UCRL- 94290
PREPRINT

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(Safeguards Evaluation Method--Insider Threat)

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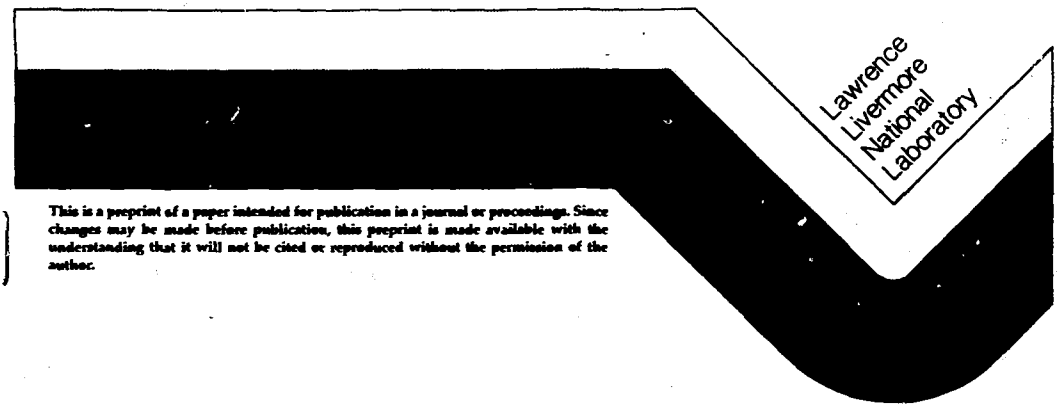
UCRL--94290

DE86 012817

This paper was prepared for submittal to
INMM 27th Annual Meeting
New Orleans, Louisiana
June 22-25, 1986



TECHNOLOGY TRANSFER -- INSIDER PROTECTION WORKSHOP

(Safeguards Evaluation Method--Insider Threat)

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Abstract

The Safeguards Evaluation Method--Insider Threat, developed by Lawrence Livermore National Laboratory, is a field-applicable tool to evaluate facility safeguards against theft or diversion of special nuclear material (SNM) by nonviolent insiders. To ensure successful transfer of this technology from the laboratory to DOE field offices and contractors, LLNL developed a three-part package. The package includes a workbook, user-friendly microcomputer software, and a three-day training program. The workbook guides an evaluation team through the Safeguards Evaluation Method and provides forms for gathering data. The microcomputer software assists in the evaluation of safeguards effectiveness. The software is designed for safeguards analysts with no previous computer experience. It runs on an IBM Personal Computer or any compatible machine. The three-day training program is called the Insider Protection Workshop. The workshop students learn how to use the workbook and the computer software to assess insider vulnerabilities and to evaluate the benefits and costs of potential improvements. These activities increase the students' appreciation of the insider threat. The workshop format is informal and interactive, employing four different instruction modes: classroom presentations, small-group sessions, a practical exercise, and "hands-on" analysis using microcomputers. This approach to technology transfer has been successful: over 100 safeguards planners and analysts have been trained in the method, and it is being used at facilities throughout the DOE complex.

Introduction

Although current management practices for nuclear materials employ many leading-edge technologies, the need for new technologies continues. Over the past decade, the Lawrence Livermore National Laboratory (LLNL) Safeguards Program has developed a variety of analytic methods to support safeguards decision-makers in evaluating and enhancing their safeguards systems. These methods have focused on protection against special nuclear material (SNM) theft by nonviolent insiders. Safeguards analysts from LLNL have applied these methods successfully at numerous DOE- and NRC-licensed facilities, including research facilities, fuel manufacturing and weapons production plants, and storage facilities. However, adoption of new technologies by those responsible for nuclear materials protection requires the transfer of these technologies from the laboratory to the field. In general, transferring analysis technologies is difficult, especially for methodologies that require the user to have a specific analytical background.

LLNL has developed several important insights in their effort to transfer the Safeguards Evaluation Method--Insider Threat to the DOE nuclear safeguards community. The Safeguards Evaluation Method was designed to help evaluate the effectiveness of physical security and material control and accountability systems against theft or diversion of special nuclear material (SNM) by nonviolent insiders. It was developed in response to requests by several facilities for a method that managers could use "in-house" to evaluate their own safeguards systems. The method provides a systematic and practical approach to safeguards evaluation. It can handle a wide variety of facilities with various quantities and forms of SNM.

The approach judges the effectiveness of a safeguards system according to its ability to detect theft attempts in both a timely or late manner. "Timely" detection occurs in time to prevent loss of material; "late" detection occurs after loss of material.

LLNL's success in transferring the Safeguards Evaluation Method is evidenced by the method's "in-house" use by a number of DOE facilities. This successful transfer is the result of three factors:

- A self-guided workbook that leads users through the safeguards evaluation.
- User-friendly microcomputer software that complements the workbook.

*Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

- The Insider Protection Workshop, which teaches potential users how to use the method.

