Strategic Planning in the Office of Environmental Management – 11499

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ABSTRACT

The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) is the largest environmental program in the world with many first-of-its-kind cleanup activities. Since its inception in 1989, EM has made substantial progress in nearly every area of nuclear waste cleanup, including stabilizing and consolidating high-risk material, such as tank waste and surplus special nuclear material. Strategic planning efforts produced a portfolio of opportunities for investment of American Recovery and Reinvestment Act (Recovery Act) funds, which are resulting in the creation of more than 10,000 jobs, the acceleration of mission activities, including the completion of cleanup of three sites, and a reduction in life-cycle cost. EM's ongoing strategic planning is identifying additional opportunities to leverage Recovery Act successes and to further accelerate completion of the EM mission and reduce life-cycle cost.

WHAT IS EM STRATEGIC PLANNING AND ITS ANTICIPATED OUTCOME?

The EM mission is to complete the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research. Nuclear activities produced legacy waste and contamination at the original Manhattan Project sites – Los Alamos, New Mexico; Hanford, Washington; and Oak Ridge, Tennessee – as well as major Cold War sites, such as Savannah River Site, South Carolina; the Idaho National Laboratory, Idaho; Rocky Flats Plant, Colorado; and Fernald, Ohio. Today EM has responsibility for nuclear cleanup at 16 sites covering more than two million acres in 11 states, and employs more than 30,000 Federal and contractor employees, including scientists, engineers and hazardous waste technicians. The cleanup poses unique, technically complex problems that must be solved under the most hazardous of conditions and that will require billions of dollars a year for several more decades. Cleanup activities include:

- radioactive tank waste stabilization, treatment, and disposal;
- used nuclear fuel storage, receipt, and disposition;
- special nuclear material consolidation, processing, and disposition;
- transuranic and mixed/low-level waste disposition;
- soil and groundwater remediation; and
- excess facilities deactivation and decommissioning.

The current overall strategy, challenges and plans for completing the EM mission are described in EM's report to Congress in January 2009[1], pursuant to section 3130 of the National Defense Authorization Act for FY 2009 (NDAA Report) and in the recent NDAA Report Update.[2] The NDAA Report and the NDAA Report Update indicate that the current life-cycle cost estimate for the EM program (from 1997 through completion) is estimated to be in the range of $273 to $327 billion,[3] including about $82 billion in actual costs from 1997 through 2009.

EM's strategic planning efforts build on the accelerated cleanup success at Rocky Flats and Fernald[4] to:

- identify innovative solutions to reduce risk faster;
- identify alternative approaches to cleanup to reduce overall life-cycle costs and accelerate cleanup schedules;
- identify and evaluate alternative priorities and funding scenarios to inform management budget decisions;
- achieve active cleanup footprint reduction goal of 90 percent by 2015; and
- develop new technical approaches for managing tank waste in a safe and compliant fashion while reducing life-cycle cost and accelerating the schedule.

The dominant program areas, in terms of the estimated cost to complete, are shown in Figure 1. Tank waste poses the most significant environmental, safety and health threat in the DOE and is the single largest cost element for EM. There are currently about 340,000 cubic meters (90 million gallons) of waste being safely stored in 230 tanks at DOE's Hanford, Savannah River and Idaho sites. A recently completed technical evaluation of transformational strategies for managing tank waste could result in life-cycle savings of approximately $19 billion.

EM's sites total 2,411 square kilometers (931 square miles) of land, as shown in Figure 1. The largest sites in terms of the land area of active cleanup (or "EM footprint") are the Hanford Site in Washington (which includes both the Richland Operations Office and the Office of River Protection) and the Savannah River Site in South Carolina, comprising more than 96 percent of the total EM land area. Opportunities exist to optimize footprint reduction through accelerated deactivation and decommissioning, soil and groundwater remediation and solid waste disposition, all of which have proven technologies and an established regulatory framework. Furthermore, EM has the opportunity to complete cleanup at 4 smaller sites by 2015 (3 of them to be completed under the Recovery Act), reducing the number of remaining EM sites to 12, down from the original 110 sites. Completing these cleanup activities reduces the surveillance and maintenance cost of managing large tracts of land and allows EM to focus on managing

[1] *National Defense Authorization Act (NDAA) for Fiscal Year 2008 Report to Congress: Status of the Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War*

[2] *Update Appendices to the Status of EM Initiatives to Accelerate the Reduction of Environmental Risk and Challenges Posed by the Legacy of the Cold War, June 2010*

[3] The life-cycle cost does not include the Department's liabilities for deactivation and decommissioning of excess (surplus) facilities from other DOE mission programs.

