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Application of the Conceptual Design
Facility Requirements for Safeguards to
Five AEC License Exempt Contractors

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Introduction

TSO is developing a conceptual design for safeguards. This design is to be a blueprint for a consistent unified system, equal in effectiveness for licensee and license exempt facilities, incorporating graduation for nuclear materials of varying degrees of strategic importance, accessibility and attractiveness and recognizing IAEA NPT requirements under the President's offer. Although the conceptual design will continue to evolve and portions related to information systems, inspection, transportation and recovery have not yet been documented,* a first cut at plant specific portions had been produced in November, 1971.

TSO was assigned the task in January, 1972 to apply the conceptual design to a selected set of Commission facilities and determine the actions needed and the costs of these actions if one were to attain conceptual design performance goals at these facilities.

Five large production type facilities were chosen (Figure I). The approach was to assign a team of AEC and TSO personnel who are specialists (e.g., physical protection, accountability, statistics, etc.) to each facility. These teams proceeded to:

- a) make an initial visit of approximately one week to study current safeguards practices at the specific facility.
- b) generate a description of plant specific safeguards practices.
- c) submit this description of plant specific safeguards practices to the facility for review.
- d) revisit the facility to confirm or modify the description of safeguards in the plant specific document.
- e) generate a set of upgrading alternatives that would represent modifications to current practices and hardware to attain the conceptual design goals.
- f) discuss these upgrading alternatives with the field office and submit the alternatives to the contractor for analysis.
- g) meet with the contractor to discuss his response including, in some cases, other alternatives.

*PNL is performing a detailed study of strategies relating to AEC safeguards inspection activities and NBS is performing a detailed study organizing safeguards information for safeguards purposes.

AISC PRODUCTION FACILITIES

- h) clarify the intent of the alternatives in those cases where it was apparent that the intent of the criteria had not been adequately communicated.
- i) analyze the second response by the contractor.

Table I depicts the field visit history. This time schedule could not have been maintained without the fine cooperation forthcoming from the contractors and field offices.

Goals

The ideal safeguards system would prevent the diversion of nuclear material by all potential diverters without regard to their motivation or resources. The cost of such a system, even if attainable, would exceed practically attainable budget levels. The conceptual system is designed at a level of safeguards which provides protection such that diversion scenarios that will defeat it require large amounts of resources plus collusion among diverters. The large resource cost limits the number of potential diverters as does the collusion requirement which also increases the likelihood of detection prior to the event.

The goals of the conceptual design facility requirements are set in terms of:

1) Immediate Techniques

- a) detecting unauthorized entry and responding to the detection in time to apprehend the penetrator or neutralize any attempt to remove nuclear material.
- b) detecting unauthorized removal and responding to the detection in time to prevent loss of material.

2) Deferred Techniques

- a) detecting loss of identifiable items or small amounts of attractive material from specific locations by specific individuals within a short time (hours to days) of removal and provide the basis for investigation and recovery.
- b) detecting larger amounts of material from material balance areas within longer periods of time (months) and provide the basis for investigation and recovery.

TABLE I

Schedule of Upgrading Activities

	<u>ARHCO</u>	<u>ROCKY FLATS</u>	<u>Y-12</u>	<u>SRP</u>	<u>CPP</u>
Initial Visit	1/72	1/72	2/72	3/72	4/72
Description of Safeguards at Facility	5/72	4/72	6/72	6/72	9/72
Revisit (Confirmation of Description)	6/72	4/72	6/72	6/72	9/72
Upgrading Alternative Submission	8/72	8/72	9/72	9/72	10/72
Upgrading Alternative Review (F.O.)	9/72	8/72	9/72	10/72	10/72
Revised Alternatives	9/72	10/72	10/72	10/72	10/72
Contractor Response	11/72	10/72	11/72	12/72	12/72
Revisit (Contractor)	12/72	11/72	11/72	12/72	12/72
Revised Contractor Response	1/73	1/73	1/73	1/73	1/73

The conceptual design goals are attained by the following practices:

1) Unauthorized Entry

An alarmed outer barrier and an assessment and response capability such that any unauthorized intruder can be apprehended or prevented from removing SNM.

2) Authorization of Entrance

A system to provide a high degree of assurance that those who enter are authorized.

3) Unauthorized Removal

An inner barrier that will detect any authorized person who is removing material. (Note the inner and outer barriers may be physically co-located but both entry and removal functions must be performed.)

4) Authorization of Removal

An assessment system that will provide assurance that unauthorized removals are not included with authorized removals and that they are not bootlegged with legitimate non-nuclear movements (e.g. repairman, garbage trucks).

5) Material Balance Areas

A structure of material balance areas exist that separate process areas from storage areas, do not span more than one process, are geographically definable and do not overlap. These should be drawn to localize losses, identify the material that is missing and identify the individual who may be responsible.

6) Control System

A control system that has individual custodians for each MBA and that consists of parallel record systems - one local, one central. Although this does not preclude fabrication of the original entry, it does require two sets of records under separate control to be falsified for "after the fact" concealment of diversion.

7) Inventory Control

An inventory control technique such that monthly inventories (six months for some aqueous processes) can be performed and inventory security can be enhanced by sealing, attribute sampling and other techniques. Greater assurance of the validity of inventories and decreased requirements for remeasurement results.

