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DOE/IG-0296

U.S. Department of Energy
Office of Inspector General

August 1991

Report on

**Departmentwide Audit of the
Visibility Over the Status of
Nuclear Materials**

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This report can be obtained from the
U.S. Department of Energy
Office of Scientific and Technical Information
P. O. Box 62
Oak Ridge, Tennessee 37831

The Secretary of Energy
Washington, DC 20585

September 5, 1991

DOE/IG--0296

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The Honorable John C. Layton
Inspector General
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Layton:

I have reviewed your report entitled "Departmentwide Audit of the Visibility Over the Status of Nuclear Materials." I understand that the Assistant Secretary for Defense Programs has already taken or planned corrective actions to address the recommendations made in the report and I have directed him to complete doing so as expeditiously as possible.

Thank you for your continuing efforts to ensure the Department's accountability.

Sincerely,

A handwritten signature in black ink, appearing to read "James D. Watkins".

James D. Watkins
Admiral, U.S. Navy (Retired)

MASTER

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Department of Energy

memorandum

DATE: August 30, 1991

REPLY TO: IG-1
ATTN OF:

SUBJECT: INFORMATION: Report on "Departmentwide Audit of the Visibility Over the Status of Nuclear Materials"

TO: The Secretary

BACKGROUND:

Attached is a copy of our audit report on the accuracy of nuclear materials assessments. The Department of Energy (DOE) requires its field offices to make complete and thorough annual assessments of contractor-held inventories and to report on nuclear materials use, inventory levels, and disposal plans for scrap and unneeded materials. Accurate assessments help ensure adequate consideration in requirements determinations, production and purchase decisions, and in decisions that affect the environment. Also, they provide DOE with the information it needs to help minimize storage costs through redistribution and consolidation of excesses.

DISCUSSION:

We evaluated the accuracy of reports on the status of nuclear materials at DOE's two major users--weapons research and development laboratories, and production and recovery activities. Specific objectives were to determine if the laboratories could support a requirement for materials they reported as in use or otherwise needed and, at the production sites, if the reports properly identified inactive material and adequately described its condition and plans for disposition.

Our audit found that report accuracy needed to be improved. The primary reasons for inaccurate reporting were the lack of guidance by Headquarters DOE, insufficient field office management of contractors to ensure accurate reports, and too little emphasis on the inventory assessments during reviews and appraisals of contractor materials management programs.

Management generally concurred with the finding and has taken or initiated actions responsive to the recommendations that will improve the accuracy of reports on the status and use of nuclear materials.

for John C. Layton
Inspector General

Attachment

cc: Deputy Secretary
The Under Secretary
Assistant Secretary for Defense Programs

DEPARTMENTWIDE AUDIT OF THE VISIBILITY OVER THE
STATUS OF NUCLEAR MATERIALS

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U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL
OFFICE OF AUDITS

DEPARTMENTWIDE AUDIT OF THE VISIBILITY OVER THE
STATUS OF NUCLEAR MATERIALS

Audit Report Number: DOE/IG-0296

SUMMARY

The Department of Energy (DOE) requires its field offices to make complete and thorough annual assessments of contractor-held inventories and to report on nuclear materials use, inventory levels, and disposal plans for scrap and unneeded materials. Accurate assessments help ensure that excess nuclear materials are adequately considered in requirements determinations, production or purchase decisions, and in environmental concerns. Also, they provide DOE with the information it needs to help minimize storage costs through redistribution and consolidation of excesses.

Our audit objectives were to determine if the laboratories could support a requirement for the materials they reported as in use or otherwise needed and, at the production sites, to determine if the reports properly identified inactive material and adequately described its condition and plans for disposition.

We reviewed nuclear materials management functions at the Office of Nuclear Materials, three weapons laboratories, two production sites and one recovery operation. The focus of the review was on uranium, plutonium, and tritium, which make up the bulk of DOE's nuclear materials inventory.

We found that the accuracy, validity, and completeness of assessment reports needed to be improved. The primary reasons for report deficiencies were the lack of guidance by DOE Headquarters, insufficient management of contractors to ensure accurate reports, and limited emphasis on inventory assessments during the reviews and appraisals of contractor materials management programs.

Management generally concurred with the finding and, in response to the recommendations, has taken positive action to improve the accuracy of reports on the status and use of nuclear material.

PART I

APPROACH AND OVERVIEW

PURPOSE AND OBJECTIVES

Over the last 45 years, DOE has acquired and produced significant quantities of nuclear material. Much of it is in warheads in the custody of the Department of Defense. The rest is at DOE laboratories, production activities, and assembly plants. Uranium, plutonium, and tritium constitute the bulk of DOE's nuclear materials inventory.

Nuclear materials managers should know the status of material and how it is being used so that stocks can be acquired, maintained, and disposed of in a safe, economical and environmentally sound manner. DOE requires its field offices to assess the status of contractor-held inventories of the material annually and to report on its use and whether it is still needed to support DOE requirements.

This audit was made to determine the accuracy of assessment reports on the status of nuclear materials at DOE's two major users--weapons research and development (R&D) laboratories and production and recovery activities. Specifically, our objective was to determine if the laboratories could support a requirement for materials they reported as in use or needed. At the production sites, our objective was to determine if the reports properly identified inactive material and described its condition and plans for disposition.

SCOPE AND METHODOLOGY

To evaluate the adequacy of nuclear materials assessments, we reviewed the nuclear materials management functions of DOE's Office of Nuclear Materials and, onsite, at DOE field office activities at San Francisco, Albuquerque, Oak Ridge, and Savannah River and at selected contractor operations under their jurisdictions. The contractor sites visited were three weapons R&D laboratories (Sandia, Livermore and Los Alamos); two production sites (the Y-12 uranium weapons production plant at Oak Ridge and the nuclear materials production facility at the Savannah River site); and the plutonium recycle and recovery operation at Los Alamos.

We reviewed the 1989 inventory assessment reports on uranium, plutonium, and tritium, the main ingredients needed to make nuclear weapons. To determine the accuracy of the reports, we compared the status of material as reported by each field office with its actual status as determined by examination of selected contractor inventory and usage records. We interviewed contractor technical personnel responsible for using the materials on those assessment report items requiring special explanation of why the nuclear materials were needed and how they would be used.

