The Economic Benefits of **The U.S. Department of Energy** for the State of Tennessee, 2008

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Center for Business and Economic Research

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Executive Summary

I. INTRODUCTION

The Department of Energy (DOE) generates significant economic benefits for the state of Tennessee. Day-to-day DOE operations help create jobs, create income, and increase state and local tax revenues across the state. In efforts to provide an estimate of the economic benefits of the DOE in the state of Tennessee, the Center for Business and Economic Research at the University of Tennessee initiated in-depth examinations of DOE activities beginning with the 1998 fiscal year.[1] The current study summarizes the key economic benefits imparted by the DOE on Tennessee using data from fiscal year 2008 (FY2008).[2] Results from this study confirm the significant and growing impacts of the DOE's activities on the state and its residents.

Key findings for FY2008 include the following:

- **Overall spending by the DOE and its contractors added approximately $4.0 billion to Tennessee's state gross domestic product (SGDP) in FY2008.**

- **DOE-related activities generated roughly $2.3 billion in total personal income in the state of Tennessee in 2008. Each in-state dollar of income directly paid by the DOE translates into a total of $2.08 in personal income for Tennessee residents.**

- **45,372 full-time jobs were created in Tennessee either directly or indirectly by the DOE in 2008, meaning that for every one DOE job there were 3.7 other jobs created across the state economy.**

- **Spending by the DOE and its contractors generated $90.1 million in state and local sales tax revenue in Tennessee in 2008.**

- **DOE employees are well-educated and highly trained by any standard. In 2008, 1,036 employees held Ph.D. degrees, 1,820 held a Master's degree, and 3,675 held a Bachelor's degree.**

- **In addition to output, income, tax, and employment effects, DOE entities and their employees donated roughly $5.7 million to various charities in FY2008.**

[1] Subsequent analyses were conducted for Fiscal Years 1998, 1999, 2000, 2001, 2003, 2004, and 2006.
[2] Note that DOE Fiscal Years end on September 30.

II. DIRECT BENEFITS OF THE DOE

DOE spending produces significant direct benefits for the state economy.

- **Approximately 12,373 full-time jobs were directly provided by the DOE and its major contractors within the state of Tennessee in 2008 with annual wages and salaries totaling $803.4 million.**

During 2008, the DOE and its major contractors employed 12,373 full-time equivalent employees living in the state of Tennessee. Nearly $803.4 million was spent on payroll alone. Including $284.7 million in pension disbursements, total income paid to current and former employees for FY2008 was approximately $1,088.1 million. The average annual salary for a DOE employee in 2008 was $64,687, significantly above the statewide average.

- **Non-payroll expenditures (or direct procurement spending) by the DOE and its contractors totaled more than $926.7 million in 2008.**

The DOE and its contractors purchased more than $926.7 million of goods and services from in-state businesses in FY2008. This non-payroll spending created sizeable increases in new income and jobs in various sectors of the state economy.

- **The DOE and its contractors paid nearly $29.4 million in state and local sales taxes in 2008.**

When the DOE and its associated contractors acquire goods and services from Tennessee businesses, they contribute to the state and local sales tax base. In 2008, direct tax payments to state and local governments totaled $21.7 million and $7.6 million, respectively. However, these figures only represent direct revenue generated by the sales tax and thus understate the total tax revenue benefits resulting from DOE operations in the state.

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

Spending by the DOE generates additional benefits when the direct spending generates new jobs and new income, sending ripples through the state economy.

- **In 2008, Tennessee's state gross domestic product (SGDP) increased by more than $4.0 billion as a result of direct, indirect and multiplier effects of DOE expenditures.**

Changes in SGDP represent benefits of the DOE on total state output from payroll and non-payroll expenditures. This figure reached $4.0 billion in the state of

Tennessee in 2008. The output multiplier was 1.87 which suggests that for every dollar directly spent by the DOE in Tennessee, SGDP increased by $1.87.

- **Total income benefits from DOE activities in Tennessee totaled $2.3 billion in 2008.**

The DOE's impact on personal income across the state of Tennessee totaled roughly $2.3 billion in 2008. For every dollar the DOE and its contractors spent on wages, salaries, and pensions, $2.08 was created in total state income.

- **The DOE operations supported 45,372 full-time jobs in the state of Tennessee in 2008.**

Direct and indirect spending generated by the DOE and its contractors in Tennessee supported a total of 45,372 jobs in-state. This suggests that for every direct job provided by the DOE, an additional 3.7 jobs were supported in other sectors of the Tennessee economy. The significant size of the multiplier reflects, in part, the high average annual salary of DOE employees in the state and the significant spending that flows from this income.

- **Total state and local sales taxes associated with DOE operations were roughly $90.1 million in 2008.**

DOE operations in 2008 gave rise to considerable increases in sales tax revenue for state and local governments in Tennessee. Total state sales taxes attributed to the DOE were $66.7 million, while sales tax revenue generated at the local level reached $23.4 million.

Table A: Summary of Economic Benefits of DOE in Tennessee, FY2008

Impact	Direct	Total
Output (SGDP)	$2,140,129,939	$4,007,354,228
Personal Income	$1,088,083,217	$2,258,911,112
Sales Tax Revenue	$29,375,900	$90,068,858
Employment	12,373	45,372

IV. OTHER BENEFITS AND INITIATIVES

Many of the benefits of DOE operations are not as easily quantified. Nonetheless, these activities still have a significant and positive impact on Tennessee, its residents, and the future well-being of residents.

- **The DOE, its contractors and employees donated more than $5.7 million in charitable contributions, community grants, and equipment to schools and organizations across Tennessee in 2008.**

- **The American Museum of Science and Energy drew 85,689 visitors during FY2008.**

Table of Contents

List of Tables and Figures

The Economic Benefits of the U.S. Department of Energy for the State of Tennessee

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. The 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 the 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 the DOE in 1999. The current report represents the seventh analysis and presents the economic benefits of the DOE for Fiscal Year 2008. The remainder of the report consists of three sections. First, the next section provides a profile of the activities of the DOE. Second, Section III provides a detailed analysis of the economic benefits for Tennessee in terms of output, income, jobs and sales tax revenue arising from activities of the DOE and its major contractors. Finally, Section IV summarizes many highlights and accomplishments that were noteworthy during Fiscal Year 2008.

II. PROFILES OF DOE ACTIVITIES[3]

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.

[3] 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, the 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 33,682-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)

The ORO is responsible for the major programs at ORNL, ETTP, and ORISE. ORO's programs are located in Oak Ridge; however, during Fiscal Year 2008, ORO also supported and provided services to the Pacific Northwest National Laboratory, the Thomas Jefferson National Accelerator Facility, and the SLAC National Accelerator Laboratory. 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 under way to correct the legacies remaining from more than 50 years of energy research and weapons production.
- **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 industries and universities. Named "Work for Others," this program achieved a record-breaking $389.5 million of work coming into ORO facilities during FY2008.

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

Oak Ridge National Laboratory (ORNL) is the DOE's largest science and energy laboratory. Managed since April 2000 by UT Battelle, a partnership of the University of Tennessee (UT) and Battelle Memorial Institute, ORNL was established in 1943 as a part of the Manhattan Project. During the 1950s and 1960s, ORNL became an international center for the study of nuclear energy and related research in the physical and life sciences. The 1970s led to an expansion of ORNL's research programs into the areas of energy production, transmission, and conservation. In recent years, ORNL has found new opportunities to apply its distinctive capabilities to nonproliferation, arms control, and national and homeland security. Today, ORNL's primary mission focus is conducting research in neutron science, energy, high-performance computing, systems biology, materials science, and national security that will lead to innovative solutions to complex problems.

As a world leader in a range of scientific areas supporting the DOE's basic research, energy, national security, and environmental missions, ORNL is actively engaged in a variety of national and international partnerships with industry and educational institutions. As a DOE steward of critical national research infrastructure, ORNL provides university, industry, and government researchers with access to its facilities on a competitive basis. The Laboratory hosts about 4000 facility users and visiting scientists every year. The $1.4B Spallation Neutron Source (SNS), completed in 2006, and the upgraded High Flux Isotope Reactor (HFIR) have placed ORNL on a path to become the world's foremost center for neutron scattering, and the Leadership Computing Facility (LCF) at ORNL is the DOE's most powerful computing complex for open scientific research. ORNL also manages the U.S. ITER project, a billion-dollar effort that supports a joint international research and development project aimed at demonstrating the scientific and technical feasibility of fusion power.

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 the 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 the 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, comprises both the Heritage Center and Horizon Center and is the primary focus for the 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 1,300-acre ETTP.

Cleanup of ETTP is an important mission for the Department. The cleanup is managed for the DOE by Bechtel Jacobs Company LLC, which both self-performs and subcontracts work.

Reindustrialization

The DOE Reindustrialization Office together with the Community Reuse Organization of East Tennessee (CROET) and the City of Oak Ridge (COR) are forging a new path in real property management, asset utilization, and public management of utility infrastructure.

Oak Ridge's Reindustrialization efforts focus on cleanup of the ETTP by transferring underutilized facilities and infrastructure to either the private sector or the local municipality (i.e., COR). Through property transfers, the site of the former Oak Ridge Gaseous Diffusion Plant (ORGDP) is being transformed into a private business/industrial park, referred to as the ETTP Heritage Center. By targeting this end state, and salvaging suitable facilities and infrastructure for transfer, the DOE is reducing Environmental Management (EM) mortgages associated with operations and maintenance (O&M) and demolition of surplus facilities. It is critical that not only buildings but also land and utility infrastructure be transferred for the Heritage Center to be a viable business/industrial park. This federal-community partnership/economic development initiative solves problems associated with environmental contamination, a damaged local economy, and the needed funding source of millions of dollars for critical demolition and remediation efforts all within one cyclical process. First, by transferring surplus assets to either CROET or COR there is a significant cost avoidance associated with reduced facility demolition. Second, these now-usable assets are able to be transferred to private sector partners for 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 the DOE's strategy to accelerate cleanup at ETTP. The current focus of the Reindustrialization Program is to transfer facilities and land to CROET, COR, and potentially other qualified parties. Since 2005, eight facilities, totaling approximately 315,000 square feet of space, and four land parcels totaling approximately 560 acres have been transferred to the COR or the private sector. There is the potential to transfer properties that could include an additional 300,000 square feet of floor space and up to an additional 300 acres of land. Also, approximately 9.5 miles of railroad and railroad right-of-way are in the process of being transferred to the community for economic development opportunities. Depending on the number of properties that are ultimately determined to be suitable for transfer, the DOE will save $20 million to $65 million in avoided demolition costs and more than $4 million per year in O&M costs.

