

FURTHERING ENVIRONMENTAL RESTORATION BY USING PERFORMANCE MEASURES

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ABSTRACT

The Office of Environmental Restoration (OER) is responsible for cleanup activities at DOE sites contaminated as a result of the Cold War. Past operations resulted in radioactive, hazardous, and mixed contamination at these sites, and OER's mission is to eliminate, or reduce to safe, prescribed levels, any risks to human health and safety or the environment that may be posed by these contaminants.

In some cases, this mission cannot reasonably be achieved using current technologies, which are either ineffective or extremely costly. Therefore, OER looks to its "sister organization", the Office of Science and Technology (OST), to provide new or improved technologies to help achieve its mission.

The cleanup activities conducted by OER are of great interest to numerous stakeholders: Congress; host states and regions; federal, state and local regulators; Indian Nations; environmental groups; and local residents. These stakeholders want to ensure that cleanups will be completed in a cost-effective and timely manner, and also want to ensure that the technologies that may be developed by OST will address the challenges posed by the contaminants at sites of interest.

Therefore, OER is working closely with OST to research, develop, demonstrate, and deploy technologies, and to define and apply performance measures for these activities. These performance measures will verify that OST research and development activities will be applicable to OER challenges, and will also help stakeholders recognize OST's contributions to OER's success.

This paper will describe the evolution and status of current OER performance measures, discuss the areas in which OST and OER are working together to identify and track these performance measures, highlight specific successes of this approach, and articulate potential shortcomings associated with some proposed performance measures.

INTRODUCTION

The Department of Energy's (DOE's) Office of Environmental Management (EM) is responsible for addressing the legacy of the cold war - remediating sites and treating, storing, and disposing of the wastes resulting from the nation's 50 years of nuclear weapons research, development, and production. Within EM, the Office of Environmental Restoration (OER) is responsible for characterizing and assessing contamination, stabilizing contaminated soil, treating ground water, decommissioning process buildings, and exhuming previously disposed wastes where the

previous disposal practices do not meet today's standards for long term worker, public, and environmental protection.

THE OER MISSION

Past operations resulted in radioactive, hazardous, and mixed contamination at a number of locations, and OER's mission is "To protect human health and the environment from risks posed by inactive and surplus DOE facilities and contaminated areas - by remediating sites and facilities in the most cost efficient and responsible manner possible in order to provide for future beneficial use."

OER is responsible for cleanup of contamination at approximately 9,700 release sites and 3,350 facilities. (A release site is defined as a unique location where a hazardous, radioactive, or mixed waste release has occurred or is suspected to have occurred. A facility is a uniquely identifiable building or structure.)

These release sites are the result of contaminants or contaminated materials being spilled, dumped, disposed of or abandoned. Some release sites require no further action while others require remediation or monitoring. OER accomplishes its remediation responsibilities by conducting the following four activities: 1) site discovery, preliminary assessment, and site inspection; 2) site characterization, analysis of cleanup alternatives, and selection of remedy; 3) cleanup and site closure (implementation of the remedy); and 4) site compliance monitoring.

KEY FACTORS IN ACCOMPLISHING OER'S MISSION

OER's ability to accomplish its mission relies upon a number of factors. A key piece of information needed to determine the appropriate remedy for a site is identification of the probable future use for that site. (For example, future use as a industrial area would allow somewhat higher levels of contamination to be isolated on site without posing an undue risk to future site users, while future use as a residential neighborhood would require most or all of the contamination to be removed to another location.)

The decision on the future use for a site must be made with local citizen involvement. But there are a number of additional stakeholders in OER's decision-making process: Congress; release site host states and regions; federal, state and local regulators; Indian Nations; and national and local environmental groups as well as the local residents. OER must assure these stakeholders that if contamination remains at a site after remediation is complete, it will be monitored and managed appropriately for as long as it has the potential to pose a hazard to the public or the environment.

Another key factor in OER's ability to accomplish its mission is the current state of technology. Current technology can identify very low levels of contamination. However, in some cases, this technology can find contaminants at concentrations that are lower than can be remediated. In other cases, the only technology capable of remediating a particular contaminant or medium is either very costly or requires many years of operation to achieve the desired cleanup level.

