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NUCLEAR WEAPONS COMPLEX

Issues Surrounding Consolidating Los Alamos and Lawrence Livermore National Laboratories

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Mr. Chairman and Members of the Committee:

We are pleased to be here today to testify on the Department of Energy's (DOE) nuclear weapons laboratories. As you requested, our testimony focuses on three areas: (1) the research, development, and testing (RD&T) capabilities of the Los Alamos and Livermore National Laboratories; (2) the recent trends in staffing and funding at DOE's weapons laboratories; and (3) options identified by the laboratories and DOE for consolidating the Los Alamos and Livermore RD&T programs. This testimony provides a baseline for future congressional deliberations on these issue.

Los Alamos and Lawrence Livermore National Laboratories maintain a deliberately redundant nuclear warhead research, development, and testing (RD&T) infrastructure.[1] The redundancy between Los Alamos and Livermore was intended to stimulate competition in the nation's efforts to design nuclear warheads. With the end of the Cold War, however, the nature of the nuclear warhead RD&T effort at the laboratories has been changing rapidly. Changes in the world, coupled with the possibility of substantial budget cuts in the nuclear weapons area, brings into question whether the nation still needs or can financially sustain the laboratories' current level of redundancy.

In summary, although Los Alamos and Livermore have duplicative RD&T capabilities in general, over the years their independent approaches have led to each developing specialized knowledge and capabilities. Over the past several years, both RD&T funding and staffing have declined significantly at the laboratories. With this recent and anticipated continued decline in resources devoted to nuclear weapons RD&T, some consolidation of the laboratories' functions has already occurred and more is in process. The laboratories believe the potential savings are small relative to the funds needed to maintain the entire nuclear weapons complex. The laboratories believe, however, that savings are possible by avoiding additional duplicative facilities in the future.

Both laboratories strongly prefer the current two-laboratory structure for weapons design. However, Los Alamos officials believe that if the nation is to maintain its nuclear competence in the event of further significant cuts in nuclear weapons RD&T, the current structure may need to be radically altered. In addition, they believe that any new configuration must maintain the current benefits of competition and peer review. As another alternative for dealing with RD&T funding reductions, DOE and the laboratories see benefit in broadening the laboratories' missions

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[1]Sandia supports both of these laboratories by designing the non-nuclear components of the weapons systems.

to research on waste management and modernization of the nuclear weapons complex.

BACKGROUND

Los Alamos National Laboratory, located in Los Alamos, New Mexico, was established in 1943 to develop the first atomic bombs. Lawrence Livermore National Laboratory, in Livermore, California, was established in 1952 to provide Los Alamos with design competition, to diversify expertise, and to handle the large volume of work anticipated in nuclear weapons development. The two laboratories design the nuclear explosive subsystems of nuclear weapons. Sandia National Laboratories, which has facilities in Albuquerque, New Mexico, and in Livermore, was established in 1945. It designs remaining components of the weapon, integrating the nuclear explosive component with many other components such as arming, fuzing and firing, and use control systems. The three laboratories are part of DOE's nuclear weapons complex, a network of facilities that collectively produce the nation's nuclear weapons.

Essentially, nuclear weapons research and development responds to requirements from the Department of Defense (DOD), although concepts for new or improved nuclear weapons generally originate with the weapons laboratories. When DOD authorizes work on a nuclear weapon beyond the conceptual stage, Los Alamos and Livermore compete with each other to develop designs for that weapon. In designing a weapon, both Los Alamos and Livermore work with Sandia. DOD and DOE evaluate the designs, and DOE assigns further development to either Los Alamos or Livermore.

RD&T CAPABILITIES

Although Los Alamos and Livermore have the same basic responsibilities--designing nuclear weapons--they have different design and testing approaches. Consequently, they have acquired different types of specialized knowledge and experience. In addition, the laboratories have designed facilities with different capabilities to support their different approaches. Officials at both laboratories credit these differences--both in scientific approach and in the knowledge gained--with advancing the state of nuclear weapons technology at both laboratories.

Both Los Alamos and Livermore are capable of initiating conceptual design studies and pursuing competing designs when DOD has identified specific warhead requirements and has requested subsequent research and development activities. Additionally, each laboratory is capable of pursuing formal development of a nuclear weapon, if assigned to do so by DOE. Hundreds of people and a vast array of sophisticated facilities enable the laboratories to carry out these activities.

