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LETTER REPORT

NRC Research and Technical
Assistance Report

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Task 1. APPLICATION AND FURTHER DEVELOPMENT
OF AUTOMATED SAFEGUARDS ASSESSEMENT TOOLS

Contributors: W. Orvis, C. Patenaude, A. Poggio, and P. Wahler

TECHNICAL ACTIVITIES

The technical activities in August 1980 focused on the application of the Safeguards Vulnerability Analysis Program (SVAP) to the SLIP facility physical security system and on the continued upgrade of the Structured Assessment Approach (SAA) data input package. Also, the year-end documentation for the efforts in this task were undertaken.

Assessing the SLIP facility

The SAA assessment of the SLIP facility was continued following the receipt of the additional physical security systems data needed for the tampering analysis. This data was sent by Russ Rentschler of RES/NMSS and Robert Shepard of NRC/RES. We will run the tampering analysis and transmit the report describing the run shortly.

We compared the new version of sets, SETSL, with the old version, SETSS. The new version is designed to handle larger problems than the old. While attempting to expand a Boolean expression, the old version would occasionally expand beyond its limits. For example, the equation

$$/(A*B*C*D+E*F*G*H+I*J*K*L)$$

has 64 terms when expanded. If 4 of these are multiplied together in an equation, it would expand to over 16 million terms. The new version handles

this problem by storing all of these terms on disc files rather than in memory. We found in our comparison that SETSL will run the larger problem faster, but on shorter problems it is slower than SETSS, because SETSL takes time doing in-out between the central processor and the disc files. For example, one problem took 1 minute for SETSS to run while it took 15 minutes for SETSL to run. This time problem will limit the value of SETSL to problems run by SVAP.

The data forms for the SVAP analysis of the SLIP facility¹ will be complete when the changes in the input data resulting from the new SETSL program are incorporated.

Upgrading the Structured Assessment Approach

Our efforts to modify the SAA preprocessor program to run on the Tektronix 4054 minicomputer continued. The preprocessor-driven program is now complete and operating correctly on the minicomputer. The area edits program (first overlay program) is nearly complete and will be put on the minicomputer soon.

Refining the tampering analysis code continued. The remaining sections of the bit-vector version have been computed. The code is in final checkout and has run a variety of data files. A description of the tampering analysis will be included in the final report.

The documentation of this effort is nearing completion. The draft User's Manual is written.² The data-gathering and data-recording procedures are written. The example facility has been developed for procedure verification.³

TASKS 2 AND 3. DEVELOPMENT OF VALUE-IMPACT METHODOLOGY

Contributors: R. Al-Ayat, G. C. Corynen, J. Huntsman*, and B. Judd*

INTERACTIONS WITH NRC/TECHNICAL MEETINGS

On 14 August 1980, R. Al-Ayat and B. Judd met in Washington with members of NMSS and NRC/RES. The purpose of the meeting was to present the results of the Value-Impact Analysis of the Data Base collected from the Babcock and Wilcox Fuel Fabrication Plant at Lynchburg. Attending were R. Dube, W. Altman, B. Mendelsohn, and H. Smith of Nuclear Material Safety and Safeguards, and R. Shepard of NRC/RES.

From 15-19 August 1980, Al-Ayat, Judd, Altman, and Smith met with the Material Control and Accounting personnel at Lynchburg. The purpose of the meeting was to review the data that had been collected, to continue the data collecting effort, to discuss upgrades, and to collect cost data for design upgrade implementation. Both meetings were highly productive.

TECHNICAL ACTIVITIES

The technical effort for this month focused on continuing to analyze the data collected from Lynchburg and beginning to document the year's effort. G. C. Corynen prepared a draft, A Formal Systems Model for Nuclear Safeguards: A Tool for Evaluating the Overall Benefits of Improved Safeguards Performance.

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TASK 4. DEVELOP IMPROVED GUIDANCE CAPABILITIES FOR MC&A SYSTEMS

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TECHNICAL ACTIVITIES

The goal of this study was to develop or recommend 1) principles and methods for protecting material accounting (MA) data from falsification and 2) organizational criteria which support safeguards effectiveness.

Four protection principles have been identified as potential checks and balances against data falsification. The four principles are:

- Data Control rule--to provide assurance that sufficient controls be involved in the handling of data, especially with respect to the introduction of original data into a system;
- Control on Controls rule--to prevent falsification occurring through improper changes in working procedures;
- Skip Echelon Verification rule--verification by senders of data that the data are properly used; and
- Secondary Echelon Forwarding rule--verification by recipients of data that the data are properly used.

We have used as a basis for this effort an LLNL study completed in 1979 which involved the systematic evaluation and critique of current MA regulations. The 1979 study led to the development of a generic, minimal material accounting (GMMA) system and a vulnerability assessment of its associated information flow diagrams.

