

AUDIT REPORT

RESEARCH AND DEVELOPMENT
AT LAWRENCE LIVERMORE
NATIONAL LABORATORY



JULY 2001

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL
OFFICE OF AUDIT SERVICES



U. S. DEPARTMENT OF ENERGY
Washington, DC 20585

July 9, 2001

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman (Signed)
Inspector General

SUBJECT: INFORMATION: Audit Report on "Research and Development at Lawrence Livermore National Laboratory"

BACKGROUND

Lawrence Livermore National Laboratory (Livermore), a major component of the Department of Energy's national laboratory system, has an annual Research and Development (R&D) budget of about \$1 billion. The Department established a set of processes and procedures to ensure that Livermore's R&D efforts are authorized by responsible Federal Officers and are consistent with the Department's mission. The objective of our audit was to determine whether Livermore was performing R&D that was not authorized by the Department.

RESULTS OF AUDIT

Based on a review of a statistically-based sample of 45 Livermore projects for Fiscal Years 1998-2000, we found that 26 projects involved R&D efforts for which the contractual authority to do the work was questionable. The 26 activities had a total value of \$7.5 million.

Under its policies for managing R&D, and consistent with the terms of the contract with the University of California, Livermore's managing contractor, the Department must authorize and approve each R&D project. Generally, such approval is predicated on the project being part of the laboratory's Work Authorization System. However, as an alternative, R&D may be approved, with limitations, as part of two other departmental programs, Work for Others or as Laboratory Directed Research and Development. Without departmental approval, Livermore has no contractual authority to conduct the R&D.

Instead of funding the 26 R&D projects through one of the approved mechanisms noted above, Livermore used several overhead accounts for this purpose. In our view, this circumvented the Department's work authorization system. While the Department's Oakland Operations Office regularly approved Livermore's overhead rates, the Laboratory's overhead submission was not described in sufficient detail to allow Federal officials to discern the complete composition of the overhead pool. Thus, the problem described in this report may not have been apparent to Department officials. Because our sample was statistically based, we were able to extrapolate to the entire universe and conclude that the number of questionable Livermore projects for the period was actually 194, with a total value of about \$33.6 million. Based on the process we found at Livermore, we are concerned that future R&D efforts will be treated in a similar fashion.

The use of Laboratory overhead accounts to fund R&D projects raises a number of general management concerns. These relate to the potential effect on (1) the Department's ability to manage its R&D portfolio; and, (2) escalating overhead rates if such funding is used to support R&D projects.

The findings in this report, parallel concerns with the Department's methodology for controlling overhead raised by the Congress in the FY 2000 Energy and Water Appropriations Act. Congress specifically suggested that the Department may have charged activities to overhead that should have been charged directly and that activities may have been funded from overhead to avoid the formal approval process.

MANAGEMENT REACTION

Management partially concurred with 3 of the 4 recommendations. Management expressed the view that the report did not provide enough information to make an assessment of the nature of the alleged unauthorized work and to determine whether or not these projects were in fact unauthorized and the estimated questioned funds involved were accurately calculated.

We are concerned that the responsible Department managers did not elect to perform their own examination of any of the projects questioned as a result of this audit. If legitimate questions existed, management could have satisfied itself as to the validity of the OIG's findings. From a contractual perspective, the Department's contracting officer is responsible for knowing the scope of work being performed, administering the contract and, specifically, for determining whether a cost should be allowed or disallowed. Management's comments and the OIG response are more fully discussed on page 5 of the report.

Attachment

cc: Deputy Secretary
Under Secretary
Administrator, National Nuclear Security Administration

RESEARCH AND DEVELOPMENT AT LAWRENCE LIVERMORE NATIONAL LABORATORY

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OVERVIEW

INTRODUCTION AND OBJECTIVE

The primary mission of the Department of Energy's (DOE) national laboratories is to perform research and development (R&D). Lawrence Livermore National Laboratory (Livermore), which is managed and operated for DOE's Oakland Operations Office (Oakland) by the University of California (University), has an annual R&D budget of about \$1 billion. Several audits by the Office of Inspector General (OIG) and General Accounting Office (GAO) have questioned the national laboratories' management of R&D; including the laboratories' authority to do certain work (see Appendix 3). Three of these audits were specific to University-managed laboratories and questioned DOE and University control over funds used for discretionary R&D projects.

The objective of our audit was to determine whether Livermore was performing R&D that was not authorized by DOE.

CONCLUSIONS AND OBSERVATIONS

Livermore performed R&D that was not authorized by DOE. For Fiscal Years (FY) 1998-2000, we estimated that 194 projects at Livermore involved R&D for which there was no contractual authority to do the work. Livermore circumvented the work authorization process by funding the R&D through overhead accounts. As a result, DOE funded about \$33.6 million of unauthorized R&D during FYs 1998-2000. If such spending continues, Livermore will spend about \$11.2 million annually for unauthorized R&D.