The community also benefits. By leveraging the transferred ETTP utility and emergency response assets, the COR can provide enhanced services to the community. In addition, creating a private industrial park provides a catalyst for job creation in the wake of the job losses associated with the restructuring of the DOE weapons complex and the completion of environmental cleanup work. By utilizing the accelerated cleanup and transfer strategy of Reindustrialization, the DOE is able to "give back," by growing and diversifying the local job market.

Wackenhut Services Incorporated

The Wackenhut Services Incorporated – Oak Ridge Team (WSI-OR) has been providing Protective Force services to the Oak Ridge Reservation's Y-12 National Security Complex, Oak Ridge National Laboratory, East Tennessee Technology Park and the Federal Office Building Complex since January 2000. The Oak Ridge Team is a unique business model consisting of Wackenhut Services, Incorporated as the prime contractor with Critique Inc and PAI Inc being fully integrated subcontractors. The WSI-OR Team currently employs 950 personnel in their Oak Ridge Operations. To support the paramilitary Protective Force Operations, the latest weapons technologies and training facilities are employed. In June 2007, the Department of Energy Oak Ridge Office and the Y-12 Site Office each awarded the WSI-OR Team with a follow-on five year contract to protect the Oak Ridge Reservation sites.

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 B&W Y-12, LLC, for the 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 65 years, Y-12 has been one of the DOE's premier manufacturing facilities. Every weapon in the stockpile has 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 300 structures that contain almost 6 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)

The Department of Energy Office of Scientific and Technical Information (OSTI) advances science and sustains technological creativity by making R&D findings available and useful so that discovery can advance. OSTI is working to develop innovations and initiatives to accelerate this process. Examples of discovery tools at OSTI that can rapidly search science information and download research results using special federated search technology include Science Accelerator (www.scienceaccelerator.gov/), Science.gov (www.science.gov) and WorldWideScience.org (worldwidescience.org). These searchable gateways, among others, enable accelerated scientific discovery and progress by providing one-stop searching of U.S. federal and global science sources. These tools perform over 80 million transactions annually for science-attentive citizens.

OSTI also coordinates an agency-wide program for the corporate management of research and development (R&D) information which, in turn, makes OSTI databases more comprehensive. This program involves over 60 DOE Headquarters Offices, Field Offices, National Laboratories, and over 4,000 other contractor facilities. OSTI also partners with 13 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. The 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 DOE's K-25 plant in Oak Ridge, Tennessee, renamed the East Tennessee Technology Park - Heritage Center. The 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, the CROET provides the community's primary voice to the DOE for community transition issues.

In November 2005, a formal memorandum of understanding between the CROET and Technology 2020 was reached to contribute to The Center for Entrepreneurial Growth (CEG) Accelerator Program. The CEG Accelerator Program includes $700,000 of revolving financing available in increments up to a maximum of $150,000 each to small and early-stage businesses in the CROET service area who participate in the CEG program. The CROET has provided $275,000 to the CEG Accelerator and Technology 2020 has obtained an additional $425,000 for the CEG Accelerator. More than twenty transactions have been done and total financing of greater than $1 million has been provided through the CEG Accelerator. By supporting CEG Accelerator, the CROET is leveraging its own resources to provide a truly regional small business program filling a much needed gap in the capital continuum in this service area.

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. The CROET subleases space in several of the buildings to private sector companies, some of which are involved in the cleanup. The CROET has identified for the DOE over 20 buildings that are candidates for transfer to the CROET. The first four buildings selected in the evaluation process were transferred in FY 2005, with two additional buildings transferred in FY 2006. In 2007, three of these buildings were sold to the for-profit, private sector at market value after upgrades were made to meet City Code requirements. A fourth building was sold in 2008.

Two land parcels, totaling approximately 24 acres, were transferred to the CROET in FY 2008. Planning is underway for the construction of the Southern Appalachian Railway Museum on one of the parcels. Work is progressing on transfer of additional facilities, infrastructure and land parcels.

Ownership of the developable parcels in the nearby Horizon Center, a 1,000 acre Greenfield site, was transferred to the CROET by the DOE in 2003. With ownership of Horizon Center now under the CROET's stewardship, marketing has become less difficult. Horizon Center is now the corporate headquarters and regional service facility for Philotechnics, a former lessee at Heritage Center.

Moreover, in cooperation with the DOE's Oak Ridge National Laboratory, the 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 is the Park's first tenant currently contructing 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 the 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 the 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, the DOE plays a significant role in enhancing Tennessee's competitive position in attracting private firms to locate within the state. In addition, the 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, & SALES TAX BENEFITS OF THE DOE IN TENNESSEE IN 2008

In this section of the report, estimates of the quantifiable DOE benefits from income, jobs, and tax revenue creation are presented. Please see the Appendix for an overview of the model used to generate these results.

DOE Expenditure Data

In the analysis to follow, estimates of the economic benefits of the DOE and its contractors are based on actual spending figures from the DOE in 2008. The economic model uses detailed expenditure data provided by the DOE and its major contractors as inputs to generate impact estimates. Since some of the contributions from smaller contractors are omitted from this study, the highlighted benefits represent a conservative estimate relative to the actual economic benefits of the DOE to the state of 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 FY2008. Total payroll, pension, and non-payroll spending in the state was approximately $2,140.1 million in 2008 – a 9.0 percent increase over 2006.[4]

There are three main components of the analysis – the direct effects of the DOE, the indirect effects, and the multiplier effects. As the DOE and its contractors provide jobs and pay their employees, employment and income are created directly. In addition, income and employment are created indirectly when the DOE purchases goods and services from Tennessee manufacturers, service providers, and vendors – firms that in turn hire workers, earn profits and generate income. The multiplier process results in the creation of income and employment as workers spend their incomes in-state and as other firms generate sales, earn profits and hire new employees.

The direct, indirect, and multiplier effects are added together to yield the total income, employment, and tax revenue impacts of the DOE. Direct effects are attributable to the actual operation of the DOE, including the hiring of DOE and contractor staff (the direct employment impact) and payments to these workers (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. Lastly, the multiplier effect occurs as the direct and indirect incomes are spent and re-spent within the state 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 earn profits, continuing the cycle. Throughout each of these subsequent rounds of spending, a portion of the direct and

[4] See "The Economic Benefits of the U.S. Department of Energy for the State of Tennessee, 2006," Center for Business and Economic Research, The University of Tennessee, Knoxville (May 2007).

indirect income leaks out of the local economy through federal taxes, payments to non-residents, savings, and spending outside of the local area. As a result, this diminishes additional impacts on the state economy and its residents.

The largest DOE expenditure category in 2008 was payroll spending, accounting for $803.4 million, or 37.5 percent of total in-state spending. Total payroll spending – including both payroll and pension disbursements – totaled $1,088.1 million. Other notable spending categories include professional, scientific, and technical services, which reached $426.8 million in 2008.

The DOE subcontracts out many of its operations to private companies. The two largest DOE contracts in Tennessee in 2008 were B&W Y-12, LLC for the operation of the Y-12 National Security Complex and UT-Battelle, LLC, a not-for-profit partnership that manages Oak Ridge National Laboratory (ORNL). Together, these two contractors accounted for 66.6 percent of the total DOE-related expenditures in Tennessee. Other major contractors include the Bechtel Jacobs Company, LLC, a clean-up contractor for the DOE's ETTP and Wackenhut Services Incorporated, which provides security for the Oak Ridge Reservation.

Table 1: DOE-Related Expenditures in Tennessee by Industrial Sector, FY2008

Sector	Expenditures (in dollars)
Mining, Except Oil & Gas	8,200
Utilities	30,468,600
Construction	47,438,100
Wood Product Manufacturing	399,200
Nonmetallic Mineral Product Manufacturing	120,300
Primary Metal Manufacturing	35,200
Fabricated Metal Product Manufacturing	3,032,900
Machinery Manufacturing	7,545,300
Computer & Electronic Product Manufacturing	14,025,500
Electrical Equipment & Appliance Manufacturing	2,317,600
Other Transportation Equipment Manufacturing	3,778,100
Furniture & Related Product Manufacturing	196,100
Miscellaneous Manufacturing	431,000
Textile & Textile Product Mills	208,600
Apparel, Leather, & Allied Product Manufacturing	2,751,000
Paper Manufacturing	1,600,000
Printing & Related Support Activities	43,000
Chemical Manufacturing	2,394,400
Wholesale Trade	20,964,800
Retail Trade	16,304,500
Air Transportation	2,861,000
Truck Transportation	1,914,000
Transit & Ground Passenger Transportation	1,304,000
Publishing Including Software	225,300
Broadcasting & Telecommunications	2,725,000
Information & Data Processing Services	210,000
Federal Reserve Banks, Credit Intermediation, & Related Services	45,000
Securities, Commodity Contracts, & Investments	6,051,000
Insurance Carriers & Related Activities	12,008,000
Real Estate	65,414,200
Rental & Leasing Services & Lessors of Intangible Assets	1,731,400
Professional, Scientific, & Technical Services	426,813,900
Management of Companies & Enterprises	80,900,000
Administrative & Support Services	39,930,400
Waste Management & Remediation Services	79,896,500
Educational Services	20,337,800
Ambulatory Health Care Services	151,600
Hospitals & Nursing & Residential Care Facilities	1,678,000
Social Assistance	359,000
Amusements, Gambling, & Recreation	24,000
Accommodation	386,000
Food Services & Drinking Places	551,000
Other Services	27,024,866
Postal Service	100,000
Payroll	803,353,250
Pensions	284,729,967
Health Insurance	125,342,356
Total Expenditures in Tennessee	**$2,140,129,939**
Total Non-Payroll Expenditures in Tennessee	**$926,704,366**

Summary of Benefits

A total of $803.4 million was directly paid to employees in the form of payroll expenditures related to DOE activities in FY2008. An additional $284.7 million was spent on pensions. A total of $926.7 million in direct non-payroll expenditures were generated, along with $29.4 million in direct sales tax contributions. After each of these monetary portions was injected into the state economy, additional income and employment effects were generated via the indirect and multiplier processes discussed above.

