The Economic Benefits of

THE U.S. DEPARTMENT OF ENERGY

for the State of Tennessee, 2006

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THE UNIVERSITY of TENNESSEE
Center for Business and Economic Research

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Executive Summary

The operations of the U.S. Department of Energy (DOE) provide a major source of economic benefits for the state of Tennessee and its residents through the creation of jobs and income as well as expansions in state and local tax bases. DOE has a unique opportunity to help influence the economic success of the region. In order to detail and verify the benefits attributed to DOE operations, the Center for Business and Economic Research at the University of Tennessee began conducting in-depth analyses of the economic impacts of DOE payroll and non-payroll spending on the state of Tennessee in 1999 for the 1998 Fiscal Year. Subsequent analyses were conducted for Fiscal Years 1999, 2000, 2001, 2003 and 2004. The current study provides an analysis of the economic benefits for Fiscal Year 2006. The results of the current study provide evidence of DOE's role as a major contributor to the Tennessee economy.

Key findings for FY 2006 include the following:

- **Spending by DOE and its contractors contributed $3.6 billion in the state of Tennessee's state gross domestic product (SGDP) in 2006.**

- **Total personal income generated in the state of Tennessee by DOE-related activities was roughly $2.0 billion in 2006. Each dollar of income directly paid by DOE in the state translates into a total of $2.10 in personal income for Tennessee residents.**

- **DOE spending supported 44,889 full-time jobs in the state in 2006, meaning that for every one DOE job, there were 3.8 jobs created in Tennessee.**

- **DOE-related spending generated $76.9 million in state and local sales tax revenue in Tennessee in 2006.**

- **DOE operations continue to rely on a highly trained and educated workforce. In 2006, 999 employees held Ph.D. degrees, 1,757 held a Master's degree and 3,154 held a Bachelor's degree.**

- **Other DOE activities serve to improve the quality of life for Tennesseans. While some enhance the productivity of Tennessee industries and workers, others contribute to the well-being of residents in a more personal manner. For example, DOE, its contractors and their employees donated over $5.7 million in 2006.**

I. DIRECT BENEFITS OF DOE

DOE spending yields significant direct benefits for the state economy.

- **DOE and its major contractors[1] provided 11,914 full-time jobs in Tennessee in 2006 with annual wages and salaries totaling $763.2 million.**

During 2006, DOE and its major contractors employed 11,914 full-time equivalent employees living in the state of Tennessee and spent more than $763.2 million in payroll expenditures. Including pension disbursement of $217.8 million, income paid to current and former employees totaled $981.0 million. The jobs are relatively high wage jobs with an average annual salary of $64,059.

- **Total non-payroll spending (or direct procurement spending) by DOE and its contractors totaled more than $982 million in 2006.**

Acquisition of goods and services from Tennessee businesses led to non-payroll spending of more than $982 million by DOE and its contractors. Non-payroll spending generates millions of dollars in new income and supports thousands of jobs in a wide array of sectors in Tennessee's economy.

- **DOE and its contractors paid nearly $21.6 million in state and local sales taxes in 2006.**

As a result of DOE and contractor purchases of goods and services in Tennessee, $16 million and $5.6 million were directly contributed to the public coffers of state and local governments, respectively. However, this number understates the total direct benefits to tax revenues resulting from DOE operations because it excludes other forms of tax payments such as payments-in-lieu-of-taxes, and business and property taxes.

II. TOTAL ECONOMIC BENEFITS OF DOE'S DIRECT SPENDING IN TENNESSEE

DOE spending ripples through the state's economy, yielding additional benefits.

- **Tennessee's state gross domestic product (SGDP) increased almost $3.6 billion in 2006 as a result of direct, indirect and multiplier effects of DOE spending.**

[1] BWXT-Y12, LLC; UT-Battelle, LLC; Oak Ridge Associated Universities; Bechtel Jacobs Company, LLC; Wackenhut Services Inc.; DOE Office of Scientific and Technical Information (OSTI); DOE Oak Ridge Office; DOE/National Nuclear Security Administration (NNSA) Y-12 Site Office; and the Office of Secure Transportation (OST).

The total output benefit, measured by changes in SGDP from payroll and non-payroll spending by DOE and its major contractors, was $3.57 billion in the state of Tennessee in 2006. The output multiplier was 1.83, meaning that for every dollar directly spent by DOE in Tennessee, the SGDP increases by $1.83.

- **DOE activities in Tennessee gave rise to a total income benefit of $2.0 billion in the state in 2006.**

DOE's impact on personal income across the state of Tennessee totaled roughly $2.0 billion in 2006. The income multiplier was 2.10 indicating that for every dollar DOE and its contractors spent on wages, salaries and pensions, results in the creation of $2.10 in total state income.

- **DOE operations supported 44,889 full-time jobs in the state of Tennessee in 2006.**

The total spending generated in Tennessee as a result of DOE operations supported a total of 44,889 jobs in the state. This means that for every direct job provided by DOE, an additional 3.8 jobs were supported in other sectors of the state's economy. This is a relatively high implied employment multiplier that reflects the high average annual salary of DOE-related employees in the state and extensive use of contracted employees. At the same time, the estimates are lower than 2004 in part because of the new impact multipliers that are used here. (See the Appendix for a complete discussion.)

- **The total state and local sales taxes attributed to DOE operations totaled more than $76.9 million in 2006.**

DOE operations give rise to significant increases in sales tax revenue for state and local governments in Tennessee. In 2006, the total state sales tax attributed to DOE was $56.9 million, while local tax coffers benefited by an additional $20.0 million in local sales tax revenue.

Table A: Summary of Economic Benefits of DOE in Tennessee, 2006
(dollars in millions)

Impact	Direct	Total
Output	$1,963.2	$3,592.5
Income	$981.0	$2,046.7
Sales Tax	$21.6	$76.9
Employment	11,914	44,889

III. OTHER BENEFITS AND INITIATIVES

Many of the benefits arising from DOE activities are not easily quantified. At the same time, these broader activities have an important positive impact on the state and its future well-being in addition to the quantifiable economic benefits.

- **DOE, its contractors and their employees donated over $5.7 million in charitable contributions, community grants, and equipment to organizations across Tennessee in 2006.**

- **In Fiscal Year 2006, over 3,000 visits by guest researchers generated approximately 18,600 overnight stays in the Knoxville-Oak Ridge area. (These visitors are not included in the impact estimates.)**

- **The American Museum of Science and Energy drew 102,041 visitors during Fiscal Year 2006.**

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THE ECONOMIC BENEFITS OF THE U.S. DEPARTMENT OF ENERGY FOR THE STATE OF TENNESSEE IN 2006

I. INTRODUCTION

Since the U.S. Department of Energy (DOE) first sited its facilities in Tennessee in the 1940s, its operations have made significant contributions to the state of Tennessee, its residents and local governments. DOE's on-going operating budget yields significant benefits to the state economy through the creation of jobs and income, increases in state output and expansions in state and local tax bases. Even though DOE's primary presence in the state is in Anderson and Roane Counties, located adjacent to the Knoxville Metropolitan Statistical Area, the economic benefits accrue statewide. The spillover of benefits into the rest of the state can be attributed to the ripple effect of initial economic benefits as well as the numerous programs offered by the DOE to companies located within the state.

The Center for Business and Economic Research (CBER) at the University of Tennessee started conducting an in-depth analysis of the annual economic benefits for Tennessee attributable to the operations of DOE in 1999. The current report represents the seventh analysis and presents the economic benefits of DOE for Fiscal Year 2006. The remainder of the report consists of three sections. First, the next section provides a profile of the activities of DOE. Second, Section III provides a detailed analysis of the economic benefits for Tennessee in terms of output, income, jobs and sales revenue arising from activities of DOE and its major contractors. Finally, Section IV summarizes many highlights and accomplishments that were noteworthy during Fiscal Year 2006.

II. PROFILES OF DOE ACTIVITIES[2]

The DOE is present in Oak Ridge in three distinct capacities: 1) the DOE Oak Ridge Office (ORO); 2) the Y-12 Site Office of the National Nuclear Security Administration (NNSA), an independent agency of the DOE; and 3) the Office of Scientific and Technical Information (OSTI). ORO and the NNSA use several contractors in the management and operation of their facilities in Oak Ridge.

[2] Profiles provided by U.S. Department of Energy and its contractors.

Based in Oak Ridge, Tennessee, the DOE's facilities are rich in history, dating back to World War II when the organization played a major role in the production of materials for the Manhattan Project. Since then, DOE's Oak Ridge facilities have expanded far beyond that first mission and today host programs implementing DOE mission elements in four major DOE programs: Science; Environmental Management; Nuclear Fuel Supply; and National Security.

The DOE's 33,719-acre Oak Ridge Reservation is located within and adjacent to the corporate limits of the City of Oak Ridge, Tennessee, in Anderson and Roane counties. There are three major plant complexes on the Oak Ridge Reservation: the Oak Ridge National Laboratory (ORNL); the East Tennessee Technology Park (ETTP); and the NNSA's Y-12 National Security Complex. Also located in the City of Oak Ridge are the Office of Scientific and Technical Information (OSTI), the Oak Ridge Institute for Science and Education (ORISE) and the American Museum of Science and Energy (AMSE). Together, these facilities and their capabilities represent a unique technological and educational resource and a major component of the growing East Tennessee Technology Corridor.

Oak Ridge Office (http://www.oakridge.doe.gov)

ORO is responsible for the major programs at ORNL, ETTP, and ORISE. ORO's programs are located in Oak Ridge; however, during Fiscal Year 2006, ORO also supported and provided services to the Pacific Northwest National Laboratory and the Thomas Jefferson National Accelerator Facility. Currently, ORO has an additional role to provide business, technical and administrative support to the Office of Science (SC) complex as a partner in the SC Integrated Support Center, which supports 10 DOE Office of Science laboratories throughout the nation. ORO manages and operates the Payments Processing Center for the entire DOE complex and the National DOE Centers for Metals Recycling and Electronic Recycling.

ORO Major Program Areas:

- The **Science** Program includes basic and applied research to advance the nation's energy resources, environmental quality, scientific knowledge, and contribute to science education.
- **Environmental Management** is an accelerated cleanup program underway to correct the legacies remaining from more than 50 years of energy research and weapons production with the majority of work to be completed by 2008.
- **Nuclear Fuel Supply** ensures that domestic uranium capabilities are maintained and transitions Department's assets to the private sector to accelerate environmental cleanup while enhancing economic growth.
- **National Security** work includes the development of technologies to detect, prevent and reverse the proliferation of weapons of mass destruction in support of our nation's homeland security.