[4] As described in the NDAA Report, the pursuit of early closure at Rocky Flats and Fernald, rather than maintaining the sites in a state that would have required continued surveillance and upkeep, resulted in savings of nearly $21 billion.

radioactive tank waste, special nuclear material, and used nuclear fuel, which are complex from a technical and regulatory standpoint. Reducing the EM footprint also frees up Departmental resources: large, secure tracks of land; state-of-the-art facilities and technologies; and a highly trained and experienced work force. Investing in accelerated footprint reduction could result in life-cycle savings of well over $1 billion.

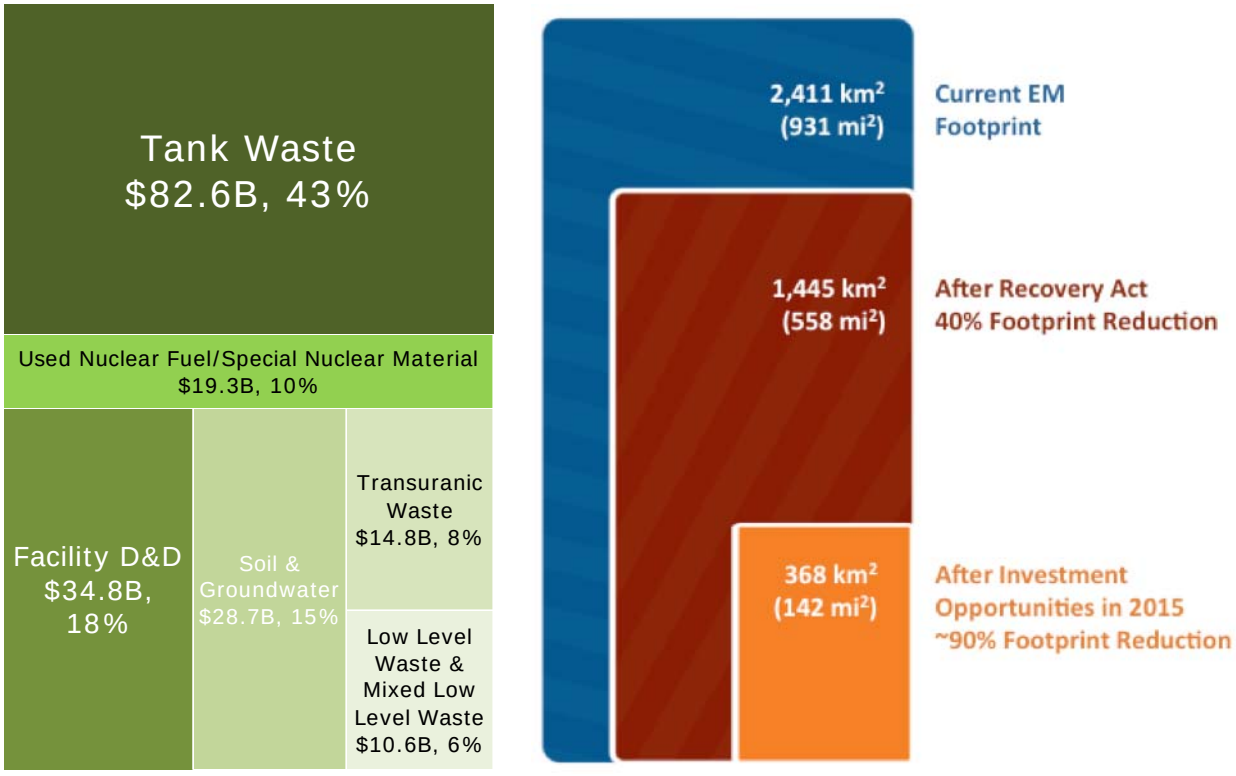

Figure 1. Estimated Remaining Costs for EM Program and Active EM Cleanup Footprint Reduction Goals

HOW IS EM STRATEGIC PLANNING CONDUCTED?