Table 2 shows that the overall economic benefits of DOE spending in Tennessee in 2008—including direct, indirect, and multiplier effects—were substantial. As a result of DOE operations, output (measured by SGDP) increased by $4,007.4 million, personal income increased by $2,258.9 million, state and local sales tax revenue grew by $90,068.9 million, and 45,372 full-time equivalent jobs were created.

Table 2: Summary of Economic Benefits of DOE in Tennessee, FY2008

Output (SGDP)	$4,007,354,228
Personal Income	$2,258,911,112
Sales & Use Tax Revenue	$90,068,858
Employment	45,372

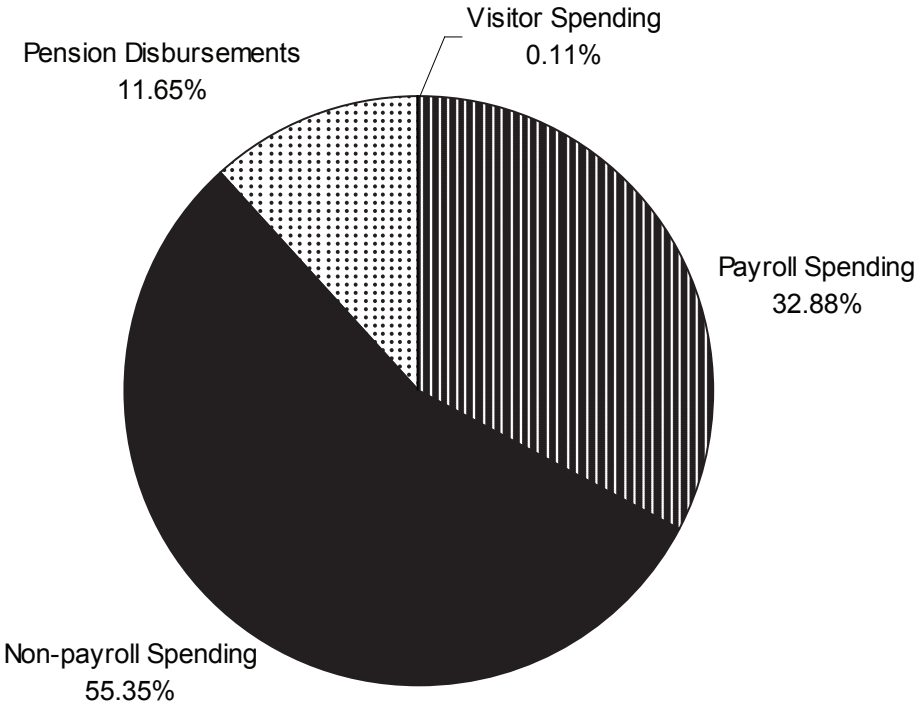
Output Benefits

In order to gauge the output benefits of DOE operations, an estimate of the increase in SGDP is included. A total of $4,007.4 million was generated in output benefits in FY2008 from the DOE and its contractors as noted above. A breakdown of the four categories that contributed to this output benefit is provided in Table 3. The largest portion of the output benefit came from non-payroll spending, which amounted to $2,218.3 million (or 55 percent of the total as shown in Figure 1), while $1,317.7 million (33 percent) was traced to payroll spending. In addition, pension disbursements generated $467.0 million and visitor spending generated $4.4 million, making up 12 percent and less than 1 percent of the total output benefit, respectively.

Table 3: DOE Output Benefit in Tennessee by Source, FY2008

Payroll Spending	$1,317,660,000
Non-payroll Spending	$2,218,258,050
Pension Disbursements	$467,014,092
Visitor Spending	$4,422,086
Total Output Benefit	**$4,007,354,228**

Figure 1: DOE Output Benefit in Tennessee by Source, FY2008



Income Benefits

Another important measure of economic benefits created by the DOE is personal income, which includes all wages, salaries, profits, interest, rents, and other forms of income earned by residents in the state economy. This measure is noteworthy because it reflects gains accruing directly to state residents. Table 4 and Figure 2 summarize these benefits for FY2008. The total increase in personal income in Tennessee attributable to DOE spending was $2,258.9 million in FY2008.

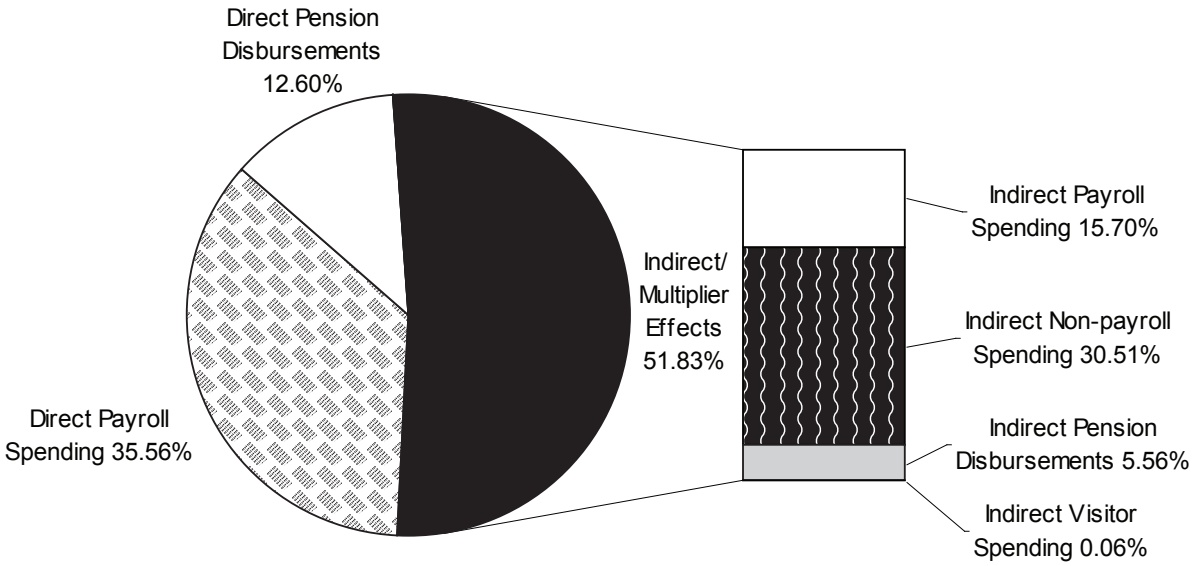
This number is split into two categories—direct effects, which made up $1,088.1 million (or 48 percent) and indirect/multiplier effects, which made up $1,170.8 million (or 52 percent) of all income benefits. Among the direct effects, $803.4 million was spent on payroll and $284.7 million on pensions. There are several indirect effects to consider that arise from DOE purchases of goods and services and spending by visitors. Non-payroll spending generated $689.2 million and visitor spending generated $1.4 million. In addition to these indirect effects are the multiplier effects from DOE-related payroll spending and pensions, which created $354.6 million and $125.7 million in benefits, respectively.

Table 4: DOE Income Benefit in Tennessee by Source, FY2008

Direct Effects	
Payroll Spending	$803,353,250
Pension Disbursements	$284,729,967
Indirect/Multiplier Effects	
Payroll Spending	$354,600,125
Non-payroll Spending	$689,194,433
Pension Disbursements	$125,679,807
Visitor Spending	$1,353,530
Total Income Benefit	**$2,258,911,112**

The implicit multiplier associated with income benefits, which is calculated by dividing the total income benefit by direct spending on payroll and pensions by the DOE, is 2.08. This suggests that every dollar of income paid directly to workers of the DOE and its contractors created $2.08 in total state income in FY2008.

Figure 2: DOE Income Benefit by Source, FY2008



Employment Benefits

Table 5 summarizes the direct employment figures of the DOE and its contractors in Tennessee, by business entity, for FY2008. There are nine entities included in this analysis, with direct employment totaling 12,373. UT-Battelle, LLC had the most workers in FY2008 (4,345), while B&W Y-12, LLC came in second (with 4,216 employees). These two contractors combined to account for 68.9 percent of DOE-related employment in FY2008. Total direct employment related to the DOE grew by approximately 505 employees since 2006, representing a 4.2 percent increase in workers.

Table 5: DOE Direct Employment Benefit in Tennessee by Entity, FY2008

Division/Contractor	Employees
UT-Battelle, LLC	4,345
B&W Y-12, LLC	4,216
Bechtel Jacobs Company	1,515
Wackenhut Services Inc.	921
ORAU	632
ORO	391
OST	214
Y-12 Site Office	82
OSTI	57
Total Direct Employment	**12,373**

The total employment benefit of DOE-related expenditures in Tennessee for FY2008 was 45,372. In addition to the 12,373 direct hires, 32,999 jobs were created indirectly and through the multiplier, accounting for 72.7 percent of the overall employment impact of the DOE. These indirect effects arise from DOE purchases and visitor spending along with multiplier effects associated with payroll spending and pensions.

Table 6: DOE Employment Benefit in Tennessee by Source, FY2008

Direct Effects	
DOE-related Employees	12,373
Indirect/Multiplier Effects	
Payroll Spending	11,104
Non-payroll Spending	17,878
Pension Disbursements	3,936
Visitor Spending	80
Total Employment Benefit	**45,372**

The FY2008 employment multiplier for DOE-related operations in Tennessee was 3.66. This suggests that for every job directly created by the DOE, an additional 3.66 jobs were generated in-state in FY2008. Given the high average salary of DOE employees ($64,687) and significant degree of subcontracting, it is not surprising that the employment multiplier associated with DOE operations is relatively large.

Sales Tax Benefit

DOE-related expenditures generated a significant amount of state and local sales tax revenue in FY2008, which are highlighted in Table 7. More than $90.0 million was paid in sales taxes in Tennessee from DOE expenditures. Of this amount, $29.4 million (32.6 percent) was generated from direct expenditures made in the state of Tennessee. Additionally, $60.1 million (67.4 percent) was generated from indirect and multiplier effects. Most of the revenue (from direct, indirect, and multiplier effects) went to the state government, but a significant portion was contributed to local governments across the state.

Table 7: DOE Sales Tax Revenue Benefit in Tennessee, FY2008

Direct Payments	
State	$21,738,166
Local	$7,637,734
Indirect/Multiplier	
State	$45,148,853
Local	$15,544,105
Total Sales Tax Revenue Benefit	**$90,068,858**

It is important to note that DOE-related activities also offer other fiscal benefits for state and local governments such as property tax revenue, business tax revenue, and payments-in-lieu-of-taxes. For example, DOE employees pay sales tax on their homes, just as other businesses contribute to the property tax base. Since the analysis in this study only considers sales tax revenue generated by the DOE and its contractors, the total fiscal benefits of the DOE in Tennessee are understated.