In addition to these DOE Mission areas, the ORO conducts research for other Federal Agencies, private industry and universities. Named "Work for Others," this

program achieved a record-breaking $366 million of work coming into ORO facilities during FY2006.

Oak Ridge National Laboratory (http://www.ornl.gov)

ORNL is a multi-program science and technology laboratory managed for DOE by UT-Battelle, LLC, since 2000. Scientists and engineers at ORNL conduct basic and applied research and development to create scientific knowledge and technological solutions that strengthen the nation's leadership in key areas of science, increase the availability of clean abundant energy, restore and protect the environment, and contribute to national security. ORNL also performs other work for the DOE, including isotope production, information management, and technical program management, and provides research and technical assistance to other organizations. Originally known as Clinton Laboratories, ORNL was established in 1943 to carry out a single, well-defined mission: the pilot-scale production and separation of plutonium for the World War II Manhattan Project. From this foundation, the Laboratory has evolved into a unique resource for addressing important national and global energy and environmental issues. Today, ORNL pioneers the development of new energy sources, technologies, and materials and the advancement of knowledge in the biological, chemical, computational, physical, engineering, environmental and social sciences. ORNL's six major scientific competencies include neutron science, energy, high performance computing, complex biological systems, advanced materials, and national security.

ORNL wins six R&D 100 awards, pushing total to 128

During FY 2006, researchers at the Department of Energy's Oak Ridge National Laboratory won six R&D 100 awards from R&D Magazine, which since 1963 has given the awards for the 100 most significant technological innovations of the year. ORNL's total of 128 awards is second only to General Electric. The following inventions received honors:

- *Hybrid Solar Lighting System*, developed by Jeff Muhs, David Beshears, Duncan Earl, Curt Maxey, Melissa Lapsa, Wes Wysor, Christina Ward and Randall Lind.
- *LandScan Global Population Database*, developed by Eddie Bright, Phil Coleman, Amy King, Budhendra Bhaduri and Ed Tinnel.
- *Metal Infusion Surface Treatment (MIST)*, developed by researchers from C3 International, assisted by staff from ORNL's Materials Science and Technology Division.
- *NanoFermentation*, developed by Tommy Joe Phelps, Lonnie Love, Adam Rondinone, former ORNL researcher Bob Lauf, and post-doctoral researcher fellows Yul Roh, Chuanlun Zhang and Ji-Won Moon.
- *TMA 6301 and TMA 4701*, developed by Materials Science and Technology Division Staff, Duraloy Technologies, and Nucor Sheet Mill Group.

Oak Ridge National Laboratory is the home of highly sophisticated experimental user facilities. These research laboratories are designed to serve not only staff scientists and engineers, but also researchers from universities, industry, foreign institutions, and other government laboratories. They simultaneously advance national research and development and fulfill the DOE missions by minimizing unnecessary duplication of effort, promoting

beneficial scientific interactions, and making the most effective use of costly and, in many cases, unique equipment. ORNL has assembled world class tools for nanoscale R&D, including the $1.4 billion Spallation Neutron Source and the Center for Nanophase Materials Sciences. ORNL is also home to the DOE's National Leadership Computing Facility, which is now the world's fastest unclassified computing facility. The diverse and sophisticated research conducted by staff scientists, coupled with the availability of unique resource equipment, is attracting a growing number of guest researchers.

Oak Ridge Institute for Science and Education (http://orise.orau.gov)

The Oak Ridge Institute for Science and Education (ORISE) is a U.S. Department of Energy institute that supports DOE's mission in seven primary areas:

- In science education, ORISE prepares the future's science and technology research leaders by administering research participation, fellowship, scholarship, internship, and workforce development programs.
- Through occupational exposure and worker health programs, ORISE draws upon a nationwide network of resources to manage innovative worker health studies and programs designed to protect the health and safety of an organization's employees, particularly former nuclear workers with health issues resulting from occupational exposures to radiation.
- ORISE's professional and technical training programs in worker health and safety as well as public health communication focus on protecting employees, the public, and the environment from health and safety threats such as pandemic flu, avian flu, and radiological terrorism.
- Through planning, research, and readiness activities, ORISE's national security and emergency management programs are strengthening the abilities of local, state, and federal government agencies to respond to terrorism and other national emergencies.
- Through its radiation emergency medicine programs, ORISE offers hands-on training programs worldwide in the medical management of radiological emergencies and a 24/7 deployable team of physicians, nurses, and health physicists who are prepared to respond to radiation incidents anywhere in the world.
- ORISE's independent environmental assessment and verification programs enhance public trust and instill confidence in the decontamination and decommissioning of radioactively contaminated sites through a rigorous evaluation and verification process of cleanup efforts.
- Through its scientific and technical resource integration programs, ORISE's proven peer review process provides an independent and objective evaluation of scientific information and research proposals, which, in turn, helps federal agencies make informed funding decisions on where to spend their research dollars.

ORISE and its programs are operated by Oak Ridge Associated Universities through a contract with DOE. Established in 1946, ORAU is a university consortium

leveraging the strengths of 96 major research institutions to advance scientific research and education by partnering with national laboratories, government agencies, and private industry.

East Tennessee Technology Park (http://www.oakridge.doe.gov/env_mgmt.html and http://www.ettpreuse.com)

The East Tennessee Technology Park (ETTP), a former gaseous diffusion plant, is also referred to as the Heritage Center and is the primary focus for DOE's Environmental Management and Reindustrialization Programs. The cleanup work that is required at ETTP consists of the decontamination and demolition of buildings and select remedial actions for soils. During the Cold War Era, the community and surrounding region of Oak Ridge made many critical sacrifices to ensure the success of the Manhattan Project, which included the uranium enrichment activities at the 1300-acre ETTP.

Cleanup of ETTP is an important mission for the Department. The cleanup is managed for DOE by Bechtel Jacobs Company LLC, which both self-performs and subcontracts work. In 2006 Bechtel Jacobs and its subcontractors employed approximately 1,371 people in the Oak Ridge cleanup effort, including ETTP.

Reindustrialization

The DOE Reindustrialization Office together with the Community Reuse Organization of East Tennessee (CROET) is forging a new path in real property management and asset utilization. The Reindustrialization concept encompasses both accelerated cleanup of contaminated government property and conversion of the Heritage Center to a private self-sustaining industrial enterprise for economic development. This federal-community partnership/economic development initiative solves problems of environmental contamination, a damaged local economy, and the needed funding source of millions of dollars all within one cyclical process. First, accelerated cleanup of these assets happens by funneling funds into decontamination efforts instead of demolition activities. Second, these now-usable assets are transferred to CROET as private sector partners for exclusive industrial use in the areas of manufacturing, research and development, and corporate headquarters, thereby guaranteeing job creation. The accelerated cleanup cycle is facilitated by the money saved in avoided demolition costs being funneled back into the cleanup process.

Reindustrialization is integral to DOE's strategy to accelerate cleanup at ETTP. The current focus of the Reindustrialization Program is to transfer facilities and land to CROET and other qualified parties. Currently, six facilities, totaling approximately 300,000 square feet of space, and 500 acres have been transferred to the private sector. The team is currently working on transfer of additional properties that could include more than 1,000,000 square feet and up to 1,000 acres. In addition, approximately 9.5 miles of railroad and railroad right-of-way will be transferred to the community for economic development opportunities. Transferring responsibility for demolition of the properties at ETTP has resulted in avoided demolition costs of $10.2M

to the federal government, and potentially could result in avoided demolition costs of close to $100 million if all property transfer is realized at completion of the project mission.

It is important to note that not only does the quantitative data indicate a large amount of progress but also a heightened amount of interest circulating around the country from the private sector. Private sector companies continue to relocate their businesses to ETTP and take advantage of the Brownfield park benefits such as the infrastructure. Fifteen companies are currently operating at ETTP To date, this has resulted in the creation of approximately 240 jobs which includes highly trained professionals, technical staff, and skilled and unskilled labor within the local community. By utilizing the accelerated cleanup and transfer strategy of Reindustrialization, DOE is able to "give back," by growing and diversifying the local job market.

Wackenhut Services Incorporated

In January 2000, DOE/ORO contracted with Wackenhut Services Incorporated (WSI) to provide protective services for the Oak Ridge Complex. WSI brought to this contract a team comprised of three small businesses: PAI Corporation; Critique, Inc.; and NCI. Under this contract, the WSI-OR team provides physical, information and personal protective services for Y-12 National Security Complex, ORNL, ETTP, and the Federal Office Building Complex. The WSI-OR team employs 865 Tennesseans who protect the DOE's Oak Ridge resources. The WSI-OR paramilitary organization is equipped with the latest technologies to protect the Oak Ridge Reservation.

National Nuclear Security Administration, Y-12 Site Office (http://www.yso.doe.gov)

The mission of the NNSA's Y-12 Site Office (YSO) is to ensure the safe, secure and cost-effective operation of the Y-12 National Security Complex. YSO employees perform program oversight, contract and administrative management and technical evaluation and assessment to meet this mission. Y-12 serves as the nation's only source of secondaries, cases, and other nuclear weapons components and provides enriched uranium for the U.S. Navy. Y-12 is a leader in materials science and precision manufacturing and serves as the main storage facility for enriched uranium. Y-12 also supports efforts to reduce the risk of nuclear proliferation and performs complementary work for other government agencies.

Plant History

Y-12 was constructed as part of the World War II Manhattan Project. Construction began in early 1943. Y-12's first mission was the electromagnetic separation of uranium-235 for use in the first atomic bomb. After World War II, Y-12 became a high-precision manufacturing facility and played a major role in the production of components for modern thermonuclear weapons. Since the end of the Cold War, Y-12's primary mission has been the remanufacture of nuclear weapons components and the dismantlement and storage of strategic nuclear materials from retired nuclear weapons systems.

