

# Expected Economic Impact of Constructing and Operating a New Onsite Disposal Facility in Oak Ridge

**Matthew N. Murray**, Director  
Howard H. Baker Jr. Center for Public Policy

**Becky Davis**, Graduate Research Assistant  
Howard H. Baker Jr. Center for Public Policy

Report Prepared for  
**UCOR**  
**URS | CH2M Oak Ridge LLC**

February 12, 2016



## Baker Center Board

**Cynthia Baker**  
Media Consultant  
Washington, DC

**Sam M. Browder**  
Retired, Harriman Oil

**Patrick Butler**  
CEO, Assoc. Public Television Stations  
Washington, DC

**Sarah Keeton Campbell**  
Attorney, Special Assistant to the Solicitor General and  
the Attorney General, State of Tennessee  
Nashville, TN

**Jimmy G. Cheek**  
Chancellor, The University of Tennessee, Knoxville

**AB Culvahouse Jr.**  
Attorney, O'Melveny & Myers, LLP  
Washington, DC

**The Honorable Albert Gore Jr.**  
Former Vice President of The United States  
Former United States Senator  
Nashville, TN

**Thomas Griscom**  
Communications Consultant  
Former Editor, *Chattanooga Times Free Press*  
Chattanooga, TN

**James Haslam II**  
Chairman and Founder, Pilot Corporation  
The University of Tennessee Board of Trustees

**Joseph E. Johnson**  
Former President, University of Tennessee

**Fred Marcum**  
Former Senior Advisor to Senator Baker  
Huntsville, TN

**The Honorable George Cranwell Montgomery**  
Former Ambassador to the Sultanate of Oman

**Regina Murray**  
Knoxville, TN

**Lee Riedinger**  
Vice Chancellor, The University of Tennessee, Knoxville

**Don C. Stansberry Jr.**  
The University of Tennessee Board of Trustees  
Huntsville, TN

**The Honorable Don Sundquist**  
Former Governor of Tennessee  
Townsend, TN

## Baker Center Staff

**Matt Murray, PhD**  
Director

**Nissa Dahlin-Brown, EdD**  
Associate Director

**Charles Sims, PhD**  
Faculty Fellow

**Krista Wiegand, PhD**  
Faculty Fellow

**Jilleah Welch**  
Research Associate

**Jay Cooley**  
Business Manager

**Elizabeth Woody**  
Office Manager

**Kristin England**  
Information Specialist

**William Park, PhD**  
Director of Undergraduate Programs  
Professor, Agricultural and Resource  
Economics

**About the Baker Center**  
The Howard H. Baker Jr. Center for  
Public Policy is an education and re-  
search center that serves the University  
of Tennessee, Knoxville, and the public.  
The Baker Center is a nonpartisan  
institute devoted to education and public  
policy scholarship focused on energy  
and the environment, global security,  
and leadership and governance.

Howard H. Baker Jr. Center for Public  
Policy  
1640 Cumberland Avenue  
Knoxville, TN 37996-3340

bakercenter.utk.edu  
865.974.0931  
bakercenter@utk.edu

**Disclaimer**  
This research was funded by URS | CH2M  
Oak Ridge LLC (UCOR) and carried out  
by researchers at the University of Ten-  
nessee's Howard H. Baker, Jr. Center for  
Public Policy. The views expressed herein  
are those of the authors alone and do not  
necessarily represent the views of URS |  
CH2M Oak Ridge LLC (UCOR)

## **Executive Summary**

The Department of Energy's Oak Ridge Office of Environmental Management (DOE-OREM) is evaluating whether to construct a new on-site disposal facility to facilitate continued cleanup activities on the Oak Ridge Reservation. Design, construction and subsequent operation of the new waste disposal facility will have a significant impact on both the regional and state economies. While the impacts will be concentrated in the Anderson, Roane, and Knox counties region, equipment rental, materials acquisition, and payroll spending will create economic ripples that will extend into other Tennessee communities. The analysis focuses on related activities, as forecasted in the draft Remedial Investigation/Feasibility Study for Oak Ridge Reservation waste disposal, from 2012 to 2047, when cleanup of the Oak Ridge Reservation will be complete. However, this analysis extends through 2055 to include the first eight years of post-closure monitoring and maintenance at the facility.

