing a system which satisfies the Upgrade Rule requirements and in preparing the necessary documentation for license application. The attributes include the following:

1. IRSs which identify technical information to be included in the evaluation of the PPS and the associated security plan, thus providing conformity in the licensing process. By responding to the information

solicited in the compendium, the licensee is committed to the submission of security plans which are more cohesive and coordinated. These physical protection plans will contain, and be limited to, only the information necessary to perform a thorough evaluation of the ability of the PPS to achieve the performance capabilities. Additionally, the licensee is relieved of the responsibility of determining the type of information required in the compendium.

2. Functional hierarchies which identify the functions and subfunctions which must be performed to achieve the objective stated in each performance capability. This allows the licensee to review his design for completeness, while enabling him to make performance trade-offs among components which interact within the same physical protection subsystem.
3. ETQs which address component performance, thus providing the licensee with a continuous self-test capability. These ETQs permit identification of component inadequacies and system incongruities. As each new component or system is added to the total system, the licensee becomes initially exposed to both the beneficial and detrimental characteristics of the component. Subsequently, this exposure broadens and necessitates the licensee's evaluation of the impact of the component on the PPS and the impact of the PPS on the component.

The one notable deficiency of the compendium concerns some inconsistencies between the information requested by the IRS and the information evaluated by the associated ETQ. In such cases, either information concerning a specific component or system is requested and then not evaluated, or information is evaluated but never requested. In addition, identical information for similar components or systems is not always requested or evaluated. However, the effects of this deficiency are minimal and could easily be corrected by a revision of these products.

In conclusion, the deficiencies of the Design Guidance Compendium are minimal when compared to its positive attributes. Maximization of its utility occurs when the compendium is implemented during the design phase of the facility, e.g., concurrently with health and safety, operations, and maintenance design considerations. However, confidence in all fixed-site nuclear facility PPSs, either planned, under construction, or in operation, is sufficiently enhanced by utilizing the compendium to warrant its implementation.

2.4.2 Critique of the SURE Methodology

The results of the SURE methodology test show the need for more extensive testing and, in particular, for the development of a "minimal" performance system to permit calibration of the methodology. This would also provide the NRC with a basis for establishing an acceptance level. The performance evaluation and sensitivity analysis both point out the need for such an acceptance level.

The results of the sensitivity analysis show that the sensitivity of the overall performance score to changes in individual component ETQ scores is a function of the total number of components contributing to the performance of a particular low-level task, e.g., intrusion sensing, and of the aggregation rules selected at hierarchy levels above that of the low-level task.

The trace-back capability provided in the SURE methodology is an invaluable tool which can be used by licensees and NRC evaluators to discuss and resolve any discrepancies in the perceived performance of the PPS. Finally, the ease with which sensitivity analyses can be performed is an additional attribute of the methodology.

3. RECOMMENDATIONS

Recommendations for further development of the Design Guidance Compendium and SURE methodology are as follows:

1. Continued development of system ETQs for systems in which performance is subject to functional and/or dynamic interaction between system elements,
2. Provision for comprehensive testing by both industry and the NRC to determine the utility, completeness, and validity of the Design Guidance Compendium and SURE methodology, and
3. Extension of the methodology to evaluate the performance provided by multiple layers of protection, given an adversary gains access to the PA, MAA, etc.

Each of these recommendations is discussed in detail in the following subsections.

3.1 CONTINUED SYSTEM ETQ DEVELOPMENT

The first recommendation, continued system ETQ development, is considered essential for situations in which it is not possible to simply select an aggregation rule, e.g., SOFT AND, independent of the specific components in the system and/or site conditions involved. Furthermore, it may not be desirable to allow rule selection to be performed by the licensee or evaluator under such circumstances. Rather, rule selection should be made on the basis of responses to a series of questions.

In addition, some systems require an interactive relationship between components for satisfactory performance to be achieved. In such cases, questions are required in order to probe the extent of the component relationships. Merely aggregating individual component ETQ scores will not provide a meaningful measure of performance. For example, a well-constructed, properly installed barrier which provides an adversary delay of 5 minutes, when evaluated as a component, could be given a high score. Similarly, a well-trained, well-equipped, highly motivated response team with a 10-minute response time could be rated highly as a component. However, only when the delay time is compared to the response time does it become apparent that the two components are incompatible as a system.

3.2 COMPREHENSIVE DESIGN GUIDANCE COMPENDIUM AND SURE METHODOLOGY TESTING

The second recommendation involves comprehensive testing of the Design Guidance Compendium and the SURE methodology by both industry and NRC users to determine the utility, completeness, and validity of the compendium and the SURE methodology in their various areas of application. The compendium and the SURE methodology should be tested, at the very least, on a hypothetical PPS which satisfies the requirements of all six performance capabilities of the Upgrade Rule. To date, limited testing has been performed using a hypothetical system for four capabilities (b), (c), (d), and (f). Ideally, the compendium and the SURE methodology should be exercised in their entirety by both industry and NRC users for an actual security plan submittal.

3.3 EXTENSION OF SURE METHODOLOGY

The third recommendation suggests that the evaluation methodology be extended to provide an estimate of protection in-depth performance. Such an extension could prove useful as a decision aid for NRC licensing personnel in the review of security plans whenever some uncertainty exists concerning a particular performance capability's acceptance. The reviewer could simply assume that the capability did not exist and obtain an evaluation of the remaining system's ability to achieve the general performance objective.

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16. ABSTRACT (200 words or less)

Limited testing of the NRC Fixed-Site Physical Protection Upgrade Rule Guidance Compendium (NUREG-0669) and the associated Sandia product, the Safeguards Upgrade Rule Evaluation (SURE) Methodology, has been completed. This exercise was aimed at determining the utility of these two products with respect to the NRC Physical Protection Upgrade Rule (10 CFR 73.45) requirements. The test exercise and its results are discussed in this four-volume report.

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