Our approach to item selection and review at the weapons laboratories differed somewhat from the approach at the production and recovery sites. Nuclear materials are measured and controlled by weight. Because inventories at the weapons laboratories had few items that, by weight, constituted most of their inventories, we were able to review enough materials to determine the

general accuracy of their assessment reports. At production and recovery sites, where inventories comprised thousands of items and tons of materials, we did not quantify the extent of any inaccuracies in the assessment reports; instead, we tested the inventory records to the extent necessary to determine whether DOE management could have reasonable assurance that the reports were accurate and valid. Our approach varied from one location to another because of considerable differences in the extent of detail and historical data that respective contractor systems could provide.

The audit was made in accordance with generally accepted Government auditing standards for performance audits. This included tests of internal controls to ensure that DOE was complying with regulations and that nuclear materials assessment report guidance furnished to and implemented by field offices was adequate to ensure accurate and timely reporting. The firm of Irving Burton Associates, Inc., participated with the Office of Inspector General in the conduct of this audit. The audit was made during the period May through December 1990 and covered the September 30, 1989 assessment report, which was the most recent report available at the time of our review.

An exit conference was held on July 17, 1991, with the Director, Office of Materials Planning, and members of his staff.

BACKGROUND

DOE contractors operate production and recovery activities at the Department's three weapons R&D laboratories and seven nuclear weapons production facilities; however, DOE's Assistant Secretary for Defense Programs (DP) has overall management responsibility for the materials. DP's Office of Nuclear Materials manages the production of nuclear materials and assists DP's Office of Military Application in managing the recovery of scrap from the production process and the retirement of weapons. DOE field offices provide onsite management of contractor operations.

Contractors make annual assessments and report to the DOE field offices on whether they are currently using or have a future need for nuclear materials in their possession. The field offices in turn appraise the preparation of the assessment reports by the contractors under their jurisdiction. DP monitors field office operations by periodic formal reviews of their materials management programs.

In DOE, individual lots of nuclear material, regardless of size or composition, are controlled and subjected to intense physical security and constant inventory verification.

OBSERVATIONS AND CONCLUSIONS

Over the years, emphasis has been placed on ensuring that sufficient quantities of nuclear materials were produced and acquired to meet cold war requirements. Also, DOE has emphasized safeguarding nuclear materials inventories. Commensurate concern, however, was not given to ensuring that materials status was properly assessed and accurately reported.

In November 1988, DOE formally established and issued nuclear materials management policies, objectives, procedures, and responsibilities to improve

DOE's visibility over the status and use of its nuclear materials. From 1988 back to the establishment of DOE in 1977, there were no official materials management directives or regulations available for use by DOE field offices or contractors. As a stop-gap measure, some field offices unofficially used a cancelled 1975 Atomic Energy Commission (AEC) materials management handbook and related directives. Others did not. One of the results was the lack of accurate reporting on the status and use of nuclear materials in the hands of contractors, a problem which persists.

With the shut-down of nuclear materials production, reduced budgets, and the impact of recent world events, efficient nuclear materials management has become a vital concern to DOE management. This concern was expressed in a March 1990 memorandum from the Principal Deputy Assistant Secretary for Defense Programs to key DOE Headquarters DP personnel and field office managers: "...Defense Programs is entering a period where supplies of nuclear materials will be severely limited. Successful management of existing inventories is crucial to meeting near-term demands..."

Various positive management actions have been taken to improve nuclear materials management. Foremost was DP's publication of an order which provided nuclear materials management policy and guidance to all field offices. DP followed up this action by providing field offices with written critiques of their initial assessment reports as well as discussing needed assessment report improvements in DOE-wide meetings and field reviews.

DP also established a DOE Nuclear Materials Coordinating Committee to provide a forum for high-level review of nuclear materials supply and demand projections, develop strategies for production and processing operations, and identify and evaluate options for providing nuclear materials. The Committee's functions include optimizing the use of existing inventories. Also, in recognition of changing world events, an ad hoc study group was established to review the Department's nuclear materials scrap retention policies and criteria. The outcome of this effort should help ensure that future decisions will satisfy nuclear materials retention requirements, keep waste at a minimum, and help to ensure environmental compliance.

During our review, DOE field offices and the respective contractors were also taking various actions to improve nuclear materials management. One of the more significant was the Albuquerque Field Office's publication of a materials management handbook for use by its contractors to promote effective and efficient management of nuclear materials inventories. In another action, the Oak Ridge Field Office extended the Headquarters DOE requirements to its contractors and provided procedural guidance for implementation. Further, at the Savannah River site, oversight and direction of nuclear materials inventories was recently improved by increasing staffing and issuing better guidance to the contractor for preparation of annual assessment reports. Finally, the contractor at Livermore initiated action to develop a plan for reducing its nuclear materials inventories.

These actions indicate that positive and significant progress has been made in improving the accuracy of reports on the status and use of nuclear materials. But more remains to be done. The categorization of inventories in assessment reports needs to be improved, actual usage of material needs to be verified, and formats need to be standardized to improve the usefulness of these reports. Increased Headquarters guidance and field office management of

contractor operations and reporting will help accomplish this. The details of our finding, as well as the corrective actions needed, are discussed in Part II of this report.

Management generally concurred with the finding and has taken or proposed corrective actions that are responsive to all of the recommendations in this report. Management added that, in their judgement, usable nuclear material at DOE's weapons laboratories may have a potential future use even if there is no specific plan for its use. Management, therefore, intends to establish a new reporting category for any such material and will direct the field offices to identify in annual inventory assessments how long material has been retained in this category. Management also stressed that the lack of immediate capacity to process scrap nuclear material may be a valid reason for retaining it as long as storage and disposition plans are identified in the annual assessment reports. Management's comments are reflected in Part III of this report.

In our opinion, the finding on insufficient Headquarters guidance (page 12) and field office management (page 13) of reports prepared on the status and use of nuclear materials indicate internal control weaknesses which management should consider when preparing the yearend assurance memorandum on internal controls. Since our review was limited it would not necessarily disclose all material internal control deficiencies that may exist.

