

Chapter 39

# Federal Research and Development in Pennsylvania

- Approximately \$2.3 billion of federal R&D funds are spent each year in Pennsylvania.
- Pennsylvania ranks 12th among the 50 states, District of Columbia, and Puerto Rico in terms of the amount of federal R&D dollars received annually.
- Approximately 10 percent of all federal funds spent in Pennsylvania each year on matters other than the direct support of individuals (i.e., such entitlements as retirement, disability, and housing assistance) is spent on R&D.

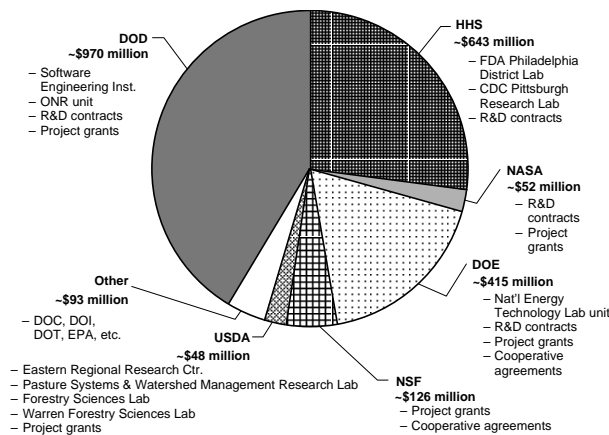


Figure 39.1 – Sources of Federal R&D Dollars Spent in Pennsylvania (Total Federal R&D ~\$2.3 billion)

## BACKGROUND

In recent years, the federal government has spent in the neighborhood of \$2.3 billion annually in Pennsylvania on research and development (R&D) activities. On average, federal R&D dollars account for approximately 10 percent of all federal funds spent in Pennsylvania each year on matters other than the direct support of individuals (i.e., such entitlements as retirement, disability, and housing assistance).

Most major federal agencies that currently support federal R&D efforts provide funding for R&D activities in Pennsylvania. Foremost among these agencies are the Departments of Defense (DOD), Health and Human Services (HHS), and Energy (DOE) which account for 41, 27, and 18 percent of all federal R&D dollars spent in the state, respectively. The National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Department of Agriculture (USDA) account for an additional 5, 2, and 2 percent of the federal R&D dollars spent in Pennsylvania, respectively. The remaining federal R&D dollars come collectively from the Departments of Commerce (DOC) and Interior (DOI) and several other federal agencies.<sup>39</sup>

All federal R&D dollars spent in Pennsylvania either cover the costs of operating federal R&D units in the state, including paying the salaries of federal R&D personnel working at these units, or are awarded as grants, contracts, or cooperative agreements to entities in the state. The following is an overview of what becomes of these federal R&D dollars once they arrive in Pennsylvania.

## FEDERAL R&D UNITS IN PENNSYLVANIA

Lemoyne, Pennsylvania, is home to DOI's Pennsylvania District Office of Water Resources.

- The Pennsylvania District Office of Water Resources is a unit of DOI's U.S. Geological Survey (USGS). It oversees the R&D activities of USGS's National Water-Quality Assessment

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<sup>39</sup> For a complete agency-by-agency breakdown of these R&D dollars, see Appendix C.

(NAWQA), Ground-Water Resources Assessment, Toxic Substances Hydrology, and Federal State Cooperatives programs. The NAWQA program conducts research on the nation's surface and groundwater resources to better understand the effect of pesticides, erosion, and bacterial contamination on water quality. The Ground-Water Resources Assessment program studies groundwater systems to develop models and simulations to better understand the workings of these systems. The Toxic Substances Hydrology program studies the behavior of toxic substances in hydrologic environments. These research activities investigate subsurface contamination at local releases and aquatic ecosystem contamination on a watershed and regional scale. The Federal State Cooperatives program studies the effects of agricultural chemicals, floods, droughts, and waste disposal on water supply and groundwater quality. This federal unit annually receives approximately \$2 million in federal R&D funds.

Newtown Square, Pennsylvania, is home to USDA's Forestry Sciences Laboratory.

- The Forestry Sciences Laboratory is a unit of the Northeastern Research Station inside USDA's Forest Service. It conducts research on forest ecosystem management. Specific research activities of this lab include developing quantitative methods to monitor the response of northeastern forest ecosystems to management and environmental stresses, looking at tree responses to interacting biotic and abiotic stressors, and developing management practices to sustain and improve the health and productivity of northeastern forests. This federal R&D unit annually receives approximately \$4.8 million of federal R&D funds and has about 50 employees.

Philadelphia, Pennsylvania, is home to a unit of DOD's Office of Naval Research, HHS's Philadelphia District Laboratory, and a Department of Veterans Affairs (DVA) R&D unit.