The DOE Office of Safeguards and Security has actively supported the transfer of this safeguards analytical tool to all DOE facilities. In addition, they have funded the development of the three-day Insider Protection Workshop. Since July 1985, six workshops have been given at various locations including: the Argonne National Laboratory, the Rocky Flats Plant, the Y-12 Plant at Oak Ridge, and the Savannah River Plant.

The body of this paper will concentrate on the Insider Protection Workshop. In the second section we discuss the role of the workbook and computer software in facilitating the transfer of the analytical tool to the field. In the third and fourth sections we discuss the workshop content and format.

Workbook and Computer Software

The Evaluation Workbook and the Evaluation Tool (ET) computer software are two key factors in the successful use of the Safeguards Evaluation Method. Both were designed for users with minimal knowledge of evaluation method theory and mathematics. In this section we present some characteristics of the Evaluation Workbook and the Evaluation Tool that we feel were particularly valuable in simplifying the technology transfer.

The Evaluation Workbook was designed for use by an *appraisal* team to *evaluate safeguards and* security effectiveness of nuclear facilities against nonviolent insiders. The workbook provides guidance for the division of effort among evaluation team members. Using this workbook, the appraisal team can complete an on-site evaluation during a three- to five-day facility inspection. The workbook begins with an outline that gives the order in which evaluations should be performed. For any particular evaluation, not all steps of the method need be done: the workbook allows for this and highlights the general steps that are always required. For example, it may be desirable initially to evaluate safeguards against single insiders and to skip the workbook section on collusion.

The sections of the workbook are keyed to each step of the method. Also, the workbook juxtaposes instructions for the evaluation and actual assessment forms used to describe the facility layout, list safeguards components, and enumerate potential adversaries and their goal-quantity of SNM. These forms provide useful documentation of safeguards components and assumptions made during the evaluation. The juxtaposition of instructions and forms is especially helpful to first-time or infrequent users of the evaluation method.

Throughout, the workbook provides guidance to the user on how to proceed with an evaluation. For example, the workbook suggests identifying major safeguards weaknesses by first evaluating safeguards against single employees. If the system performs well against single employees, then the analysis can be expanded to include collusion of two insiders.

For safeguards analysts new to the method or those uncomfortable with quantitative assessments, the workbook provides for both qualitative and quantitative evaluations of safeguards. For qualitative evaluation, judgments of effectiveness such as "high," "medium," and "low" are used. These judgments can be refined for quantitative evaluation by scoring effectiveness on a 0 to 10 scale or by assigning detection probabilities (0.0 to 1.0). The computer software can be used to calculate results for quantitative evaluations.

The Evaluation Workbook provides convenient documentation that can be revised in future facility evaluations. The workbook forms are in loose-leaf format for easy revision or replacement during repeated facility evaluations. For example, if safeguards upgrades are implemented for the material access area boundary, only limited sections of the workbook need to be revised to complete an up-to-date evaluation. The same technique applies to evaluations of buildings or facilities with similar safeguards. By making minor changes to the completed workbook for one facility, the evaluation for another facility can be accomplished with minimum effort.

Another advantage of the workbook is that it shows the systematic steps the evaluation team followed in reaching their conclusions. This is helpful to those individuals performing the evaluation because it allows them to double-check their work and assumptions, and it provides a means to support their results. Also, the documentation of these systematic steps gives management a "warm" *feeling* that *the results weren't* "pulled *out of a* hat."

The accompanying computer program can be used to perform quantitative analysis. Each workbook includes the Evaluation Tool (ET) personal computer software on a floppy disk. The ET program uses data and quantitative judgments collected in the workbook to evaluate safeguards effectiveness. Its analytical tasks include safeguards evaluation, sensitivity analysis, and documentation. The computer-aided evaluation provides finer resolution of strengths and weaknesses. ET also allows the user to quantify the benefits of safeguards improvements. Coupled with the workbook, the computer program can be used by facility operators to test the effectiveness of safeguards modifications before implementation.

These features of the ET computer program enhance insider protection evaluation and improve technology transfer of the method:

- Facilitates analysis of effects of different judgments and safeguards programs.
- Identifies safeguards strengths and weaknesses and suggests upgrades.
- Aids in comparison of possible safeguards upgrades.
- Speeds reevaluation of a facility.

The ET software is user-friendly: it contains clear, concise on-screen instructions; it is menu-driven, and it provides an on-line "help" function. An example and detailed instructions

are provided in the workbook. The program displays results in both tabular and graphic form, and it stores the evaluation data and results on a floppy disk.

Acceptance of the evaluation method was enhanced by designing the software for IBM Personal Computers and compatible machines. Furthermore, the actual hardware requirements to make full use of the software are minimal. Requirements are: an IBM PC compatible microcomputer with 256K RAM, two floppy disk drives, and a monitor and graphics board. To print the results, an IBM or EPSON parallel printer with graphics capability is needed.