Just as OER's stakeholders are involved in future land use decisions, they are also involved in OER's decision-making process regarding which remedy to use for a specific contaminant at a specific site. In this case, OER and its stakeholders want cleanups to be completed in a cost-effective and timely manner. They also want to make sure that new technologies, when developed, will help achieve the site-specific remediation objectives.

Therefore, when OER's mission cannot reasonably be achieved using current technologies, OER looks to EM's Office of Science and Technology (OST) to provide new or improved technologies to help achieve OER's mission.

For contaminants or media for which current technologies are not applicable, are costly, or are time consuming, OER works closely with OST to identify the specific current technology shortfall or disconnect. OER and OST also work closely to define the remediation challenges posed by the specific contaminants at each release site. OER also prioritizes its technology needs. OST has knowledge on what technologies are available from industry, and what technologies may require only minor modifications to be applicable to OER challenges. OST also has the expertise to identify promising technologies early in their development, and to nurture these technologies, helping to develop them to the point where they can be applied to OER challenges.

PERFORMANCE MEASURES

EM is responsible for addressing contamination at a total of 113 geographic locations. Since cleanup of all these sites cannot be at one time, each EM organization has developed performance measures to track progress towards completing the organization's mission.

In 1993, passage of the Government Performance and Results Act (GPRA) resulted in increased interest in performance measurement. As a result, a more regimented process was established to plan, track, and report progress. The GPRA requires Federal agencies to develop Strategic Plans to articulate each program's fundamental mission and goals, Annual Performance Plans to provide a direct link between the longer-term goals outlined in the Strategic Plan and what managers are doing on a daily basis, and Annual Performance Reports to describe what was accomplished for the resources expended and how well the preceding performance plan's goals were met.

The EM strategic objectives supported by OER include "Clean up as many as possible of the Department's 53 remaining contaminated geographic sites by 2006"; "Reduce the life-cycle costs of environmental cleanup"; and "Maximize the beneficial reuse of land and effectively control risks from residual contamination". (The 53 sites referred to here were those remaining to be cleaned up at the beginning of 1998. During 1998, five sites were completed, leaving 48 remaining to be cleaned up as of the beginning of 1999.) These objectives are supported through specific success measures, which are based on aggressive planning scenarios and maximum

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possible gains in efficiency. As such, they represent challenges rather than specific commitments.

OER's performance measurement system did not spring forth as a finished product - it went through three stages in its development, leading to complete integration with the commitments made by the Secretary of Energy to the President of the United States under the GPRA.

Between 1994 and 1996, OER instituted several "summary measures" as a result of EM becoming a pilot project under the GPRA.

In 1996, while progress was reported at the summary measure level, a new process was also refined and implemented to track progress at the release site and facility level. This transition period began to focus on corporate performance measures.

In 1997, EM refined its corporate-level measures to further focus on achieving EM's mission and communicate program progress and outcome. Other measures will address those cross-cutting areas essential to accomplishing program results effectively and efficiently.

In 1997, EM developed a single set of corporate level performance measures to be used both for internal management and to meet external requirements. These corporate performance measures are the current metric for evaluating progress in EM, and form the basis for EM's share of the commitments made in the Secretary's agreement with the President. Specifically, environmental restoration progress is measured as the number of release sites completed and the number of facilities decommissioned. Two phases of each measure are captured: the completion of the assessment phase and the overall completion of the release site or facility. The completion of numerous release sites and facility decommissionings ultimately leads to the completion of an entire geographic site. As of the end of FY 1998, cleanup at 65 geographic sites (out of a total of 113) had been completed.

As an example of how release sites and facilities are used to develop goals and to track progress, the 1998 performance measures for OER were:

	Planned	Actual
Number of release site cleanups	280	290
Number of facility decommissionings	70	108

Including the above accomplishments, as of the end of FY 1998, the following progress had been made:

4,124 release site cleanups completed

448 facilities decommissioned

But clearly EM cannot accomplish its mission unless all its offices work together. For example, by working together, OER and OST can map out a strategy that will yield the right technologies at the right time, enabling OER to achieve its mission faster and at lower cost.

But the organizations must also be able to demonstrate and communicate their achievements.

OER believes that performance measures should serve as a management tool, and should evolve over time as program activities change. Properly constructed performance measures can help identify the direct impact of actions taken, can help improve management systems, and can help accomplish strategic objectives (such as site closure, worker transition, local economy long-term economic viability, etc.). Performance measures should also be an integral part of accomplishing the OER mission, not something added on or treated like a “score card”.