DOE and weapons laboratory officials have identified about 60 areas of required capabilities for nuclear weapons RD&T. (These areas are listed in app. I.) For ease of discussion today, we have grouped these areas into five general categories: (1) nuclear weapons design, (2) materials research and fabrication, (3) high explosives technology, (4) weapons engineering and testing, and (5) nuclear testing. Evaluating the comparative technical aspects of the laboratories' RD&T capabilities was beyond the scope of our work. My testimony today will summarize the laboratories' similarities and differences in these general areas. Because Sandia's primary mission is to design and engineer non-nuclear components rather than nuclear components, Sandia's duplication with the other laboratories is limited.

Nuclear Weapons Design

A key weapons capability is understanding all aspects of nuclear weapons. This responsibility is the job of the nuclear weapons designer. The capabilities needed for maintaining weapons expertise require a broad range of knowledge in several fields including (1) computation--the development and implementation of theoretical models for predictive computer simulations of nuclear weapons designs; (2) weapons physics--the development of a detailed and thorough understanding of the basic physics of nuclear weapons; and (3) high explosives technology--the provision of data essential for calculating and designing explosive systems.

In terms of similarities, Los Alamos and Livermore each has about 40 experienced scientists who design the nuclear components of the weapons. These designers work closely with others, such as computational and materials scientists and engineers. Both laboratories also have the supercomputing facilities necessary to model the complex theoretical and mathematical simulations involved in weapons design.

Los Alamos and Livermore differ, however, in their design philosophies and approaches. These different philosophies and approaches require unique capabilities in areas such as weapons physics and materials technology. For example, both laboratories have been working to design and fabricate a nuclear component with a reduced risk of accidentally dispersing plutonium. To reach this safety goal, Los Alamos' design approach uses a component made of uranium instead of plutonium, while Livermore's design uses plutonium but separates the high explosive and fissionable materials.

Maintaining and strengthening each laboratory's nuclear design capability is a frequent consideration for DOE when it selects a laboratory to pursue a design. In addition, the laboratories have both benefitted from each other's designs:

Design approaches developed by one laboratory are sometimes incorporated into designs by the other laboratory. For example, Los Alamos is now pursuing further development of Livermore's fire-resistant nuclear component design. Similarly, Livermore's design for the "Peacekeeper" incorporated a major component of a Los Alamos design.

Materials Research and Fabrication

Nuclear weapons contain numerous types of nuclear and non-nuclear materials, including specially designed non-nuclear plastics and metals. Accordingly, laboratories that design nuclear weapons must have the capability to research and develop these materials and to fabricate components from them. This capability is currently important because of the need to understand the effects of aging and certain environments on these materials' performance.

In the area of materials research and development, Los Alamos and Livermore are alike in that each researches and develops nuclear materials such as plutonium, tritium, highly enriched uranium, and special salts (which increase weapons' yield). Each laboratory also researches and develops non-nuclear materials such as plastics, metals, and ceramics.

However, as with the design process, the two laboratories have different materials research and development approaches. For example, Los Alamos is developing a dry-machining process to fabricate plutonium components, while Livermore is developing a precision die-casting process to achieve the same end. With regard to other plutonium operations, Los Alamos has extensive plutonium processing capabilities while Livermore is focused on fabrication technologies.

For materials other than plutonium, the laboratories differ in their on-site research, development, and fabrication capabilities. That is, while Los Alamos has extensive on-site materials capabilities, Livermore relies primarily on commercial sources or on the facilities in the rest of the nuclear weapons complex.

High Explosives Technology

Modern nuclear weapons rely on high explosives for their operation. Because explosives detonation occurs at intervals of about a millionth of a second, testing requires specialized high-speed optical, electrical, and other diagnostics capabilities. Once small quantities of new explosives have been developed and tested, larger quantities must be produced and tested to determine the hydrodynamic effects--that is, how the explosives react with other materials within a weapon and whether the desired performance characteristics are achieved. Hydrodynamic

tests require special equipment, such as high-speed optical diagnostic equipment and radiographic diagnostic equipment. Radiographic diagnostic equipment allows researchers to obtain an x-ray picture of the inside of the exploding device.