- The R&D Management Command is a unit of the Office of Naval Research (ONR) inside DOD. ONR is headquartered in

Arlington, Virginia, and provides R&D managers to oversee the extramural R&D programs of the Navy and Marine Corps performed by universities, nonprofit organizations, or for-profit companies. ONR sponsors extramural R&D programs in information, electronics, and surveillance; ocean, atmosphere, and space; engineering, materials, and physical science; human systems; and naval expeditionary warfare. This federal unit annually receives approximately \$779,000 of federal R&D funds to support the in-house management activities of about 10 full-time equivalent employees (FTEs).

- The Philadelphia District Laboratory is a unit of HHS's Food and Drug Administration. It conducts research on the safety and efficacy of human drugs. This federal unit annually receives approximately \$407,000 of federal R&D funds and has about five FTEs directly involved in R&D activities.
- While the principal focus of the Philadelphia VA Medical Center is providing medical care to veterans, it is also the location of a number of research activities. In a recent year, this federally owned and operated facility was the site of 270 projects with total funding of approximately \$4 million. These R&D activities focus on a wide range of topics, including substance abuse treatment and rheumatology-immunology.

Pittsburgh, Pennsylvania, is home to DOD's Software Engineering Institute, HHS's Pittsburgh Research Laboratory, DOE's National Energy Technology Laboratory–Pittsburgh, DOI's Pennsylvania Cooperative Fish and Wildlife Research Unit, and a DVA R&D unit.

- The Software Engineering Institute is a federally funded research and development center (FFRDC) sponsored by the Office of the Under Secretary of Defense for Acquisition and Technology and operated by Carnegie Mellon University. It focuses exclusively on advancing the practice of software engineering because software is such a critical part of U.S. defense systems. It seeks to ensure that operational software in software-intensive systems, be they defense or nondefense systems, is of the highest

quality possible. Specific R&D activities of the institute focus on management practices of software producers, especially as they affect quality and productivity, and on the technical practices of the industry as they affect the ability of software engineers to understand and control the functional and nonfunctional aspects of software systems. This federally owned and contractor-operated unit annually receives approximately \$38 million of federal R&D funds and has about 400 employees.

- The Pittsburgh Research Laboratory is a unit of the National Institute of Occupational Safety and Health (NIOSH) inside HHS's Centers for Disease Control and Prevention (CDC). It conducts research to promote the health and safety of miners by investigating ways to reduce dust and noise in the mine environment and improving the safety of explosives and blasting practices. Specific research activities of this unit include developing a coal combustion-sensitive test for smoke detectors, studying ways to detect and control spontaneous heating in coal mine pillars, and studying the performance of automatic sprinklers for extinguishing belt fires under ventilated conditions. This federal R&D unit annually receives approximately \$18.4 million in federal R&D funds and has about 228 FTEs.
- The National Energy Technology Laboratory–Pittsburgh, formerly a part of the Federal Energy Technology Center, is a unit of DOE. It is affiliated with the National Energy Technology Laboratory–Morgantown in West Virginia. It develops technologies related to coal, oil, and natural gas (i.e., fossil energy) and environmental cleanup. Specifically, the laboratory focuses on advancing the commercialization of pollution-reduction technologies, the more efficient use of fossil fuels, and developing technologies to clean up DOE-managed and -generated waste. While the laboratory maintains a modest in-house R&D capability, most of its staff oversees extramural R&D projects conducted with federal R&D funds. This federal laboratory annually receives approximately \$87 million of total funds, only about \$11 million of which is spent on R&D activities conducted on-site. The laboratory has about 143 employees.

- The Pennsylvania Cooperative Fish and Wildlife Research Unit is part of DOI's USGS. It is on the campus of Pennsylvania State University. It conducts research on fish and wildlife populations. Specific research activities of this unit include studies of deer populations and the effects of agricultural activities on trout streams. This federal R&D unit annually receives approximately \$203,000 of federal R&D funds and has about two FTEs.
- While the principal focus of the VA Medical Centers in Pittsburgh is providing medical care to veterans, they are also the location of a number of research activities. In a recent year, these federally owned and operated facilities were the site of 236 projects with total funding of approximately \$3 million. These R&D activities focus on a wide range of topics, including schizophrenia, sleep and cognitive disorders, aging, alcoholism, nephrology, oncology, urology, and vascular surgery.

University Park, Pennsylvania, is home to USDA's Pasture Systems and Watershed Management Research Laboratory.

- The Pasture Systems and Watershed Management Research Laboratory is a unit of USDA's Agricultural Research Service (ARS) located on the campus of Pennsylvania State University. It conducts research to develop land, water, and plant management systems to preserve the quality of ground and surface waters in the Northeast and to ensure that crop production and grazing can be sustained profitably. Specific research activities of this unit include developing technology to reduce off-frame inputs of feed, fuel, and chemicals and identifying the effects of land management on water quality and quantity. This federal R&D unit annually receives approximately \$3.2 million of federal R&D funds and has about six FTEs.