OER's current performance measures are primarily associated with completion of site assessments and cleanups. In effect, OER's objective is to put itself out of business. OER program priorities are: manage projects well; work with regulators and other stakeholders to focus on actual cleanup; move quickly on high-risk site cleanups; and find new, creative, “out-of-the-box” ways to do business. Because the OER program represents the bulk of the EM cleanup mortgage, faster and cheaper ways of remediating sites must be developed and implemented.

LINKAGE BETWEEN OER AND OST PERFORMANCE MEASURES

The following figures illustrate how OER's success in accomplishing its mission is dependent upon OST's success in accomplishing its mission. These two figures show the clear relationship between OST and OER.

Figure 1 shows that remediation costs are reduced as new and improved technologies are applied to contaminated ground water or the vadose zone.

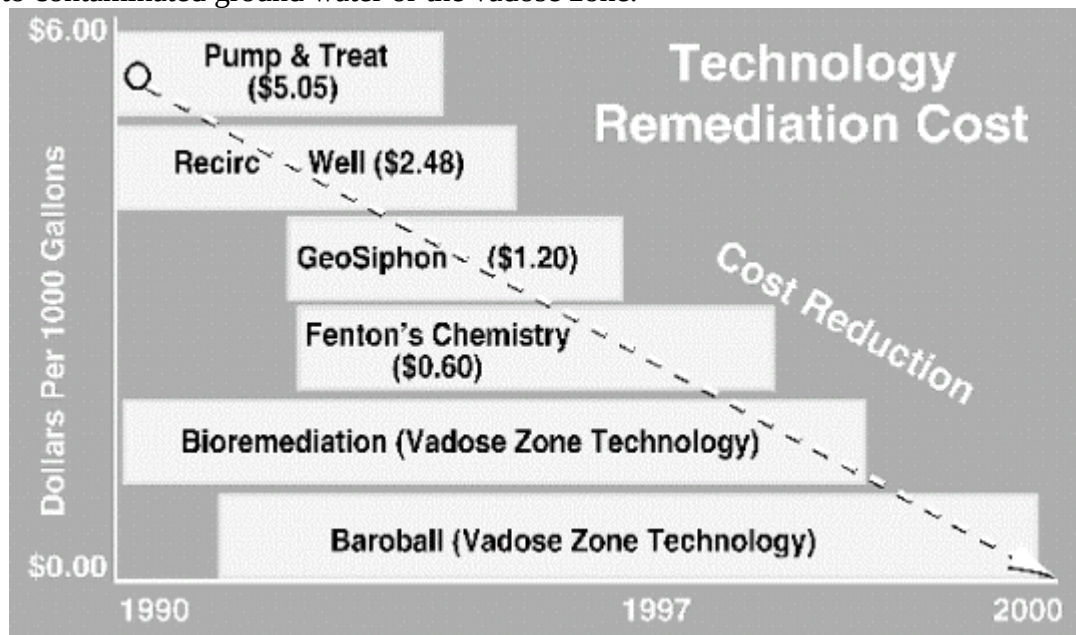


Figure 1. Technology Remediation Cost

Figure 2 shows that the length of time over which the remediation technology must be applied can be reduced significantly by new and improved technologies.