Additional DOE Contributions to Tennessee

There are several benefits that are associated with DOE activities in the state of Tennessee in addition to the economic benefits mentioned above. For example, the DOE supports a variety of programs that focus on community engagement, technology partnerships, contributions to the Tennessee educational system, reuse of government assets, grants, and job creation initiatives. Each of these programs have increased the overall well-being of residents in Tennessee.

Perhaps one of the more personal ways in which the DOE benefits the community at large is through charitable contributions. In FY2008, the DOE, its contractors, and employees donated a substantial amount of money to a variety of community-related charities, schools, and other organizations. Table 8 summarizes these contributions by entity and by donation source. Overall, more than $5.7 million was donated by the DOE, its contractors, and its employees in FY2008. Although these monetary contributions play a key role in the local economy, there are various activities related to community involvement that are not captured in Table 8. This suggests that these numbers understate the overall benefits that accrue to the state from DOE operations.

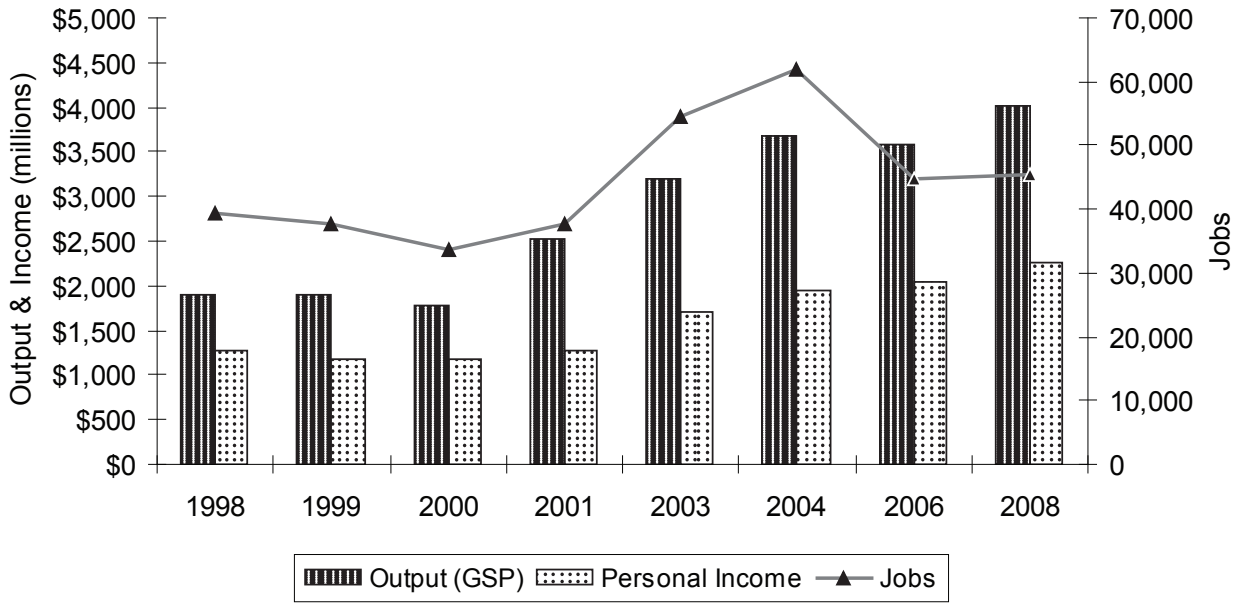
Table 8: DOE Community Charitable Contributions by Entity, FY2008

Entity	Corporate Contributions	United Way, CFC, etc.	Other Charitable Contributions	Donation of Equipment	Matching Funds for Education	**Total**
B&W Y-12	719,996	762,946	135,273	9,500	20,565	**$1,648,280**
Y-12 Site Office	--	41,491	--	--	--	**$41,491**
OSTI	--	10,884	--	--	--	**$10,884**
BJC	--	120,066	349,331	--	5,225	**$474,622**
UT-Battelle	475,939	939,857	662,309	544,494	--	**$2,622,599**
ORO	--	56,062	87,721	--	--	**$143,783**
ORAU	302,269	102,953	--	22,000	--	**$427,222**
WSI	--	50,000	293,026	--	--	**$343,026**
OST	--	--	--	--	--	**$0**
Total	**$1,498,204**	**$2,084,259**	**$1,527,660**	**$575,994**	**$25,790**	**$5,711,907**

Trends in the Economic Benefits of the DOE

The Center for Business and Economic Research has performed similar studies analyzing the economic benefits of DOE-related activities dating back to 1998. In fact, studies have been completed annually since Fiscal Year 1998 with the exception of Fiscal Years 2002, 2005, and 2007. Figure 3 illustrates the trends in the main results from each of the studies dating back to 1998. The overall trend indicates that the economic benefits from the DOE in the form of output, income, and employment generated are increasing over time.

Figure 3: Trends in the Economic Benefits of DOE



IV. HIGHLIGHTS AND ACCOMPLISHMENTS

Oak Ridge National Laboratory

Construction Summary

Since UT-Battelle became ORNL's managing contractor in 2000, 13 new facilities, representing more than 1.2 million square feet of new, energy-efficient space, have been constructed on the ORNL campus. Six of ORNL's new buildings have achieved Leadership in Energy and Environmental Design (LEED) certification from the U.S. Green Buildings Council, and ORNL has received numerous awards for its sustainable building design and construction.

In 2008, the **Joint Institute for Biological Sciences**, constructed with funding from the State of Tennessee, was completed and placed in service as headquarters for the BioEnergy Science Center (BESC), one of three Bioenergy Research Centers launched by the DOE to accelerate basic research in the development of cellulosic ethanol and other biofuels. Construction of a facility to house the Joint Institute for Neutron Sciences (JINS), which serves as an intellectual center for the neutron sciences and as a gateway for users of ORNL's neutron beam facilities, began late in 2008 and is scheduled for completion in April 2010. JINS will foster joint faculty positions between ORNL and its university partners and will assist multi-institutional research teams using neutron scattering and other uses of neutron beams to develop new applications.

A new facility is planned to house ORNL's extensive chemistry and materials development programs. This facility, to be completed in 2013, will provide 140,000 square feet of modern laboratories, substantially enhancing ORNL's ability to perform important research, to operate safely and efficiently, and to attract and retain top scientists.

Initiatives and Accomplishments

The combination of the Spallation Neutron Source (SNS), the High Flux Isotope Reactor (HFIR) and the Oak Ridge Electron Linear Accelerator (ORELA) makes Oak Ridge the **world's foremost center for neutron science**. SNS holds the world record for beam power at pulsed sources, and HFIR, the world's highest-flux reactor-based neutron source, is equipped with the world's brightest source of cold neutrons. Specialized instruments at SNS and HFIR provided users from ORNL and other institutions with exceptional tools for studying the structure and dynamics of materials at the molecular level.

ORNL's Cray XT Jaguar computing system is the **world's most powerful machine for open science**, with a peak performance of 1.64 petaflops (quadrillion floating point operations per second). The Jaguar system is used by scientists in academia, industry, and government to tackle some of the world's most complicated challenges in science and energy. ORNL is also working with the University of Tennessee to develop and operate **a second petascale computer, Kraken**, for the National Science Foundation.

ORNL's strengths in advanced materials and chemical sciences are being applied to expand the scientific foundations for new and improved energy technologies. The Center for Nanophase Materials Sciences (CNMS), one of five DOE Nanoscale Science Research Centers, served more than 400 users in 2008, taking advantage of the capabilities of SNS, HFIR, and the high-performance computing systems at ORNL. With the new chemical and materials science building, the CNMS will sustain ORNL's leadership in tailored design, synthesis, and characterization of nanoscale materials and related molecular processes.

ORNL's programs in biological systems science and climate and environmental science are focused on the challenges of observing and understanding the functioning of complex biological systems, from the cellular level to the ecosystem. In addition to leading the BESC, with its focus on developing viable, plentiful and clean alternative fuel sources for the future, scientists at ORNL are studying climate change, environmental remediation, and human health. **Five ORNL researchers were among thousands of scientists worldwide who were recognized for their support to the Intergovernmental Panel on Climate Change (IPCC), which shared the 2007 Nobel Peace Prize with former Vice President Al Gore.**

With the nation's largest and most diverse energy R&D program, ORNL develops technologies to expand the supply of reliable, affordable, and environmentally sound energy and to improve energy efficiency. Through the **Zero Energy Building Research Alliance (ZEBRAlliance)**, ORNL is working with the Tennessee Valley Authority (TVA) and area builders to bring innovative energy efficiency tools and techniques to new and existing houses in the region. A partnership with General Electric will bring a hybrid electric water heater developed by ORNL to the marketplace in 2009. The **National Transportation Research Center**, located on Pellissippi Parkway in Knox County, offers unique capabilities for addressing transportation issues and concerns. ORNL's research on high-temperature superconducting materials has led to the development of advanced power transmission cables that are now being deployed by utilities, enhancing the reliability of the nation's electricity supply. ORNL has also worked with TVA to develop tools to improve **situational awareness of the electric grid**; its real-time national visualization tool, called VERDE (for Visualizing Energy Resources Dynamically on Earth), was used to assist DOE staff in responding to three 2008 hurricanes.

Building on its heritage as a premier nuclear energy research laboratory, ORNL has demonstrated the recycling of spent nuclear fuel from a commercial reactor to produce fuel pellets suitable for use in a light-water reactor. Through a cooperative R&D agreement with USEC, Inc., ORNL is supporting the development and deployment of next-generation uranium enrichment technology. **ORNL also leads the U.S. contributions to ITER**, an international effort to build an experimental fusion reactor in Cadarache, France.

The ORNL Safeguards Laboratory was designated a national user facility in 2008, providing an internationally recognized capability for hands-on testing, evaluation,

and validation of radiation measurement equipment, as well as customized training. Customers and users include the radiation detection industry, university nuclear engineering and nonproliferation programs, the DOE, the National Nuclear Security Administration, the Defense Threat Reduction Agency, and other national laboratories.

Through the Community and Regional Resilience Initiative (CARRI), ORNL is working with three communities in the Southeast (Charleston, South Carolina; Gulfport, Mississippi; and Memphis, Tennessee) to develop processes and tools that can be used to strengthen a community's ability to withstand a major natural or man-made disaster with minimal impact on basic government and business services.