EM's strategic planning is a collaborative effort between the individual sites and headquarters to identify, evaluate and select potential investment opportunities that will leverage Recovery Act achievements and existing resources to complete the EM mission faster and at lower cost. Disparate potential investment opportunities are evaluated using a standard method to assess their benefits and impacts. Each potential investment opportunity is evaluated in terms of the following:

- Estimated required investment, above the currently planned baseline
- Estimated life-cycle cost savings
- Expected return on investment
- Percent of site active cleanup footprint completed
- Schedule acceleration
- Jobs impact.

EM uses its independently reviewed baselines and out-year planning estimates as the basis for comparison. The baselines are represented in Project Baseline Summaries, which include life-cycle cost, schedule and scope required to complete specific cleanup projects. Project Baseline Summaries are further divided into analytical building blocks (ABBs) to provide the resolution

necessary for developing various strategic options. ABBs are separate stand-alone activities within a site, consisting of similar activities with similar schedules and disposition paths. An ABB is a discrete, site-specific component of existing EM scope that can realistically be managed, assessed, budgeted, executed, reprioritized and communicated as a whole. ABBs are assigned the relevant program mission category based on the scope of work (tank waste, deactivation and decommissioning, low-level/mixed low-level waste, transuranic waste, etc.). ABB cost data are divided into "progress costs" (costs related to completing EM scope) and "maintenance costs" (cost associated with maintaining existing material, waste, and facilities in safe, stable condition, as well as site infrastructure). Potential investment opportunities are evaluated by estimating the impact of acceleration on the ABB cost profiles encompassed by the investment opportunity. ABBs with the highest maintenance costs often provide the greatest potential return on investment if they can be accelerated.

RESULTS OF STRATEGIC PLANNING EFFORTS

American Recovery and Reinvestment Act

EM's strategic planning efforts in 2008 identified a suite of potential investment opportunities, some of which ultimately were selected for funding through the American Recovery and Reinvestment Act (Recovery Act) in 2009. The $6 billion of Recovery Act investment is producing approximately $7 billion in life-cycle cost reduction and cost avoidance, a reduction of EM active cleanup footprint by 40 percent, acceleration of a number of EM's performance metric completion and an acceleration of the closure of three sites (see Figure 2). The investment opportunities were recommended for funding through the Recovery Act because of their significant potential for life-cycle cost reductions, return on investment, creation of thousands of jobs, and ability to be quickly implemented.

Accelerated completion of the EM mission under the Recovery Act included accomplishment of the following (as of December 2010):

- Reduced EM footprint 609 square kilometers, with an additional 357 square kilometers reduction planned, for a total of 40 percent reduction
- Demolished about 153,000 square meters of buildings of the 564,000 square meters planned
- Disposed 0.9 million cubic meters of debris and soil of the 1.4 million cubic meters planned
- Disposed 69,000 cubic meters of low-level and mixed low-level waste of 85,000 cubic meters planned
- Dispositioned 2,300 cubic meters of transuranic waste of 8,100 cubic meters planned
- Disposed 1.4 billion kilograms (1.8 million short tons) of mill tailings at Moab of 1.8 billion kilograms (2 million short tons) planned.

Recovery Act projects demonstrate EM can achieve substantial program acceleration and life-cycle cost savings by making additional strategic investments in the near term. EM is ready now to capitalize on the Recovery Act investments, leveraging Recovery Act resources and building on the efficiencies gained, to further reduce life-cycle cost and accelerate completion.