8) Measurement System

A measurement system that provides measurement values for all flows and inventories for each MBA. Quantities that are estimated or calculated "by difference" are not good indicators of diversion.

9) Limit of Error

A measurement quality control program and the generation of random and systematic errors for each measured flow or inventory and the monthly generation of the propagated limit of error of MUF with accompanying one period and multiperiod safeguards analysis. This provides a control on the quantity of MUF and is helpful in isolating major error components and reducing them thus making the control more sensitive.

10) Selected Internal Controls

The adoption of other accountability techniques (seals, process accountability, accountability cross checks, spot checks, etc.) provides capability for detecting diversions of small amounts from specific locations by specific individuals within a short time.

Proposed Upgrading Actions

This section summarizes the general actions that would have to be taken to meet conceptual design goals.

1) Unauthorized Entry

All facilities would need to provide an alarmed perimeter. Most facilities would require some additional response capability although in a few cases this can be achieved by relocation of guard personnel. The goal of preventing unauthorized entry and unauthorized removal could not always be attained by a co-located alarmed perimeter. The differing geographical configurations of the facilities did not permit any single solution that could be applied to all of them. Improved communications would be necessary at some facilities.

2) Entry Authorization

Present practices and procedures would be sufficient for the most part. Some modifications will be necessary to keep vehicular traffic to a minimum inside the inner (removal) barrier.

3) Unauthorized Removal

Every facility would require the installation of personnel monitors, package monitors and some means of assurance that SNM cannot be removed on vehicles. The limitations of entry consistent with a small number of monitored exits, given the existing design of facilities with many access and egress points, would create implementation difficulties. The desire of many facilities to co-locate entry and inner (removal) barriers also would create problems since the inner (removal) barrier, if extended beyond the building or area where the SNM is handled, permits the transfer of SNM to a very large class of people and vehicles that would not normally need or have direct access to the material.

4) Removal Authorization

Means for meeting the requirement for escort or sealing of vehicles that are authorized to carry SNM to prevent "piggybacking" would be a major problem. In addition, there are problems associated with prohibiting vehicles not carrying SNM from crossing the barrier set up for unauthorized removal.

5) Material Balance Area

The material balance areas currently used by the facility would meet these criteria: In a few facilities, areas that were currently designated as control areas would be upgraded to balance areas. In a few cases, additional storage MBAs were proposed to separate material in process from that in storage. In some cases, consolidation of existing storage MBAs would be permitted if the facility wished to combine them. The existence of several material balance accounts in the same geographical area with each spanning other areas would have to be ended. Breaking the accounts into subaccounts in each MBA but maintaining the MBA as the sum of the subaccounts would be a satisfactory solution.

6) Control Systems

The requirement for production floor custodians would necessitate action at several of the facilities.

7) Inventory Control

All facilities would have to upgrade their inventory controls to meet the conceptual design criteria. In all cases, the difficulty of attaining this objective would be small.

8) Measurement System

In a few cases, unmeasured streams were detected and means were found to

measure these. In at least one case inventory estimates will have to be used for substantial periods because of the costs of providing measurement. For this facility the book inventories would be confirmed from time to time by clean out. The problem of feed and inventory measurements for aqueous process was a major accountability problem at four of the facilities. All of the facilities were moving toward increased use of non-destructive assay prior to the exercise. The upgrading alternatives which, in many cases, recommended NDA for hard to measure scrap, waste, and inventory streams were well received by the facilities and confirmed the direction they had already charted.

9) Limit of Error

One contractor already has such a capability but the remaining contractors would require system modifications.

10) Miscellaneous Techniques

Such practices already exist at many of the facilities visited.

Future Safeguards R&D

The studies described in this paper were directed to facilities with high inventories and large throughputs. The conceptual design facility requirements have been generated for these production type facilities. A new set of studies has been initiated to look at facilities characterized by low throughput. These facilities are the R&D type activities with which the Commission abounds.

This activity was initiated with a visit by a team of specialists to the Los Alamos Scientific Laboratory. The study plan is the same as the one applied to the facilities already studied. In addition, there are groups at Los Alamos performing safeguards R&D work which will be utilized to complement these studies. These activities at LASL include competent researchers investigating specialized non-destructive assay approaches. This plus the fact that virtually every kind of R&D activity exists at Los Alamos should lead to substantial findings.

At the same time that the safeguards improvements are being developed, the conceptual design will be expanded to incorporate general criteria for R&D facilities. The first step has already been taken in this direction at a meeting between Technical Support Organization and Los Alamos researchers.

Concurrent activities in conceptual design development are being performed by the Pacific Northwest Laboratories and the National Bureau of Standards. The PNL activity is directed toward the cost effectiveness of alternative inspection strategies. The NBS study is looking at utilization of various types of information for safeguards, and at the overall structure for safeguards responsibilities. Another paper at this meeting will be presented by NBS relating to this subject.

The PNL study is being performed with assistance from the Richland Operations Office and is utilizing Hanford Complex as the first model. The study will evaluate sets of inspection strategies ranging in intensity across the entire inspection spectrum. These will be evaluated in terms of the additional assurance generated for each incremental expenditure.

The conceptual design will also incorporate design criteria for safeguards and criteria applicable to the transportation of special nuclear materials.