Researchers at ORNL won six R&D 100 Awards for innovative technologies in areas ranging from national security to the advanced materials industry. These awards are presented annually by R&D Magazine in recognition of the year's most significant technological innovations; since their initiation in 1963, **ORNL has won a total of 140 awards, more than any other national laboratory and second only to General Electric.**

In support of the DOE's technology transfer mission, ORNL and UT-Battelle continue to support technology transfer and economic development. Innovations from ORNL have led to the creation of **84 new companies since 2000**. In June 2008, NellOne Therapeutics, a regenerative-medicine spinout, was launched with funding from Battelle Ventures and its Tennessee affiliate, Innovation Valley Partners. The company is exploring the creation of protein therapeutics based on scientific discoveries made at ORNL.

A new focus on partnerships led to expanded relationships with local, regional, and national organizations, including Technology 2020, the Tennessee Valley Corridor, and the Southern Growth Policies Board. In April 2008, ORNL hosted its second **Global Venture Challenge**, an event combining a venture capital forum and a business competition for students. In September 2008, East Tennessee business and agency leaders launched Innovation Valley Inc., a regional partnership created to implement a new five-year economic development blueprint for the Knoxville–Oak Ridge Innovation Valley. The partnership is chaired by UT-Battelle's president and CEO. ORNL also assisted Hamilton County and Chattanooga officials in a successful effort to bring a new Volkswagen automotive assembly plant to the Enterprise South megasite in southeastern Tennessee.

The Oak Ridge Science and Technology Park, chartered in 2006, is the nation's first technology park located on the campus of a national laboratory. In August 2008, Pro2Serve broke ground on its $14 million National Security Engineering Center, the park's first new building. An existing facility houses the park's Halcyon Commercialization Center, home to a branch office of C3 International, a nanotechnology company based in Alpharetta, Georgia.

Support to Improving Education

In its role as ORNL's managing contractor, UT-Battelle places a particular emphasis on promoting science education and has **donated more than $8 million to regional outreach initiatives, including $4.5 million for science education**, since April 2000. As part of a philosophy of "legacy investments," **UT-Battelle has equipped more than 40 high school science laboratories, with donations in 2008 to schools in Morgan, Roane, Scott, and Sevier counties**. In June 2008, UT-Battelle announced a $100,000 donation to help build new science laboratories at Roane State Community College's Oak Ridge campus.

UT-Battelle was a leader in the $61 million renovation of Oak Ridge High School, which was completed in 2008. UT-Battelle's contributions included a $2 million gift and loaned executives for the project's design, communication, and fundraising efforts. The Oak Ridge Public Schools Education Foundation (ORPSEF), chaired by ORNL director Thom Mason, led a community fundraising effort that provided $8 million to the renovation project and is building a $4 million endowment to support the city's schools.

UT-Battelle continues its sponsorship of a **scholarship worth up to $20,000** that is awarded annually to an outstanding high school senior who is the son or daughter of an ORNL employee. Students commit to study science, mathematics, or engineering at the University of Tennessee.

ORNL and UT-Battelle provide a variety of educational experiences for students from kindergarten through high school. During the 2007–2008 academic year, ORNL provided mentored research experiences for all **24 members of the inaugural class of the Tennessee Governor's Academy**. In addition, 42 high school students and 19 teachers from the Appalachian region worked with ORNL scientists on inquiry-based, applied projects in science, math, and computer technology through the 2-week Summer Institute for Math, Science, and Technology co-sponsored by ORNL and the Appalachian Regional Commission. UT-Battelle also continued its sponsorship of other ongoing educational programs, including the annual FIRST Lego League tournaments (in partnership with Tennessee Technological University), the ORNL Speakers' Bureau, the Science Bowl, the Science Olympiad, and the Tennessee Junior Science and Humanities Symposium.

At the postsecondary level, ORNL offers more than **30 education programs**. In 2008, these programs served some **1,100 students and faculty from nearly 300 colleges** and universities in the United States and around the world. In January 2008, ORNL signed a mentor-protégé agreement with Jackson State University in Jackson, Mississippi. This initiative, which will provide students and faculty with access to ORNL's facilities, equipment, and staff, is only the second such agreement between a DOE laboratory and a Historically Black College or University. The first agreement was signed in July 2007, by ORNL and Morehouse College in Atlanta. ORNL has also established a research agreement with Georgetown University Medical Center, with the

goal of combining Georgetown's extensive collection of molecular and clinical data and ORNL's supercomputing capabilities to facilitate biomedical research.

ORNL continued to expand its partnerships with the University of Tennessee and the UT-Battelle "core universities" (Duke University, Florida State University, Georgia Institute of Technology, North Carolina State University, Vanderbilt University, the University of Virginia, and Virginia Polytechnic Institute and State University). Connections to the academic community include shared research, new science initiatives, and 61 joint faculty positions.

Oak Ridge Associated Universities

Initiatives and Accomplishments

In 2008 Oak Ridge Associated Universities broke ground on a new Center for Science Education. The $20 million facility, which will be four stories and provide 73,000 square feet of new space, is scheduled to open in February 2009. In addition to offices, it will house ORAU's "classroom of the future."

ORAU's quality in the field of **Illness and Injury Surveillance** and worker health issues is recognized nationwide. In 2008 a total of 3,464 beryllium lymphocyte proliferation tests were conducted in the ORAU Beryllium Laboratory with an error rate of 0.2%, only one-tenth of the target rate. In addition to continuing to perform tests for the former vendor Worker Beryllium Surveillance Programs, the ORAU lab performed beryllium lymphocyte proliferation tests for active workers from ten sites at the request of the site medical directors.

ORAU completed 2004-2006 annual reports for all participating Illness and Injury Surveillance Program (IISP) sites and completed three 2007 reports with four additional 2007 reports in progress.

During FY2008, ORAU worked with the the DOE to produce numerical and graphical analyses of current beryllium exposure monitoring data and medical surveillance data to enhance reporting of summary and site-specific beryllium registry data. The report "2008 Current Beryllium-Associated Worker Registry Summary" is posted on the DOE website.

ORAU plays a critical role in clean-up of DOE sites by providing **Independent Environmental Assessment and Verification** to provide assurance that facilities and materials are properly prepared for public or other appropriate use. The quality of the Radiochemistry Laboratory's analytical sample analyses is without match in the industry. During FY2008, communication enhancements were realized through implementation of a new and upgraded information management system. The laboratory obtained acceptable results on 320 of 320 blind performance samples. Having 100 percent acceptable third-party performance tests is far superior to the industry standard and significantly impacts ORAU's reputation as a leader in the field of independent environmental verification.

In 2008, a team of ORAU health physicists completed a two-year effort of researching and implementing advanced Global Positioning System (GPS)-based survey technologies to greatly improve the accuracy of data reporting methods for environmental surveys and assessments. This program advancement effort, which was initiated by ORAU fiel0d staff, began in 2006 and has involved countless hours of research, instrumentation testing and troubleshooting, procedure writing, the development and testing of a Global Information System (GIS) database, and numerous field tests and equipment modifications. The incorporation of this innovative technology into the IEAV survey program has greatly improved data quality and report presentation, and has provided the government and the public with an invaluable, accurate, and permanent record of environmental measurements.

At the request of the DOE, ORAU undertook a two-year project, completed in 2008, to perform independent reviews and data validation for the Nondestructive Assay Program (NDA) at the K-25 site. The site contractor was developing and implementing a program to perform NDA measurements of special nuclear material hold-up in process piping and components. Because of the overwhelming safety significance of the NDA program, DOE selected ORAU to support the independent verification effort. In order to support DOE's mission to successfully complete the decontamination and decommissioning of the K-25 building, the ORAU survey team 1) conducted substantial technical reviews of more than 20 NDA program documents; 2) served as technical team members for several Criticality Incredible program readiness assessments led by the DOE; 3) developed and implemented an independent verification program for validation of NDA measurements at K-25, which included the use of a specialized measurement system (HMS-4) to quantify U-235 holdup in piping; and 4) performed independent laboratory analyses of foamed process pipe samples to quantify various radionuclides.

ORAU provided assistance to NRC by assessing radiological doses to users and possessors of radium-dial timepieces. The Energy Policy Act of 2005 expanded the definition of by-product nuclear material, which brought radium under the jurisdiction of the NRC. In preparation, the NRC asked ORAU to model the radiological doses to individuals who may be exposed to radium timepieces under a variety of situations. ORAU's report provided critical information as to whether proposed regulations would adequately protect the public from any associated health and safety risks.

The availability and responsiveness of the Radiation Emergency Assistance Center/Training Site (REAC/TS) personnel, equipment, and facilities allows ORAU to provide unique capabilities in **Radiation Emergency Management**. In the past year REAC/TS responded to 200 calls for assistance for medical assistance or presumed radiation exposure.

ORAU also participates in drills and exercises to improve the nation's capability to respond to radiological events ranging from accidental industrial exposures to incidents involving weapons of mass destruction (WMD). During one of the largest Department

of Homeland Security (DHS) exercises in recent history involving multiple federal, state, and local agencies, a team of one physician, one health physicist, and two nurse/paramedics from ORAU was deployed to Portland, OR, well within four hours. In the same exercise, the Cytogenetic Biodosimetry Laboratory (CBL) capability was tested with 12 blood samples demonstrating the CBL's ability to respond effectively and timely to a radiological event. The successful testing of the CBL capability during an exercise is a significant improvement and addition to the REAC/TS program and the nation's emergency response arsenal. In addition, REAC/TS deployed in less than one minute to the Methodist Medical Center of Oak Ridge during the Oak Ridge National Laboratory Full Field Exercise.

REAC/TS' other mission is to provide training to medical and emergency personnel around the world. In addition to providing courses at federal facilities, nuclear plants and hospitals across the country, the Pan American Health Organization (PAHO) and the World Health Organization (WHO) have redesignated the REAC/TS as a PAHO/WHO Collaborating Center for Radiation Emergency Assistance.

ORAU provides **National Security and Emergency Management** capabilities to test and improve national strategy and readiness relating to weapons of mass destruction (WMD) terrorism. In 2008, ORAU successfully planned, coordinated, and executed ten interagency exercises across the country. The largest had to be planned over three separate venues (Guam, Phoenix, and Portland, Washington). The planning and execution required extraordinary coordination with federal, state, and local stakeholders in order to produce a technically challenging and realistic exercise.