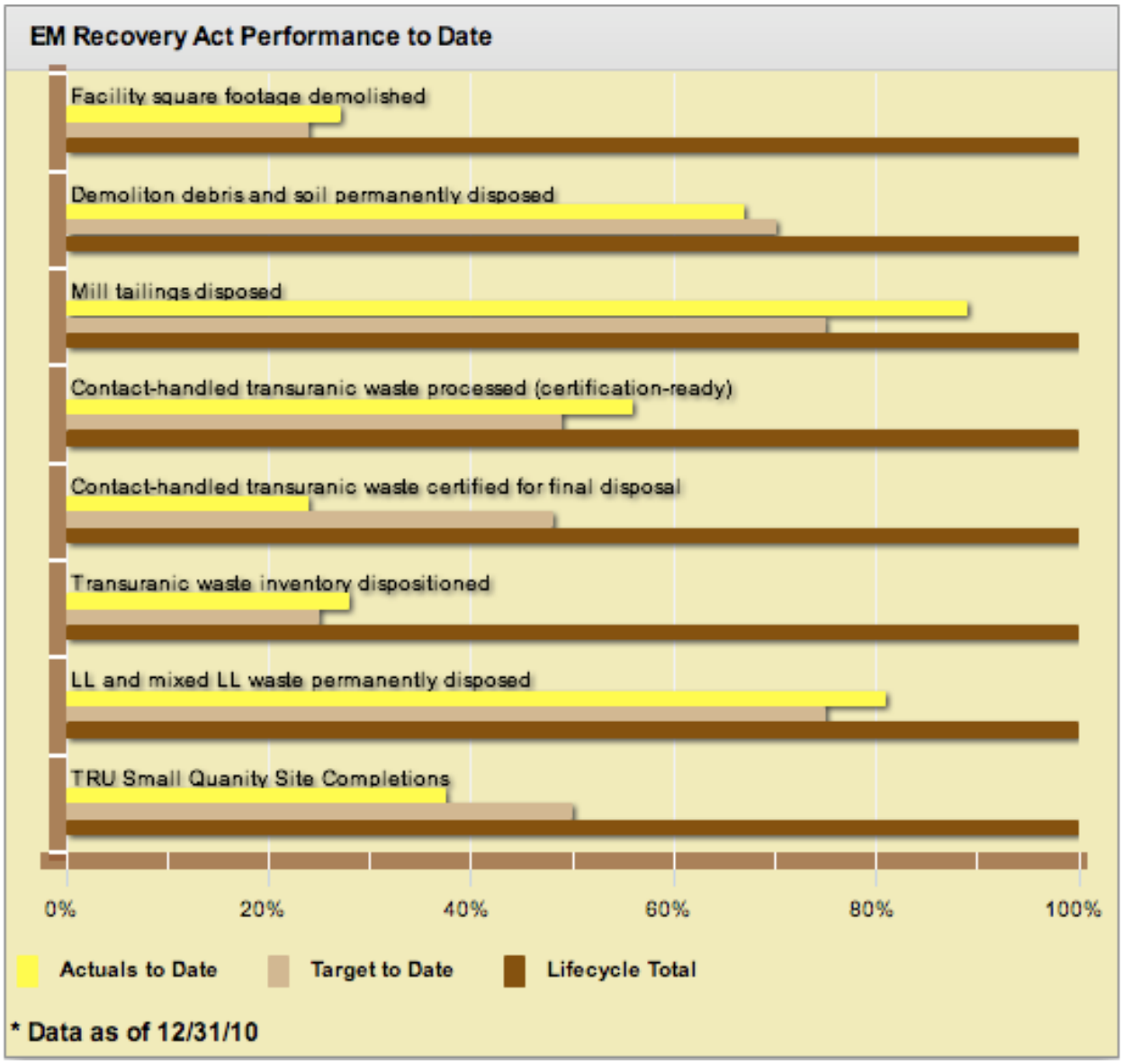

Figure 2. Recovery Act Accomplishments to Date

Additional Investment Opportunities

Ongoing strategic planning efforts have identified additional investment opportunities to leverage the successes achieved under the Recovery Act. These are designed to accomplish the following:

- Achieve substantial cost savings and schedule acceleration without sacrificing compliance, safety, or cleanup specifications
- Maximize economies of scale by leveraging Recovery Act investment in newly developed resources
- Continue the progress in facility deactivation and decommissioning activities accomplished under the Recovery Act, where substantial visible progress is being made

- Achieve maximum footprint reduction and resulting surveillance and maintenance savings
- Free land and facilities for other uses
- More efficiently retrieve and treat tank waste
- Benefit local communities by maintaining Recovery Act jobs.