The audit identified a material internal control weakness that management should consider when preparing its yearend assurance memorandum on internal controls.

(Signed)
Office of Inspector General

RESEARCH AND DEVELOPMENT NOT AUTHORIZED BY DOE

Livermore Performed Unauthorized Research And Development

Livermore performed R&D that was not authorized by its contract. To fund an R&D project it must be approved as part of the Work Authorization System (WAS), Work for Others (WFO), or Laboratory Directed Research and Development (LDRD) programs. Instead of funding the R&D through one of the approved methods, Livermore categorized the work as "technical activities" and funded it out of one of its overhead accounts. Because many of Livermore's technical activities appeared to involve R&D -- defined as a systematic study directed toward fuller scientific knowledge and the use of that knowledge to develop useful materials, devices, systems, or methods -- we statistically selected 45 technical activities to examine. The examination showed that 26 were questionable because they had the characteristics of R&D, such as developing devices or methods based on research. For example:

- Livermore developed a new generation of instruments to identify target deoxyribonucleic acid (DNA) sequence. Since the development of these instruments was based on earlier research of polymerase chain reaction and DNA, it was actually R&D.
- Livermore developed a high-pressure gas loader that also met the definition of R&D because the work involved the development of a device. Further, the approach used to develop the gas loader was similar to that used in another R&D project (that is, Science of Seawater). In each case, Livermore used the knowledge and understanding gained from research to develop a new analytical device.
- Livermore developed equipment that allows researchers to shape and finish materials, at an atomic level, with minimal sub-surface damage. This work meets the definition of R&D because the equipment was developed based on prior research on atmospheric pressure plasma processing.
- Livermore researched and developed software that calculates doses of medication based on an individual's cellular activity and depicts how DNA will respond to certain chemical exposures. This meets the definition of R&D because the goal of the work was to (1) acquire fuller scientific knowledge and understanding of individual cellular activities, (2) assess the impact of the medication on the cells, (3) and determine how DNA would respond to chemical exposures.

In addition to meeting the definition of R&D, there was corroborating evidence that the laboratory considered the work to be R&D. Of the 26 questioned technical activities, 6 had been proposed under the LDRD program. Four, in fact, were authorized and funded as LDRD and also received overhead funding. Further, 10 of the 26 questioned technical activities were included in the Engineering Directorate's annual research, development and technology reports, which highlight the results of Livermore's R&D work.

Based on our examination and Livermore's actions, we concluded that the 26 were in fact R&D projects. The questioned technical activities ranged in value from \$17,000 to \$1.1 million. Projection of the sample results to the universe showed that about 194 technical activities performed during FYs 1998-2000 were unauthorized R&D.

Methods for Authorizing Research and Development

Under the terms of the contract with the University, DOE can authorize R&D conducted at the laboratory as: WAS, WFO, or LDRD.

- Under WAS, Livermore identifies R&D in support of specific DOE programs. These activities are to be reviewed and authorized by DOE. Authorized work is funded directly by DOE.
- Under WFO, Livermore can assist other Federal agencies and non-federal entities. Oakland's review and authorization is required by the contract. The non-DOE sponsors fund the work.
- Under LDRD, Livermore can perform discretionary R&D. Such work is reviewed and authorized by Oakland. The work is funded out of the laboratory director's LDRD account, which is a percentage of the budget.

DOE must authorize and approve each R&D project. Without authorization, Livermore has no contractual authority to do R&D. In fact, the contract states that DOE will not reimburse Livermore for the cost of independent R&D.

Work Authorization Process Circumvented

Livermore did not have effective controls to eliminate R&D activities from its overhead accounts. Although one directorate had established guidance to determine if R&D activities were proposed for funding through overhead accounts, the guidance was not appropriate. While

we acknowledge that the unauthorized R&D may have been meritorious, the work was not approved or funded as WAS, WFO, or LDRD. Instead, Livermore performed the questioned technical activities by funding them through one of three overhead accounts: General and Administrative; Organization Personnel Charges; and Program Management Charges. Livermore used this funding mechanism because it considered the work important even though it had not been authorized as R&D. Thus, Livermore circumvented the work authorization process.

Oakland approved Livermore's overhead rates. However, Oakland was not aware that portions of Livermore's overhead rate submissions represented R&D projects because the laboratory's overhead rate submissions were not described in detail. Thus, excessive funding was inadvertently provided to Livermore and used by the laboratory to fund unauthorized R&D projects.