Both the workbook and computer software are playing important roles in the adoption of the Safeguards Evaluation Method. In this section we have presented some of the aspects of the workbook and computer software that facilitate field adoption. In the remaining two sections, we discuss the Insider Protection Workshop and its unique contribution to the technological transfer of the Safeguards Evaluation Method.

Workshop Content

The three-day Insider Protection Workshop speeds acceptance of the Safeguards Evaluation Method because it not only explains the evaluation method but also motivates the participants, provides them with the necessary background, and illustrates a sample application. The workshop includes four main topics:

- The nature of potential insider threats to SNM at DOE facilities.
- Current insider protection methods, human reliability programs, physical security measures, material control procedures, and material accountability systems.
- Practical techniques for identifying needed improvements, designing effective upgrades, and setting priorities for allocating limited resources.
- Practical experience applying the method to a facility.

The workshop begins with information about potential insider threats. This is provided to ensure that participants understand the nature of potential insider threats, and the need to balance insider and outsider protection. Explaining the nature of the threat includes common insider vulnerabilities, who the potential adversaries are, and the current DOE threat guidance. An understanding of the nature of insider threats provides the motivation for learning and applying the evaluation method.

To evaluate safeguards for the insider threat, participants need to have an understanding of insider measures. The workshop covers the capabilities and vulnerabilities of insider protection measures, the relationship of alternative protection measures for deterring malevolent acts, detecting and preventing theft and diversion attempts, and mitigating the consequences of a successful threat. The four types of protection measures forming an integrated safeguards system are covered in the workshop:

- Human reliability programs, including psychological screening, security awareness programs, and security clearances.
- Physical protection, including surveillance, physical barriers, and access controls.
- Material control, including administrative procedures and monitors.
- Material accountability, including records and physical inventories.

During the workshop, each student is given an Evaluation Workbook and taught how to use it. The emphasis in the workshop, however, is on the use of the Safeguards Evaluation Method in improving safeguards: this includes identifying and designing upgrades, and allocating resources. The workshop concentrates on how to use the evaluation and its results to assist the nuclear material manager in his/her objectives of safeguarding the material. Thus the workshop focuses on not only the technology itself, but what the technology can do for the user.

One of the main features of the workshop is a sample application of the method that demonstrates the concepts and techniques presented in the classroom. The sample application allows the participant- "to learn by doing." It also allows the participants to visualize how the method could be applied at their facility. This exercise involves the evaluation of safeguards at a nuclear material storage facility. Participants tour the facility, document safeguards, and evaluate the safeguards effectiveness. Without this step, LLNL feels that the participants would not truly adopt the method as a tool they can use, but would instead view it as an interesting concept of limited value to their particular application.

These four elements of the workshop are all vital to its success, but their ability to achieve their objectives is dependent on the workshop's format. In the next section, we discuss the degree to which the workshop participants absorb the concepts and ideas as a function of the workshop format.

Workshop Format

We strongly believe in a highly interactive workshop format. Equally important, the length of the workshop has a direct bearing on the number of participants attracted: it is difficult for participants to attend a workshop and remain attentive for an extended period of time. We vary instruction modes in the Insider Protection Workshop: classroom presentations, small-group sessions, and "hands-on" analysis with microcomputers.

The classroom presentations are informal, and ample time is devoted to discussions among participants. These discussions allow participants from different functional areas and facilities to

explore common concerns, problems, and solutions. The discussions also foster an acceptance of the concepts and methods presented.

During the practical exercises, the participants work in small groups of three to five people. This cooperative learning environment is helpful in developing a solid understanding of the method's capabilities. These groups are arranged to reflect the mix of skills used in a typical evaluation team, and they usually represent personnel from operations, physical security, and material control and accountability. Not only does this mix provide a real-world flavor to the exercise, but it also allows the participants to develop a feel for the integrated nature of insider-protection systems.

Microcomputers are used throughout the evaluation exercise. Each small working group is provided with a computer with which they evaluate safeguards using the ET computer program. Computer instruction is greatly aided by a system of "slave" computer monitors. In addition to their own computer and monitor, each working group has a second monitor, which is connected to the instructor's computer. This makes it possible for all participants to follow on the "slave" monitors the instructor's use of the program, while at the same time exercising the program on their own computer. By working through an evaluation using the microcomputer, participants become more familiar with the method and its use for conducting safeguards evaluation, sensitivity analysis, and upgrade prioritization.

Conclusion

Three main factors have contributed to the successful transfer of the Safeguards Evaluation Method from LLNL to DOE facilities: the Evaluation Workbook, the Evaluation Tool computer software, and the Insider Protection Workshop.

The Insider Protection Workshop is unique, and comments from participants about the workshop have been positive. On the evaluation form completed by all participants at the close of each workshop, the vast majority indicated that they were "likely" or "very likely" to apply the evaluation method. So far, over 100 safeguards planners and analysts have been trained in the method. It is being used at many DOE facilities.