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# A Safeguards Case Study of the Nuclear Materials and Equipment Corporation Uranium Processing Plant, Apollo, Pennsylvania

## Executive Summary

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Office of  
Nuclear Material Safety and Safeguards

U.S. Nuclear Regulatory  
Commission

Performed at the Request of  
The Honorable Morris K. Udall, Chairman  
Committee on Interior and Insular Affairs  
U.S. House of Representatives



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## Introduction

The objectives of this report are (1) to characterize, to the extent possible, the Atomic Energy Commission's (AEC's) safeguards requirements and the safeguards systems and procedures in place at the Nuclear Materials and Equipment Corporation's uranium processing plant in Apollo, Pennsylvania, during the mid-1960s, and (2) to develop, based upon this characterization, a list of safeguards features which would be considered deficiencies under current NRC safeguards requirements. Appendices A and B to this report provide a detailed characterization of the AEC safeguards requirements and the safeguards systems and procedures in place at the NUMEC uranium processing plant during the mid-1960s. The main report contains a list of those specific areas in which the NUMEC safeguards program would be considered deficient under current NRC requirements. The main report also discusses the AEC safeguards requirements and regulatory philosophy during the mid-1960s and the NUMEC physical protection and material control and accounting programs in the context of current NRC regulatory requirements. The findings of the report are summarized below.

## Safeguards Requirements in the mid-1960s

In the early to mid-1960s, the safeguards requirements for special nuclear material differed depending upon whether the special nuclear material was leased from the AEC or held under AEC contract. (Private ownership of special nuclear material was prohibited until August 1964.) Specific requirements also differed among contracts. However, material control and accounting requirements for leased material and contract material, for which the contractor was financially responsible for losses, generally included maintenance of records of receipt, inventory, and transfer of special nuclear material, periodic inventories, and semiannual material balance reports. These requirements did not specify the level of detail to be reflected in the records, the scope of inventories, or the extent to which material was to be measured. There were significant differences between the physical protection required for SNM held under AEC contract and SNM held under AEC lease. For contract SNM, physical protection requirements included access controls, a security clearance program, physical barriers, and storage of SNM under alarm or guard patrol. In contrast, there were no physical protection requirements for SNM held under AEC lease.

NUMEC was a so-called "mixed" facility, holding material under both AEC leases and AEC contracts. NUMEC attempted to meet the differing AEC requirements by developing a safeguards program which was identical for all special nuclear material, regardless of origin, and was structured with the expressed intent of meeting the most stringent of the varying contractual, lease, and regulatory requirements. NUMEC was not entirely successful in this endeavor.

#### The AEC Philosophy of Financial Responsibility

The basic philosophy of the AEC in developing and implementing its safeguards requirements was that the physical protection and material accountability controls which AEC licensees, being private corporations, could be expected to give special nuclear material (SNM) and the severe criminal penalties provided by the Atomic Energy Act of 1954 were adequate to protect the national interest from the standpoint of unlawful diversion. The expectation that licensees would provide adequate protection and accountability for SNM was based upon its high intrinsic value and their financial responsibility for its loss or damage.

The application of this criterion of financial responsibility had deleterious effects in five areas. First, the physical protection given to special nuclear material was directly related to the licensee's or contractor's perception of the likelihood of theft or diversion. If a licensee or contractor concluded that theft of special nuclear material was not a credible risk, his physical protection program could be expected to reflect this feeling. Second, financial responsibility required the accounting for and reporting of total losses rather than the inventory differences themselves, which are more significant from a safeguards viewpoint. Third, contractors and licensees were reluctant to report losses of special nuclear material or to recover scrap because of their financial obligation to pay the AEC for all material lost. Fourth, the linking of safeguards to financial management of contracts also had the effect of diffusing safeguards responsibility within the AEC organizational structure. Fifth, the AEC was reluctant to dictate safeguards system improvements to the licensees because such action might be perceived as unnecessarily costly or burdensome to an industry whose development the AEC was trying to promote.

Indeed, such action might be perceived as unwarranted government interference in private enterprise. By the mid-1960s, some members of the AEC staff felt that they were adequately protecting the government's interest so long as they made the licensee or contractor pay the government for any losses of special nuclear material.

Although the financial responsibility criterion was initially appealing, it was ultimately deemed insufficient to adequately protect the national interest from the standpoint of unlawful theft or diversion.

#### Physical Protection Program Deficiencies

The review of the physical protection program in place at the NUMEC uranium processing plant during the mid-1960s disclosed 45 specific areas in which NUMEC's program failed to meet current NRC requirements. NUMEC's access controls, containment controls, response force timeliness of engagement, response force likelihood of engagement, and response force adequacy were all insufficient to meet current requirements.

- . NUMEC's access controls were insufficient to meet current requirements for entry controls and searches, escort procedures, badging, and surveillance.
- . NUMEC's containment controls did not meet current requirements for exit searches, control during evacuations, activities within material access areas, physical barriers, tamper-safing, and surveillance.
- . NUMEC's response forces could not adequately assure a timely engagement of an armed assault because of failure to meet current requirements for intrusion and duress alarms, illumination, physical barriers, and the size, deployment, and communications capability of the guard force.
- . NUMEC's response forces could not adequately ensure that an armed assault would actually be engaged due to failure to meet current requirements for guard supervision, instruction, motivation to use deadly force, communications, contingency planning, and command and control capabilities.

The NUMEC response force was not adequate to react effectively to an armed assault because of failure to meet current requirements for guard force training, size, and coordination with local law enforcement authorities.