The planning of another major exercise began in 2008. To date, ORAU members of the planning team have planned, developed, and facilitated 34 formal meetings; 12 Seminars; Workshops; and Functional and Tabletop exercises in advance of the upcoming exercise, which is based on a major earthquake in Southern California. Participants include 23 state agencies and a combination of 12 federal and non-governmental agencies working in conjunction with three Regional Emergency Operations Centers, seven southern region operational areas, and four inland region operational areas. Numerous other "firewalled" exercises will occur simultaneously. In addition, ORAU employees have trained over 235 controller and evaluators as "train the trainers" in support of this exercise.

ORAU Senior Operations Planners worked with the State of California and the Department of Homeland Security Domestic Nuclear Detection Office to design and implement a **Preventive Radiological/Nuclear Detection Taskforce**. With a mission to develop a comprehensive, statewide, preventive program to protect California from radiological and nuclear threats, the taskforce is currently working towards the design of a statewide implementation strategy.

ORAU senior staff provided logistical and operational support to the **FBI Hostage Rescue Team (HRT)** by deploying with the team to the Republican and

Democratic National Convention Sites in August and September, 2008. These planners normally deploy with the HRT on exercises or similar National Security Special Events, where they assist in equipment maintenance and operational assistance in the Joint Operations Center. ORAU personnel coordinated interagency planning efforts for events such as the Annapolis Peace Conference, New Years Eve, the Super Bowl, State of the Union Address, 9/11 Ceremony of 2008, the 2008 Papal visit, and the UN General Assembly. Planning began for support of security efforts for the presidential inauguration in January 2009.

ORAU staff in the FBI's Terrorist Explosive Device Analytical Center's (TEDAC) provide the Bureau with forensic science capabilities. Accomplishments include the following:

Latent Print Examinations Conducted:	10,861
Latent Prints Developed/Claimed:	3,368
Integrated Automated Fingerprint IdentificationSystem Comparisons:	77,082
Items Processed for Trace Evidence:	5,234
DNA specimens/Mass Spectrometry Validation Samples analyzed:	713
Photographs Taken:	104,941

ORAU has a history of providing **Professional and Technical Training** programs and today strives to significantly enhance worker health and safety and public health preparedness through training and education. ORAU's efforts in this field increased dissemination of worker health and safety and public health information to numerous individuals and organizations within the DOE complex and other federal agencies.

During FY2008, ORAU planned, conducted, evaluated, and reported on a series of **pandemic flu tabletop exercises** designed for quarantine stations, first responders, and medical and health professionals at port-of-entry locations in international airports in Honolulu, HI; Miami, FL; Newark, NJ; and Dallas, TX; and a seaport in Anchorage, AK. ORAU assisted the DOE ORO in pandemic flu planning and preparedness and presented a summary to ORO staff at a quarterly all hands ORO staff meeting. In addition, ORAU designed, developed, coordinated, and conducted Regional Workshops across the country aimed at identifying healthcare delivery gaps and solutions in four communities in pandemic influenza preparedness. Communities that participated included Champaign, IL; Winston-Salem, NC; Peoria , IL; and Summit County, OH.

ORAU also designed, developed, coordinated, and conducted two international Pandemic Influenza Planning Workshops for the Asian Pacific Economic Cooperative. The two workshops were held in Taiwan and Peru, and 25 Asian and Pacific nations participated with representatives from China and Japan as well as South American countries.

To ensure that the nation's healthcare system is prepared to respond to a radiological incident, ORAU has assisted the Centers for Disease Control (CDC) in developing two tool kits for public health and emergency room personnel. More than 9,800 copies of the tool kits (including DVDs, CDs, fact sheets, and brochures) have been distributed across the U.S. and to health officials in fourteen nations. More than 25,000 health professionals have taken the related online course, and 500,000 have visited the Physicians Rad Terrorism web site developed by ORAU.

ORAU's Nanotechnology website has provided up-to-date worker safety information to the DOE and DOE contractors across the country. A total of 34,775 hits with 13,109 unique visitors on the website have been recorded for FY2008 (a 100 percent increase from FY2007). In FY2008, ORAU added a new section to the site providing resources on nano safety training and procedures.

In terms of dollars and in terms of reach across the country, ORAU's **Science and Education Programs** comprise the largest segment of the company. ORAU has sustained a national leadership role in the conduct of workforce development programs by recruiting applicants from across the country and placing them in DOE facilities and other federal research centers.

ORAU participants represented 531 four-year U.S. colleges and universities which exceeded the Performance Target of 18 percent or 483 four-year U.S. institutions by 9.9 percent. In addition, institutions were located in all 50 states plus the District of Columbia and Puerto Rico. The diversity of institutions and geographic representation is particularly impressive because the majority of the research participation opportunities in ORAU operated programs are located in the Southeastern states.

During 2008, ORAU supported participants in a wide range of internships, undergraduate scholarships, graduate fellowships, postgraduate research, and other educational programs and activities. Participants were engaged in research or other educational activities at a variety of DOE laboratories, DOE Headquarters, and at the research centers of other federal agencies through the DOE's Work for Others Program. More than a dozen federal agencies have utilized the resources of ORAU to replicate programs similar to those developed and operated for the DOE. Through its close, long-standing partnership with Oak Ridge National Laboratory (ORNL), ORAU managed ongoing research participation programs and developed new initiatives in response to specific needs of the ORNL. All of these activities continued to establish ORAU as a national leader in workforce development and the operation of scholarship, fellowship, internship, and research participation programs. These ORAU programs support the DOE's mission to strengthen the foundations of science by training the next generation of science, engineering, technology, and supporting professionals required to maintain U.S. scientific competitiveness.

For five consecutive years, ORAU has partnered with ORNL to present the **Day of Science**, an event designed to showcase ORNL's unique resources to hundreds of

students and faculty from HBCUs and other MEIs with the goal of attracting them into internships and collaborations at ORNL. Building on the success of this event, ORAU again partnered with ORNL in FY2008 to expand the Day of Science to showcase the entire DOE system. By applying unique skills in recruitment, event planning, Web design, electronic registrations, and program design, ORAU successfully attracted nearly 1,000 students and faculty for the expanded event that was held at the Knoxville Convention Center, making the event one of the largest DOE outreach activities ever held. A massive recruitment campaign was implemented with the focus on HBCUs, ORNL core universities, ORAU member schools, and majority institutions with large minority populations. All DOE laboratories brought exhibits that were staffed with scientific, HR, and education program staff to interact with the students and faculty. In addition to learning about the unique capabilities of each of the DOE's laboratories, students had the opportunity to hear major speakers on cutting edge science, as well as to learn about the DOE's internship programs. Faculty attended a session on working with the DOE and its laboratories and participated in a technical workshop designed to help them position their schools for DOE funding opportunities.

In 2008, ORAU assisted the DOE in administering the 18th Annual National Science Bowl (NSB). The year's event was associated with the largest number of regional science bowl competitions in NSB history, logging the largest number of teams to ever participate in the NSB competition. It included the first Congressional Reception held specifically for NSB teams and for the first time the finals of the competition were held at the historical National Building Museum to attach greater prestige to the event and allow greater federal participation. Finally, ORAU attracted a significant increase in corporate sponsor participation and contributions to enhance the program even further.

In its **Scientific and Technical Resource Integration** programs, ORAU strives to promote the quality of DOE funded research and other scientific and technical information through the coordination and conduct of independent and objective peer and merit reviews. During FY 2008 ORAU conducted reviews of 1,875 research proposals, programs, projects, centers, human health risk assessments, post-doctoral applications, and technical work products involving 2,404 scientific and technical reviewers and/or subject matter experts. These reviews were conducted for the DOE, the U.S. Department of Homeland Security, U.S. Environmental Protection Agency, and U.S. National Aeronautics and Space Administration.

ORAU also coordinated 31 advisory committee and subcommittee meetings for the DOE Offices of Advanced Scientific Computing, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics, and Nuclear Physics. ORAU assisted with research review activities for these other DOE offices: Civilian Radioactive Waste Management; Energy Efficiency and Renewable Energy; Health and Safety; and the National Nuclear Security Administration Offices: Advanced Simulation and Computing; and Defense Programs.

During the year ORAU coordinated 211 mission-related workshops, Federal Advisory Committee meetings, and program reviews for the DOE, the DHS, and the North American Research Strategy for Tropospheric Ozone (NARSTO) consortium. One of these meetings, the Second Annual DHS University Network Summit in Washington, D.C, was attended by more than 500 people from federal/state/local government, academic, commercial, media, private sector, and medical agencies. There was representation from 13 minority-serving institutions and attendees from Australia, Belgium, Canada, England, Germany, Italy, Japan, Singapore, Sweden, United Kingdom, and the United States. Of the 114 speakers at the Summit, 47 were from the domestic academic arena, 16 from the international academic arena, 32 from the domestic government arena, 10 from the international government arena, 8 from the domestic industry arena, and 1 from the international industry arena.

ORAU also manages the **University Radioactive Ion Beam (UNIRIB) consortium**. In collaboration with the ORNL physics division, UNIRIB commissioned a new spectroscopic tool to study neutron-rich fission fragments, called LeRIBSS, providing new world class research capabilities. In an invited talk a UNIRIB researcher presented the results of the first experiments at the prestigious international Exotic Nuclei and Atomic Masses conference in September 2008.

UNIRIB staff also developed a compact isobar spectrometer and separator, based on the multi-pass-time-of-flight (MTOF) principle. In 2008, the MTOF separator capability was developed and demonstrated with a resolving power of 40,000 exceeding the design goal of 15,000. The significantly improved resolution has experimental implications. This opens the possibility of very important (by-product) experiments where unknown masses of nuclei can be determined to a level of accuracy that will enable theorists to differentiate between theories.

Bechtel Jacobs Company LLC

During FY 2008, environmental cleanup contractor Bechtel Jacobs Company LLC made significant progress under its contract with the DOE to clean up the Oak Ridge Reservation as well as the David Witherspoon Inc. site in South Knoxville.

Initiatives and Accomplishments

Transferred Land Parcels ED-5 East and ED-7 to the Community Reuse Organization of East Tennessee (CROET) for economic development.

Transferred the Fire Station K1652 and an accompanying 2.2 acre land parcel to the City of Oak Ridge. The City of Oak Ridge now supplies ETTP Fire and Emergency Response Services from this transferred facility. This concluded a massive transition involving all major BJC and DOE operational entities. Personnel and equipment transitioned so that response service was transparent to the user with enhanced operational capability.