Projected economic impacts of the environmental cleanup program that account for the design, construction, operation and closure of a new on-site disposal facility include a significant increase in state output or state gross domestic product (state GDP), personal income (which accrues to residents of the state), sales and use tax revenue, and employment for the duration of the project. Expenditures incurred to support construction, materials and equipment procurement, and overhead will lead to dispersion of these impacts across a significant portion of the state economy. Highly-skilled management, engineers, operators, laborers, foremen, security, and professional employees of DOE-OREM and its contractors will spend disposable income in a manner that will create additional jobs and income. The same will be true of workers employed by vendors supplying materials and equipment. Increased business activity and worker spending will boost sales and use tax revenues for state and local governments.

### **Key findings (which account for direct, indirect and multiplier effects):**

- **DOE-OREM and its contractors spend an estimated \$1.3 billion in nominal output (\$638 million in PDV terms) in Tennessee. Approximately \$1.0 billion of that total is projected to accrue to Anderson, Roane, and Knox counties.**
- **Over the life of the environmental clean-up project, a total of \$695 million (\$345 million in PDV terms) in personal income is projected to be paid to Tennessee residents, of which \$609 million (a PDV of \$302 million) would go to individuals in the three-county region.**
- **Employment in Tennessee is estimated to rise by 6,830 jobs due to the projected new on-site waste disposal facility. Approximately 5,721 of those jobs are projected to be filled in Anderson, Roane, and Knox counties.**
- **State and local sales tax revenues of \$54 million (\$18 million in PDV terms) are estimated to accumulate to Tennessee from spending by DOE-OREM and its contractors. Of that total, \$50 million (a PDV of \$16 million) in tax revenues are projected for the three-county region.**

# Expected Economic Impact of Constructing and Operating a New Onsite Disposal Facility in Oak Ridge

## Introduction

Planning, construction, operation, and closure of the proposed on-site storage facility by the Department of Energy's Oak Ridge Office of Environmental Management (DOE-OREM) would generate a significant economic impact on both the local and state economies. The impacts would be concentrated near the site in the Anderson, Roane, and Knox Counties region. Equipment rental and material acquisition, along with payroll spending, would generate smaller but still significant impacts in additional Tennessee counties. Planning for the proposed facility began in 2012, meaning that some expenditures have already been incurred.

The project's planning stage is scheduled to last through 2018. Phase I of the construction for Cells 1 and 2 of the on-site disposal facility would begin in 2019 and continue through 2022. Operation of the site would commence in 2022 and continue for approximately 22 years, ending in 2044. During that time, phase II of construction for Cells 3 and 4 is scheduled to take place from 2027 to 2029, with construction of phase III for Cells 5 and 6 from 2034 to 2036. Closure of the cells is anticipated to begin in 2044 and last to 2047. After closure, long-term, monitoring and maintenance would begin. The scope of this report examines projected spending through 2055, including the first eight years of long-term monitoring and maintenance.

The analysis summarizes the economic impacts expected to arise over the course of the on-site disposal facility life-cycle. The study's primary focus is on the projected economic impacts for the Anderson, Roane, and Knox Counties region and for the greater Tennessee economy. The projected impacts are measured by employment, personal income, and gross state domestic product (SGDP or output). Estimates of state and local sales and use tax revenues arising from the waste disposal facility's life-cycle and related activities are also provided to capture payments made by individuals and businesses on sales taxable goods and services.

## Methodology

Direct, nominal and present discounted value (PDV) totals for projected output, personal income, sales tax revenue, and employment are reported in Table 1. Direct expenditures signify spending for the project before it circulates through the economy to create indirect and multiplier effects. Nominal values represent the aggregate spending over the entire life of the project considered here, 2012 to 2055, and includes direct, indirect, and multiplier impacts. It is common practice to use present discounted value for streams of expenditures and revenues when they accrue over the course of multiple years. The PDV reflects the nominal annual stream of dollar values after adjusting (i.e. discounting) for the time value of money. Nominal benefits that accrue further out in the time horizon will generally have a lower PDV than similarly-valued nominal benefits that are realized early in the impact window. A higher discount rate – the interest rate used to discount nominal benefits – will generally lead to a lower PDV. All PDVs in this analysis are discounted back to 2012 and include direct, indirect, and multiplier impacts.

The total increase in output for the immediate site location in Anderson, Roane, and Knox Counties is estimated to be \$1.0 billion or a Present Discounted Value\* of \$499.9 million over the life of the project, expanding from an initial spending level of \$723.3 million. Personal income grows to \$608.7 million or to \$302.3 million in PDV terms from \$381.1 million. The PDV of sales tax revenue associated with building the new on-site storage disposal facility totals \$15.6 million, which is discounted from a nominal value of \$49.7 million and grows from a direct investment of \$18.2 million. Overall employment related to the project reaches 5,721 full-time equivalent jobs in the three-county region, growing from 2,682 direct hires.