Y-12 National Security Complex (http://www.y12.doe.gov/.index.html/)

The DOE's primary National Security mission in Oak Ridge is carried out at the Y-12 National Security Complex. Operated by BWXT Y-12, LLC, for DOE's NNSA, the Y-12 National Security Complex is a manufacturing facility that plays an integral role in NNSA's Nuclear Weapons Complex. Programs at Y-12 include manufacturing and reworking nuclear weapon components, dismantling nuclear weapon components returned from the national arsenal, serving as the nation's storehouse of special nuclear materials, preventing the spread of weapons of mass destruction, and providing special production support to other programs. The Y-12 National Security Complex was part of the Manhattan Project. Its job was to process uranium for the first atomic bomb. Construction of Y-12 started in February 1943; enriched uranium production started in November of the same year. For more than 64 years, Y-12 has been one of the DOE's premier manufacturing facilities. Every weapon in the stockpile has some components manufactured at the Y-12 National Security Complex. Today, NNSA's Y-12 National Security Complex manufacturing facility stretches over approximately 800 acres with some 500 structures that contain 7.0 million square feet of floor space.

The Y-12 National Security Complex is undergoing significant changes as its modernization plans progress. The modernization of this facility will ensure the continuation of a vital national security resource for the country and an economic mainstay in East Tennessee.

The Office of Scientific and Technical Information (http://www.osti.gov)

To accelerate scientific progress, it is essential to accelerate the diffusion of science knowledge. Therefore, the DOE Office of Scientific and Technical Information (OSTI), on behalf of DOE Headquarters Office of Science, is working to speed up knowledge diffusion by improving access to science information. For example, by developing deep-Web databases that can be searched in parallel, not sequentially, the contact rate between scientists in distant communities is greatly increased. Examples of these databases and other leading-edge e-government information systems at OSTI include the Information Bridge (www.osti.gov/bridge), Energy Citations Database (www.osti.gov/energycitations), and E-print Network (www.osti.gov/eprints). Patrons of OSTI collections, including DOE and other federal and contractor researchers, academic institutions, science-attentive citizens, and U.S. industry, use OSTI systems 80 million times annually.

OSTI coordinates an agency-wide program for the corporate management of research and development (R&D) information which in turn makes OSTI's databases for DOE more comprehensive. This program involves over 60 DOE Headquarters Offices, Field Offices, National Laboratories, and over 4000 other contractor facilities. OSTI also partners with 12 federal agency counterparts in providing Science.gov, a premier "one-stop" Web system for citizens and researchers to access the government's R&D collections.

Community Reuse Organization of East Tennessee (http://www.croet.com)

The Community Reuse Organization of East Tennessee (CROET) was established in November 1995. CROET is a nonprofit organization created to engage in activities to stimulate growth in the region's economy and to reindustrialize and reuse the facilities of the U. S. Department of Energy's K-25 plant in Oak Ridge, Tennessee, renamed the East Tennessee Technology Park - Heritage Center. CROET has successfully assisted the private sector in creating quality jobs in the region by using the underutilized land, facilities, equipment, personnel, and technologies available at the Oak Ridge complex. As the Community Reuse Organization for the region, CROET provides the community's primary voice to the Department of Energy for community transition issues.

On July 1, 2004, a formal agreement between the CROET New Business Development Loan Fund (managed by Southeast Community Capital, SCC) and the Knox County government (via Mayor Mike Ragsdale) was reached to create the Knox County Technology & Jobs Fund (KCTJF). The KCTJF is a $4 million debt fund available to small and early-stage businesses in the CROET service area that do not have access to traditional capital. The CROET New Business Development Loan Fund and Knox County are each providing $290,000 as loan loss reserve for the KCTJF; these funds allow SCC to obtain $4 million of private sector funds (generally from banks) to capitalize the KCTJF, a leverage ratio of over 6:1. By supporting the KCTJF, CROET is leveraging their own resources to provide a truly regional small business fund larger than any in existence previously.

The Heritage Center, previously known as the K-25 site, is now undergoing a fast-track cleanup that involves decontamination and demolition of most of the buildings on site. CROET subleases space in several of the buildings to private sector companies, some of which are involved in the cleanup. CROET has identified for the Department of Energy over 20 buildings that are candidates for transfer to CROET. The first four buildings selected in the evaluation process were transferred in 2005, with two additional buildings transferred in 2006. Work is progressing on transfer of an additional 10 facilities including buildings, infrastructure and land parcels.

Ownership of the developable parcels in the nearby Horizon Center, a 1000 acre Greenfield site, was transferred to CROET by the Department of Energy in 2003. With ownership of Horizon Center now under CROET's stewardship, marketing has become less difficult. Since the construction of Theragenics' isotope production facility in 2001, Horizon Center is now the corporate headquarters and regional service facility for Philotechnics, a former lessee at Heritage Center. In addition, negotiations continue for the siting of another company in the instrumentation and controls industry.

Moreover, in cooperation with DOE's Oak Ridge National Laboratory, CROET has leased approximately 12 acres of land for the development of the Oak Ridge Science and Technology Park. Pro2Serve, a locally owned technology consulting firm will be the Park's first tenant with the construction of a 100,000 square foot Research & Development (R & D) and office facility. The Oak Ridge Science and Technology Park

is being developed to facilitate technology transfer to the private sector and commercialization efforts spawned by R&D at ORNL by providing more immediate proximity to the Laboratory. The Park has long range expansion potential of up to 40 acres.

What DOE Facilities Offer Tennessee

The presence of DOE and its contractors in Tennessee gives rise to many benefits, both quantitative and qualitative. Obviously, the facilities discussed above provide employment and income for residents of the state. The jobs provided are most often high-skilled, high-paying jobs resulting in a high quality workforce comprised of some of the top researchers in their field. The presence of DOE also provides the state with national recognition as a leader in manufacturing, advanced materials, neutron sciences, biological sciences and transportation technologies. With its R&D capacity and technology sharing programs, DOE plays a significant role in enhancing Tennessee's competitive position in attracting private firms to locate within the state. In addition, DOE is active in bringing federal research grant money to the state and its institutions of higher education. The DOE facilities provide an excellent resource to the University of Tennessee through expanded research capabilities and academic programs. The remainder of the report details the more easily quantifiable economic benefits attributed to the operations of DOE supported facilities in Tennessee and enumerates important qualitative benefits to households, firms and workers.

III. JOB, INCOME, OUTPUT AND SALES TAX BENEFITS OF DOE IN TENNESSEE IN 2006

This section of the report estimates some of the quantifiable DOE benefits due to job and income creation, and tax collections. The model used to generate the estimates is described in the Appendix.

DOE Expenditure Data

The analysis measures economic benefits based on the actual expenditure patterns of DOE in 2006. The data used as inputs to the economic impact model consist of detailed expenditure data for the 2006 Fiscal Year that were provided by DOE and its major contractors. Additionally, the Office of Secure Transportation (OST), a field office of DOE located outside the state but with expenditures in Tennessee, provided the ORO with the detail of those expenditures. The benefits detailed below represent a conservative estimate of the actual benefits attributable to DOE's presence in Tennessee.

Steps were taken in the data collection process to prevent the double counting of contracted and subcontracted spending. Expenditures were disaggregated into 59 major industrial sectors for input into the model. Table 1 displays DOE-sponsored spending in Tennessee by sector for Fiscal Year 2006. Total payroll, pension, and non-payroll spending in the state in 2006 was $1,963.2 million.

The analysis is divided into the direct effects of DOE, the indirect effects, and the multiplier effects[3]. Income and employment are created directly as DOE pays workers' wages. Income and employment are created indirectly as DOE purchases goods and services from Tennessee manufacturers, service providers, and vendors and as these firms hire workers, earn profits, and so forth. The multiplier process results in the creation of income and employment as workers spend their incomes in Tennessee and other firms earn income and profits and hire employees. The direct, indirect, and multiplier effects are added to yield the total income, employment, and tax revenue impacts. Direct effects are attributable to the actual operation of DOE. These direct effects include the hiring of DOE and contractor staff (the direct employment impact) and the payments to these employees (the direct income effect). Indirect effects result from DOE purchases of goods and services and spending by visitors to the American Museum of Science and Energy. Finally, the multiplier effect occurs as the direct and indirect incomes are spent and re-spent within the local economy. For example, DOE employees spend a portion of their wages and salaries in the local community on goods and services such as housing, clothing, and food. Likewise, the owners of businesses receiving these payments will use a portion of the proceeds to pay their employees and make profits, and the cycle continues. During each of these subsequent rounds of spending, a portion of the direct and indirect income leaks out of the local economy through federal taxes, payments to non-residents, savings and spending outside of the

[3] As described in detail in the Appendix, new multipliers have been used in this report.

local area, diminishing the additional local income through each successive round of expenditures[4].

Payroll spending represents the largest expenditure category of DOE direct spending, accounting for $763.2 million, or 38.9 percent of the total spending in Tennessee. Total payroll spending-including both payroll and pension disbursements-totaled $981.0 million. Other notable spending categories include professional, scientific and technical services, and construction.

DOE contracts out the majority of its operations to private companies. The two largest DOE contracts in Tennessee in 2006 were for BWXT Y-12 LLC for the operation of the Y-12 National Security Complex and UT-Battelle, a not-for-profit partnership that manages Oak Ridge National Laboratory (ORNL). Together these two contractors accounted for 61.1 percent of the total DOE-related expenditures in Tennessee. Other major contractors include the Bechtel Jacobs Company LLC, a clean-up contractor for DOE's ETTP and Wackenhut Services Incorporated, which provides security for the Oak Ridge Reservation.

[4] The Appendix provides a more detailed discussion of the methods.