Transferred the K1515 Water Plant and appurtenant structures plus select site water distribution lines. Coordinated with CROET and the City of Oak Ridge on the construction of a new site sewage lift station, terminated operation of the on-site sewage treatment plant and transferred to the City of Oak Ridge select sewage collection lines. The city will use these facilities to support DOE activities at ETTP as well as other development on the extreme western end of the City of Oak Ridge.

Completed leasing activity in FY 2008 with CROET in support of the privatization of ETTP includes:

The K-792 Area, comprised of 11 acres and 2 buildings totaling ~7,000 square feet. As a result of this lease, a major trans-modal area has been developed in support of regional economic development.

The lease of the K-1251 Barge Area complements the K-792 Trans-Load Area as an additional transportation outlet for the region.

The New 229 Boundary – The revised ETTP 229 Boundary was approved and published in the Federal Register. The new boundary will help facilitate transfer of roads and utilities to the City of Oak Ridge. In conjunction with this accomplishment, a new 229 boundary fence was completed and approved by security.

Additional accomplishments include:

- Completed final preparations for the demolition of the west wing of the massive WWII era K-25 building, and began actual demolition in December 2008.
- Completed non-destructive assay (NDA) program upgrade and activated state-of-the-art NDA facility to support K-25 waste disposal decisions.
- Disassembled and removed bridge connecting K-25 west wing with north end.
- Demolished K-1024 laboratory, office and filter test building. Prepared K-1101 and K-1201 (ETTP Air and Nitrogen Plants) for demolition.
- Designed and installed K-25 haul road truck portal to facilitate increased EMWMF waste shipments.
- Demolished the 11-acre K-1401 building and backfilled the site.
- Demolished 3 predominantly uncontaminated facilities and 13 low-risk/low-complexity facilities.
- Demolished 16 decommissioned facilities at ETTP; demolished cumulative of 219 facilities at ETTP.
- Dispositioned 89,000 tons (6,500 truck loads) of cleanup-generated waste at the DOE's Environmental Management Waste Management Facility.
- Treated 1.03 million pounds of waste at the Toxic Substances Control Act Incinerator.
- Disposed of 8,700 truck loads of excavated soil and debris from the David Witherspoon Inc. 1630 site in south Knoxville.
- Removed the last of the nuclear fuel from the Molten Salt Reactor Experiment at ORNL.

Wackenhut Services, Inc.

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. The first payment of $100,000 was made in January 2004 and the last payment of $100,000 will be made in January 2009.

WSI-OR is a sponsor of the Oak Ridge Secret City Festival and has continued its contribution of $7,500 for 2008.

WSI-OR contributed $25,000 to Methodist Medical Center to assist in its Robotic Surgery Campaign to be paid over a five year period. The first payment of $5,000 was paid in 2008. Each year a $5,000 will be made through 2012.

WSI-OR contributed $50,000 to Habitat for Humanity of Anderson County to be paid over a five year period. The first payment of $10,000 was made in 2007. Each year through 2011, $10,000 will be paid.

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

Contributions were made to over 70 local and regional educational, charitable and community efforts in order to improve quality of life throughout the region. Many WSI-OR employees give generously of their time as well as working with non-profit organizations and schools throughout the region.

The company sponsors many fundraising events for local and regional non-profit organizations such as the Annual Literacy Event, Make-A-Wish Foundation Gala, Go Red for Women Event and numerous others. Additionally, the company is very involved in efforts for the American Cancer Society and its Relay for Life Program.

WSI-OR has the 5th largest contribution to the United Way of Anderson County with an employee campaign that totaled $50,000. The company is the major sponsor of the annual United Way Golf Tournament and is also a major 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 funds distribution committee, the nominating committee, the marketing committee and by volunteering at United Way events. The 2007 and 2008 kick-off events were led by the WSI-OR General Manager.

WSI-OR is involved in numerous community organizations and is a Millennium Partner of the Oak Ridge Chamber of Commerce ($15,000 premium above membership dues) a Premier Partner of the Knoxville Area Chamber Partnership ($5,000 premium

above membership dues) 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 continues to make significant changes through its modernization programs to ensure the effectiveness of this vital national security facility for the country and primary economic contributor in East Tennessee.

Modernization Activities

Y-12 is leading the Nuclear Weapons Complex in building demolitions, having demolished 284 buildings for a total of 1,257,000 square feet of building space. In FY 2008, Y-12 has removed a total of 149,000 square feet of building space.

The primary goal of the **Y-12 Facilities and Infrastructure Recapitalization Program** is to remove structures no longer needed to meet Y-12's missions. It also helps Y-12 transform to a 21st century nuclear enterprise through extensive reuse of existing facilities and construction of necessary new facilities.

Potable Water System Upgrades

Construction is underway on the $62.5 million potable water system upgrades project which is a key part of complex transformation at Y-12. The new system will provide Y-12 with a more reliable and cost-effective source of potable water.

The multi-year project includes two new 220 foot-tall, two million gallon tanks, pumps, and distribution piping to provide a new primary and backup water supply to the Y-12 plant; underground pipe repairs and replacement of more than 9,000 feet of deteriorated original cast iron water mains; and sprinkler system modifications. The potable water system at Y-12 provides water for process, sanitary and fire suppression purposes and is considered "mission essential."

Completion of HEUMF facility

A major construction project, begun in 2004, to build the **Highly Enriched Uranium Materials Facility (HEUMF)** was completed in September 2008. The $549 million facility—Y-12's ultra-secure uranium warehouse of the future—will replace aging facilities with a single state-of-the-art storage facility. The HEUMF is a large, primarily reinforced concrete structure with adjoining equipment and administrative areas which provides storage capacity for thousands of containers of material to be held in specially designed storage racks.

The HEUMF will play a major role in helping the National Nuclear Security Administration accomplish its mission of protecting the nation's inventory of highly

enriched uranium -- the nation's vital security asset. In addition to being a modern facility for receiving, shipping and providing long-term storage of HEU, the HEUMF is an integral part of NNSA's plan to move from a Cold War-era nuclear weapons complex to a 21st century national security enterprise. It is also to be a key part of Y-12's long-range modernization plan.

New Hope Center – Energy Efficient

The New Hope Center at the Y-12 National Security Complex has been recognized as a LEED Certified facility by the U.S. Green Building Council. The Leadership in Energy and Environmental Design program is a program of the United States Green Building Council and guides building design toward more environmentally friendly buildings.

Y-12 Construction Safety

The B&W Y-12 Direct-Hire Construction team has worked two million hours, covering a four-year period without a lost-time injury. Much credit for the accomplishment goes to the Knoxville Building and Construction Trades Council (KBCTC), which provided well-trained, skilled, and safety-conscious personnel who embraced Y-12 safety programs.

New Apprenticeship Program

With what looks to be a resurgence of the nuclear power industry, particularly in the Tennessee Valley and across the Southeast, skilled craft workers are in short supply, and there is strong competition for these workers. That is why the Y-12 National Security Complex is reviving an apprenticeship program to recruit and train workers in nine skilled crafts: boilermakers, carpenters, electricians, insulators, ironworker/riggers, outside machinists/millwrights, painters, pipefitters, air conditioning and refrigeration mechanics and welders.

As employees of B&W Y-12, apprentices receive on-the-job training in critical skill areas at Y-12. They also must attend classroom training sessions conducted by the respective union locals. Upon completion of the apprenticeship, trainees earn their journeyman's card. Program standards are based on recommendations from the United States Department of Labor and the Bureau of Apprenticeship and Training.

Collaborative Research

As part of its pursuit to transform into a more responsive and affordable enterprise that supports a broader national security mission, Y-12 has taken its recent designation by NNSA as the Uranium Center of Excellence (UCE) and began aggressively pursuing innovative ways to support NNSA's transformation plans. A central part of the UCE business and technology strategy is to form mutually-beneficial and long-term alliances with institutions having similar interests. For example, B&W Y-12 and Oak Ridge Associated Universities have signed a memorandum of understanding for a collaborative research partnership.

Small Business Initiatives

B&W Y-12 supports NNSA's goal to increase 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—such as procurement, construction and project management—to Y-12. Several major projects have been completed under this initiative.

B&W Y-12 leads the DOE complex in mentor-protégé agreements with small businesses and Historically Black Colleges and Universities (HBCUs). B&W Y-12 has signed mentor-protégé agreements with 20 small businesses and Historically Black Colleges and Universities, including Norfolk State University, Southern University, Fisk University, South Carolina State University, Tennessee State University and Alabama State University. B&W Y-12 was instrumental in having the first ABET, Inc. accredited Nuclear Engineering program established at South Carolina State University. This is the first newly-established nuclear program in 20 years and the only accredited program at an HBCU.

B&W Y-12 held a Mentor-Protégé Conference, bringing together company representatives and Historically Black Colleges and Universities that are part of the company's Mentor-Protégé Program. The "HBCU Day" was created so that both sides of the mentor-protégé pairing can provide insight into each side of the relationship. Participants included representatives from South Carolina State University, Tennessee State University, Southern University and A&M College, Fisk University, Alabama State University and Norfolk State University, which is the latest signee to the program.

The DOE Mentor-Protégé Program is designed to encourage DOE prime contractors to assist small disadvantaged firms certified by the Small Business Administration (SBA) under Section 8(a) of the Small Business Act, which includes women-owned small businesses, historically black colleges and universities and other minority institutions of higher learning and small business concerns owned by service-disabled veterans. The program provides B&W Y-12 a mechanism for entering into integrated working agreements and for providing non-financial assistance to these entities. The agreements are designed to enhance the protégé's business and technical capabilities, and to foster long-term business relationships between small businesses or universities and DOE prime contractors. B&W Y-12 representatives discussed their needs regarding production, research, security, safety and work force planning and recruiting, as well as describing the requirements of the mentor-protégé contracting program.

Veterans' Conference

The Y-12 National Security Complex and The University of Tennessee Center for Industrial Services Procurement Technical Assistance Center joined with several East Tennessee agencies for the **East Tennessee Veterans Business Conference in 2008**. The purpose of the annual Veterans Business Conference is to increase business opportunities for service-disabled veterans and veteran-owned small businesses. At the

conference, small business owners had the opportunity to attend a “Meet the Buyers” session of federal, state, local governments, and DOE Prime Contractors. Buyers from Fort Campbell and the Veterans Administration also attended. Veteran-owned businesses had the opportunity to schedule “one on one” appointments to explore possible business opportunities. Franchise options for small businesses, technology transfer and emerging business opportunities and business planning for small businesses were included.