The current emphasis on improved nuclear weapons safety has resulted in more research and development of insensitive high explosives (IHE). The IHE effort requires first developing new IHE molecules that contain the required insensitivity and energy and then developing quantities sufficient for testing. Both Los Alamos and Livermore are capable of developing and performing hydrodynamic testing on IHE, and both have a full range of diagnostic techniques to accomplish this testing.

However, each laboratory is investigating different molecules. Each laboratory also uses different diagnostic techniques and facilities to obtain data necessary to further the design. For example, Los Alamos is developing explosive compounds with a high nitrogen content, while Livermore is pursuing the development of paste explosives. Each laboratory's particular approach to designing these explosives determines the types of diagnostic tools that will be needed to evaluate the explosives' performance.

Associated capabilities, such as the development and testing of detonators, are also required. A large number of detonators must be manufactured and statistically tested to determine their reliability. Both laboratories design detonators. Los Alamos fabricates its own detonators for testing, while Livermore obtains its detonators for testing primarily from DOE's Mound plant or commercially if available. As for the explosives needed for testing, both laboratories design explosives. Los Alamos fabricates large quantities of explosives. Livermore has limited fabrication capabilities and often obtains the necessary quantities of explosives from DOE's Pantex Plant.

Weapons Engineering and Testing

Weapons engineering involves furthering the development of a nuclear weapon from design to production. To do so, components and subsystems must be assembled and tested to ensure that the weapon can withstand the environmental stresses it could undergo throughout its stockpile life and enroute to its target.

Both laboratories design, analyze, and assemble components and conduct environmental tests. Both laboratories have environmental testing facilities that subject components and subsystems to a variety of environmental conditions, such as temperature, shock, and vibration. Although both laboratories have environmental facilities, they both use the Sandia environmental testing facilities for some aspects of full-scale environmental testing.

Nuclear Testing

Calculations and laboratory experiments alone cannot adequately predict everything that occurs in nuclear weapons explosions. These explosions occur not only at temperatures and pressures exceeding those of the sun but also in reaction times on the order of less than a millionth of a second. Nuclear tests, conducted underground at the Nevada Test Site, provide data to detect problems that calculations and non-nuclear laboratory experiments cannot.

Diagnostic equipment must be designed to obtain data on various types of radioactive emissions from a nuclear explosion in the millionths of a second before the equipment is destroyed. After the tests, the radioactive remnants are extracted, taken back to the laboratory, and examined to help determine the weapon's yield and other characteristics.

Both Los Alamos and Livermore conduct tests at the Nevada Test Site and design diagnostic equipment to obtain the data necessary to further their weapons designs. As with hydrodynamic testing, each laboratory's particular design approach determines the specific types of diagnostic tools needed to evaluate the weapon's performance. Both laboratories employ a wide range of diagnostic techniques to evaluate weapon performance. In general, Los Alamos emphasizes data obtained from neutron emissions, while Livermore emphasizes data obtained from x-ray emissions. Both laboratories have the capability to examine the radioactive remnants of the nuclear explosions.

Because of decreased resources for underground testing and the potential for nuclear test restrictions, both laboratories have increasingly emphasized, above-ground non-nuclear laboratory testing. Although above-ground testing cannot supplant underground testing, it can provide experimental data to help compensate for reduced underground testing.

FUNDING AND STAFFING PROFILES

Los Alamos, Livermore, and Sandia were formed essentially to ensure excellence in the nation's nuclear weapons capabilities. Nuclear weapons RD&T and related programs, such as Inertial Confinement Fusion and Verification and Arms Control Technology, currently account for about half of the laboratories' funding. However, the laboratories have become multipurpose, with a wide variety of funding sources, including other DOE programs such as Energy Research, as well as other federal agencies, primarily the Department of Defense. (Detailed funding and staffing data for the three laboratories are contained in app. II.)

Over the past few years, total laboratory funding has decreased slightly at Los Alamos and Sandia and increased slightly at Livermore. However, in the past few years, funding for the RD&T program has decreased at all laboratories. (See app. II, fig.II.1) This has led the laboratories to seek alternate means of maintaining RD&T program capabilities. Thus, the RD&T program is now supported by other programs in DOE, DOD, and other government agencies.

In addition, the RD&T program is shrinking relative to the total laboratory budget. In 1983, RD&T formed 45 and 40 percent of Los Alamos' and Livermore's total budgets, respectively. By 1991, these percentages had declined to 30 and 29 percent.