Warren, Pennsylvania, is home to the USDA's Warren Forestry Sciences Laboratory.

- The Warren Forestry Sciences Laboratory is a unit of the Northeastern Research Station inside USDA's Forest Service. It con-

ducts research on ecosystem management. Specific research activities of this lab include studying regeneration and forest renewal and investigating the sugar maples in the Allegheny Plateau forests. This federal R&D unit annually receives approximately \$950,000 of federal R&D funds and has about 16 employees.

Wellsboro, Pennsylvania, is home to DOI's Research and Development Laboratory.

- The Research and Development Laboratory is a unit of the Leetown Science Center inside DOI's USGS. It conducts research on the restoration of depleted fisheries and other aquatic biological resources. Specific research activities of this unit include developing information and technology to better understand the aquatic ecosystems in the northeastern United States. Recently, this has included developing the National Fish Broodstock Database and enhancing the feeding ecology of double-crested cormorants in Lake Ontario. This federal R&D unit annually receives approximately \$955,000 of federal R&D funds and has about 19 FTEs.

Wyndmoor, Pennsylvania, is home to USDA's Eastern Regional Research Center.

- The Eastern Regional Research Center is a unit of USDA's ARS. It consists of seven research divisions—the Dairy Products Research Laboratory; the Engineering Science Research Laboratory; the Food Safety Research Laboratory; the Hides, Lipids and Wool Research Laboratory; the Microbial Food Safety Research Laboratory; the Plant Science and Technology Research Laboratory; and the Plant-Soil Biophysics Core Technologies Laboratory. The center conducts research on agricultural commodities, including milk, meat, hides, leather, wool, fats, oils, fruits, vegetables, and juices, to ensure food quality and safety. Specific research activities of this center include biophysical and biochemical research on the use of soil fungi for plant nutrient uptake and on the development of biosensors for detect-

ing pathogenic bacteria in food, developing technology to lower costs for feedstock, and developing technology in ethanol production that will improve competitiveness of ethanol as a fuel or fuel additive. This federal R&D unit annually receives approximately \$22.3 million of federal R&D funds and has about 215 FTEs.

Coatesville and Lebanon, Pennsylvania, are home to VA Medical Centers. While the principal focus of these federally owned and operated facilities is providing medical care to veterans, each center is also the location of a number of research activities. In a recent year, these federally owned and operated facilities were the site of 58 R&D projects with total funding of less than \$300,000. These R&D activities focus on a wide range of topics, including diabetes, Alzheimer's disease, congestive heart failure, and substance abuse.

#### FEDERAL R&D GRANTS TO PENNSYLVANIA ENTITIES

Every major institution of higher education in Pennsylvania is the recipient of significant federal R&D dollars each year through grants made by federal agencies to faculty, graduate students, and research centers. The vast majority of the R&D grants are made by HHS, NSF, and DOD to individual faculty members and therefore ultimately inure to the benefit of such institutions as the University of Pennsylvania (U of Penn), Pennsylvania State University (PSU), the University of Pittsburgh (Pitt), Thomas Jefferson University (TJU), MCP Hahnemann University (formerly Allegheny University of the Health Sciences) (MCPHU), Temple University, Carnegie Mellon University (CMU), Lehigh University, and Villanova University. The table below shows the total number of R&D grants that were active in FY 1998, highlighting those made by HHS, NSF, and DOD to parties at the various institutions and estimates of the total dollars transferred to them in FY 1998 pursuant to the terms of these grants. Among the grants in the "Other Agencies" category going to PSU are \$9 million from USDA, \$6 million from NASA, \$4 million from DOE, and \$3 million from the Environmental Protection Agency (EPA). Almost all of the grants in

**Table 39.1 – Sources of Federal R&D Grants to Higher Education in Pennsylvania**

Institution	HHS		NSF		DOD		Other Agencies		Total	
	Amount	#	Amount	#	Amount	#	Amount	#	Amount	#
U of Penn	\$245M	1,010	\$13M	214	\$9M	46	\$10M	83	\$277M	1,353
PSU	\$30M	185	\$24M	444	\$19M	112	\$25M	538	\$98M	1,279
Pitt	\$167M	664	\$13M	208	\$8M	32	\$4M	51	\$192M	955
TJU	\$56M	262	\$1M	7	<\$1M	2	<\$1M	3	\$57M	274
MCPHU	\$34M	185	\$1M	7	\$1M	4	<\$1M	5	\$36M	201
Temple	\$24M	121	\$2M	29	\$1M	2	\$1M	17	\$27M	169
CMU	\$9M	63	\$23M	253	\$11M	52	\$8M	65	\$51M	433
Lehigh	\$1M	9	\$3M	81	\$4M	19	\$1M	14	\$9M	123
Villanova	<\$1M	2	\$1M	10	\$1M	4	<\$1M	14	\$2M	30
Other	\$7M	57	\$7M	159	\$4M	9	\$2M	49	\$21M	274
<b>Total</b>	<b>\$573M</b>	<b>2,558</b>	<b>\$88M</b>	<b>1,412</b>	<b>\$57M</b>	<b>282</b>	<b>\$53M</b>	<b>839</b>	<b>\$771M</b>	<b>5,091</b>

this same category going to U of Penn (\$8 million of the \$10 million) are from DOE.