As noted above, tank waste poses the most significant environmental, health and safety threat in the DOE and is the single largest cost element for EM. EM recently developed an enhanced tank waste treatment strategy to implement transformational technologies and reduce costs at risks at the Hanford and Savannah River sites. Investing in the enhanced strategies would result in an improved, optimized, and less costly tank waste cleanup program. An estimated total near-term investment of about $2 billion to pursue this strategy could result in life-cycle savings of up to $19 billion.

Transformational technologies include in-tank solid-liquid separation and Cesium^{137} removal using rotary microfiltration and small column ion exchange for pretreatment; fluidized bed steam reforming for low activity waste treatment; advanced solvents for radionuclide solvent extraction; and next-generation melter development and alternative glass formulations for waste vitrification. These technologies will provide advanced processes to separate low activity waste from tank waste and therefore minimize the volume of immobilized high and low level waste. For example, it is expected that key radionuclides, such as Technetium, can be encapsulated at a much higher level into a steam-reformed waste form than the current borosilicate glass waste form. EM's tank waste optimization strategy has three main components (see Figure 3).

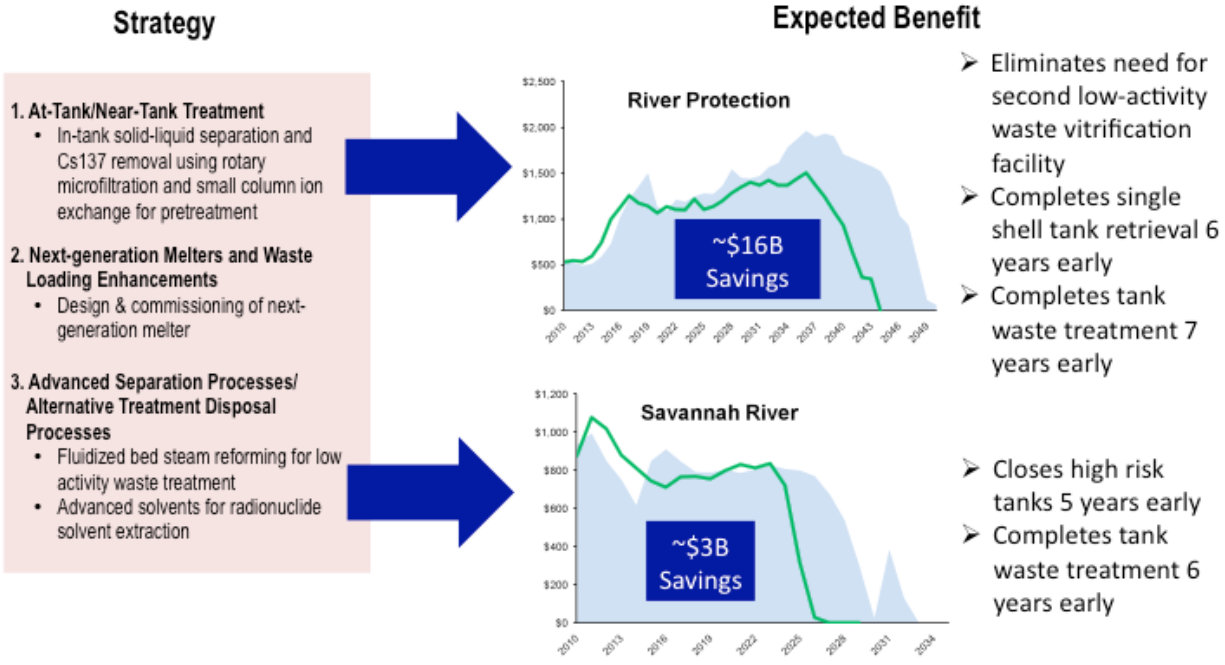

Figure 3. Enhanced Tank Waste Strategies Could Yield Large Life-Cycle Savings

About 140,000 cubic meters (37 million gallons) of tank waste is stored in 49 tanks at the Savannah River Site. A near-term investment at Savannah River of nearly $600M over the previous baseline enables implementation of the enhanced strategy, accelerating tank waste disposition by six years at a savings of about $3B.