Total laboratory staffing for 1991 was approximately 7,600 full-time-equivalents (FTEs) at Los Alamos and 7,900 at Livermore. As with funding, the number of staff directly supporting RD&T has declined since 1983. (See app. II, fig.II.2) In 1983, Los Alamos had about 1,700 FTEs and Livermore about 1,580 FTEs directly supporting RD&T. By 1991, Los Alamos had 1,280 FTEs and Livermore about 1,150 FTEs directly supporting RD&T. However, many laboratory staff who work on RD&T projects also work on other projects.

Over the past few years, total laboratory funding has decreased slightly at Los Alamos and increased slightly at Livermore. Over the last few years, Sandia has also experienced RD&T funding and staffing reductions, along with a reduction in total funding.

LABORATORY AND DOE CONSOLIDATION OPTIONS

With the world's changing political situation, and with progress in arms control negotiations, the number of nuclear weapons required in the stockpile is decreasing. To respond to these recent changes, DOE and laboratory officials believe that the national RD&T program will shift into new areas, including designing and testing safer, more secure weapons and supporting increased arms control and verification activities. In addition, DOE and the laboratories are pursuing several initiatives to modify both laboratory structure and missions to maintain technical capabilities at the laboratories.

In May 1991, recognizing that the future nuclear RD&T budget will be austere, DOE convened a Weapons Research, Development and Testing Consolidation Working Group, which was recommended by a larger DOE study of ways to reconfigure the entire nuclear weapons complex. The group included DOE officials and representatives of Los Alamos, Livermore, and Sandia, who provided technical assistance, as well as representatives from outside of DOE. The primary objective of the working group was to identify options that would help DOE satisfy essential RD&T

and production requirements while minimizing the costs to operate and modernize the RD&T portion of the nuclear weapons complex. A second major objective was to identify the extent to which independent peer review requires duplicative facilities and capabilities, as opposed to common resources shared by multiple working groups.

In August 1991, the laboratories recommended that even though laboratory independence should be maintained with regard to RD&T, consolidation in many areas should be examined. The laboratories' analysis estimated that $50 million to $100 million in annual operating costs could be saved within 3 to 5 years by consolidating components of selected RD&T functions related to plutonium, tritium, high explosives development and testing, and nuclear testing. A 1991 study anticipated that the consolidation of test and support operations at the Nevada Test Site will result in an estimated annual savings of up to $20 million.

As a result of these findings, DOE is currently studying consolidation alternatives and associated costs and savings in three major areas: plutonium, tritium, and hydrodynamic testing. Consolidation options include moving Livermore's plutonium activities to Los Alamos and consolidating tritium functions at Los Alamos and DOE's Savannah River Site.

During our work, we noted however, that the potential costs of consolidation have yet to be determined. For example, consolidating plutonium and tritium operations in fewer locations will involve capital costs for construction and equipment. In addition, DOE and the laboratories have noted that these costs may or may not be offset over time by decreased operating costs and that there are potential costs associated with decommissioning and decontaminating facilities being vacated.

In another effort to review the potential for consolidating facilities, DOE recently established an ad hoc panel of experts to review the future direction of one of the critical components of the nuclear weapons program--hydrodynamic testing. On the basis of information from the panel, DOE officials decided not to consolidate hydrodynamics testing at this time. However, DOE has asked Los Alamos to incorporate the diagnostics that Livermore needs into the design of a Los Alamos enhanced hydrodynamic test facility that is currently being designed, thus allowing for the potential for future joint use of the Los Alamos facility.

Both laboratories agree that there is potential for increased use of shared facilities and that future costs could be avoided by not constructing duplicative facilities. Each laboratory estimates that it will need over $1 billion to maintain its infrastructure and build new facilities over the next 20 years. However, for a single facility to meet the needs of the different approaches used by each laboratory's scientists,

the facility would need to be jointly designed by both laboratories.

The laboratories believe that while it is valuable to pursue the annual savings to be gained through consolidation, these savings will be small in relationship to the funds needed for the entire nuclear weapons complex. They also believe that further funding cuts and consolidation are not possible without affecting the essential character and independence of at least one of the laboratories and that further severe funding cuts would cause irreparable damage to the nation's nuclear competence. According to Los Alamos officials, a reduction of 25 percent of the total nuclear weapons RD&T budget (which includes the budgets for Los Alamos, Livermore, Sandia and the Nevada Test Site) would diminish capabilities so much that the current two-laboratory structure for weapons design could not be effectively sustained.