These activities are particularly significant because they fund much of the “basic research” so critical to expanding our knowledge and understanding of fundamental scientific phenomena. In addition, these funds account for a substantial portion of the dollars available each year to various academic departments within these institutions, such as the Medical School at the U of Penn.

Several other nonacademic institutions in Pennsylvania also receive a significant amount of federal R&D grants each year. Foremost among the institutions that received R&D grants in FY 1998 are Children’s Hospital of Philadelphia (\$34 million), Milton S. Hershey Medical Center in Hershey (\$29 million), Fox Chase Cancer Center in Philadelphia (\$28 million), Wistar Institute in Philadelphia (\$17 million), and Concurrent Technologies Corporation of Harrisburg, Johnstown, Pittsburgh, and West Chester (\$11 million).

Scattered among these grants, as well as among the contracts discussed in the section below, are small business innovative research (SBIR) awards. These are special awards made by the SBIR programs supported by the 10 federal agencies with annual budgets for extra-

mural R&D of more than \$100 million. In a recent year, small businesses in Pennsylvania received 154 SBIR awards totaling \$41 million. Examples include a \$600,000 award from DOD (Navy) to Unistry Associates, Inc., in Havertown for work on protection of Naval computers from denial-of-service attacks and a \$250,000 award from the Department of Education to Dancing Dots Braille Music Technology in Upper Darby for work on the conversion of Score™ files to music Braille.

Also included among these grants are formula grants from federal agencies. Formula grants differ from the much more common project grants in that the money transmitted through formula grants is allocated to a state or one of its subdivisions in accordance with a distribution formula prescribed by law or regulation. Among the formula grants benefiting Pennsylvania are ones valued at more than \$6.1 million from USDA's Cooperative State Research, Education, and Extension Service (CSREES) going to State Agricultural Experiment Stations, forestry schools, and veterinary colleges for the support of research in agriculture, forestry, and animal health and disease. Similarly, a modest formula grant goes from DOI's USGS to the Water Resources Research Institute in Pennsylvania every year to foster research in water and water-related problems.

#### OTHER FEDERAL R&D ACTIVITIES IN PENNSYLVANIA

Several entities in Pennsylvania also receive notable sums in the form of contracts or cooperative agreements from federal agencies for specific R&D efforts. By far, the majority of these funds go in the form of contracts from DOD to Boeing-Sikorsky and the Pennsylvania-based divisions of Lockheed Martin, which in FY 1998 received \$199 million and \$64 million, respectively, in contracts for R&D work on the Comanche helicopter. Note that both companies also receive a significant amount of funds from DOD for non-R&D work on this project. In addition, Concurrent Technologies Corporation received \$82 million of R&D contracts from federal agencies in FY 1998. Note that these amounts are in addition to the federal R&D grants also received by Concurrent Technologies Corporation. Pennsylvania-based units of

United Defense and General Electric also received \$37 million and \$30 million, respectively, in federal R&D contract funds in FY 1998. CMU, U of Penn, and PSU also received contracts from various federal agencies to conduct R&D for the federal government, which totaled several million dollars for each university. Although these amounts are notable, they do not come close to eclipsing the funds that these institutions receive from federal R&D grants.

A total of \$160 million of federal R&D dollars in the form of cooperative agreements was also received in FY 1998 by entities located in Pennsylvania. By far the largest of these cooperative agreements came from DOE for a project in Allentown involving the development of power plant clean coal technology. Other parties involved in this federally supported R&D project include the city of Lakeland in Florida, Foster Wheeler Corporation, and Siemens Westinghouse Corporation. Other federal agencies awarding cooperative agreements to Pennsylvania-based entities include DOD and NSF. Among these latter cooperative agreements are awards supporting two of NSF's Science and Technology Centers—the Center for Light Microscope Imaging and Biotechnology at CMU and the Center for Research in Cognitive Science at U of Penn. In addition, Pennsylvania is home to two of NSF's Materials Research Science and Engineering Centers—the Mesoscale Interface Mapping Project at CMU and the Laboratory for Research on the Structure of Matter at the U of Penn.