R&D 100 Awards

A research chemist and his revolutionary cloth invented to clean surfaces leaving no sticky residue, even down to the nanoscale, have captured a prestigious R&D 100 award, along with three other researchers at the Y-12 National Security Complex. R&D magazine issues the awards in recognition of the year’s most significant technological innovations.

Canned Subassembly Refurbishment

The Y-12 National Security Complex has reached a major milestone in the National Nuclear Security Administration’s Stockpile Stewardship Program with completion of the canned subassembly production for the B61 **Life Extension Program**.

Under the LEP, B61-7 and B61-11 strategic nuclear bombs are being retrofitted with the refurbished canned subassemblies produced by Y-12. The canned subassembly contains the secondary — the second stage of modern thermonuclear weapons. The designation for the retrofit is Alteration 357, and the retrofit will significantly extend the life of this strategic bomb.

Work on the B61 ALT 357 also benefited from Y-12’s Throughput Improvement Program, or YTIP. Several YTIP actions resulted in lowering costs to ensure the final schedule was achieved within budget.

Community Outreach Activities

In the area of community outreach, B&W Y-12 is committed to supporting charitable activities and educational initiatives to improve the quality of life in the communities where company employees live and work.

The company contributed a total of $1.1 million over four years to Oak Ridge High School for its renovation project. B&W Y-12 has made contributions to other area schools for computer equipment and upgrades; science laboratory equipment; biology equipment; and other literacy, learning and GED programs. In addition, the company sponsors area science and engineering bowls, fairs and competitions.

With one year remaining of a five-year commitment, B&W Y-12 has invested $220,000 in the Project Grad initiative in Knoxville. Project Grad is a national program geared to improve educational opportunities for students in disadvantaged inner-city Knoxville schools.

B&W Y-12 partners with Oak Ridge and Anderson County High Schools to train students in current manufacturing job skills. The Manufacturing Partnership program provides workplace skills and hands-on design and manufacturing experience for students interested in manufacturing and technology. The company provides experts to interact weekly with students to give them a broader perspective on working in a professional manufacturing or technical environment.

The company administers a Matching Gift Program for employee contributions to accredited colleges and universities. Total annual corporate matches range from $18-25,000 through this program. B&W Y-12 has funded endowment scholarships for graduating high school students in East Tennessee. One is for study in the University of Tennessee's College of Engineering and the other is awarded annually through the East Tennessee Foundation for study of science or engineering at Roane State Community College or Pellissippi State Technical Community College.

B&W Y-12, its employees and retirees are major contributors to area United Way organizations. The total 2008-09 Y-12 United Way Campaign pledge was nearly $800,000. Contributions are distributed to the United Way organizations in the counties where employees designate their contributions.

In addition to the annual United Way campaign, charitable organizations are selected to receive employee assistance through the Y-12 Days of Caring program. Contribution collections include a food drive for Second Harvest Food Bank, a school supplies program for Aid to Distressed Families in Appalachian Counties, and clothing and health aids for residents of Florence Crittendon Agency and their infants. In addition, an annual drive is held to collect and contribute coats, hats, gloves, scarves and other warm clothing for the homeless in our community through the Volunteer Ministry Center in downtown Knoxville.

The company sponsors many community fundraisers for health and welfare non-profit organizations, such as the annual Literacy Luncheon, community Volunteer Fire Departments, and community public libraries.

B&W Y-12 supports employees in team walks, runs and bike rides, including the March of Dimes; American Cancer Society's Relay for Life; National Kidney Foundation Walk; and the Eskimo Escapades, which raises money for the Patricia Neal Rehabilitation Center and the Dream Connection.

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 volunteer workers and participants. Y-12 employees have been volunteering for projects in the Great Smoky Mountains National Park for several years. B&W Y-12 makes an annual grant commitment of $5,000 to the Great Smoky Mountains National Park for supplies and provides a group of 35 – 75

volunteers for two or three projects each year. The Volunteers in the Park (VIPs) have competed more than 10,000 volunteer hours in the National Park and have received national recognition for their efforts.

B&W Y-12 sponsors an annual Day of Volunteering during which more than 500 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 the local Scarboro Day Care Center. B&W Y-12 provides funds to buy supplies (such as paint, mulch and landscaping plants) for the volunteers' projects. In 2008, the company funded 35 projects for about $20,000.

The company supports the Friends of ORNL community lecture series, Arts Council of Oak Ridge organizations, Oak Ridge Playhouse, and the Oak Ridge Civic Music Association performances. Other community events include Veterans Day activities, the annual Martin Luther King Day program at the American Museum of Science and Energy in Oak Ridge, and the African American Appalachian Arts annual Kuumba Festival in downtown Knoxville.

B&W Y-12 also sponsors the annual National Night Out community event in Oak Ridge. Support is also given to community fire, drug and school safety educational programs.

The company participates in environmental awareness and pollution prevention activities such as activities of the East Tennessee Clean Fuels Coalition and the City of Oak Ridge's annual Earth Day event.

Economic Development Activities

B&W Y-12 is committed to being a good community partner and spends more than $100,000 annually in business 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 Roane County, Leadership Knoxville, and East Tennessee Regional Leadership.

In addition, B&W Y-12 supports other area economic development initiatives, such as the Tennessee Valley Corridor Summit and Technology 2020. 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 by pledging $15,000 a year for five years.

The Office of Scientific and Technical Information

Initiatives and Accomplishments

Science Accelerator Introduced – The OSTI, introducing scalability in federated government search, developed the initial version of the Science Accelerator to demonstrate the capabilities that will eventually yield the technology to search at least 1,000 scientific databases in parallel. The Science Accelerator of tomorrow will offer a captivating blend of knowledge diffusion technology. Utilizing available resources and building upon the success of OSTI's existing, groundbreaking information access technology, the Science Accelerator will consolidate and expose to distributed search all of the important web-accessible collections of scientific knowledge related to the DOE mission.

WorldWideScience.org Supported Globally – On June 12, 2008, in Seoul, South Korea, the multilateral **WorldWideScience Alliance** was established to govern WorldWideScience.org. The alliance was established to serve as the permanent governance structure of WorldWideScience.org. WorldWideScience.org introduced federated searching across global science sources and gives citizens, researchers and anyone interested in science the capability to search science portals not easily accessible through popular search technology. The Alliance consists of 13 founding member organizations representing 38 countries.

DOepatents Launched – The OSTI introduced a searchable collection of more than 20,000 patent records resulting from DOE and predecessor-agency funding. The database represents a growing compilation of patents resulting from research supported by the DOE, and demonstrates the Department's considerable contribution to scientific progress from the 1940s to the present. DOepatents consists of bibliographic records, with full text where available via either a PDF file or an HTML link to the record at the United States Patent and Trademark Office. The database is updated frequently with new information. Highlights include a compilation of noteworthy DOE innovations from the past few decades; resource links for inventors; recent inventions; and patent news.

DOE Data Explorer Launched – In June 2008, the OSTI introduced a new resource, the DOE Data Explorer, for discovering Department of Energy scientific research data wherever they reside. This data discovery tool was developed as a way to guide users to scientific research data—such as computer simulations, numeric data files, figures and plots, interactive maps, multimedia, and scientific images—generated in the course of DOE-sponsored research in various science disciplines. It is intended to be particularly useful to students, the public, and to researchers who are new to a field or looking for experimental or observational data outside their normal field of expertise.

Science.gov 5.0 Launched – In September 2008, Science.gov 5.0 provided users the capability to search additional collections of valuable science content, more easily target searches, and readily find links to additional information on their science topics of interest. Seven databases and portals were added to the 200 million

pages of science information at Science.gov. New information included thousands of patents resulting from DOE research and development, documents and bibliographic citations of DOE accomplishments, millions of scientific e-prints from around the world, comprehensive, peer-reviewed toxicology data for thousands of chemicals, cancer-related information of all kinds for all audiences, a digital archive of biomedical and life sciences journal literature, and information on toxicological effects of drugs and other chemicals. In addition, Science.gov 5.0 provided a “clustering” feature which grouped results by subtopics or dates, as well as links to related EurekAlert! Science News and Wikipedia information on science topics of interest. The Alerts and Email Search Results services were updated.

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). These multipliers represent the most recent regional multipliers available and supplant those used in the last study. The multipliers are calculated from the industries of the North American Industry Classification System (NAICS).

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 2008 is 2.19, while the average multiplier for 2006 was 2.15. 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 2008 is 0.57 and for 2006 was 0.56. The employment multipliers, which represent the total change in the number of jobs that occur in all industries for each additional one million dollars of output delivered to final demand by the industry, averaged 16.25 in 2008 and averaged 17.14 in 2006.

The main purpose of this study is to analyze the benefits of the operations of the DOE in Tennessee. The economic benefits accruing to the state are measured by the increase in production of goods and services as measured by State Gross Domestic Product, the number of jobs created, and the amount of personal income that is generated for residents. The main fiscal benefit accounted for in this study is the additional sales tax revenue generated for state and local governments due to the increase in economic activity of the DOE.

The economic impact measures are further broken down into direct, indirect, and multiplier effects. Direct effects are those specifically associated with the DOE. Workers employed by the DOE and its contractors represent the direct employment benefit of the DOE. Likewise, the expenditures by the 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 the DOE and its contractors that contribute to the facility's direct fiscal benefit.

Indirect effects arise from the 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 the DOE. For example, many of the business services utilized by the DOE are purchased from firms within Tennessee. The economic effects of the DOE increase as the share of raw materials and other inputs acquired within the region increase. Only the portion of the expenditures 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 the source of new income in the state. State and local governments gain benefits due to the taxes on these sales, but this impact is counted separately. Therefore, the size of the DOE's indirect impact on regional jobs and income 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 the DOE are unique in that most private sector firms would not be expected to attract many visitors. However, since many of the facilities at the DOE provide research opportunities for visiting scientists and the public at large is interested in science and energy, the visitor effect has both a substantial quantitative and qualitative benefit. The quantitative effect of visitors to the DOE is due to their expenditures on lodging, food, entertainment, etc. incurred in the state during a visit.

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 employees will be spent on retail sales. If employees go 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 the DOE's activities. It should be noted that during each of these subsequent rounds of spending, a 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 the DOE, the model allows calculation of the output, income, employment, and sales tax revenue impacts accruing in the state of Tennessee.