Table 1: DOE-Related Expenditures in Tennessee by Industrial Sector, 2006

Sector	Expenditures
Forestry, fishing, and related activities	652,000
Mining, except oil and gas	471,000
Utilities	54,595,779
Construction	62,009,813
Wood product manufacturing	256,000
Nonmetallic mineral product manufacturing	4,309,741
Primary metal manufacturing	90,561
Fabricated metal product manufacturing	2,699,468
Machinery manufacturing	17,390,101
Computer and electronic product manufacturing	14,507,627
Electrical equipment and appliance manufacturing	5,083,294
Motor vehicle, body, trailer, and parts manufacturing	425,000
Other transportation equipment manufacturing	1,189,949
Furniture and related product manufacturing	431,200
Miscellaneous manufacturing	123,585
Textile and textile product mills	286,200
Apparel, leather, and allied product manufacturing	1,923,696
Printing and related support activities	57,000
Chemical manufacturing	2,938,520
Wholesale trade	22,401,741
Retail trade	12,629,672
Air transportation	9,104,000
Truck transportation	2,435,200
Transit and ground passenger transportation	2,072,000
Other transportation and support activities	32,000
Publishing including software	113,902
Broadcasting and telecommunications	1,804,120
Information and data processing services	325,000
Federal Reserve banks, credit intermediation and related services	84,800
Securities, commodity contracts, investments	4,317,000
Insurance carriers and related activities	10,285,000
Real estate	13,210,678
Rental and leasing services and lessors of intangible assets	1,709,400
Professional, scientific, and technical services	470,409,556
Administrative and support services	88,502,022
Waste management and remediation services	660,000
Educational services	19,757,116
Ambulatory health care services	2,324,644
Social assistance	16,611,000
Amusements, gambling, and recreation	25,000
Accommodation	108,000
Food services and drinking places	225,906
Other services	13,897,967
Payroll	763,198,102
Pensions	217,833,999
Health Insurance	119,630,595
Total Tennessee Expenditures	**$1,963,150,955**
Total Non-payroll Expenditures	**$982,118,853**

Summary of Benefits

In FY2006, direct benefits of DOE-funded activity in Tennessee included: $763.2 million in payroll, $982.1 million in non-payroll expenditures, $217.8 million in pensions, $21.6 million in state and local sales tax, and 11,914 full-time jobs. This initial injection of money works its way through the state's economy to produce more economic impacts through the indirect and multiplier effects described above.

Total economic benefits of DOE spending in Tennessee – direct, indirect and multiplier effects – include a $3,592.5 million increase in output or state gross domestic product (SGDP), a $2,046.7 million increase in personal income, $76.9 million in state and local sales and use tax revenue, and the support of 44,889 full-time equivalent jobs (see Table 2).

Table 2: Summary of Economic Benefits of DOE in Tennessee, FY 2006

Output (SGDP)	$3,592.2 million
Personal Income	$2,046.7 million
Sales and Use Tax Revenue	$76.9 million
Employment	44,889 jobs

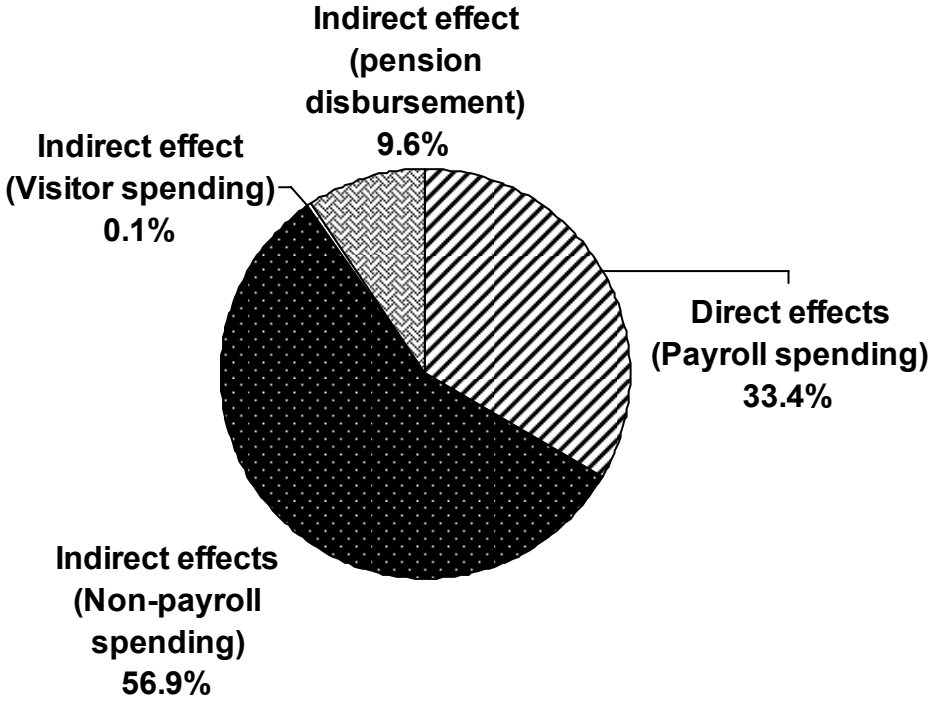
Output Benefits

The output benefit of DOE activities is measured by the increase in SGDP from expenditures made within the state. SGDP is the broadest measure of economic activity available. For FY 2006, the value of production at DOE combined with the value arising because of DOE's spending totaled $3,592.5 million (see Table 3 and Figure 1). The leading source of output benefits was non-payroll spending which accounted for $2,043.8 million or 57 percent of total SGDP. Payroll spending generated an additional $1,202.8 million or 33 percent, and pension disbursements and visitor spending gave rise to remaining increases. As a result of spending and re-spending in the state's economy, DOE-related expenditures resulted in an implicit output multiplier of 1.83. This indicates that for every dollar spent by DOE in Tennessee, the SGDP increases by $1.83.

Table 3: DOE Output Benefit in Tennessee by Source, 2006 (in millions)

Payroll Spending	$1,202.8
Non-payroll Spending	$2,043.8
Pension Disbursements	$343.3
Visitor Spending	$2.6
Total Output Benefit	$3,592.5

Figure 1: DOE Output Benefit in Tennessee, by Source



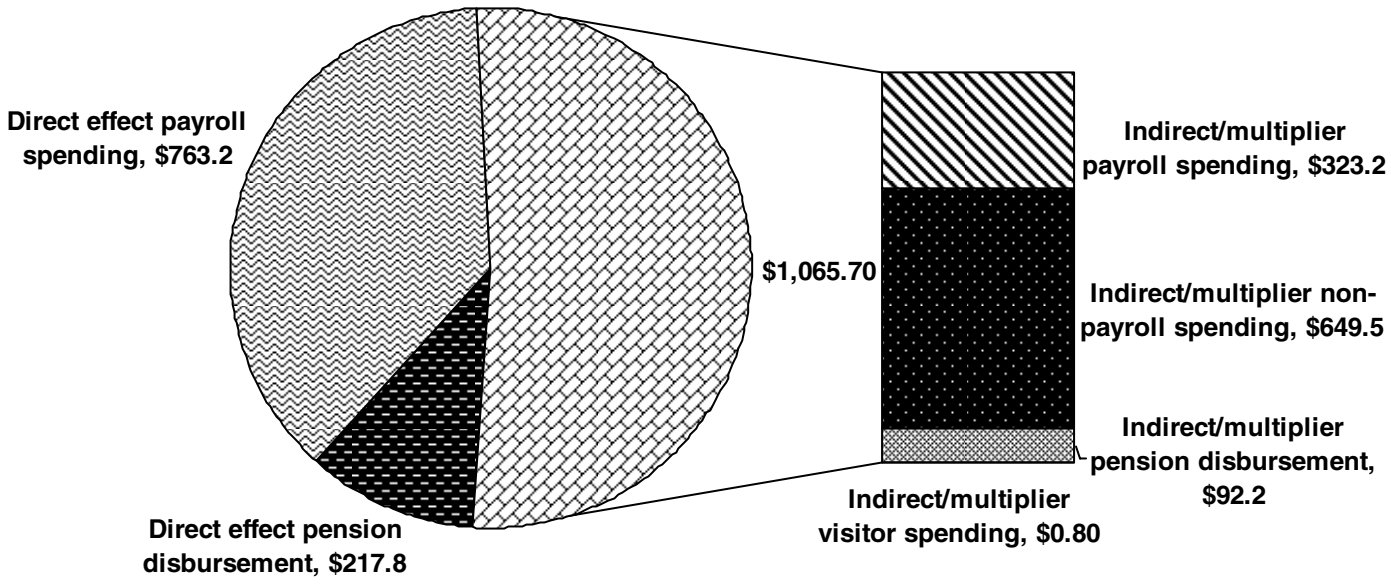
Income Benefits

Personal income is another broad measure of the economy and includes all wages, profits, interest, rents, and other forms of income earned by people in the Tennessee economy. The increase in total personal income arising because of DOE expenditures was $2,046.7 million (see Table 4 and Figure 2). These effects can be distributed among direct effects and indirect/multiplier effects. Direct income effects result because of expenditures on wages and salaries and pension disbursements of DOE employees and account for $981.0 million in 2006. Indirect effects arise from DOE purchases of goods and services and spending by visitors to DOE-related facilities. Finally, multiplier effects occur as DOE payroll and non-payroll spending ripples through the state's economy. In 2006, non-payroll expenditures accounted for $649.5 million in indirect and multiplier income benefits. Visitor spending gave rise to $0.8 million in income benefits. The remaining $415.4 million in benefits result from the multiplier effect of payroll and pension disbursements. Table 4 summarizes the income benefit to the state of Tennessee as a result of DOE activity in 2006.

Table 4: DOE Income Benefit in Tennessee, by Source, 2006 (in millions)	
Direct Effects	
Payroll Spending	$763.2
Pension Disbursements	$217.8
Indirect/Multiplier Effects	
Payroll Spending	$323.2
Non-payroll Spending	$649.5
Pension Disbursements	$92.2
Visitor Spending	$0.8
Total Income Benefit	**$2,046.7**

The implicit income multiplier, which is calculated by dividing the total income benefit by direct spending on income, is 2.10. In other words, every dollar of income paid directly to the employees of DOE or its contractors results in the creation of $2.10 in total state income.

Figure 2: DOE Income Benefits, by Source 2006 ($millions)



Employment Benefits

The total employment benefit of DOE in Tennessee in FY 2006 was 44,889 full-time equivalent jobs (see Table 5). The direct employment of DOE and its major contractors was 11,914; an additional 32,975 jobs were supported through the purchase of goods and services in Tennessee, visitor and guest scientist spending, and the effects of employees spending their income in Tennessee. A decomposition of direct employment is provided in Table 5. BWXT Y-12 LLC and UT-Battelle represented the two largest DOE-related employers in the state with 4,508 and 4,051 employees residing in Tennessee, respectively. Combined, these two contractors accounted for 71.8 percent of the total direct employment benefit.