Table 1: Summary of the Direct, Nominal, and Present Discounted Value of Economic Benefits of Continued On-Site Waste Disposal in Anderson-Roane-Knox Counties

Impact	Direct	Nominal Total	PDV Total
Output (GDP)	\$723,274,572	\$1,018,394,247	\$499,875,457
Personal Income	\$351,083,200	\$608,677,578	\$302,315,277
Sales Tax Revenue	\$18,170,311	\$49,672,419	\$15,646,327
Employment	2,682	NA	5,721

DOE-OREM and its contractors also spend a portion of their personal income in counties other than Anderson, Roane, and Knox Counties. Similarly, equipment rental and procurement of materials do not take place solely in the three-county region. For this reason, the analysis of DOE-OREM-related expenditures for the proposed on-site disposal facility has been expanded to capture the collective economic impact in all affected Tennessee counties; however, the direct impact is the same for the three-county region and the state as a whole. The nominal value and PDV of state GDP is higher than that of Anderson, Roane, and Knox Counties, totaling \$1.3 billion and \$637.7 million respectively. The same is true for total personal income, which amounts to a nominal \$694.7 million and totals \$344.5 million when discounted. The PDV (nominal value) of sales tax revenue is 14.1 million (9.0) percent larger than that of the three-county region, equaling \$17.8 million (\$54.1 million). An estimated 6,830 jobs would be related to activities associated with the planning, construction, operation and closure of the proposed on-site disposal facility.

Table 5: Summary of the Direct, Nominal, and Present Discounted Value of Economic Benefits of Continued On-Site Waste Disposal in Tennessee

Impact	Direct	Nominal Total	PDV Total
Output (GDP)	\$723,274,572	\$1,299,336,274	\$637,670,006
Personal Income	\$351,083,200	\$694,714,277	\$344,522,191
Sales Tax Revenue	\$18,170,311	\$54,125,248	\$17,830,746
Employment	2,682	NA	6,830

## **Economic Impacts**

The study estimates \$723.3 million would be spent by the environmental cleanup program during the life-cycle of the proposed on-site disposal facility. The potential economic impacts associated with these expenditures are substantial. The nominal stream of output for the Anderson, Roane, and Knox Counties region is estimated to be \$1.0 billion, reflecting the total increase in the production of goods and services from all sources over the span of the project. In present discounted value (PDV) terms, output in the three-county region grows by \$499.9 million due to the construction and operation of the new facility. Broadening the scope to all of Tennessee, the PDV of state GDP grows to \$637.7 million, or a nominal value of \$1.3 billion. Tennesseans in the three-county region are expected to accrue an estimated \$302.3 million in discounted personal income, while around \$344.5 million in discounted personal income will be added to all of Tennessee. Cities and counties will see a PDV (nominal) stream of sales tax revenues totaling \$15.6 million (\$49.7 million) from the three-county region while the state will see \$17.8 million (\$54.1 million). A total of 5,721 individuals will be employed in the Anderson, Roane, and Knox Counties area due to the life-cycle activities of the new on-site disposal facility. Some of these individuals will reside outside the three-county region. Expanding the scope of employment to all of Tennessee, 6,830 individual will be employed from life-cycle activities of the new on-site disposal facility.

Payroll spending incurred for the construction and operation of the on-site waste disposal facility would translate into disposable income for workers who would be expected to spend a significant portion in Tennessee, creating additional jobs and income, and contributing to state and local sales tax revenues. Direct non-payroll expenditures through equipment rental, materials and operations materials spending, and overhead costs incurred in Tennessee create in-state impacts on output (final sales), employment, income and the base of sales and use tax through vendor sales.<sup>1</sup> Much of the payroll income generated in supplier firms throughout the supply chain is subsequently spent, enhancing state economic activity and further boosting sales tax revenue. The data presented below reflect all of these effects and represent the total economic impacts arising from construction and operation of the proposed waste disposal facility. The full effects are captured using RIMS II multipliers that identify impacts on output, income and employment.<sup>2</sup>

<sup>1</sup>Overhead is calculated as 15 percent of payroll, equipment rental, materials and operation materials for a given year.