While we questioned the use of overhead funds for R&D, we reviewed other technical activities funded through these overhead accounts and found them to be appropriate. For example, Livermore appropriately used one overhead account to pay for an assessment of risk to laboratory buildings from seismic activity. The laboratory also appropriately used another overhead account to develop strategies and solicit proposals for its Engineering Center.

**Projects Funded
at the Expense of
Authorized Research
and Development**

From October 1998 through September 2000, Livermore spent over \$33.6 million on 194 unauthorized R&D projects questioned in this audit. Unless better controls are established, Livermore can be expected to expend an additional \$11.2 million annually on unauthorized R&D if such spending continues at the rate experienced during FYs 1998-2000. As the funding for the unauthorized work is based on approved overhead rates, the cost of the work is assessed against authorized projects, such as the National Ignition Facility. This is not the intent of DOE or the Congress and should not occur.

RECOMMENDATIONS

We recommend that the Manager, Oakland Operations Office direct Livermore to:

1. Discontinue ongoing, unauthorized R&D;
2. Establish procedures to prevent overhead accounts from being used to fund unauthorized R&D;
3. Submit to DOE for review and authorization a description of all technical activities to be funded from overhead accounts; and,
4. Reimburse DOE for the cost of unauthorized R&D.

MANAGEMENT REACTION

Management partially concurred with recommendations 1, 2, and 3, and non-concurred with recommendation 4. Management believes the report did not provide enough information to make an assessment of the nature of the alleged unauthorized work and to determine whether or not these projects were in fact unauthorized and the estimated questioned funds involved were accurately calculated.

Recommendation 1: Management stated that the OIG applied criteria prescribing that R&D related activities had to be identified specifically in the Work Authorization System, Work for Others or LDRD in order to be appropriately authorized. No other criteria were considered. Also, Defense Programs and Oakland contend that the criteria for determining whether R&D activities are authorized should be expanded to include overhead expenses associated with technical activities. Examples include: employees between assignments, post-doctoral research fellows, as well as the development of new techniques, procedures and tools that are not commercially available for the unique work that Livermore performs.

Recommendation 2 and 3: Management was concerned that there was too little information in the draft report to make an assessment of the nature of the alleged unauthorized work. It believed such information is required to determine whether or not these projects were in fact unauthorized and whether or not the estimated funds involved were accurately calculated. Therefore, the Defense Programs and Oakland response is to defer concurring with the OIG recommendation until more information is provided.

Recommendation 4: Management stated the OIG's sampling technique does not appear to generate a valid projection to the entire population because 1) the accounts were not segregated and projected by fiscal year thus creating a large potential for distortion and; 2) the population was not stratified properly. Large dollar amounts should be sampled at a 100 percent rate and only small dollar amounts should be sampled and extrapolated to the universe.

AUDITOR COMMENTS

Management's statement regarding criteria is correct. We acknowledge that the audit was based on the Department's own criteria for authorizing work for its laboratory system. We clearly conveyed to both Livermore and Federal officials that this was the case. In our opinion, this is not the appropriate forum to comment on proposed or contemplated changes to the Department's policy as to appropriate R&D activities. However, any policy change which expands the definition of overhead appears to run contrary to concerns expressed by the Congress and by the current and recent administrations. Nonetheless, in the context of this audit, the fact that management's response to the audit report urges, prospectively, a broadening of the criteria, suggests that the audit correctly identified R&D at Livermore which was not properly authorized. Management also takes the position that the OIG did not provide enough information to allow the Department to make a judgment as to the appropriateness of the cited R&D activities. We fail to understand the logic of proposing changes to the key criteria when, if as management contends, there is insufficient evidence to support such changes.

We believe that the Department has not chosen the correct course of action in this matter. First, Livermore personnel, as is Livermore protocol, received copies of all relevant documents that had been provided to the OIG staff during the audit. Second, Oakland management was aware of the specifics of the 26 Livermore projects that we questioned. In addition, although Livermore personnel, at times, questioned whether our analysis had considered certain matters, we found that these matters did not affect our conclusion as to whether work was or was not unauthorized R&D. Finally, despite long delays in the process of obtaining management's comments on the audit report, the Department apparently made no effort to perform its own independent examination of even one of the projects questioned in the audit. Indeed, Defense Programs and Oakland officials had the information necessary to independently assess whether there was a pattern of unauthorized R&D, funded through overhead accounts, at Livermore. Had management done so, constructive corrective action could have been pursued and achieved.

The sampling methods and techniques employed in this audit are standard in the profession, are explained in detail elsewhere in this report, and speak for themselves. While management is free to contest our extrapolations, we believe there is sufficient information provided for management, at a minimum, to test the transactions listed as examples in our report, and if they are independently confirmed as not meeting current criteria, to initiate constructive corrective action.