The 177 underground storage tanks at the Hanford Site contain more than 189,000 cubic meters (50 million gallons) of tank waste. A near-term investment at Hanford of about $1B over the previous baseline enables implementation of the enhanced strategy, accelerating tank waste disposition by seven years at a savings of about $16B.

EM's footprint reduction investment opportunities include reducing the EM footprint by 90 percent at EM's two largest sites, Savannah River and Hanford, as well as opportunities enabling cleanup at a number of other sites to be completed on an accelerated schedule (see Figure 4). These opportunities also include acceleration of transuranic legacy work to take maximum advantage of disposal operations capacity at the Waste Isolation Pilot Plant, the underground geologic repository used to dispose of the nation's defense-related transuranic radioactive waste. Implementing these opportunities would reduce EM's complex-wide footprint by about 90 percent in 2015.

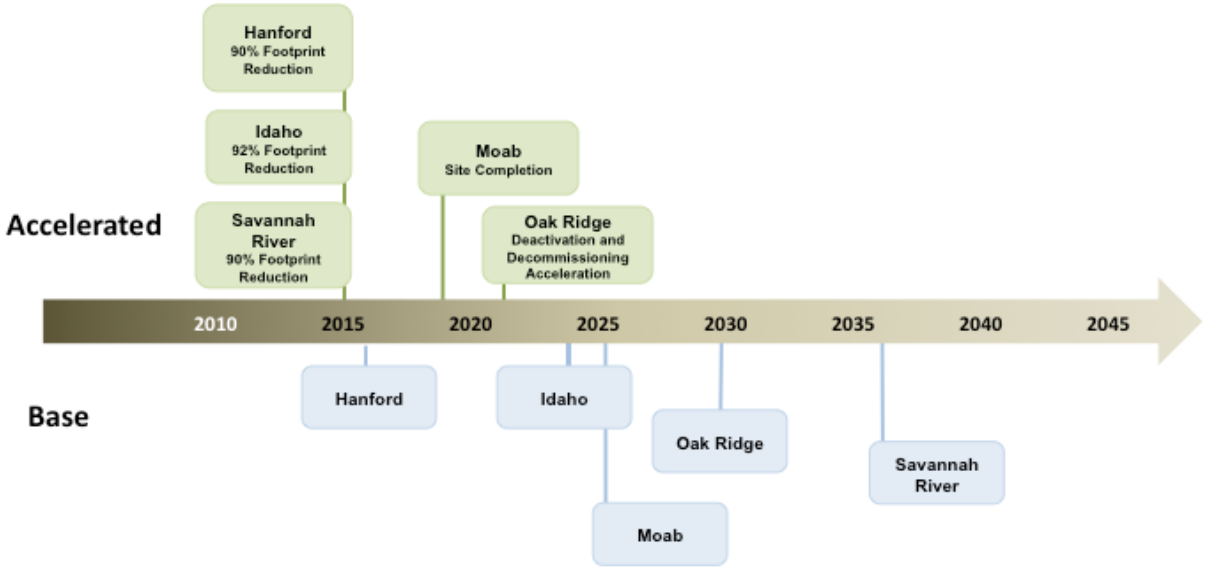

Figure 4. Additional Footprint Reduction Investment Will Accelerate EM Cleanup

The footprint reduction investment opportunity at Richland continues acceleration of the River Corridor area cleanup achieved under the Recovery Act. Under the Recovery Act, cleanup of the Hanford Reach National Monument will reduce the active footprint by approximately 49 percent by 2011. Continuing acceleration of the River Corridor will enable EM to reduce the overall Hanford footprint by approximately 90 percent by 2015. The River Corridor area encompasses about 570 square kilometers (220 square miles) of the Hanford site along the Columbia River. This includes the 100 Areas, where nine nuclear reactors formerly operated, and the 300 Area, which was formerly used for uranium fuel production and research activities.