<sup>2</sup>Regional Input-Output Modeling System (RIMS II) multipliers were acquired from the U.S. Bureau of Economic Analysis. These multipliers vary by region. Multipliers for the state of Tennessee and an aggregate for Anderson, Roane, and Knox Coun-

Of the four spending categories used in the analysis, payroll spending contains the largest level of expenditures for the on-site waste disposal project. To capture the total economic impact for this spending category, RIMS II multipliers are employed for the industry aggregate “Household” sector. Of the non-payroll spending associated with the project, materials and operations materials account for the largest share of expenditures. To arrive at the economic impacts for this category of spending, multipliers from the following RIMS II North American Industrial Classification System (NAICS) codes were averaged for output, income, and employment.

### *Economic Benefits for Anderson, Roane, and Knox Counties*

Projected impacts of the construction and operation of the proposed on-site storage facility would lead to a significant increase in output, personal income, sales tax revenue, and employment for the duration of the project. Table 1 summarizes the findings. A 4 percent rate was assumed for discounting purposes. This model is commonly used to measure the economic impact of projects that provide benefits to society at large. The present discounted value of total output in Anderson, Roane, and Knox Counties is \$499.9 million. Building and operating the waste disposal facility would generate to Tennesseans in the three-county region personal income of \$302.3 million in present discounted value terms. Business activity and worker spending, including multiplier effects, would boost sales and use tax revenues for state and local governments by a PDV of \$15.6 million. Construction and operation of the on-site waste disposal facility would necessitate a significant labor pool over the course of the project. Total employment, plus employment created in supplier firms and through ripple effects of the spending multiplier, will total 5,721 jobs for Tennesseans. Without discounting the expenditures used to calculate output, personal income and sales tax revenue, the impact values grow to \$1.0 billion for output, \$608.7 million in personal income and \$49.7 million in sales tax revenue due to continued on-site waste disposal in Anderson, Roane, and Knox Counties.

Table 1: Summary of the Direct, Nominal, and Present Discounted Value of Economic Benefits of Continued On-Site Waste Disposal in Anderson-Roane-Knox Counties, TN

Impact	Direct	Nominal Total	PDV Total
Output (GDP)	\$723,274,572	\$1,018,394,247	\$499,875,457
Personal Income	\$351,083,200	\$608,677,578	\$302,315,277
Sales Tax Revenue	\$18,170,311	\$49,672,419	\$15,646,327
Employment	2,682	NA	5,721

Of the \$499.9 million generated in PDV output benefits for the three-county region, \$191.0 million reflects payroll spending, a number representing 38.2 percent of total output impact. Non-payroll spending represents \$308.9 million, the remaining 61.8 percent of GDP

ties are used. The multipliers quantify the cumulative effects on total industry output, earnings, and employment that result from a change in final demand. Final demand in this analysis reflects expenditures on facility construction and operation from 2012-2055.

in the Anderson, Roane, and Knox Counties region. Table 2 displays the total output impact of continued on-site waste disposal for the three-county region.

Table 2: Summary of the Present Discounted Value of Output Impact of Continued On-Site Waste Disposal in Anderson-Roane-Knox Counties, TN

Impact	Total
Payroll Spending	\$191,012,784
Non-payroll Spending	\$308,862,672
<b>Total Output Impact</b>	<b>\$499,875,457</b>

A breakdown of the total present discounted value of the income impact from life-cycle activities of the proposed on-site waste disposal facility is provided in Table 3. Direct payroll from DOE-OREM totals \$175.7 million in PDV terms and accounts for 58.1 percent of the total income benefit. Indirect and multiplier effects that arise from DOE-OREM-related purchases of goods and services for the construction and operation of the facility total a PDV of \$126.6 million (or 41.9 percent of the income benefit). The implicit multiplier associated with income benefits, calculated by dividing the total income benefit by the direct spending on payroll by DOE-OREM, is 1.72. This means that for every dollar of income paid directly to workers of DOE-OREM and its contractors created \$1.72 in total income for Anderson, Roane, and Knox Counties.