Table 5: DOE Direct Employment Benefit in Tennessee by Entity, 2006

Division/Contractor	
BWXT Y-12, LLC	4,508
UT-Battelle, LLC	4,051
Bechtel Jacobs Company	1,280
Wackenhut Services Inc.	865
ORAU	539
ORO	396
OST	134
Y-12 Site Office	83
OSTI	58
Total Direct Employment	**11,914**

DOE-related employment fell by less than 1 percent from 2004 from 11,951 to 11,914 full-time equivalent jobs. Because of the change in the multipliers used to gauge impacts (see Appendix), the number of jobs supported through the purchase of goods and services within the state, visitor spending, and the induced effects of DOE employees spending their income in Tennessee also decreased. Table 6 provides a breakdown of employment impacts by source.

Table 6: DOE Employment Benefit in Tennessee, by Source, 2006

Direct Effects	
DOE employees	11,914
Indirect/Multiplier Effects	
Payroll Spending	10,781
Non-payroll Spending	19,067
Pension Disbursements	3,077
Visitor Spending	50
Subtotal	**32,975**
Total Employment Benefit	**44,889**

The implied employment multiplier for DOE-related activities in Tennessee for FY 2006 is 3.8 which means that for every job created directly by DOE, a total of 3.8 jobs are supported throughout the state. The resulting employment multiplier is higher than for most other industries, suggesting that DOE-related activities have a larger capacity

to support jobs, due to the higher than average salary of $64,059 received by DOE-related employees and the extensive use of contracted employees.

To give a perspective on the relative size of the DOE-related employment benefit, the 44,889 jobs supported by DOE is roughly equivalent to the *total* number of jobs[5] in the following counties: Hamblen (43,973), Maury (43,845), and Putnam (43,068). Another way to gauge the employment benefit is to compare the number of jobs arising due to DOE-related activities to total Tennessee employment in various industry sectors. The employment benefit impact is roughly equivalent to the total number of people in Tennessee employed in the Information industry (49,600) and the Fabricated Metal Products manufacturing industry (42,600)[6].

Sales Tax Benefit

The total contribution of DOE-related activities to state and local sales tax revenue in the state of Tennessee for FY 2006 is estimated to be $76.9 million. Of that total $56.9 million accrues to the state's sales tax coffers and the remaining $20.0 million accrues to state and local governments. Sales tax revenues are generated through indirect and multiplier processes as DOE employees spend a portion of their income at local area businesses and these businesses remit the sales tax. Businesses receiving payments from DOE pay their employees, who spend a portion of their income at local businesses and as the money spent works through the economy, state and local sales taxes are generated. In addition to sales taxes, DOE activities result in additional fiscal benefits such as payments-in-lieu-of-taxes, property taxes, and business taxes. However, this study only examines sales tax revenue, therefore the total fiscal benefits attributable to DOE is significantly larger than the benefit discussed here.

Table 7: DOE Sales Tax Revenue Benefit in Tennessee, 2006 (in millions)

Direct Payments	
State	$16.0
Local	$5.6
Indirect/Multiplier	
State	$41.1
Local	$14.2
Total Sales Tax Revenue Benefit	$76.9

Additional DOE Contributions to Tennessee

In addition to the substantial economic benefits of DOE's presence in the state discussed above, there exist many other avenues by which DOE and its contractors contribute to the state's economy and well-being through the various programs it offers and supports. These programs include: community involvement; technology partnerships resulting in the establishment of new businesses and technical assistance

[5] Information on total number of jobs by county is for 2005 and is available from the Bureau of Economic Analysis. <www.bea.gov>

[6] Information on number of jobs by sector is available in "An Economic Report to the Governor of the State of Tennessee" <http://cber.bus.utk.edu/erg/erg2007.pdf>

to Tennessee firms; contributions to Tennessee educational institutions; and reuse of government assets, DOE grants and job creation initiatives to offset the downsizing of government operations in East Tennessee. These DOE-supported programs have been instrumental in reshaping the state's economy by leading to new products and processes and by improving the overall well-being and competitiveness of the state's economic base. Section IV highlights many of the accomplishments of these initiatives.

One of the more personal ways in which DOE benefits the community at large is through charitable contributions. DOE, its contractors, and their employees made significant contributions to charitable causes in 2006. The donations ranged from local United Way campaigns to donations of equipment to area schools. In total, over $5.7 million in charitable donations can be directly attributed to DOE operations in Tennessee. A detail of the donations by contractor is provided in Table 8. Of course, community involvement extends beyond monetary donations as staff and employees of these firms are active in civic organizations and volunteer programs. Therefore, the figures presented in Table 8 understate the overall benefits that accrue to the state.

Table 8: DOE Community Charitable Contributions by Entity, 2006

	Local Activities	Corporate Contributions	United Way, CFC, etc	Charitable Contributions	Donation of Equipment	Matching Funds for Education	**TOTAL**
BWXT Y-12	85,115	740,532	646,957	41,640	880,588	27,210	**2,422,042**
OSTI	--	--	9,551	--	--	--	**9,551**
BJC	--	--	145,025	506,511	--	6,425	**657,961**
UT-Battelle	--	847,207	819,231	--	--	--	**1,666,438**
ORO	--	--	47,175	--	--	--	**47,175**
ORAU	--	516,000	86,000	--	36,216	--	**638,216**
Wackenhut	145,178	--	52,663	16,400	--	--	**172,628**
Y-12 Site Office	--	--	113,000	--	--	--	**113,000**
TOTAL	**230,293**	**2,103,739**	**1,919,602**	**564,551**	**916,804**	**33,635**	**5,768,624**

IV. HIGHLIGHTS AND ACCOMPLISHMENTS

Oak Ridge National Laboratory

Construction Summary

The first neutrons at the Spallation Neutron Source—"spalled" at 2:04 p.m. April 28, 2006— climaxing a seven-year $1.4 billion construction project and launched a new era of scientific research in Oak Ridge. Finished "on time, on budget and on scope" with an excellent safety record, the facility will eventually contain a suite of 24 instruments and greatly expand scientists' ability to study and manufacture lighter and stronger materials.

Located adjacent to the SNS, ORNL's Center for Nanophase Materials Sciences was officially completed and hosted 139 visiting researchers in 2006. The $65 million facility, also completed ahead of schedule and under budget, allows users to study and create materials 100,000 times smaller than a human hair. The NanoScience Center is one of five nanomaterials user facilities built by the Department of Energy at federal laboratories across the United States.

To be completed in 2007 is the Joint Institute for Biological Sciences, an $11 million building funded by the state of Tennessee for research, focused primarily in the burgeoning field of bioenergy, by ORNL and University of Tennessee scientists.

Initiatives and Accomplishments

The Spallation Neutron Source was completed, with the first neutrons passing through the instrument in spring, 2006, and the SNS set to come fully online by 2008. The High Flux Isotope Reactor in the fall of 2006 passed a major milestone in its quest to become one of the world's leading sources of "cold" neutrons for advanced scientific research. When fully operational in late spring, 2007, the reactor will combine with the laboratory's Spallation Neutron Source to make Oak Ridge the world's center for neutron sciences.

The ORNL Cray X1 computer recently achieved the milestone of 119 teraflops, making it the most powerful open-source supercomputer in the world. ORNL has announced that its capacity will be increased to a 1 petaflop system by 2008.

The U.S. Project Office for ITER, an international effort to build an experimental fusion reactor in Cadarache, France, was moved to Oak Ridge in 2006. The U.S. effort hopes to benefit both from ORNL's considerable fusion expertise and the laboratory's successful experience with the SNS construction project. ITER, Latin for "the way," seeks to explore the feasibility of power from fusion – the process that heats the sun and stars. Several ORNL staff members have joined or are scheduled to join both the U.S. and International ITER teams.

ORNL also announced plans in 2006 for the Oak Ridge Science and Technology Park, the first private business office development to be located onsite at a national laboratory. The 12-acre park, with plans to expand to approximately 40 acres, will be

occupied by university branch offices, start-up companies and outside industry, offering tenants better access to ORNL researchers, instruments and facilities.

Technology Transfer and Economic Development maintained their exciting pace in utilizing ORNL technologies and capabilities to start-up new companies. In FY2006, ORNL assisted in the establishment of seven new local companies by transferring technologies to establish new products.

More than 200 new user proposals have been submitted to the CNMS for fiscal year 2007 in response to the center's annual call. In fiscal year 2006, 106 proposals were approved and 139 users came to Oak Ridge. CNMS has surpassed that number already, hosting 156 users in FY2007. The complete list of CNMS-supported nanoscience user research projects is posted on the CNMS Web site at http://www.cnms.ornl.gov/active_user_projects/projects.shtm.

The Joint Institute for Computational Sciences (JICS) was established in 1991 through the Science Alliance, which is a UT Center of Excellence, and ORNL. JICS combines the efforts of the state and federal governments and the University of Tennessee. The institute focuses on existing areas of emphasis for development of research programs between the ORNL Computing & Computational Sciences Directorate and participating institutions. DOE's Center for Computational Sciences at ORNL has partnerships with universities, government institutions and major industrial firms. The partnerships are essential to solving complex scientific problems that require the enormous power of supercomputers.

Now under construction, the Joint Institute for Biological Sciences is receiving $11.6 million in funding to construct the research facility on the ORNL campus along with $3 million for special equipment related to that research. Research will focus on solving the biological problems of bioenergy, specifically creating cellulosic-based fuel from organic material such as poplar trees. Construction on the Joint Institute for Biological Sciences began in spring 2004.

UT-Battelle continued their support of economic development organizations across the southeastern United States. In particular, note that UT-Battelle:

- Actively participated, in partnerships with regional economic development organizations, in the recruitment of new nanotechnology companies to the region.
- Assisted in the establishment of the Tennessee SBIR Proposal Assistance Center being developed by the University of Tennessee Center for Industrial Services.
- Assisted Mississippi Universities in the establishment of the Mississippi Homeland Security Technology initiative.
- In support of a "Lab of the South" concept, maintained strong relationships with Kentucky, Alabama, Mississippi, North Carolina, South Carolina, and began to develop relationships with Florida, Georgia and Virginia. This included the utilization of contracted employees representing many of these states.

- Established an account manager approach to supporting local economic development initiatives. Assignments of staff to key regional economic development organizations was made and a memorandum of agreement with each was created and signed.