PART II

FINDING AND RECOMMENDATIONS

Visibility Over the Status of Nuclear Materials

FINDING

DOE requires its field offices to make complete and thorough annual assessments of the status of contractor-held nuclear materials inventories and to report on how the materials are being used, whether inventory levels are reasonable for program objectives, and whether plans exist for disposing of scrap and unneeded material. The accuracy, validity, and completeness of assessment reports need to be improved. We found that nuclear materials were routinely being reported as "in use" or "needed" when they were actually "excess" to any defined requirement. The primary reasons for inaccurate reporting were the lack of guidance by Headquarters DOE, insufficient management of contractors to ensure accurate reports, and too little emphasis on the inventory assessments during the reviews and appraisals of contractor materials management programs. As a result, excess nuclear materials may not be adequately considered in requirements determinations, production or purchase decisions, and in decisions that affect the environment. Also, DOE may lack the information needed to minimize storage costs through redistribution and consolidation of excesses.

RECOMMENDATIONS

We recommend that the Assistant Secretary for Defense Programs:

1. Provide field offices with specific guidance on how the annual inventory assessments should be conducted and in what format the results should be reported.
2. Provide DOE field offices with specific reporting criteria for recoverable scrap material. The guidance should require that assessment reports identify the age, composition, and disposition plans for scrap inventories.
3. Require all field offices to ensure that contractors implement DOE Order 5660.1, *Management of Nuclear Materials*, as appropriate.
4. Require field offices to take action as required to ensure that information contained in contractor-prepared nuclear materials inventory assessment reports is accurate and valid.
5. Require the Office of Nuclear Materials and DOE field offices to make the prescribed materials management reviews and appraisals in the depth, scope, and frequency called for in DOE Order 5660.1.

MANAGEMENT REACTION

Defense Programs Director, Office of Materials Planning, generally agreed with the finding and has taken or proposed corrective actions which are responsive to all of the recommendations. Part III of this report includes detailed management and auditor comments.

DETAILS OF FINDING

REQUIREMENTS FOR NUCLEAR MATERIALS MANAGEMENT

DOE Order 5660.1, *Management of Nuclear Materials*, dated November 30, 1988, establishes the policy, objectives, procedures and responsibilities for the management of nuclear material within DOE.

In accordance with the Order, the Office of Nuclear Materials prepares the Department's annual Nuclear Materials Management Plan. The plan compares the materials available to those required to support warhead production requirements and R&D programs and identifies any shortfalls that must be made up by new production or recovery. The plan depends on the accuracy of field office assessment reports on the amounts, status and forms of nuclear materials in the hands of contractors.

The Office of Nuclear Materials is required to centrally manage nuclear materials identified as excess to requirements of currently approved programs. To ensure efficient and effective policy implementation, the Office is required to make periodic formal reviews of DOE field office materials management programs.

A key requirement of DOE Order 5660.1 is for DOE's field offices to implement a materials management program for the contractors under their jurisdictions. Field offices are required to ensure that contractors acquire and retain only those nuclear materials needed to support approved program objectives; that materials excess to defined needs are identified and handled promptly in accordance with the requirements of the Order; and that scrap material is either processed or disposed of in accordance with DOE policy and procedures. An essential part of the materials management program is the contractors' preparation of the annual assessment reports.

To see that the above is done, field offices are required to make complete thorough annual assessments of these reports on contractor-held inventories to show how the materials are being used, whether inventory levels are reasonable compared to program objectives, and whether plans exist for disposing of scrap and unneeded material. For projects with material exceeding a specified weight (e.g., 2 kilograms for enriched uranium), field offices are required, in their assessment reports, to explain why it is needed and how it will be used. Inventories are to be assessed as of September 30 each year with results reported by December 31.

Field offices are also required to formally appraise and report on the adequacy of policies and procedures used by its contractors to manage nuclear materials. Inventory value governs the frequency with which appraisals are required. Appraisals are required either annually or biennially depending on inventory value.

ACCURACY AND VALIDITY OF REPORTING

The September 30, 1989 assessment reports of contractor-held nuclear materials were of limited management value because they contained inaccuracies and lacked sufficient detail. They did not provide valid justifications for continued retention of materials or adequately describe the status and condition of the materials. The audit results for the weapons laboratories and the production and recovery sites are discussed below.

Weapons Laboratories

The weapons laboratories are required to prepare inventory assessment reports. In the assessment reports, the weapons laboratories generally classified materials in one of three categories: "in use," "inactive" or "excess." The "inactive" category was used to describe materials for which there was no current requirement, but which the laboratories considered were still needed for some future requirement. Our examination disclosed that the reports were incorrect in classifying most of the material, with inaccuracies ranging from 52 to 88 percent of the items reviewed.

We found that nuclear materials were reported as "in use" when the materials had been "excess" and in storage for extended periods--in some cases 17 years--with no evidence of a valid requirement, and "inactive" (but still needed) even though there was no evidence of a future requirement. Also, materials that were unusable in their present form and unneeded, continued to be reported as needed for weapons R&D. A discussion of results at each laboratory follows.

Sandia. Nearly all of Sandia's nuclear materials inventory is enriched uranium. We reviewed 81 items, of which 74 were uranium; the remaining 7 were plutonium. Of the 81 items, 39 were being used on approved projects and reported correctly. The other 42 items were not. We found:

- o Twenty-five items reported as "in use" had been unused and in storage for periods dating back to 1979;
- o Fifteen items reported as "inactive" (but still needed) were shown as being held for projects that had been completed, and;
- o Two items, which were unused and in storage since 1983, were omitted from the assessment report.

Among the items reported incorrectly was a weapons component made up of a significant amount of enriched uranium. It was reported as "in use" as part of a bomb mockup needed for training. Sandia records showed that the item was received in January 1984 and immediately placed in storage where it has remained ever since. The Sandia engineer currently responsible for the item stated that he was unaware of how the item was reported in the assessment report. As far as he knew, a bomb mockup never existed. Apparently the uranium was obtained based on plans that did not materialize. We found no evidence that Sandia personnel responsible for preparing the assessment report contacted the appropriate program personnel to verify its actual status or

continued need. Since there was no evidence of a current or future requirement, the uranium for the mockup should have been reported "excess" to any defined need. Details of the Sandia review are in Appendix A.

Livermore. Livermore's nuclear materials inventory consisted primarily of plutonium and enriched uranium, with a negligible amount of tritium. The 35 items we reviewed included 27 plutonium items, 6 enriched uranium items and 2 tritium items. Of these, 4 plutonium items were being used in approved weapons research projects and were correctly reported. The other 31 items were not, as follows:

- o Nineteen items were reported as currently "in use" to support weapons R&D even though the material had been unused and in vault storage for periods of up to 17 years.
- o The other 12 items were reported as "inactive" but were to be retained indefinitely. Laboratory personnel could not identify a requirement for this material which had been on hand in an inactive status for periods dating back to the early 1970's.