To help maintain the existing laboratory infrastructure despite the expected decline in RD&T funding, the laboratories believe that their role should be expanded beyond nuclear weapons RD&T. The laboratories believe they should have an increased role in designing manufacturing processes for DOE's Complex 21 initiative, which involves the design and construction of the future nuclear weapons complex. Finally, the laboratories believe they should have an increased role in waste management research. According to Los Alamos officials, new and more efficient waste management and manufacturing processes developed by the laboratories could eventually reduce the nuclear weapons complex's estimated $12 billion annual operating budget for atomic energy defense activities significantly. DOE and laboratory officials have begun discussing ways in which the laboratories' missions could be expanded to include such areas.

Los Alamos and Livermore officials believe that the current two-laboratory structure for design efforts has enormous benefits in the areas of competitive innovation and peer review, where there is no source of expertise outside of the laboratories. According to Los Alamos and Livermore officials, the laboratories have recently strengthened their inter-laboratory peer review process in response to the projected smaller stockpile, the reduced number of nuclear tests, and the need for assured safety and security.

While Los Alamos officials strongly prefer to maintain the current two-laboratory RD&T structure and to broaden the laboratories' mission to include Complex 21 and waste management issues, they have conducted preliminary studies on alternative configurations. If further RD&T funding cuts prevent continuance of the two-laboratory structure, they believe the following alternative configurations could maintain technical excellence in the nuclear weapons program:

-- Under the first alternative, both laboratories would continue to design weapons, but only one would engineer and test them. This alternative would maintain the current benefits of peer review and competition between Livermore and Los Alamos designers. The laboratory responsible for design, engineering, and testing would need a full array of facilities. Los Alamos officials estimate that this alternative approach would save from $150 million to $200 million a year in annual operating costs. However, the costs of relocating necessary staff and capabilities have not been studied.

-- The second alternative would use the experience of the French nuclear weapons laboratories as a model. Under the French structure, competition and peer review exist under a single program for nuclear weapons design. According to Los Alamos officials, their own experience with two independent design teams, to study alternative design safety approaches, has shown that this concept could work in some instances.

-- The third alternative would use the experience of the British Atomic Weapons Establishment as a model. The British have the option of using American design laboratories for competition and peer review. Los Alamos officials advanced the idea that, with a considerable relaxation of current limitations on exchanging information among national programs, a single American design laboratory could depend on the French and British laboratories for peer review and intellectual competition.

Livermore officials believe that maintaining the laboratories' scientific independence would be difficult in the face of extensive consolidation and severe funding cuts, which reduce the scope and capability of the RD&T program. Los Alamos officials believe that if RD&T funds continue to decrease and if no restructuring occurs, then laboratory capabilities will so erode that both Los Alamos and Livermore will become mediocre laboratories.

This concludes my prepared statement, Mr. Chairman. I would be pleased to answer any questions the Committee might have.

Weapon RD and T Capabilities

I. NUCLEAR DESIGN

Nuclear Design

- Primary Design
  - High Explosive Systems/Hydrodynamics
  - Neutronics
  - Burn and Boost
  - Codes and Code Development
  - Experimental Hydrodynamics
    - Devices
    - Test Facilities
    - Design
  - Radiation Transport
  - Equation of State for Weapon Materials
- Secondary Design
  - Radiation Transport
  - Opacity
  - Plasma Physics
  - Hydro and Instability
  - Thermonuclear Burn

Physics Laboratories

- Accelerators
- Other Facilities

Computations

- Computers (Mainframes and Operating Systems)
- Architecture and Computational Methods
- Device and Weapons Engineering

II. MATERIALS RESEARCH AND FABRICATION

Plutonium

- Metallurgy
- Part Fabrication
- Advanced Development Support
- Weaponization Program Support
- Processing/Waste Stream Control
- Stockpile Assessment
- Special Isotope Separation

Tritium

- Research and Development
- Test Program Support
- Gas Transfer System (Weapons)
- Materials Compatibility

Uranium

- Metallurgy
- Part Fabrication
- Processing/Manufacturing
- Waste Stream Control
- AVLIS
- Weaponization Program Support

