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INTERIM REPORT

LAWRENCE LIVERMORE LABORATORY

August 7, 1980
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Division of Safeguards, Fuel Cycle
and Environmental Research
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Dear Bob:

Enclosed are ten copies of the monthly letter report for May 1980.

ANDREW J. POGGIO
Program Leader
Nuclear Systems Safety/Safeguards Program

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Enclosures

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NRC SAFEGUARDS MATERIAL CONTROL PROJECT
MONTHLY LETTER REPORT FOR MAY 1980

A. J. Poggio
Program Leader

TASK 1. ASSESSMENT METHODOLOGY APPLICATIONS AND DEVELOPMENTS

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

TECHNICAL ACTIVITIES

We continued our Task 1 activities in two major areas:

- Upgrade of the Structured Assessment Approach
- Analysis of the SLIP facility

Each of these areas is treated in detail below. During May we did not make significant progress in upgrading the computational portions of SAA, i.e. the partitioning and bit vector schemes.

Upgrade of the Structured Assessment Approach

In order to make the Structured Assessment Approach (SAA) more user-oriented, we have devoted significant effort to upgrading the input portion of the code, which is the portion that deals with preparing data in a format suitable for processing by SAA. We have been programing a Tektronix 4054 minicomputer to prepare the bulk of the input data. In addition, we have beeen preparing an SAA data-gathering handbook to aid the analyst in data collection. This handbook will be described later.

This month we upgraded the portion of the input program referred to as the the facility description program which consistently and systematically converts the facility physical layout data into a computer-acceptable form. The facility description program has been based on the program used in SVAP. The initial programing was completed this month and we are presently using trial data to exercise all options of the program and to assure ourselves of

proper operation. We have also begun documenting the corresponding portion of the user's manual.

As an additional aid for data gathering, we have been developing an SAA data-gathering handbook. During May, forty-two of the required seventy-two handbook forms for physical security were prepared in a format suitable for use in the field. During the coming month the physical security portion of the handbook will be completed. The material control and accounting (MC&A) portion of the data-gathering handbook is being developed at a slower rate. We discussed several options for these forms during May and are soliciting comments from LLNL staff members regarding an appropriate format.

Analysis of the SLIP Facility

During May we performed an SAA vulnerability assessment of the physical security system of the SLIP nuclear fuel processing facility. In particular, we analyzed the physical security system of the high-enriched scrap processing building. The data collection was initiated during February, when A. Parziale, R. Shepard, and E. McAlpine collaborated during the initial preparation of the data, and was completed in April. The data was subsequently converted into the proper format with a few days effort and entered into the LLNL CDC-7600 computer. The following computer-generated reports were provided by the SAA:

- Monitor coverage of strategic special nuclear materials (SSNM) targets as well as entry and exit paths through the facility
- Weak collusion analysis determined by authorized access to monitor equipment
- Probability of detecting an adversery determined by performance parameters and availability of monitors and of support equipment
- Sensitivity to single element failure

The CDC-7600 CPU time required to generate these four reports was slightly over two minutes.

To complete the vulnerability assessment, we will perform a tampering analysis. Since the data required for this analysis was not available, we have begun to generate a list of questions to elicit the necessary information.

Plans

During June, we intend to continue the vulnerability assessment of the SLIP facility and to prepare a document of the LLNL assessment. Also, we intend to bring the bit vector and partitioning algorithms near completion as we continue to upgrade the SAA. During June, LLNL will also formulate a list of questions regarding the SLIP MC&A system and the tampering protection system. Work will continue on the SAA data-gathering handbook.

LLNL will conduct a briefing at NRC headquarters on progress made in this material control project on June 3. At that time we will also discuss the future plans for this project.

TASKS 2 AND 3. DEVELOPMENT OF VALUE-IMPACT METHODOLOGY

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

INTERACTION WITH THE NRC

Discussions concerning Task 2 were held with Barry Mendelsohn and Carl Withee of the NRC Office of Nuclear Material Safety and Safeguards (NMSS) this month. B. Mendelsohn expressed interest in devoting part of this task's resources to analyzing and discussing the value to of early detection. His concern was also expressed in a Telex received on May 20, emphasizing that such an analysis is needed to aid the NRC in choosing the detection parameters for the MC&A Upgrade Rule. We consider expanding the Value-Impact Methodology beyond the facility's safeguards system necessary and worthwhile, and had recommended this to the NRC earlier.

Thus far in our work on the Aggregated Systems Model (ASM), we have found that the benefits of early detection can be expressed as a shorter time to resolving the alarms and an increased probability of determining the status of special nuclear material (SNM) as either accounted for or unaccounted for. Other measures of performance, such as the diversion index and the deterence index, can also change due to a shortened alarm time.

The societal benefits of a more timely material deversion alarm can be further expressed in terms of increased probability of recovery of the diverted SNM and increased probability of apprehending the adversary or adversaries. These benefits, however, have not been explicitly considered in the ASM. Currently no information is available to directly quantify these benefits to society. An attempt to develop a structure to mathematically formulate the problem started this month. We hope the input data required can be provided by experts here in the lab. A preliminary version of the model was presented at an internal review of the task at the end of the month.