An example of an incorrectly reported item from the "inactive" category was a weapons part made of a large amount of enriched uranium. The laboratory had obtained the part in the early 1970's for use in a weapons program experiment. The program was cancelled shortly afterwards, but the item was retained unused and in storage since 1974. The responsible research engineer stated that he had decided to keep the item because it was unique and expensive to fabricate. He acknowledged that there was no known requirement for such an item. It should have been reported as "excess" to any defined current or future requirement. Details of the Livermore review are in Appendix B.

Los Alamos. Plutonium makes up most of the Los Alamos nuclear materials inventory. Of the 265 items we reviewed, 251 were plutonium, 11 were enriched uranium, and 3 were tritium. Nearly all of these materials were allocated to the Los Alamos' weapons R&D projects. Although Los Alamos is an R&D facility, it does recycle and recover plutonium. The results of our review of materials assigned to that project are discussed later with the production and recovery site results.

We found that 31 of the 265 R&D project items were being used to support valid requirements and reported correctly. The other 234 items were not. They were made up of scrap and other materials, and included 228 items of plutonium, 5 of uranium and 1 of tritium. For much of the scrap material, Los Alamos lacked the resources to recover it within a reasonable period of time. If scrap material was needed, it should have been transferred to the recycle and recovery project. Otherwise, it should have been reported as "excess" to Los Alamos' defined R&D requirements.

Examples of the discrepancies we found included 24 plutonium items. Although they were reported as still needed for weapons R&D, they could be unusable in their present form because they contained traces of other nuclear materials, which would have to be extracted to make the plutonium usable. However, since Los Alamos did not have an adequate onsite extraction capability, the 24 items sat in storage for over 6 years with no apparent disposition plans. The assessment report should have shown this material as

"excess" to any defined R&D requirement, with a detailed description of its status and condition so that DOE could decide on disposition. Details of the review of materials in Los Alamos' R&D projects are in Appendix C.

Inactive Materials at the Weapons Laboratories. Laboratory personnel generally acknowledged that the assessment reports contained inaccuracies but, in the case of "inactive" materials, they maintained that future requirements may arise at which time the materials would be needed. However, as stated above, there was no evidence, documented or otherwise, of a requirement or defined need that would support contractor retention of the materials. The assessment reports should have accurately described the status of this material to enable Headquarters DOE to decide on its disposition.

Production and Recovery Sites

DOE Order 5660.1 stipulates that the rate of materials use or turnover should be a major consideration in assessing the continued need for nuclear materials, including scrap material being held for reprocessing and recovery. Usable materials identified as unneeded for production and unusable but recoverable materials that exceed onsite processing capabilities are to be identified in the assessment report as excess. DOE Order 5660.1 also requires that assessment reports describe the circumstances relating to inactive material and identify any problems that could affect its recovery or use.

The inventories at Savannah River and at the Oak Ridge Y-12 Plant included tons of materials made up of thousands of individually controlled items. We selectively tested these inventories from multiple projects to include all three types of materials to the extent necessary to conclude whether DOE management could have reasonable assurance that the assessment reports were accurate and valid.

The audit showed that there was no assurance that the assessment reports for the two production sites we reviewed (Savannah River and Y-12), and to some extent for the Los Alamos recovery operation, were accurate and valid. The Savannah River and Y-12 reports were more of an accounting for nuclear materials than an evaluation of need because they provided quantitative data without showing how much of the material was needed or how and when it would be used. The Savannah River and Los Alamos reports were also misleading as they described some scrap material as being held for recovery when there was an apparent lack of capacity or capability to recover the material within a reasonable period of time. The audit results at the Savannah River and Y-12 production sites and the Los Alamos recovery operation are discussed below.

Savannah River. We reviewed 172 items, including 112 from among 785 items of plutonium scrap that Savannah River reported as being held for reprocessing and recovery. Of the 112 items, 72 had been at Savannah River for periods ranging between 10 to 16 years. All had been there for more than 5 years. The assessment report gave no indication of the age of this backlog or when it would or could be processed.

The other 60 items included all three types of materials--plutonium, enriched uranium and tritium. We were unable to determine from contractor records how long they had been at Savannah River or whether they experienced any activity prior to the date of their last recorded transaction, the only data that was readily available. These data showed that during the prior 3-year period, 14 of the 60 items had experienced activity considered

substantive, such as the item changing form or composition. The last transaction shown for each of an additional 20 items was nonsubstantive, such as correction of an inventory count or change in storage location. We could not determine from the records whether any meaningful activity took place prior to that time. For 19 of the items, there was no activity at all during the 3-year period and for the remaining 7 items there was no transaction record.

After discussing the status of all 60 items with cognizant contractor personnel, we concluded that the assessment report should have identified 29 of the 60 items as inactive materials. However, from the way the report was presented, there was no indication of the status of the material other than that it was all active and still needed. Based on this and the actual versus the reported status of the scrap material, we concluded that DOE Headquarters could not be reasonably assured that the Savannah River report constituted an accurate and valid assessment of the nuclear materials inventory.

Oak Ridge (Y-12 Plant). The contractor prepared the assessment report and submitted it to the Oak Ridge Field Office on January 4, 1990. However, Oak Ridge did not forward the report or any of the data in it to DOE Headquarters. Cognizant Oak Ridge personnel said the report was not submitted because they were awaiting Headquarters guidance on how the data should be presented. Oak Ridge suggested a format to DOE Headquarters but received neither feedback on the suggestion nor any inquiries on the reports whereabouts.

Even if the report had been submitted, it would have been of questionable value to Headquarters. Our review of the contractor-prepared report showed that the Y-12 assessment report did not classify materials in a manner that would show whether they were needed or how they were being used. Therefore, it was difficult to determine the actual status of the materials without obtaining explanations from cognizant DOE and contractor personnel.

We examined 37 items to test the Y-12 assessment report for validity. Of the 37 items, 23 were reported correctly; the materials were apparently needed to support a valid requirement. The other 14 items were questionable. For example, they included two items made up of enriched uranium that had been inactive and in storage for over 14 years. Both items contained traces of an explosive chemical which made the materials unusable in their present forms.