Support to Improving Education

ORNL supports a number of educational programs aimed at elementary and high school students and teachers in the region. UT-Battelle has funded more than 30 area science labs since 2000 through a series of $10,000 gifts to enhance and upgrade science classrooms and laboratories. In 2006, gifts were presented to science labs at Oakdale H.S., Bearden H.S., Farragut H.S., Union County H.S., and Cherokee H.S.

UT-Battelle provided $87,000 to connect Oak Ridge High School to Internet2, a dedicated high-speed network operated by a consortium of 207 universities that opens countless educational opportunities to students and faculty.

UT-Battelle has committed $50,000 to increase stipends for students in the Graduate School of Genome Science and Technology, offered through the University of Tennessee and Oak Ridge National Laboratory. The program is a unique, multidisciplinary program for full time graduate study culminating in an MS or PhD degree in the emerging field of functional genomics.

UT-Battelle funded a science field trip for May 2006 for the Grand Oaks Elementary School to the NASA's Marshall Space flight Center in Huntsville, Alabama. Oak Ridge High School Science Olympiad Team received funds from UT-Battelle to facilitate their participation in the national competition.

The UT-Battelle scholarship, presented annually to the child of an employee of Oak Ridge National Laboratory, consists of $5,000 annual increments over a four-year period to an outstanding graduating high school student who plans to study science, mathematics or engineering at UT.

Educational partnerships with the laboratory's "core universities" continue to increase with the recent addition of Vanderbilt University. Vanderbilt joins Duke, Florida State, Georgia Tech, North Carolina State, the University of Virginia and Virginia Tech as part of ORNL's core university arrangement with Oak Ridge Associated Universities and UT to engage in joint faculty appointments, shared research, major new science initiatives, and leadership in the academic research community.

UT-Battelle continues to provide support and leadership to help inspire community involvement in a project to upgrade the high school, which was built in 1951. This effort included committing $2 million to the project and encouraging voters to approve an increase in the city's sales tax – which voters did overwhelmingly. The ORNL associate lab director for the Spallation Neutron Source, chairs the Oak Ridge Education Foundation Board, which is nearing its goal of raising $8 million for the $55 million high school project

Another program UT-Battelle supports through the American Museum of Science and Energy is the Ecological and Physical Sciences Study Center, a unique learning experience for students from kindergarten through eighth grade that is aligned with the Tennessee Science Curriculum Framework. The center covers math, physical science, and life science courses taught at a variety of locations, including Freels Bend Cabin, area schools, the American Museum of Science and Energy and other locations.

For the past 15 years, ORNL and the Appalachian Regional Commission (ARC) have provided a two-week Summer Science Honors Academy. This program allows outstanding students from the thirteen-state ARC region to participate in ongoing laboratory research projects applying the tools and methods used at ORNL in science, mathematics and technology. About 40 students and 10 teachers participate annually.

UT-Battelle has launched an innovative new plan to strengthen math and science education in East Tennessee. The company has paid a $10,000 “signing bonus” as an incentive for three teachers, two starting in Union County and one in Morgan County. UT-Battelle also is talking with other area schools in rural communities that have had difficulty attracting qualified math and science teachers.

Other ongoing educational programs sponsored by UT-Battelle include the Junior Science and Humanities Symposium, sponsored by ORNL, UT, the U.S Army Research Office, and the U.S. Naval Research Office; educational tours for schools and other groups; the ORNL Speaker's Bureau; corporate memberships at the American Museum of Science and Energy; the Science Olympiad; the First Lego League; UT Math Contest and the Science Bowl.

Oak Ridge Institute for Science and Education

Initiatives and Accomplishments

In 2006, ORISE continued to prepare the next generation of scientists by placing nearly 5,000 participants from more than 900 colleges and universities in more than 150 science education and research programs with more than 200 national laboratories and federal agencies. These programs will help DOE and other federal agencies address future human capital issues resulting from an aging workforce eligible for retirement within the next decade. The ORISE-managed science education programs will funnel top students into the employment pipeline by providing internships in DOE’s national laboratories and other facilities nationwide.

Through the planning and execution of 28 homeland security and emergency preparedness exercises and readiness events in 2006, ORISE continued to prepare federal, state and local agencies in how to deal with incidents involving weapons of mass destruction and resulting in mass casualties. Additionally, ORISE provided continuing hands-on medical education at 20 different locations worldwide to more than 1,000 pre-hospital emergency response personnel, hospital health care personnel, emergency planners, and public health personnel on handling the medical aspects of radiation emergencies. ORISE also neared completion of its cytogenetic biodosimetry

laboratory, an international resource that can be used to calculate the radiation dose of individuals exposed to ionizing radiation. This resource is a critical component of our nation's ability to respond to a mass casualty event involving nuclear materials.

The year 2006 marked the first full year of DOE's National Supplemental Screen Program (NSSP), managed by ORAU. The NSSP is being used to identify those former DOE site employees who may have been exposed to hazardous substances at work. In this initial year, more than 2,500 former DOE workers signed up for the free medical screenings, which are designed to identify occupational diseases, such as chronic respiratory illnesses, hearing loss, kidney or liver disease, and some forms of cancer.

Since beginning work in 2003 on the radiation dose reconstruction project awarded by the National Institute for Occupational Safety and Health to ORAU, the ORAU team has completed 17,000 dose reconstruction reports on former energy workers who may have developed cancers due to work-related radiation exposures. These workers may be eligible for benefits under the Energy Employees Occupational Illness Compensation Program Act.

ORISE staff conducted eight pandemic flu exercises at U.S. international airports and land-locked ports of entry. More than 600 representatives from U.S. Customs and Border Protection, quarantine stations, hospitals, airlines, and airport authorities walked through the steps of how they would respond if arriving overseas airline passengers had worsening symptoms of the flu. Participants then identified strengths and areas for improvement in working with the issues and parties involved.

Work by ORISE's Radiochemistry Laboratory in 2006 helped the Nuclear Regulatory Commission (NRC) to build public safety and trust in the operations of the power plants overseen by the agency. To determine whether dangerous levels of tritium could potentially endanger drinking water supplies around 13 nuclear power plants in the Midwest, the NRC called on ORISE to exclusively carry out a series of independent radioanalytical evaluations. Staff analyzed more than 700 water samples plus soil, vegetation, and fish samples. The NRC and plant officials are using ORISE's results to address ways to prevent future unintentional releases.

To help those overseeing government-funded research to make informed decisions on where to spend their research dollars, ORISE completed more than 42 scientific peer reviews of 2,203 research proposals, asset types, health risk assessments, or projects in 2006. These reviews involved nearly 1,220 select reviewers from 350 universities in 49 states. ORISE also received a $3 million contract to conduct peer reviews on scientific and technical documents related to work on DOE's proposed Yucca Mountain nuclear waste and storage repository.

ORISE's Procurement Department was recognized in 2006 with the DOE "Facility Management Contractor Small Business Diversity Achievement Award" and the U.S. Small Business Administration's "2006 Dwight D. Eisenhower Award for Excellence in Small Business Subcontracting." ORISE was also recognized for

excellence in safety with the DOE "Voluntary Protection Program (VPP) Star of Excellence Award" for "full dedication and total commitment to the principles of VPP" over the past three years as a VPP Star Site.

Support to Improving Education

ORISE provided more than $180,000 in FY06 in scholarships, fellowships, education grants and other contributions for area public schools, and colleges and universities across the nation.

ORISE distributed more than 50,000 free books to area children since 2001 as a sponsor of Dolly Parton's Imagination Library

During FY 2006, ORAU gave $200,000 to the Oak Ridge Education Foundation as a part of its 5 year $1 million commitment.

Bechtel Jacobs Company LLC

During FY 2006, environmental cleanup contractor Bechtel Jacobs Company LLC made significant progress under its Accelerated Cleanup and Closure contract with the DOE. Notable accomplishments in FY 2006 included:

Initiatives and Accomplishments

- demolishing the K-29 Building, a large former gaseous diffusion building built in 1951 that was composed of two floors of approximately 290,000 feet each;
- developing a new plan for demolishing the K-25 and K-27 gaseous diffusion buildings that will better protect workers from deteriorated conditions in the buildings by reducing the number of workers and hours in the buildings;
- demolishing 23 predominantly uncontaminated facilities, 21 low-risk/low-complexity facilities, and 10 facilities in a grouping called "Balance of Site – Laboratories Group";
- removing more than 16,000 tons of scrap metal from the K-770 Scrap Yard and all of the scrap from the K-1064 Scrap Yard;
- demolishing more than 180 decommissioned facilities at ETTP;
- shipping 363 cylinders of depleted uranium hexafluoride, which completed the project;
- completing the Haul Road project, which allows the company to transport waste from ETTP to EMWMF without traveling on public roads;
- dispositioning 151,219 tons (12,117 truck loads) of cleanup-generated waste at DOE's Environmental Management Waste Management Facility;
- completing remediation of Melton Valley, a waste repository site on the Oak Ridge Reservation, which involved placing engineered multi-layered caps on 145 acres of waste disposal sites; excavating and disposing of more than 50,000 yd of

contaminated soil; and excavating, repackaging, and storing more than 200 concrete waste casks for future treatment and disposal.

Wackenhut

Initiatives and Accomplishments

In the area of community outreach, Wackenhut Services, Inc.—Oak Ridge Team (WSI-OR) pledged $500,000 to Oak Ridge High School for its renovation project.

WSI-OR is a sponsor of the Oak Ridge Secret City Festival and has increased its contribution to $7,500 for 2007.

WSI-OR contributed $50,000 to Methodist Medical Center to assist in its Robotic Surgery Campaign.

WSI-OR supports regional leadership programs including Leadership Oak Ridge, Leadership Anderson County and the East Tennessee Regional Leadership Association.

Contributions were made to dozens of other regional schools, charities and community efforts in order to improve local quality of life.

WSI-OR is a presenting sponsor of the annual Anderson County Go Red for Women Luncheon.

The company sponsors many fundraisers for non-profit organizations such as the annual Literacy Luncheon and The Make-A-Wish Gala and is also very involved in the local Relay for Life Event.

WSI-OR has the 5th largest contribution to the United Way of Anderson County with an employee campaign that totaled $52,663. The company is the major sponsor of the annual United Way Golf Tournament and is also a contributor to the annual kick-off event. Additionally, a number of WSI-OR employees give their time to United Way by serving on the board of directors, the Great Tennessee Turbo Turtle Race committee, the funds distribution committee, the nominating committee and by volunteering at United Way events. The 2007 kick-off event is being led by the WSI-OR General Manager.