Other Weapons Materials Activities

- Metal
- Plastics and Composites

III. HIGH EXPLOSIVES TECHNOLOGY

- Formulation
- Synthesis
- Detonation Properties/Characterization
- Processing/Machining
- Test Firing
- Detonators
- Actuators

IV. WEAPONS ENGINEERING

Weapons Engineering

- Engineering Design
- Production
- Stockpile Management
- Stockpile Surveillance
- Telemetry Systems

Weapons Testing

- Temperature
- Vibrations and Shock
- Aging
- Other

V. NUCLEAR TESTING

Nuclear Test

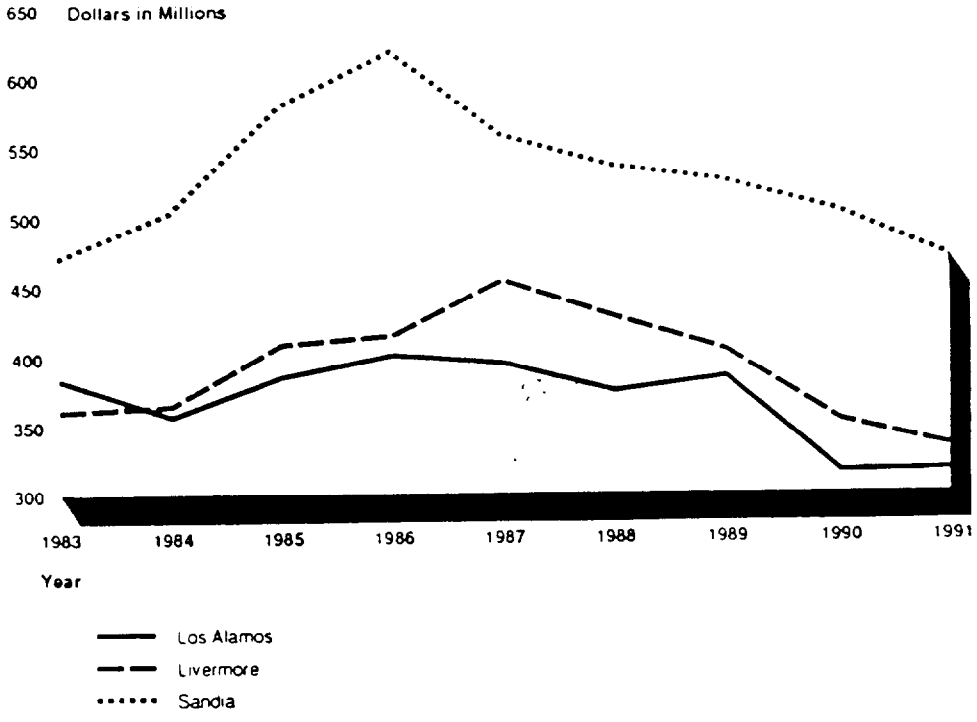
- Diagnostic Design Development
- Radiochemistry

- Nuclear Test Engineering
- Containment Evaluation
- Field Evaluation
- Emplacement Operations