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TECHNICAL ACTIVITIES

Since the first Data Collection Phase from the Babcock and Wilcox Fuel Fabrication Plant, Lynchburg is completed, work this month on Task 2 consisted of using the data to:

- analyze the Baseline System Performance, which includes identifying sensitive data, and performing sensitivity analyses.

- perform a preliminary evaluation of the value of process monitoring for safeguards purposes. We reviewed the work performed by Pacific Northwest Laboratory for the Babcock and Wilcox Fuel Fabrication Plant, Lynchburg. The relevent information garnered from it and our knowledge of the facility formed the bases for the evaluation. The results of our preliminary evaluation indicate that the use of process control, production control, and quality control data can greatly enhance the safeguards performance in some areas of the facility, but the cost effectiveness varies. Other upgrades, such as daily item checks and physical protection upgrade rule benefits, were also evaluated.

- prepare for the briefing and working session scheduled for June 2nd through 6th at the NRC.

The June working session is a contract deliverable. The purpose of the session is fourfold:

1) to present to NMSS staff the measures of value chosen for our Value-Impact Analysis and agree on their adequacy
2) to discuss the set of diversion scenarios established at our visit to the Babcock and Wilcox Fuel Fabrication Plant, Lynchburg
3) to review the results of our Baseline system
4) to agree on the specific upgrade rules to be evaluated for V-I analysis.

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

Contributors: P. Chilton,** D. Dunn, G. Kufahl,**
J. McDonnel,** and A. Vergari**

TECHNICAL ACITIVITIES

The purpose of this task is to develop or recommend three safeguards guidance capabilities for MC&A systems. These are:

1) concepts, principles, and methods for protecting material accounting (MA) data from falsification
2) MA checks and balances for detecting theft or diversion
3) MA organizational criteria which support safeguards effectiveness.

We are using as a basis for this task the generic, minimal material accounting (GMMA) system developed in FY79 for the NRC by J. Lim and J. Huebel of LLNL. Four protection principles have been derived from this system that, when implemented in accordance with specified organizational criteria, will provide protection. We have chosen as a safeguards effectiveness measure the number of colluders required to tamper with and defeat the MA system.

The four protection principles are:

1) The rule of three for original data (R3OD). This principle assures that three people are involved in the introduction of original data into the system. This can be achieved in many ways.
2) The control on controls procedure (CC). This principle assures that control procedures which function to ensure integrity and accuracy of measurements and original data are themselves protected or controlled by two people. This can also be achieved in several ways.
3) The skip echelon verification (SEV). This is a verification process which requires assurances that data provided to MA elements, such as

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consistency checks, are properly used and that correct data are reported to the next echelon. Personnel assignments to the function accomplishing the verification can vary according to individual situations.

4) The secondary echelon forwarding (SEF). This is a verification process that requires the echelon normally reporting to the usual responder to report to the NRC Regions as well. As with SEV, the alternate report can be used to verify formal reports and then be destroyed.

Organizational criteria which support safeguards effectiveness are detailed in each of the principles. The first principle, R30D, calls for three persons' involvement in original data. The second, CC, requires additional review before changing procedures that could affect data in the MC&A systems. The third and fourth principles, SEV and SEF, both involve organizational features and have a significant impact on safeguards.

We have applied these principles to the GMMA system. As a result, three colluders are required to tamper with and defeat the upgraded system. Providing the four principles are implemented effectively, the concern for access controls and functional separation has been essentially eliminated in the GMMA system.

Draft documentation for this task has been prepared and is undergoing internal review.

TASK 5. ANALYSIS OF THE ROLE OF AN INTER-FACILITY SNM ACCOUNTING SYSTEM FOR NRC SAFEGUARDS ASSURANCE

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

TECHNICAL ACTIVITIES

This task addresses two basic concerns. One concern is to identify the current NRC safeguards value of data currently being reported. The other concern is to identify what could reasonably be reported and what its impact would be. For this task, both concerns are considered from the point of view of NRC's capability to detect internal licensee MC&A system falsifications that could result in theft or diversion of a significant quantity of SNM.

The first step in the study was to review documentation on the two existing reporting systems, the Nuclear Materials Management Safeguards Systems (MMMSS) and the Safeguards Status Report System (SSRS), and to prepare a summary documentation of the essential features of each.

We are attempting to produce a data flow-chart which includes both systems and identifies the many interactions between licensees and the NRC. Identifying the many interactions is difficult, because many are informal (i.e., not mandatory in a formal sense) and are not consistently accomplished.

Our preliminary investigation and analysis of the current data flows has not provided any new insight into the suitability of the data to detect internal falsification. The more difficult task will be to determine what could reasonably be done to detect internal falsification. Our approach to this question is to search for minimum data requirements. This part of the effort is just beginning. Draft documentation for this task is underway, including a description of a data flow-chart showing interaction between the NRC, NMMSS, SSRS, and licensees.

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