Similar circumstances existed with an additional 2 of the 14 items. Together they made up a significant amount of enriched uranium that had been inactive at Y-12 for over 3 years. They were also unusable in their present forms.

The recovery process required to make this type of material usable is both hazardous and lengthy. For this reason, Y-12 management had apparently assigned a low priority to its recovery. Although we do not question this decision, the assessment report should have clearly described the materials status and condition.

Los Alamos Recovery Operation. In addition to weapons R&D, Los Alamos performs another essential function--the recycle and recovery of plutonium from scrap material. At the time of the audit, about 5,200 items of scrap and bulk residue materials containing weapons grade plutonium were being held for recovery. The Los Alamos assessment report identified about 51 percent of these materials as being held for immediate recovery and about 48 percent for recovery in "future years." Less than 1 percent was identified as excess.

To test the accuracy and validity of the assessment report, we reviewed 1,271 items of scrap material that was subdivided in Los Alamos inventory records into 15 separate categories based on the material's composition and physical properties. We found that much of the material had been at Los Alamos in the same condition and status for periods dating back to 1979. It included materials for which Los Alamos lacked either an adequate capability or the capacity to recover within a reasonable period of time. It also included materials which possibly should be declared waste. For example:

- o Thirty-five crucibles and molds, which had been used as processing containers, contained residual amounts of plutonium. Twenty-two of the containers had been at Los Alamos in the same condition for periods dating back to between 1979 and 1984. None of these materials had been scheduled for recovery.
- o Eight plutonium items were coded as being mixed with neptunium. Six of the 8 items had been at Los Alamos since 1979 and the other 2 since 1980 and 1981. Los Alamos does not have an adequate separation capability to recover the plutonium without discarding the neptunium, which the laboratory wanted to retain. Material such as this should be highlighted in the assessment report to enable a DOE decision on its disposition.

Although Los Alamos has recovered sizeable amounts of plutonium, cognizant Los Alamos personnel told us that the current inventory represents at least a 5-year processing backlog and that, because of its condition, some of the material may never be recovered, at least not on site. We concluded, therefore, that the Los Alamos assessment report was uninformative because it did not describe the true condition and status of the material and, in using the phrase "future years," the age of the backlog was obscured.

WHY INVENTORY ASSESSMENT REPORTS WERE INACCURATE

The primary reasons for inaccurate reporting were insufficient Headquarters guidance; lack of field office management to ensure that contractors prepared accurate reports; and too little emphasis on inventory assessments during reviews and appraisals of contractor materials management programs.

Guidance From Headquarters

DP's Office of Nuclear Materials had not provided sufficient guidance to field offices on the need and importance of accurate and timely nuclear materials assessments and reports. It had not provided a standard reporting format, issued guidance on how assessments should be conducted, or specified the level of detail required. Headquarters also did not follow up with field

offices on assessment reports that were late or not submitted, thus minimizing the importance of the reports to the field offices.

Field Office Management

Field offices are responsible for ensuring that nuclear materials retained by contractors are limited to what is needed to support approved programs. We found, however, that preparation of the inventory assessments had been delegated to the operating contractors with little or no field office guidance, involvement, or oversight.

Our audit showed that the field offices generally accepted the assessment reports without question or making any "test checks" to see if contractor procedures and controls were adequate to ensure accurate and valid reporting. For example, at Sandia and Livermore, the person responsible for preparing the assessment reports went no further than to ask the engineer or technicians responsible for use of the materials whether they were still needed. Whatever the technician said was recorded. At Sandia, we found that several of the technicians holding nuclear materials were not even asked. In these instances, the status of the materials as reported the previous year was merely reentered on the new report. Field office test checks of the validity of report information are needed to ensure accurate and valid reporting.

Reviews and Appraisals of Materials Management Practices

The periodic formal reviews of the materials management practices of field offices had not been adequately performed by the Office of Nuclear Materials. With few exceptions, the field offices had not appraised contractor practices.

Office of Nuclear Materials. While this office had not reviewed the materials management programs of all the Field Offices as required by DOE Order 5660.1, some aspects of the programs were reviewed as part of materials management field trips. However, the scope and depth of the reviews were limited and the results were not formally documented.

Field Offices. Based on inventory value, Savannah River, Y-12, and Los Alamos should have been appraised annually; Sandia and Livermore every 2 years. With the exception of appraisals of the Y-12 contractor by the Oak Ridge Field Office, there was general noncompliance with this requirement at the locations we audited. The last documented contractor appraisal made by the Savannah River Field Office was in 1982. The Albuquerque Field Office had not appraised its contractors at production sites since 1987. Of the three DOE weapons laboratories, only Los Alamos had been appraised since the issuance of DOE Order 5660.1, and that appraisal was incomplete as it did not address the laboratory's management of plutonium. The San Francisco Field Office had not appraised Livermore since the mid-1970's.

Complete and timely review and appraisals are needed to ensure that DOE field offices and contractors are complying with DOE nuclear materials management policies.

IMPACT OF INACCURATE NUCLEAR MATERIALS ASSESSMENT REPORTS

Valid nuclear materials assessment reports are needed so that DOE can accurately forecast nuclear materials requirements. Accurate assessments would also help make sure that environmental problems are not aggravated and that nuclear materials storage costs are kept at a minimum consistent with safeguard and security requirements.

Forecasts of Nuclear Materials Requirements

Accurate forecasts of nuclear materials are needed to ensure that acquisition and recovery actions are kept to the minimum essential to meet requirements. Without accurate assessment reports, DOE is unable to identify unneeded or excess nuclear materials that can be used to offset its overall requirements. An example, as discussed on page 8, was the quantity of enriched uranium that Sandia incorrectly reported as needed for a bomb mockup. Although the mockup did not exist and there was no future defined requirement, the Albuquerque field office used the assessment report in forecasting a need for Sandia to retain the uranium through the year 2005.

Retaining unneeded nuclear materials for projects like the bomb mockup could result in the unnecessary purchase or recovery of materials. Headquarters forecasts and allocations during 1989 and 1990 were made at a time when the Office of Nuclear Materials was projecting a significant shortfall in uranium availability for Fiscal Year (FY) 1992 and beyond. For example, while Sandia was holding approximately \$500,000 in excess uranium, the Office of Nuclear Materials was making a FY 1992 budget request to buy \$100 million worth of uranium. (The FY 1990 and 1991 budgets had similar requests.) The request stood until July 1990 when it was deleted because of competing priorities and the impact of recent world events on requirements.