The active EM footprint at Savannah River is about 800 square kilometers (310 square miles). Cleanup at the Savannah River Site is rapidly reducing the EM footprint towards the central area of the site, which contains the special nuclear materials and tank waste. Footprint reduction activities include cleanup of reactor and industrial areas and related soil contamination. Under the Recovery Act, remediation and facility deactivation and decommissioning projects in the outer areas (C, D, K, M, P, and R Areas) will reduce the active footprint by approximately 67 percent by 2011. Soil and groundwater remediation in various areas of the site will be accelerated, along with the disposition of more than 4,500 cubic meters of legacy transuranic waste. With additional investment in the near-term, cleanup activities at Savannah River can further reduce the active EM footprint to 80 square kilometers (31 square miles) for a total footprint reduction of 90 percent by 2015. As a result, much of this land will then be available for other uses.

The footprint reduction investment opportunity at the Idaho National Laboratory includes accelerating transuranic waste disposition. The Radioactive Waste Management Complex contains an estimated 65,000 cubic meters of stored transuranic waste and more than 7,480 cubic meters of buried waste to be retrieved. This opportunity completes disposition of this waste nine years earlier than currently planned. As a result, the EM footprint at Idaho will be reduced from 3 square kilometers (775 acres) to about 1 square kilometer (247 acres) by 2012, which is a 68 percent footprint reduction, and 0.3 square kilometers (62 acres) by 2015, which is a total of 92 percent footprint reduction. Investment in this opportunity enables removal of a large risk to the Snake River aquifer, the largest underground water source in the state.

Oak Ridge investment opportunities consist of the acceleration of cleanup activities in the current EM baseline, including deactivation and decommissioning of excess facilities, treatment and disposal of wastes (including remote-handled transuranic wastes), soil and groundwater remediation, and reconfiguration of waste management facilities and utilities. Oak Ridge opportunities also include the deactivation and decommissioning of additional excess facilities from National Nuclear Security Agency, Office of Science, and Office of Nuclear Energy to reduce surveillance and maintenance costs of the Department as a whole and provide land reusable for scientific missions. The investment opportunities include the following:

- Alpha 5 (Building 9201-5 in the Y-12 National Security Complex) is an extremely large Hazard Category 3 uranium processing facility constructed in 1944. It is four stories high and contains about 56,000 gross square meters (600,000 gross square feet) of floor space. Cleanout of waste at Alpha 5 under the Recovery Act creates an opportunity for deactivation and decommissioning to be completed four years ahead of the current schedule, enables removal of a large risk to groundwater from mercury and other contaminants at the site and eliminates one of the highest risk surplus facilities in the Department.

- Accelerated deactivation and decommissioning of the Bethel Valley Reactor Area facilities, which consists of four research reactors constructed in the 1940s and 1950s and their ancillary support facilities, would allow the demolition of more than 6,700 gross square meters (72,000 gross square feet) of buildings, preserve the historic Graphite Reactor, eliminate potential sources of contamination, and accelerate remedial actions.

- The Biology Complex, which is comprised of seven primary structures (twelve total buildings), was originally built and used to support Y-12's uranium enrichment mission. Accelerated deactivation and decommissioning of four of the buildings under the Recovery Act make completion of the eight remaining buildings a prime candidate for substantial acceleration.

Additional footprint reduction investment opportunities have been identified at other sites, including the Moab site in Utah. The Moab mill in Utah processed uranium ore for nuclear weapons and power, leaving behind tailings and other heavy metals, covering 0.5 square kilometers (130 acres) and rising to as much as 27 meters (90 feet) in some places. Recovery Act funding accelerated progress in moving a 14.5-billion-kilogram (16-million-ton) tailings pile away from the Colorado River to a DOE-constructed disposal cell near Crescent Junction. Investing to maintain the second shift and two train shipments per day, six days a week, as achieved under Recovery Act, accelerates completion of the site to 2019, from the planned completion date of 2025.

NEXT STEPS

EM's strategic planning is focused on identifying innovative solutions to reduce risk faster, accelerate schedules and reduce overall life-cycle cost. A portfolio of investment opportunities is maintained to inform management budget decisions and to optimize cleanup as funding permits.

Strategic planning is iterative and ongoing. The current suite of potential investment opportunities are being further evaluated and refined by EM Headquarters in coordination with the sites to more precisely estimate costs and potential impacts, identify which are viable and how those could best be implemented. In parallel, EM will continue to evaluate implementation of Recovery Act and other projects to identify lessons that can be applied to future potential investment opportunities.