APPENDIX 1

SCOPE

The audit was performed at Oakland (Oakland, California), and Livermore (Livermore, California) from March 2000 to January 2001. The technical activities reviewed were performed during FYs 1998-2000.

METHODOLOGY

To accomplish the audit objective, we:

- Interviewed DOE and Livermore personnel;
- Statistically sampled and reviewed 45 technical activities performed at Livermore that were funded through Livermore's overhead accounts (see Appendix 2);
- Reconciled project cost data on Livermore's data submission to the general ledger;
- Reviewed contract provisions for *Government Performance and Results Act of 1993* performance measures related to the audit objective; and,
- Reviewed prior OIG and GAO audit reports.

The audit was performed in accordance with generally accepted Government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. Accordingly, we assessed the significant internal controls with respect to the authorization process for research and development, including the controls for obtaining DOE's approval and funding. Instead of performing our own assessment of the reliability of computer-processed data, we relied on work done by the auditors who tested Oakland's and Livermore's financial systems as part of the audits of DOE's financial statements for FYs 1998 and 1999. We also relied on the computer systems work done as part of Livermore's internal audit of the laboratory's financial general ledger system. None of these audits disclosed any material weaknesses with computer-processed data. No performance measures relevant to the audit objective were noted. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit. We discussed the finding with representatives of Oakland and Livermore on March 22, 2001.

APPENDIX 2

SAMPLING OBJECTIVES, TECHNIQUE, AND EVALUATION

Objectives

The sampling objective was to determine the number of unauthorized R&D projects Livermore financed using overhead funds.

Technique

We used the Audit Command Language statistical sampling software to randomly select the sample and the U.S. Army Audit Agency statistical sampling software to evaluate the sampling results. The sampling universe consisted of 332 technical activities that Livermore identified as being charged to overhead accounts during FY 1998-2000¹. We established a confidence level of 90 percent with an expected error rate of 10 percent, which resulted in a sample size of 45 projects. The sampling units were the individual technical activities.

We used attribute sampling. The attribute tested was whether a technical activity was an R&D project as defined by Federal and DOE regulations and whether the work was authorized as WAS, WFO, or LDRD. Any project that met the definition of R&D and was not authorized by DOE was considered a sampling error. We obtained project summaries and discussed the projects with key project officials to determine if the technical activities were R&D.

Evaluation

Based on our review of project summaries and discussions with principal investigators, 26 of the 45 technical activities met the definition of R&D. At the 90 percent confidence level, 194 of the 332 projects were R&D.

¹"Technical activities" was a term that the auditors and Livermore personnel agreed to use for identifying all activities, other than administrative and support functions, that Livermore performed using overhead funds.

RELATED OFFICE OF INSPECTOR GENERAL AND GENERAL ACCOUNTING OFFICE REPORTS

- *Management of the Laboratory Directed Research and Development at the National Renewable Energy Laboratory*, OIG Report No. WR-B-99-05, July 12, 1999. The National Renewable Energy Laboratory funded 21 unqualified projects as LDRD.
- *Management of the Laboratory Directed Research and Development Program at the Lawrence Livermore National Laboratory*, OIG Report No. CR-B-98-02, November 14, 1997. Actions taken in FYs 1996 and 1997 by DOE and Livermore increased the level of discretionary research work conducted at Livermore by an equivalent of \$19 million. This increased level of discretionary research was primarily obtained by: removing G&A allocations from LDRD projects; using performance fee revenues and licensing and royalty income for discretionary research; and assessing a 6 percent LDRD surcharge on intra-Departmental requisition orders from other DOE laboratories.
- *Discretionary R&D Funds*, GAO Report No. RCED-91-18, December 5, 1990. DOE controls were weak over the administration and use of discretionary R&D funds at the Livermore, Sandia, and Los Alamos National Laboratories. DOE had not effectively implemented the control mechanisms contained in DOE Order 5000.1A. Further, DOE had neither formally reviewed nor set a funding ceiling applicable to the basic research component of Los Alamos' Discretionary R&D program and had no formal systems of controls in place covering basic research.
- *Exploratory Research and Development Program at Argonne National Laboratory*, OIG Report No. ER-0-89-07, June 6, 1989. Argonne National Laboratory used overhead funds during the 3-year audit period for: (1) \$7.2 million in research that did not meet the DOE Order 5000.1A definition of Exploratory Research & Development (ER&D), (2) ER&D that exceeded the authorized funding level by \$2.5 million, and (3) ER&D expenditures that were not authorized or reported to DOE.
- *Exploratory Research and Development Funds at Los Alamos National Laboratory*, DOE/IG-0267, May 17, 1989. Los Alamos spent \$97.7 million more than authorized for its discretionary R&D. DOE was aware of this practice but did not take effective action to make Los Alamos comply with the established requirements of the ER&D program.

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