Table 3: Summary of the Present Discounted Value of Income Impact of Continued On-Site Waste Disposal in Anderson-Roane-Knox Counties, TN

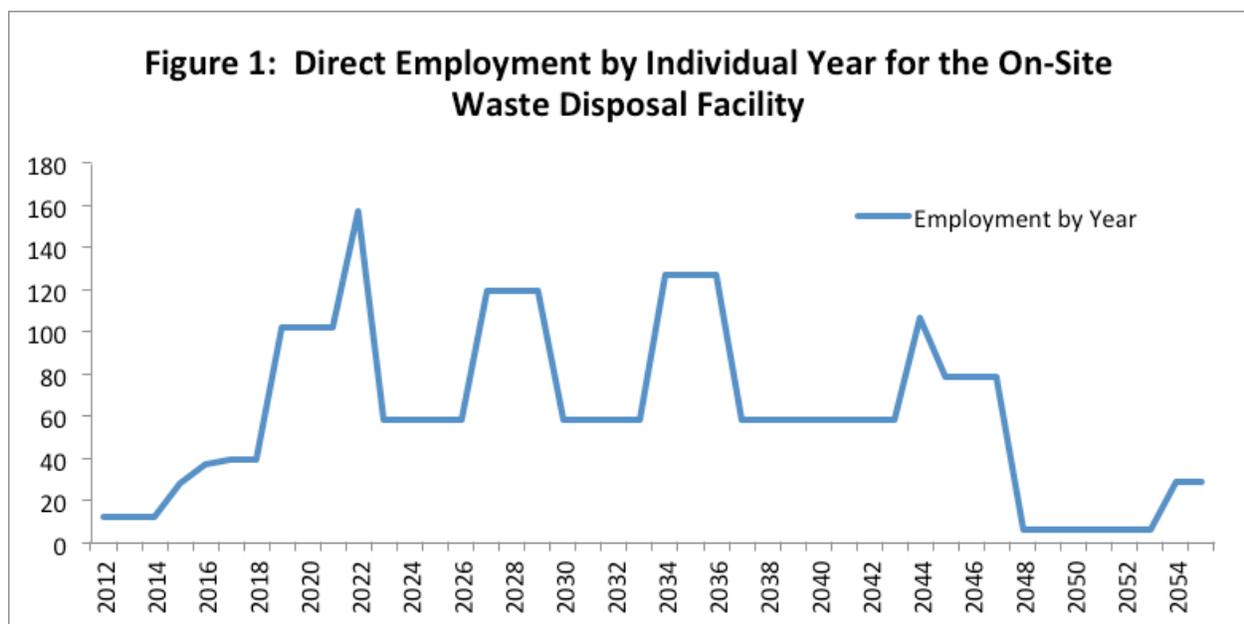
Impact	Total
Direct Payroll	\$175,692,406
Indirect/Multiplier Payroll Spending	\$48,596,520
Indirect/Multiplier Non-payroll Spending	\$78,026,351
<b>Total Income Impact</b>	<b>\$302,315,277</b>

The total employment benefit from the on-site waste disposal facility construction and operation in Anderson, Roane, and Knox Counties will be 5,721—a figure that sums annual FTE jobs across all years of the project (see Table 4). The direct number of employees associated with the project represents the aggregate number of individuals employed each year from 2012 to 2055. Figure 1, on the other hand, displays direct employment by year, which is the same input for both the three-county analysis and the state analysis to follow. A total of 3,039 jobs will be created indirectly and through multiplier effects, accounting for 53.1 percent of the total employment benefit. The employment multiplier for the three-county region is 2.1. For every

job directly created by constructing and operating the on-site waste disposal site, a total of 2.1 individuals will be employed in the Anderson, Roane, and Knox Counties region.

Table 4: Summary of the Total Annual Employment Impact of Continued On-Site Waste Disposal in Anderson-Roane-Knox Counties Across All Project Years

Impact	Total
Direct Employees	2,682
Indirect/Multiplier Payroll Spending	1,413
Indirect/Multiplier Non-payroll Spending	1,626
<b>Total Employment Impact, All Years</b>	<b>5,721</b>



The number of workers at the facility would vary considerably year-by-year with peaks at each of the three construction phases and during closure.

### *Economic Impact for Tennessee*

The following analysis is comparable to that conducted for Anderson, Roane, and Knox Counties. The main difference reflects the set of RIMS II output, income, and employment multipliers calculated by the Bureau of Economic Analysis and a broadened impact region that is defined as the entire state. The multipliers used above were specific to Anderson, Roane, and Knox Counties (combined). Those used below represent the most recent regional multipliers available and specific to the state of Tennessee rather than the three-county region. The set of direct expenditures for payroll and non-payroll are identical for the state and the three-county area. Direct employment is also the same for both regions.