A nuclear facility which processed significant quantities of strategic special nuclear material and employed a physical protection program comparable to that at the NUMEC Apollo facility during the mid-1960s could not be licensed today because it would not meet current NRC physical protection requirements.

#### Material Control and Accounting Program Deficiencies

The review of the material control and accounting program in place at NUMEC in the mid-1960s disclosed 89 specific deficiencies or practices which would be violations of current NRC requirements. NUMEC's program was insufficient to meet current requirements in each of the following areas:

NUMEC's organizational structure did not provide for independence of accountability functions from production functions, organizational checks and balances, written functional relationships, current and complete procedure manuals, and training and requalification programs.

NUMEC's material control area structure did not provide for measurement of all material moved between material balance areas, localization of material losses to specific process areas, inclusion of the vaults and labs in the material balance area structure, and adequate custodial separation of responsibilities.

As much as twenty percent of NUMEC's inventory was carried on estimated values, not measured values. This practice enabled NUMEC to delay indefinitely the identification of their true loss situation. In particular, most internal transfers were not measured, and accountability measurements were not made of liquid or gaseous effluents or of solid waste for burial prior to 1966. Unmeasured scrap material was allowed to accumulate indefinitely without recovery.

NUMEC had no measurement control program for controlling the quality of accountability measurements, nor did they have a statistics program for accountability measurements. Both programs are required of current licensees.

NUMEC's physical inventory practices did not provide for: physical inventories on a regularly scheduled basis, much less a bimonthly basis, as NRC currently requires; inventory procedures ensuring that each item would be inventoried exactly once and that each item would be measured; sufficient documentation of inventory instructions and procedures; recording and reporting (to the AEC) the results of each physical inventory and reconciliation of plant records to the results of physical inventories.

NUMEC's accounting system was based on production records, and the AEC found in 1965 that NUMEC apparently had not kept complete production records for any contract since the plant began operation. NUMEC's records would have been insufficient to meet current requirements in that they were incomplete or nonexistent for shipments, receipts, waste disposals, material processed, material in scrap and filters, and material inventoried. In addition, central and subsidiary records were not and could not be reconciled with each other, as is currently required.

NUMEC's internal control system did not provide for: tamper-safing of containers of SNM in storage, a system of unique item identification, documentation of all inter-MBA transfers, a means of controlling and accounting for internal transfer documents, records providing current knowledge of SNM in item form, two-person confirmation of the contents of SNM containers, or sufficient procedural overchecks on shipments.

NUMEC's management oversight system did not provide for: selection and approval of all accountability procedures by the accountability manager, periodic audits of the accountability system, statistical analysis of shipper-receiver and inventory differences, or an item control system capable of determining whether discrete items were missing or not.

A nuclear facility which processed significant quantities of strategic special nuclear material and employed a material control and accounting program comparable to that at the NUMEC Apollo facility during the mid-1960s could not and would not be licensed today because it would not meet current NRC material control and accounting requirements.

### Conclusions

Despite the weaknesses identified above, the documents reviewed indicate that the AEC considered NUMEC's physical protection program to be in compliance with (and in some cases, to exceed) 1964 requirements and standards. Although the AEC in 1964 considered NUMEC's material control and accounting program to be inadequate with respect to requirements and standards of the time, the AEC did not order NUMEC to cease operation because of the deficiencies in its accountability program.

Based upon the safeguards deficiencies disclosed as a result of this study, the staff has concluded that:

- . The physical protection and material control programs at NUMEC during the mid-1960s were inadequate and would not necessarily have prevented the theft of a significant quantity of special nuclear material.
- . The material accountability program at NUMEC during the mid-1960s was inadequate and would not necessarily have detected the theft of a significant quantity of special nuclear material.

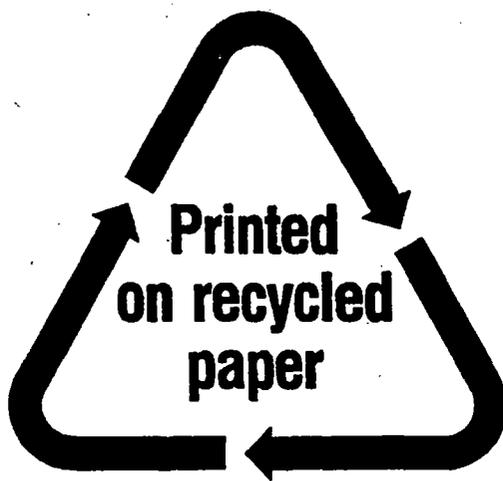
Therefore, it is possible that significant quantities of high enriched uranium could have been removed from the NUMEC Apollo facility during the mid-1960s, by a knowledgeable insider or an outside group with the assistance of an insider, without detection. It is, of course, also possible that no such removal occurred. Our review did not develop any information to indicate that a theft did or did not occur, only that the system would not have been able to detect a theft.

The number (45 physical protection and 89 material control and accounting) and significance of the specific areas in which NUMEC's 1964 safeguards system would fail to meet current NRC regulatory requirements indicate the marked degree to which safeguards requirements have changed for licensed nuclear facilities since 1964. Therefore, the staff concludes that substantial improvements have been made in the effectiveness of safeguards required at licensed plants since the mid-1960s.

Note:

The main report and Appendix B of this document contain proprietary information as defined in 10 CFR 2.790 and thus are available only as approved by the Office of Nuclear Materials Safety and Safeguards, U.S. Nuclear Regulatory Commission. Appendix A contains material classified confidential (National Security Information) and is available only to those with the proper clearance and a need to know.

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