Contributions are made to numerous other charities, educational initiatives and non-profits through the WSI-OR Community Partnership Committee comprised of employees from throughout the company.

WSI-OR is involved in numerous community organizations as well and is a Millennium Partner of the Oak Ridge Chamber of Commerce, a Premier Partner of the Knoxville Area Chamber Partnership, a member of the Anderson County Chamber of Commerce, the East Tennessee Economic Council and the Tennessee Business

Roundtable. Additionally, the company is an annual sponsor of the Tennessee Valley Corridor Summit

Y-12 National Security Complex

The Y-12 National Security Complex is undergoing significant changes as its modernization plans progress. The modernization of this facility will ensure the continuation of a vital national security resource for the country and an economic mainstay in East Tennessee.

Construction Summary

The most visible of these modernization projects are two new privately financed buildings; the Jack Case Center and the New Hope Center. The sprawling, three-story, 412,000-square-foot Jack Case Center will contain office space for 1,200 people, a new cafeteria, a new occupational health center, laboratory space and conference space. The 137,700-square-foot New Hope Center will be the new public face of Y-12. It will contain office space for 300 people, a visitor's center, badging office and a public exhibit center to highlight Y-12's proud tradition. Employees currently housed in more than 20 separate buildings will move into these new facilities, which will allow Y-12 to demolish a large number of obsolete, inefficient 1940s-era facilities and radically reduce the Y-12 site footprint. The new buildings are being built with private-sector financing totaling more than $125 million, and over the next 25 years, this approach could save nearly $100 million in reduced operating, maintenance and renovation costs. The two buildings, which are being treated as one project, are more than 90 percent complete, and the work is slightly ahead of schedule. Construction is expected to be completed in late summer 2007. Energy conservation measures were at the forefront of both buildings' design. The New Hope Center and the Jack Case Center both include many energy conservation measures. The New Hope Center is also a LEED (Leadership in Energy and Environmental Design) certified project, meeting all the requirements set forth by the U.S. Green Building Council.

Construction of the Highly Enriched Uranium Materials Facility, the HEUMF, was awarded in August 2004 to Caddell/Blaine, a joint venture of Caddell Construction of Montgomery, Alabama; and Blaine Construction of Knoxville. HEUMF construction is more than 50 percent complete, with operations expected to begin in 2010 (facility completion in 2009). The heavily fortified HEUMF represents the largest design effort at Y-12 in more than a decade. The new facility will allow Y-12 to consolidate storage of nuclear materials, improve our security posture, and make managing nuclear assets more efficient and less expensive. Construction of the new storage facility is the keystone of our modernization effort. The building, scheduled for completion in 2009, will radically reduce the current storage footprint, dramatically improving security while lowering costs.

A new, consolidated production facility called the Uranium Processing Facility, or UPF, is one of the capstones of Y-12 modernization. UPF will accelerate consolidation of aging facilities, allow consolidation of production operations currently housed in multiple buildings, reduce the size of the plant's highest security area by 90 percent,

improve security posture and thereby make the plant both more secure and more efficient. The UPF could mean a reduction of $150 to $200 million in annual operating costs, which would result in the payback of its construction costs in about five years and some $3 billion in lifetime savings. Currently, the UPF team is awaiting Critical Decision 1 to begin preliminary design. Preliminary design may begin in June 2007. The schedule is for UPF construction to start in 2010 with operations to begin in 2018.

Initiatives and Accomplishments

In the area of community outreach, BWXT Y-12 pledged a minimum of $1 million dollars to Oak Ridge High School for its renovation project. That amount could increase to $2.5 million, based on BWXT Y-12's level of success as the operating contractor for the Y-12 Complex. The company has already given $800,000 to the ORHS project as part of the overall commitment.

BWXT Y-12 is the corporate sponsor of the Oak Ridge Secret City Festival. The company also provided $200,000 to help underwrite the production of a two-part documentary on Oak Ridge. The documentary, entitled "Secret City" was produced to help preserve the history of Oak Ridge and the Manhattan Project facilities including Y-12.

BWXT Y-12 also is working with nearby Knoxville to support Project Grad, a national program geared to improve disadvantaged inner-city schools, and has agreed to a five-year commitment to the project for a total of $250,000, with $60,000 earmarked for 2007.

Y-12 also is working with Anderson County High School and Oak Ridge High School on a manufacturing partnership to help training students in 21st century job skills. The Manufacturing Partnership kicked off at the start of the current school year. The program provides workplace skills and hands-on design and manufacturing experience for students interested in manufacturing and technology. The manufacturing partnership provides subject-matter experts from BWXT Y-12, the company that manages the Y-12 National Security Complex, to spend one day per week interacting with students on a professional basis to give them a broader perspective on working in a technical or manufacturing environment.

Contributions were made to dozens of other regional schools, charities and community efforts in order to improve local quality of life, including $50,000 in 2007 to the Methodist Medical Center to assist in the procurement of robotic surgery equipment.

The company sponsors many community fundraisers for health and welfare non-profit organizations, such as the annual Literacy Luncheon. Y-12 employees receive corporate support for participation in team fundraiser walks and bike rides, including the March of Dimes and the American Cancer Society's Relay for Life events, the National Kidney Foundation Walk, the Eskimo Escapades, which raises money for the Patricia Neal Center, and The Dream Connection.

Employee, retirees and corporate United Way contributions annually total more than $600,000. The 2006 United Way total contribution was $646,957. Contributions are distributed to the United Way organizations in the counties where employees live and designate their contributions.

In addition to the annual United Way campaign, a charitable organization is selected to receive employee assistance through Days of Caring contributions, such as school supplies, health and beauty supplies, etc. An annual drive is also held to collect and contribute used coats to an area homeless shelter. Employees also give annually to the Second Harvest Food Bank.

In addition to corporate contributions and sponsorships, Y-12 employees are committed to serving the communities in which they live and work. Employees volunteer their time in local government; as board members for non-profit agencies; as mentors, coaches and scoutmasters for youth; and as participants.

Economic Development Partner: BWXT Y-12 is committed to being a good community partner and spends more than $100,000 per year in business community memberships. The company is a member of and participates in area Chambers of Commerce, East Tennessee Economic Council, Tennessee Business Roundtable, and the Tennessee Chamber of Commerce and local leadership programs, including Leadership Oak Ridge, Leadership Anderson County, Leadership Knoxville and East Tennessee Regional Leadership. In addition, BWXT Y-12 supports other area economic development initiatives, such as the Tennessee Valley Corridor Summit and Technology 2020. BWXT Y-12 is a major sponsor of the Tennessee Valley Corridor Summit, which is a regional and national showcase for technology and technology companies in the area. These organizations and programs, including the JOBS Now program to create jobs in East Tennessee, are paramount to continued growth and success of the area. The company has made a commitment to support the Jobs Now program, pledging $15,000 per year for five years.

Y-12 employees have been volunteering for projects in the Great Smoky Mountains National Park (GSMNP) for the past 10 years. Over the past nine years, Y-12 has made an annual grant commitment of $5,000 to the Great Smoky Mountains National Park and provided a group of volunteers ranging from 35 to 135 persons for several project activities each year. The Volunteers in the Park (VIPs) have competed more than 10,000 volunteer hours in the GSMNP.

BWXT Y-12 is leading the DOE complex in mentor-protégé agreements both with colleges and universities and small businesses. These agreements are part of the company's economic development activities. BWXT Y-12 has signed mentor-protégé agreements with 20 small businesses and Historically Black Colleges and Universities, including Southern University, Fisk University, South Carolina State University and Tennessee State University. Y-12 is providing a loaned administrator to serve as technical liaison between Y-12 and South Carolina State University.

Y-12's annual Safety Expo, a day set aside to focus on safety and safe work practices both on the job and in the home, has become an Oak Ridge community-wide event and attracts thousands of participants. An estimated 10,000 people, both employees and the general public, attended the 2006 Safety Expo.

For the past five years, BWXT Y-12 has held a Day of Volunteering during which more than 300 BWXT Y-12 employees volunteer for a wide range of community projects at non-profit organizations, such as the YWCA, Ronald McDonald House, Oak Ridge Public Library and area nursing homes. Projects include everything from helping with landscaping at the local Children's Museum to cleaning and painting at a local day-care center. BWXT Y-12 provides funds to buy supplies (such as paint, mulch and landscaping plants) for the volunteers' projects.

Support is also given to area fire, drug and school safety educational programs and environmental awareness and pollution prevention.

Department of Energy regulations require that excess government property be offered to Federal and State organizations, such as schools and prisons, through the Tennessee Surplus Computer Program. BWXT Y-12 has made contributions to schools for computer purchase and upgrades; science laboratory equipment; biology equipment; and other literacy, learning and GED programs of $29,610.

BWXT Y-12 administers a Matching Gift Program for employee contributions to accredited colleges and universities. Corporate matches are made annually in the amount of $27,210 through this program.

Small Business Initiatives: Y-12 is helping support NNSA's goal to increase the amount of direct federal contracting with the small business community through Y-12's partnership with the U.S. Army Corps of Engineers. Under this arrangement, USACE provides federal support to Y-12 in areas, such as procurement, construction and project management. Three major projects are in the final stages under this work.

Since 2002, Y-12 Facilities and Infrastructure Reduction Program, called FIRP, has made significant facility upgrades through recapitalization projects and clearing real estate for new facilities. Over the past five years, FIRP has invested more than $260 million in site improvements while reducing the deferred maintenance backlog by more than $107 million.

Along with the demolition of old buildings, three utility line items totaling more than $137 million are under way and will dramatically improve both the operability and the reliability of the potable water, steam and compressed air systems for Y-12. More than $23 million has been invested in roofing repairs and replacements to the tune of more than 13 acres of new roofing for mission-essential facilities.