Nuclear Effect Simulation Facilities

LABORATORY STAFFING AND FUNDING

Figure II.1: Research, Development, and Testing Funding Levels, 1983-1991



LABORATORY STAFFING AND FUNDING

Figure II.2: Research, Development, and Testing Staffing Levels, 1983-1991

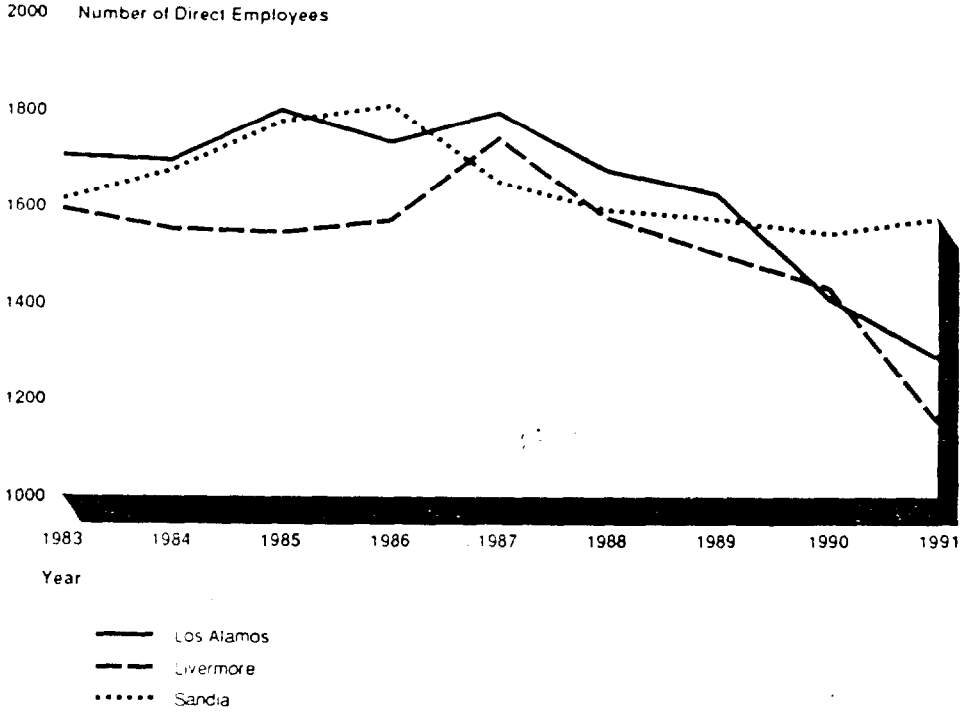


Table II.1: Los Alamos National Laboratory Funding and Staffing for Fiscal Year 1991

Funding and Staffing Category	Costs ($ in millions)	% of Total	Staff (in FTEs)	% of Total
Defense Programs				
Research, Development, and Test	316.4	30.2%	1283	17.0%
All Other Defense Programs[a]	182.3	17.5%	816	10.8%
Subtotal Defense Programs	498.7	47.8%	2099	27.8%
Other Department of Energy Funding				
Energy Research	117.0	11.2%	551	7.3%
Environmental Restoration	92.3	8.8%	307	4.1%
Nuclear Energy	20.1	1.9%	92	1.2%
Intelligence	18.3	1.8%	18	.2%
New Production Reactor	17.0	1.6%	63	.8%
Civilian Radioactive Waste	15.5	1.5%	61	.8%
Conservation and Renewable Energy	12.1	1.2%	53	.7%
Environment, Safety, and Health	4.0	.4%	22	.3%
Fossil Energy	1.0	.1%	4	.1%
Human Resources Mgmt and Administration	.6	.1%	0	0.0%
Policy, Planning, and Analysis	1.0	.1%	6	.1%
Subtotal Other DOE	298.9	28.6%	1177	15.6%
Reimbursables				
Department of Defense	159.0	15.2%	518	6.9%
Other DOE Installations	42.0	4.0%	146	1.9%
Nonfederal	17.0	1.6%	58	.9%
Other	16.0	1.5%	160	2.1%
Nuclear Regulatory Commission	2.0	.2%	10	.1%
Subtotal Reimbursables	236.0	22.6%	902	11.9%

Funding and Staffing Category	Costs ($ in millions)	% of Total	Staff (in FTEs)	% of Total
Other Miscellaneous and Indirect Sources				
General Plant Projects	10.6	1.0%	[b]	[b]
Overhead Personnel	[b]	[b]	1957	26.0%
Support	[b]	[b]	1283	17.0%
Construction and Operations Capitalized	[b]	[b]	147	1.9%
Subtotal Miscellaneous & Indirect	10.6	1.0%	3387	44.8%
Total Lab	1044.0	100.0%	7565	100.0%

[a]All other Defense Programs includes Inertial Confinement Fusion, Production and Surveillance, Program Direction, Verification and Arms Control Technology, Nuclear Safeguards and Security, Materials Production, and Defense Waste and Environment.

[b]Information accounted for in other categories.

Source: Extracted from Los Alamos Institutional Plans and operating statements. We did not independently verify these data.