Environmental Concerns

Over the last several years, DOE decisions affecting the disposition of nuclear materials considered increasing environmental concerns and regulatory restrictions. While the assessment reports are not used to make environmental decisions, their accuracy would be helpful in ensuring sound decisions on the disposition of scrap nuclear material because without accurate assessment data, the possibility exists of DP unnecessarily recovering, from scrap, nuclear materials that may already be available elsewhere. When materials are unnecessarily recovered, wastes (both primary and secondary) are byproducts. DOE, therefore, needs good data to preclude any actions which generate unnecessary waste.

Holding Costs

The retention of unneeded nuclear materials unnecessarily adds to storage costs. With nuclear materials, the cost is especially high because of the rigid requirements for safeguards and security. The annual costs to store, maintain and conduct the frequent inventories required at DOE's three weapons laboratories currently is over \$11 million.

There may be cost reduction opportunities at DOE's three weapons laboratories if nuclear materials inventories were reduced or consolidated. At Sandia, for example, the contractor has nuclear materials stored in five

separate locations. Our audit showed that Sandia had no defined need for much of its nuclear materials inventory. Consideration should be given to seeing if Sandia can identify future needs for any of the nuclear materials. If not, action should be taken to transfer the excess to a location where it could be used or stored. Any residual amounts still needed at Sandia could be consolidated in one location.

MANAGEMENT INITIATIVES

The issuance of DOE Order 5660.1 in November 1988 marked the beginning of a number of actions taken to improve DOE's nuclear materials management. From the establishment of DOE in 1977, there were no official materials management directives or regulations available for use by DOE field offices or contractors. As a stop-gap measure, some field offices unofficially made whatever use they could of a cancelled 1975 AEC materials management handbook and related directive. Others did not. The problems discussed above can, in part, be attributed to a residual effect of a 11-year absence of official guidance.

In addition to the issuance of DOE Order 5660.1, other positive management actions have been recently taken by Headquarters DOE. This includes formation of a Nuclear Materials Coordinating Committee and an ad hoc study group to evaluate DOE's current methodology and criteria for use of economic discard limits for nuclear materials. The Committee was established to provide a forum for high-level review of nuclear materials supply and demand projections and to develop strategies for production and processing operations. Among other things, the committee was chartered to identify and evaluate options and strategies for providing nuclear materials, which should include optimizing the use of existing inventories.

An ad hoc study group was established in October 1990 in recognition of changing requirements for nuclear materials scrap and residue. This group should help ensure that future decisions will satisfy nuclear materials retention requirements, keep waste at a minimum, and improve environmental compliance.

Field offices and their contractors have also taken the following actions recently to improve nuclear materials management.

- o One of the more significant actions was the Albuquerque Field Office's October 1990 publication of a *Materials Management Handbook* for use by its contractors to enhance management and use of nuclear materials inventories. The handbook includes a section on inventory assessments. Albuquerque has held training sessions to acquaint its contractors with the handbook. This initiative should be a major factor in correcting the problems discussed.
- o Another action was taken in June 1990 when the Oak Ridge Field Office published an order that extended the requirements of DOE Order 5660.1 down to the Oak Ridge contractors and provided procedural guidance for implementation. This action together with a continuation by Oak Ridge

of quality appraisals of contractor practices should further enhance the effectiveness of nuclear materials management at their DOE production sites.

- o At the Savannah River site, action was recently taken to increase staffing to provide more rigorous oversight of the contractor and its materials inventories. In addition, guidance has been provided to the contractor for preparing the inventory assessment report, including information on content, format, and scope. The contractor prepared reports are then reviewed before they are forwarded to DOE Headquarters.
- o And, in June 1990, the contractor at Livermore initiated action to develop a plan for reducing the nuclear materials inventory at the laboratory's plutonium facility. A laboratory official told us that the action was taken because the amount of inactive material in the facility was starting to place a burden on the personnel who had to safeguard and inventory the materials. Although the inactive material was still in inventory at the time of the audit, the action taken shows Livermore's awareness of the problem and their intent to resolve it.

PART III

MANAGEMENT AND AUDITOR COMMENTS

In responding to our draft version of this report, Defense Programs' Director, Office of Materials Planning, generally agreed with the report and stated that a number of actions have been completed or initiated that will enhance the usefulness and reliability of reporting on the status and use of nuclear materials. Management comments and our responses follow.

Management Comments. DP stated that the 1989 inventory assessments were the first reports prepared under DOE Order 5660.1, *Management of Nuclear Materials*. Beyond the general guidance provided in this Order, more detailed guidance was not available at the time the 1989 assessments were prepared. Although improvements are needed, such as additional justification for continued retention of materials and improved descriptions of materials use, the 1989 assessments, as written, did have some management value. Also, much was learned from the 1989 assessment reports, and written critiques were made by Headquarters and provided to most field offices.

Since the 1989 reports, a number of progressively significant improvements were made by Headquarters and the field offices in preparing the 1990 reports and in providing guidance for the 1991 assessments. Overall, these enhancements have resulted in more complete, thorough, accurate, and timely assessments of contractor-held inventories.

Auditor Comments. Management's initiatives, many of which are recognized in Part I and II of this report, are positive steps. Specific management actions (taken or planned) on the recommendations included in the report are discussed below.

Recommendation 1

Provide field offices with specific guidance on how the annual inventory assessments should be conducted and in what format the results should be reported.

Management Comments. DP stated that, while it has not provided detailed supplementary guidance on inventory assessments (e.g., a standardized format for the reports), it has emphasized in DOE Order 5660.1 and subsequent guidance and during visits to DOE field offices the need and importance of accurate assessment reports. DP said that it not only plans to continue the meetings and visits, but will provide a standard format for inventory assessments and require additional explanation and justification for project inventories. It will be up to the field offices to determine and develop the detail and procedures needed for conducting and reporting nuclear materials assessments.

DP added that there is a need for flexibility in the retention and storage of materials not currently in use. The reasons given were that other DOE programs generally show little interest in excess materials and very few DOE sites are willing to receive and store excess materials from other sites.

Also, some of the currently usable nuclear materials may have a potential long-term future use and should not necessarily be categorized as excess to a site's defined programmatic needs. DP, therefore, in its guidance, intends to establish a new "inactive" category for any such materials.