Infrastructure Reduction

- The Infrastructure Reduction program, called IR, reached a major milestone by demolishing its millionth square foot in the month of August 2006. IR completed a successful year of demolitions by demolishing 14 facilities, reducing the footprint at Y-12 by an additional 109,119 square feet.
- Since FY 2001, IR has demolished 258 facilities/structures totaling 1,001,429 square feet. Specifically in August 2006, IR demolished five buildings totaling 74,935 square feet. These buildings included an old garage and a foundry, one of the last 'H'-shaped buildings in the Oak Ridge Complex.
- In fiscal 2007, IR plans call for the removal of an additional plan on removing 103,000 square feet of buildings
- Y-12's Infrastructure Reduction team recently returned $1 million to its customer, Y-12's Facilities and Infrastructure Recapitalization Program. The savings resulted from two tasks completed last fiscal year that demolished more than 100,000 square feet of old buildings at Y-12.

Y-12 Recognized for Environmental Accomplishments

- The Y-12 Pollution Prevention team won a 2006 White House Closing the Circle Award for outstanding federal environmental stewardship. The nomination, entitled "Partnering at Y-12 through Y-12's Multi-Organizational Reduce/Reuse/Recycle Team," was selected from among 200 nominations as one of 16 to receive an award. This activity also won a National Nuclear Security Administration Pollution Prevention Environmental Stewardship Award Certificate for Best in Class in the Recycle category. BWXT Y-12 has received a total of 22 Pollution Prevention awards since 2001.
- In Fiscal Year 2006, BWXT Y-12 implemented 84 pollution prevention initiatives with a reduction of more than 138.6 million kilograms (more than 305.6 million pounds) of waste and a cost savings/avoidance of almost $5.73 million. For the future, there are more than 88 additional pollution prevention projects in various stages from planning through implementation being pursued by the Y-12 Pollution Prevention Program.
- The Y-12 National Security Complex has done an exceptional job preventing pollution during the past several years. Since 1993, the Y-12 Complex has completed more than 611 pollution prevention projects including on-going recycling projects that resulted in the elimination of more than 783.5 million kilograms (almost 1.73 billion pounds) of waste at an estimated cost avoidance of more than $44.8 million.

The Office of Scientific and Technical Information

Initiatives and Accomplishments

Science.world Partnership: A partnership between DOE and the British Library was signed into place by Dr. Raymond Orbach with Lynne Brindley, Chief Executive of the British Library, in London, England in January 2007. The Statement of Intent announced plans to partner in the development of a searchable global science gateway, descriptively called "Science.world," a concept (patterned after Science.gov) conceived and promoted by OSTI. Other nations will be invited to join the partnership.

The signing ceremony was held in conjunction with the Winter Meeting of the International Council for Scientific and Technical Information (ICSTI), in which the Office of Scientific and Technical Information (OSTI) was represented. OSTI will take the lead in developing a Science.world prototype by the end of 2007. OSTI has operated Science.gov since its inception in 2002.

Science.gov 4.0: OSTI hosts the USA.gov science portal, Science.gov, and launched Version 4.0 in February 2007. Science.gov is an interagency initiative of 16 U.S. government science organizations within 12 Federal agencies. Access to more than 1,800 scientific Web sites and over 50 million pages of government science is provided via one query. Science.gov 4.0 offers a number of enhancements over previous versions, most notably the application of grid technology to full text relevance ranking, which is believed to be a first anywhere. Science.gov, is now deploying DeepRank to allow search and relevancy ranking across full text of documents when full text is available, is an OSTI-hosted gateway to over 1,800 sites and databases of federal R&D information, over 360 of which are DOE's.

Internationally, and in concert with two multilateral information exchange agreements, a current initiative of OSTI includes representation of DOE and the United States in a partnership with the British Library to establish a searchable Global Science Gateway patterned after the model of Science.gov. Other national and international organizations are also invited to join in this effort to create and implement this vision of a searchable international science resource.

E-print Network Reaches 1 million E-prints: OSTI's E-print Network, a fast-growing searchable scientific communications network, now boasts full-text search and access to 1 million e-print documents. By linking to publicly accessible sites around the world, the E-print Network makes available a search of information in basic and applied sciences, primarily in physics but also chemistry, biology and life sciences, materials science, nuclear sciences and engineering, energy research, computer and information technologies, and other disciplines of interest to DOE. Most documents included in the network are recent scientific literature. Also available: Access to more than 22,000 scientific Web sites organized by scientific disciplines; an Alert Service; and more than 2,900 links to relevant scientific societies.

DOE Patents, to be launched in 2007, will be a central collection of accurate Department of Energy patent information, historic and current, comprised of bibliographic records. Each record will be linked to full text at the US Patent and Trademark Office.

OSTI celebrates its 60th Anniversary in 2007. OSTI has delivered science information to the public since 1947. Through collections and Web services, OSTI makes DOE research results available to scientists, researchers, and engineers in the DOE community and beyond; as well as academia, the international science community, and science attentive citizens. Several celebratory events will be held throughout the year.

On behalf of the Department's Office of Science, OSTI supported the IAEA's 50th anniversary celebration at the 50th General Conference held at Vienna's Austria Center in September 2006. Several key country delegations provided special historical exhibits. The U.S. delegation hosted a display focusing primarily on the key role President Eisenhower played in establishing the IAEA. Many of the U.S. memorabilia items were provided from OSTI, including documents from the U.S. delegation to four of the Atoms for Peace Conferences (1955, 1958, 1964 and 1971), Eisenhower photographs, publications by Glenn T. Seaborg about the IAEA, samples from Understanding the Atom series, and several key Enrico Fermi documents. In addition to the OSTI collection, the U.S. display included a bust of Eisenhower created for the IAEA in 2003 to commemorate the 50th anniversary of the “Atoms for Peace” speech from 1953, a CD of the 2003 presentation ceremony, and the text of the speech itself (from the Dwight D. Eisenhower Library).

V. APPENDIX

The new RIMS II output, income, and employment multipliers used in this analysis are specific to Tennessee and are calculated by the Bureau of Economic Analysis (BEA). The multipliers are calculated from the industries of the North American Industry Classification System (NAICS) as opposed to the Standard Industrial Classification (SIC) System, the basis of previous multipliers.

There are 59 industries aggregated into three (output, income, and employment) multipliers based on NAICS. Output multipliers represent the total dollar change in output that occurs in all industries for each additional dollar of output delivered to final demand by the industry. For example, the average output multiplier for all industries in 2006 is 2.15, while the SIC-based multiplier for 2004 was 2.12. The income multiplier represents the total dollar change in household earnings for each additional dollar of output delivered to final demand. The income multiplier for 2006 is 0.56 and for 2004 was 0.59. The largest change in the multipliers is seen in the employment multipliers which represent the total change in the number of jobs that occurs in all industries for each additional 1 million dollars of output delivered to final demand by the industry. The employment multiplier was 25.24 for 2004 and 17.19 for 2006. A simple average of the employment multipliers shows a big difference, the ratio of the 2006 average multiplier to the 2004 average multiplier was 0.683. This means that if everything else remains the same, there will be 68.3 percent fewer jobs using the new multipliers. This difference is likely due to changes in productivity. For example, gross product per worker in manufacturing was up over 12 percent in 2004 while the number of manufacturing jobs was down. As worker productivity increases, each new dollar of output simply does not create as many jobs.

The main purpose of this study is to analyze the benefits of the operations of DOE in Tennessee. While the general methods used here are the same as in previous studies, we now utilize new impact multipliers.

The economic benefits accruing to the state are measured by the increase in production of goods and services (SGDP), the number of jobs created and the amount of personal income that is generated for residents. The main fiscal benefit is the additional sales tax revenue generated due to the increase in economic activity of DOE.

The economic impact measures are further broken down into *direct, indirect*, and *multiplier* effects. *Direct* effects are those specifically associated with DOE. Workers employed by DOE and its contractors represent the direct employment benefit of the laboratory. Likewise, the expenditures by DOE on wages and salaries are the direct income effect. Direct fiscal effects arise through a range of taxes on businesses such as property and sales taxes from the investment in real and personal property and purchases of sales taxable items. Additionally, there are payments-in-lieu-of-taxes and other fees paid by DOE and its contractors that contribute to the facility's direct fiscal benefit.

Indirect effects arise from DOE's procurement of raw materials, services, supplies, and other operating services that help support jobs in regional businesses, as well as expenditures by visitors to the facilities supported by DOE. For example, many of the business services utilized by DOE are purchased from firms within Tennessee. The economic effects of DOE increase as the share of raw materials and other inputs acquired within the region increase. Only the portion of the expenditure actually retained by an in-state vendor can be used in the calculation of the firm's indirect income benefit to the state economy. For example, if new computers are purchased from a supplier in Middle Tennessee but the computers were actually manufactured outside the state, only the mark-up of the machines above cost would be counted as new income in the state. State and local governments gain benefits due to the sales tax on these sales, but this impact is counted separately. Therefore, the size of DOE's indirect impact on regional jobs and incomes depends primarily on the dollar value of regionally purchased goods and services and whether these same goods and services are produced within the region or imported into the community.

The indirect effects arising from visitors to DOE are unique in that most private sector firms would not be expected to attract many visitors. However, since many of the facilities at DOE provide research opportunities for visiting scientists and the public at large is interested in its science and energy, the visitor effect has both a substantial quantitative and qualitative benefit. The quantitative effect of visitors to DOE is due to their expenditures on lodging, food, entertainment, etc. incurred in the state during their visit. DOE maintains data on the number of guest scientists using DOE facilities during the year and also visitors to the American Museum of Science and Energy. Estimates of expenditures per day were based on recent surveys conducted by the Knoxville Convention and Visitor's Bureau.

Finally, multiplier effects are created as the additional income generated by the direct and indirect effects is spent and re-spent within the local economy. For example, part of the wages received by DOE's employees will be spent on retail sales. If the employee goes shopping in Nashville, part of the sales receipt will be used to pay local employees of the retail establishments. These employees will in turn spend a portion of their income in the state on groceries, housing, clothing, etc., thereby adding to the amount of statewide personal income directly attributed to DOE's activities. It should be noted, during each of these subsequent rounds of spending, a large portion of the income generated leaks out of Tennessee's economy through taxes, savings, and spending outside the state, thereby diminishing the increment to total state income attributable to these firms.

Total economic impacts attributed to increased business activity are computed as the sum of the direct, indirect, and multiplier effects. The model used in this report was developed by the Center for Business and Economic Research at the University of Tennessee to calculate economic impacts of firm activity using the RIMS II multipliers specific to Tennessee. Using the expenditure and employment data provided by DOE, the model allows calculation of the output, income, employment, and sales tax revenue impacts accruing in the state of Tennessee.