Table II.2: Lawrence Livermore National Laboratory Funding and Staffing for Fiscal Year 1991

Funding and Staffing Category	Cost (dollars in Millions)	% of Total	Staff (in FTEs)	% of Total
Defense Programs				
Research, Development, and Test	$332.8	28.6%	1147	14.5%
All Other Defense Programs[a]	172.8	14.9%	621	7.9%
Subtotal Defense Programs	505.6	43.5%	1768	22.4%
Other Department of Energy Funding				
Nuclear Energy	135.6	11.7%	385	4.9%
Energy Research	82.9	7.1%	365	4.6%
Environmental Rest. and Waste Mgmt.	50.9	4.4%	154	1.9%
Civilian Radiation Waste	33.0	2.8%	55	.7%
Chief Financial Officer	.4	< .1%	2	< .1%
Intelligence	8.6	.7%	31	.4%
Fossil Energy	5.5	.5%	40	.5%
Security Affairs	3.0	.3%	12	.2%
Environment, Safety, and Health	3.5	.3%	9	.1%
Conservation and Renewable Energy	2.5	.2%	6	.1%
Policy, Planning, and Analysis	.3	< .1%	1	< .1%
Admin. and Human Resource Mgmt.	.3	< .1%	0	0.0%
Space	.1	< .1%	0	0.0%
Subtotal Other DOE	326.4	28.1%	1060	13.4%
Work for Other/Reimbursables				

APPENDIX II

Funding and Staffing Category	Cost (dollars in Millions)	% of Total	Staff (in FTEs)	% of Total
Department of Defense	253.3	21.8%	617	7.8%
Other DOE Installations	50.8	4.4%	174	2.2%
Other	8.1	.7%	28	.4%
NASA	5.4	.5%	19	.2%
Nuclear Regulatory Commission	3.8	.3%	13	.2%
Other Federal Agencies	2.4	.2%	8	.1%
Subtotal Work For Others	323.8	27.8%	859	10.9%
Other Miscellaneous and Indirect Sources				
General Plant Projects	7.3	.6%	[b]	[b]
Indirect Personnel	[b]	[b]	4111	52.1%
Department of Energy Capital	[b]	[b]	100	1.3%
Subtotal Misc. & Indirect	7.3	.6%	4211	53.3%
Total Lab	$1,163.0	100.0%	7898	100.0%

[a]All other Defense Programs include Inertial Confinement Fusion, Production and Surveillance, Program Direction, Verification and Control Technology, Safeguards and Security, Atmospheric Release Advisory Capability, and Materials Production.

[b]Information accounted for in other catergories.

Source: Extracted from Lawrence Livermore Institutional Plans. We did not independently verify these data.

Table II.3: Sandia National Laboratories Funding and Staffing For Fiscal Year 1991

Funding and Staffing Category	Costs (dollars in millions)	% of Total	Staff (in FTEs)	% of Total
Defense Programs				
Research, Development, and Test	$469.1	38%	1575	18.3%
All Other Defense Programs[a]	252.3	20.4%	987	11.5%
Subtotal Defense Programs	721.4	58.4%	2562	29.8%
Other Department of Energy Funding				
Environmental Rest. and Waste Mgmt.	58.1	4.7%	179	2.1%
Conservation and Renewable Energy	32.6	2.6%	117	1.4%
Energy Research	26.8	2.2%	108	1.3%
Civilian Radioactive Waste	26.3	2.1%	91	1.1%
Fossil Energy	8.6	.7%	42	.5%
New Production Reactors	5.4	.4%	28	.3%
Nuclear Energy	5.1	.4%	12	.1%
Subtotal Other DOE	162.9	13.2%	577	6.7%
Work Other Than for DOE/Work for Others				
Department of Defense	274.8	22.3%	917	10.7%
Other Federal Agencies	24.1	2%	103	1.2%
Other DOE Installations	14.4	1.2%	52	.6%
All Other	14.3	1.2%	40	.5%
Nuclear Regulatory Commission	13.9	1.1%	54	.6%
Subtotal Work For Other	341.5	27.7%	1166	13.6%
Other Miscellaneous and Indirect Sources				
General Plant Projects	8.8	.7%	[b]	[b]
Indirect Personnel	[b]	[b]	3074	35.7%
Direct Support	[b]	[b]	1221	14.2%
Subtotal Misc. & Indirect	8.8	.7%	4295	50.0%

Total Lab	$1,235.0	100.0%	8600	100.0%

[a]All other Defense Programs include Inertial Confinement Fusion, Production and Surveillance, Program Direction, Verification and Control Technology, Nuclear Materials Safeguards and Security, and Defense Waste.

[b]Information accounted for in other categories.

Source: Extracted from Sandia Institutional Plans. We did not independently verify these data.

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