Auditor Comments. Management's actions are responsive to Recommendation 1. The new "inactive" category will enhance accurate reporting as long as assessment reports distinguish between inactive materials with defined uses and inactive materials being held for potential long-term future use.

Recommendation 2

Provide DOE field offices with specific reporting criteria for recoverable scrap material. The guidance should require that assessment reports identify the age, composition, and disposition plans for scrap inventories.

Management Comments. Before addressing Recommendation 2, DP stated that as a result of capacity and capability limitations, processing of economically recoverable scrap has not kept pace with its generation. This has resulted in a scrap backlog. Since there are a limited number of facilities capable of processing uranium and plutonium scrap and limited storage capacity at DOE sites, there is no time limit for storage of economically recoverable scrap. DP did agree, however, that the length of time scrap is stored and the disposition plans for backlogged scrap should be identified to Headquarters DP in the annual inventory assessments.

DP added that the existing guidance requires that recoverable scrap be reported in the quarterly Nuclear Materials Management and Safeguards System (NMMSS) reports and in the annual inventory assessments. The NMMSS reports include scrap in supply projects and in accounts which are not covered in inventory assessment reports.

In light of the above, DP said that it plans to require additional explanation and justification for project inventories in assessment reports. This will include scrap inventories. The age of the scrap backlog and disposition plans (i.e., storage onsite, processing onsite, transfer offsite, etc.) would be part of the additional explanation and justification in assessment reports.

Auditor Comments. Management's actions are responsive to Recommendation 2.

Recommendation 3

Require all field offices to ensure that contractors implement DOE Order 5660.1, *Management of Nuclear Materials*, as appropriate.

Management Comments. DP stated that implementation of DOE Order 5660.1 by operating contractors has been and will be addressed during DP reviews of field office nuclear materials management programs. Field office implementation is also underway. For example, the Albuquerque Field Office has already issued to its contractors a Nuclear Materials Management (NMM) Handbook. The Savannah River Field Office is preparing supplementary guidance on NMM program implementation and has, also, increased staffing to provide more rigorous oversight of contractor-held inventories. Also, the Oak Ridge Field Office has published an order extending 5660.1 to its contractors. All

of these local initiatives have or will include guidance on assessment report content, format, and scope.

Auditor Comments. Management's comments are responsive to Recommendation 3.

Recommendation 4

Require field offices to take action as required to ensure that information contained in contractor-prepared nuclear materials inventory assessment reports is accurate and valid.

Management Comments. In providing additional guidance to the DOE field offices, DP said that it will ask that verification procedures be developed to ensure the accuracy and validity of the inventory assessments. (The mechanism for accomplishing verification will be up to the field offices.) DP plans to ask that the verification procedures used be described in contractor appraisal reports and discussed during DP reviews of field office NMM programs.

Auditor Comments. Management's actions are responsive to Recommendation 4.

Recommendation 5

Require the Office of Nuclear Materials and DOE field offices to make the prescribed materials management reviews and appraisals in the depth, scope, and frequency called for in DOE Order 5660.1.

Management Comments. DP stated that its Office of Materials Planning has been conducting materials management reviews at DOE field offices since May 1989. But, because of staffing shortages, the reviews have not been as detailed as they would have liked. The only DOE field offices not yet visited are San Francisco, Pittsburgh and Schenectady. DP added that the Office of Materials Planning intends to continue these reviews and has plans to visit the Savannah River, Idaho, Richland, and Albuquerque Field Offices, and the Rocky Flats Office, during the remainder of FY 1991. DP concluded that conducting reviews of 10 DOE field offices within a 2-year period requires additional staff. Additional staff is being hired.

DP said that due to staffing problems, the field offices have been slow in conducting contractor appraisals. During 1990 appraisals were conducted by the Albuquerque, Chicago, Oak Ridge, Idaho, and Schenectady Field Offices. In providing supplementary guidance on NMM implementation to the DOE field offices, DP will request a schedule for their 1991 contractor appraisals. Staff augmentation to perform appraisals is also planned at the field offices.

Auditor Comments. Management's actions are responsive to Recommendation 5. The additional Headquarters and field office staff will help ensure that Headquarters reviews and field office assessments have adequate depth and scope and are done in a timely manner.

Management Comments. Management provided the following specific comments for the items the auditors reviewed at the Sandia and Livermore laboratories.

Sandia: Because of its historical significance, DP will permit Sandia to retain the enriched uranium for the bomb mockup as long as the material is acknowledged to be "inactive" and the need for retention is reviewed periodically.

Livermore: DP will allow Livermore to retain items that can be justified for surveillance work or for R&D that can be documented in current test plans and readiness reports.

Auditor Comments. DP decisions on where to retain materials are appropriate as long as the reporting sites report the accurate status of materials and the reasons for wanting to retain the materials are fully documented.

Management Comments. With respect to the Los Alamos sample items, the Los Alamos contractor stated that, although material in the Los Alamos R&D account may be excess to one experiment or program, it is not necessarily excess to Los Alamos' overall R&D needs, and it may be held for potential future use.

Auditor Comments. We agree that materials that are excess for one project or experiment could be needed elsewhere within an R&D laboratory. However, the availability of excess materials would be unknown to other potential users unless the materials were identified as excess at the project or experiment level. The materials we found to be excess were reported by Los Alamos as "in use" or otherwise still needed. The length of time the materials had been on hand in an inactive status (up to 10 years for the sample items) indicates either that its availability was not made known to other potential users or it was excess to overall Los Alamos R&D requirements.

Management Comments. The Los Alamos contractor stated that the audit report should distinguish between their capability and current capacity in discussing why scrap materials in the R&D and recovery projects were not recovered. Los Alamos said that it has the recovery capability but lack the funding needed to increase capacity to the extent necessary to recover all of the scrap material presently on hand.

Auditor Comments. The distinction between capability and capacity is not the issue in this report. Accurate reporting is. We found that scrap material that was apparently unneeded and/or unrecoverable onsite was reported by Los Alamos as currently "in use" or otherwise needed for R&D. Whether the problem was capability or capacity, the materials should not have been reported as "in use".

Management Comments. The Albuquerque Field Office stated that the scrap material at Los Alamos that contained traces of various elements and that the auditors classified as "excess" could still be used in R&D experiments.