Table 5 summarizes the total present discounted value of the economic impact of DOE-OREM’s life-cycle activities associated with the proposed on-site waste disposal facility from 2012 to 2047 and monitoring and maintenance through 2055. The estimated impact includes direct, indirect, and multiplier effects, which are substantial. In this model, the PDV of state GDP grows by nearly \$637.7 million from facility construction and operation. Approximately \$344.5 million in discounted personal income would be generated by the project, with \$17.8 million in discounted state and local sales tax revenue is expected be raised. A total of 6,830 jobs will be filled due to DOE-OREM’s project. In nominal terms, output totals \$1.3 billion, while personal income grows to \$694.7 million. The nominal total for sales tax revenue collected from continued on-site waste disposal in the state is \$54.1 million. The nominal value and PDV of output, personal income, sales tax revenue, and employment would all be larger for Tennessee as a whole, compared to only focusing on the three-county region.

Table 5: Summary of the Direct, Nominal, and Present Discounted Value of Economic Benefits of Continued On-Site Waste Disposal in Tennessee

Impact	Direct	Nominal Total	PDV Total
Output (GDP)	\$723,274,572	\$1,299,336,274	\$637,670,006
Personal Income	\$351,083,200	\$694,714,277	\$344,522,191
Sales Tax Revenue	\$18,170,311	\$54,125,248	\$17,830,746
Employment	2,682	NA	6,830

Table 6 provides a breakdown of the total output benefit. Of the \$637.7 million in PDV of output generated by the on-site waste disposal facility, \$250.0 million, or 39.2 percent of the total, represents payroll spending. The remaining \$387.6 million in PDV of state GDP is generated through non-payroll spending on the project.

Table 6: Summary of the Present Discounted Value of Output Impact of Continued On-Site Waste Disposal in TN

Impact	Total
Payroll Spending	\$250,027,864
Non-payroll Spending	\$387,642,142
<b>Total Output Impact</b>	<b>\$637,670,006</b>

Table 7 shows the total income benefit of constructing, operating and monitoring the on-site waste disposal facility in Tennessee from 2012-2055 is \$344.5 million in present discounted value terms. Direct payroll is the same for the three-county region as it is for the state as a whole, but accounts for a smaller share of total income benefits at 51.0 percent compared to

the 58.1 percent for the three-county region. The indirect and multiplier effects are larger for Tennessee than only looking at Anderson, Roane, and Knox Counties, since the ripple effects are able to disperse across all 95 counties in the state. The indirect and multiplier effects total \$168.8 million in PDV terms. The income multiplier at the state-level is 1.96, so every dollar of income paid directly to workers of DOE-OREM and its contractors creates \$1.96 in total state income.

Table 7: Summary of the Present Discounted Value of Income Impact of Continued On-Site Waste Disposal in TN

Impact	Total
Direct Payroll	\$175,692,406
Indirect/Multiplier Payroll Spending	\$67,483,453
Indirect/Multiplier Non-payroll Spending	\$101,346,331
<b>Total Income Impact</b>	<b>\$344,522,191</b>

Table 8 shows the total employment benefit from construction and operation of the proposed on-site waste disposal facility in Tennessee is an estimated 6,830 jobs. Again, 2,682 direct hires are associated with the project, with multiplier effects producing 4,148 additional individuals at the state-level. The employment multiplier is larger for the state as a whole than the three-county region, going from 2.1 for Anderson, Roane, and Knox Counties to 2.5 for all of Tennessee.

Table 8: Summary of the Total Annual Employment Impact of Continued On-Site Waste Disposal in TN Across All Project Years

Impact	Total
Direct Employees	2,682
Indirect/Multiplier Payroll Spending	1,919
Indirect/Multiplier Non-payroll Spending	2,229
<b>Total Employment Impact</b>	<b>6,830</b>

## Conclusion

Continued on-site waste disposal supporting cleanup of the Oak Ridge Reservation will require the construction and operation of a new facility in Oak Ridge, Tennessee. The construction and operation of this facility would have a significant economic impact on the

Anderson, Roane, and Knox Counties region as measured by personal income, sales and use tax revenue, and employment.

Direct nominal spending in Tennessee attributable to the production of the new on-site waste disposal facility would total approximately \$723.3 million. When circulated through the state economy, these funds would generate \$1.3 billion in output benefits, \$694.7 million in personal income benefits for residents, and \$54.1 million in sales and use tax revenue for state and local governments in Tennessee. After discounting these nominal values, the project provides \$637.7 million in discounted output benefits, \$344.5 million in discounted personal income benefits for state residents, \$17.8 million in discounted sales and use tax revenue for the state and local governments in Tennessee, and a total of 6,830 individuals employed from the project.