The approach taken herein was to examine the vulnerabilities in the GMMA system from the point of view of a systems analyst and an internal auditor and then determine some acceptable methods for alleviating them. After doing this, we found that the methods could be categorized into the four principles or rules given above.

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Our approach to setting organizational criteria is basically to ensure that there is adequate separation of responsibilities for elements of control mechanisms. The protection principles described earlier are control mechanisms in the same sense as the consistency tests and "Access" controls required by current regulations. The organizational structure involved in implementing any control mechanism obviously must incorporate separation of duties in order to be effective.

Draft documentation on Task 4 is undergoing internal review at LLNL. A final version should be available in mid-September.

TASK 5. ANALYSIS OF THE ROLE OF AN INTERFACILITY SNM
ACCOUNTING SYSTEM FOR NRC SAFEGUARDS ASSURANCE

Contributors: D. Dunn, J. McDonnel,* and R. Mullin*

TECHNICAL ACTIVITIES

This task is concerned with analyzing the role and effectiveness of the current NRC interfacility material accounting system in deterring or detecting both SNM diversion and facility material accounting falsification. The primary objectives of this task are:

- To characterize current national MC&A (material control and accounting) information flows and corresponding detection mechanisms,
- To identify deterministic accounting checks and balances that could be employed using currently available data,
- To determine additional data needs and corresponding safeguards checks and auditing mechanisms.

The initial phase in this study was to review documentation on the two existing reporting systems, the Nuclear Materials Management Safeguards Systems (NMMSS) and the Safeguards Status Report System (SSRS). A data flow chart which includes both systems and which identifies the many interactions between licensees and the NRC was developed and reported in the April-June Quarterly Report. Identifying the many interactions was difficult because many are informal (i.e., not mandatory in a formal sense) and are not consistently accomplished.

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We then analyzed the formal data received by the NRC; namely, the Transaction Reports (Form 741) and Material Status Reports (Form 742) submitted directly by licensees, and the Inventory Balance Reports (Form 327) prepared and submitted by the Regions for each licensee. The purpose of the analysis was to consider the present and potential value of the reported data as checks and balances to protect against material accounting fraud and SNM diversion. We have identified deterministic checks and balances that could be exercised by the NRC in its safeguards management role. The checks and balances would utilize currently available data and would also require additional data needs. However, only relatively minor changes are needed in order to significantly increase capabilities of an NRC interfacility material accounting system. Some highlights of results to date follow.

Recommendations which, if implemented, would provide safeguards assurance improvements consistent with a reasonable level of data reporting requirements include:

- 1) Require licensees to submit a Material Status Report (NRC Form 742) to NMMSS concurrently with each required physical inventory. The data for the 742 is readily available at inventory time and compliance should require very little additional effort. This would allow frequent precise updating of the NMMSS and facilitate verification of individual data entries with those received via the Safeguards Status Report System (NRC Form 327) prepared from licensee inventory data by the several NRC Regions.
- 2) Eliminate the requirement for the 742 report now submitted March 31 and September 30. The NMMSS can provide this data from 742s submitted at inventory time together with information available from already required Material Transaction Reports (NRC Form 741) submitted by each licensee.
- 3) Require submission of a "Book" 742 report to NMMSS each month not involving a physical inventory. This data could be taken from the records of the licensee as are the present 742 reports. Submissions

could be made as of the same calendar day of physical inventories. The data for this 742 submission is currently needed to meet the requirements of informal material monthly balance reports now provided to the Regions and monthly loss and discard reports now provided to the NMMSS as well as to the Regions. This requirement would formalize some current informal reporting. A NMMSS monthly material balance updated with 741 data can be compared with the data of each submitted 742.

- 4) The summary inventory difference data now submitted by the Regions to the NMMSS should be keyed to dates of licensee 742 submissions to facilitate verification of these separately obtained data.
- 5) Eliminate requirements for separate monthly loss and discard reports and separate monthly material balance reports.
- 6) Provide for periodic data verification and data inconsistency checks with monitoring and review by Headquarters as part of the NRC safeguards management role.

A check and balance using current available data is a comparison of 327 data with a combination of 742 and 741 reports. At least twice each year there appears to be compatibility of data received by the two systems.

Observed inconsistencies can be clues to falsification attempts also. Knowledge on the part of a potentially fraudulent person or colluding group that checks and balances are being performed (even at a late date) can be a deterrent. We feel that only relatively minor changes are needed in additional reporting requirements in order to significantly increase the capabilities of an NRC interfacility material accounting system.

Documentation on Task 5 has started and a draft report should be available in the near future.