Auditor Comments. We agree that scrap material can be used for R&D purposes, but there was no indication of any projected defined need for any of this material at Los Alamos or elsewhere. Also, as the report indicates, the scrap material had been inactive in storage for extended periods. In the case of scrap plutonium containing traces of other elements, the assessment report should have accurately described its condition and status.

PART IVAPPENDICESDetailed Audit ResultsSandia National Laboratory

Sandia's nuclear materials inventory consisted almost entirely of enriched uranium. The laboratory had a fully automated inventory control system that contained detailed usage data back to 1979 on each of approximately 2,500 separately controlled items or quantities of materials. To determine the accuracy and validity of Sandia's assessment report, we selected for review 81 items that made up 83 percent of the total weight of Sandia's nuclear materials inventory. Of the 81 items, we found that 39 were reported correctly in Sandia's assessment report and 42 were not. The 42 items accounted for 91 percent of the total weight of the items reviewed. Details on these 42 items follow.

- o Twenty-five items were reported as "in use" although they had been in storage unused for periods dating back to 1979, prior to which there were no readily available records. Ten of the 25 items consisted of fuel elements for a reactor that was used in 1979 to support a container test program. Sandia technical personnel stated that the program was completed a number of years ago and that the fuel elements have not been needed or used since that time. No future requirement was projected. The other 15 items were made up of enriched uranium items of various weights for which the laboratory was unable to define a valid current or projected requirement.
- o Another 15 items of enriched uranium were shown as "inactive" but were being held pending completion of a study involving reactor safety. However, the project under which the study had been conducted had been inactive for several years. Technical personnel said there were no plans to do additional work that would require the use of these materials. The items reserved for the project had been in storage at Sandia for periods dating back to at least 1979.
- o Two items of enriched uranium had been omitted from the report. They were reactor fuel plates that were received in 1983 but never used. There was no documented need for this material.

We noted that prior to preparation of their FY 1989 assessment report, Sandia technical personnel had identified and coded a number of items in their inventory as "excess." Twenty-five of those items were among the 81 items we reviewed. However, Sandia's assessment report classified 24 of the 25 items as "in use" or "inactive." We attributed this inconsistency to a need for more interaction between the project offices and the office responsible for preparation of the assessment report.

Detailed Audit ResultsLawrence Livermore National Laboratory

Over half of Livermore's nuclear materials inventory consisted of plutonium with the balance made up mostly of enriched uranium. The laboratory had only a negligible amount of tritium. In total, the nuclear materials inventory included about 5,000 line items that were identified separately in the laboratory's automated inventory control system. Usage data in the automated system was limited to the most recent 2-year period. Obtaining the complete history of any item that predated that period required a labor-intensive manual search of records from several of the prior systems. Because of this limitation, we asked laboratory personnel to randomly select and provide complete histories for 35 items that weighed 2 kilograms or more.

We analyzed the data for the 35 items provided by the laboratory. In terms of weight, the 35 items made up about 8.5 percent of Livermore's nuclear materials inventory. We found that 31 of the 35 items were reported incorrectly. They accounted for about 90 percent of the weight of the materials reviewed. Based on these results, we concluded that further review was unnecessary. The incorrectly reported items included the following, all of which should have been reported as "excess" to any defined need.

- o Nineteen items were reported as currently "in use" to support weapons R&D. We found, however, that all of these materials had been in vault storage and unused for periods of up to 17 years. The technical people currently responsible for the materials were unable to identify any current or future requirement that would justify its continued retention. In some cases, they were unaware of why it was originally obtained.
- o The other 12 items were reported as "inactive," but were to be retained indefinitely. They included four items that were "in use" between 1977 and 1987 on a project that has since been completed. The other eight items had not been used since the early 1970's, if at all. Laboratory personnel were unable to identify any specific future requirement or any unique circumstances that would warrant continued retention of these materials.

Detailed Audit ResultsLos Alamos National Laboratory

Most of the Los Alamos weapons nuclear materials inventory consisted of plutonium. We selectively reviewed 265 items, all but 14 of which were plutonium. All but several of these items were selected from among approximately 5,200 line items which the laboratory's inventory control system identified as materials assigned to weapons R&D. In making the selection, we considered weight and/or status and condition as indicated by identifier codes in the inventory records. This latter criterion enabled the review to be expanded to cover groups of items because the status and condition of items in each group were the same or similar. Of the 265 items reviewed, 234 were reported incorrectly.

- o There were 127 plutonium items with scrap codes which showed they were unusable in their present form but were recoverable. Los Alamos had been holding this material in storage for periods dating back to the early 1980's. Although it was reported as needed for weapons R&D, there were no current or future plans identified for its recovery or use. Materials like this do not belong in an R&D project. If it were to be recovered, the materials should have been reported under the project for materials recycle and recovery. Otherwise, it should have been reported excess to R&D requirements.
- o A similar situation existed with 15 other plutonium items comprised of various forms of scrap. The only difference was that these items were not coded as scrap in the inventory records. This material also should have been either scheduled for recovery or declared excess.
- o Another 24 plutonium items that were reported as still needed for weapons R&D could be unusable in their present form because they contained traces of other elements. Los Alamos did not have an adequate onsite capability to recover the plutonium from this material. It had been in storage for periods in excess of 6 years with no plans identified to effect its ultimate disposition. The assessment report should have shown the material as excess with a detailed description of its status and condition.
- o The remaining two plutonium items were also reported incorrectly. In one case, the technician responsible for the material told us that although a requirement for the item did not currently exist, he wanted to retain it for possible future use. However, he could give no indication of how or when it would be needed. The other item was reported as "in use" even though it had been inactive for several years. It should have been reported as either inactive or excess depending on whether a future need could be identified.
- o There were three uranium items trapped in a duct, two of which were coded as "usable" for weapons R&D while the other was coded as

"scrap." The report was inconsistent because the status of all three items was the same. It was, also, incorrect because the materials would be unusable until recovered from the duct, which according to Los Alamos personnel would probably not be done, at least not in the near-term.

- o Two uranium items that were weapons components and mixed with plutonium were incorrectly reported as "in use" in the weapons R&D program. The two components were unusable in their present form and unrecoverable onsite. They should have been reported as "excess" with a description of their condition.
- o One tritium item reported as "inactive" was incorrectly shown as still needed for weapons R&D. This material was in the form of a liquid condensate that had collected as residue from the tritium containment system. Los Alamos personnel stated that it could not be recovered and was technically waste.

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