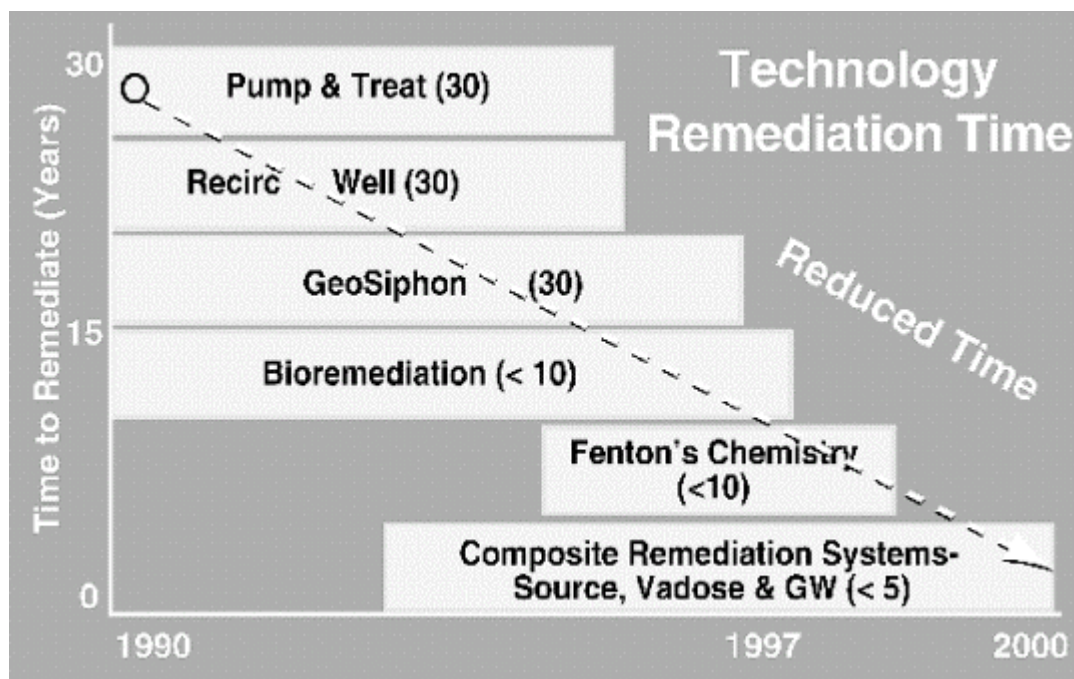


Figure 2 Technology Remediation Time

Taken together, the figures show that OST's successes in providing new and improved technologies to address contamination form the basis for OER to complete cleanups at contaminated sites in a timely and cost efficient manner. Simply put, OST's technologies not only provide new methods to address contamination, but also lower the cost of addressing that contamination.

The OER/OST partnership described by these figures show how, by working together, OER and OST can achieve environmental cleanup at the lowest cost. But even with new and improved technologies, EM's program will require decades to complete. And even though illustrations such as these figures help to demonstrate the value of the new and improved technologies, it is still necessary for OER and OST to be able to show their stakeholders that the ongoing funding associated with developing, demonstrating, or deploying new technologies is well spent.

To ensure that the linkage between OER's technology needs and OST's technology development activities is clear to stakeholders, OER and OST are working closely together to develop and apply performance measures for technology research, development, demonstration, and deployment. These performance measures will verify that OST research and development activities will be applicable to OER challenges, and will also help stakeholders recognize OST's contributions to OER's success.

A key component of programmatically valid and useful performance measures is the establishment of program baselines, and subsequent comparison of program costs with the originally baselined (or anticipated) costs. OER is working to develop a valid baseline that provides an accurate estimate of program costs from today to program completion. This baseline can then be used to evaluate potential new technologies to see if they will result in overall programmatic savings.

A long-term comparison is important because comparisons in any given year will probably indicate that an existing technology is less expensive than a new technology. This is because the cost of the new technology must include the cost of its development, demonstration, site-specific optimization activities. After several deployments, the cost of applying new technology generally comes down significantly. But a "year by year" comparison does not provide credit for these future cost savings. Therefore, OER prefers to use lifecycle cost savings associated with a new technology as a performance measure.

OER also believes that it is appropriate to "weed out" technologies during the development process before they get to the demonstration stage. Technology demonstration can be very costly, and only the technologies most likely to result in significant life-cycle savings should be demonstrated and deployed. To identify the most promising technologies, OST and OER must continue to work closely together to identify the underlying technological challenges, and to aggregate these challenges (if appropriate) to ensure that the smallest number (or least costly) technologies will address the most significant challenges. Therefore, it is important that the performance measures not penalize EM for winnowing down the number of technologies initially

considered (and funded for development), and demonstrating a much smaller number of technologies. Even after demonstration, some technologies may not be appropriate for multiple (or even singular) deployment. In this case, it is also important that EM receive credit for learning that this technology no longer promises the cost savings that initially caused it to be funded through the demonstration stage, and not be penalized under the concept that the technology "should never have been demonstrated at all." OER believes there is value in learning what does not work as well as what does work, and suggests that whatever performance measures evolve over time should recognize that some projects will not yield positive results. These should not be considered failures.

OER is concerned that some stakeholders may prefer performance measures associated with "number of deployments." OER believes this will result in sub-optimum programmatic decisions being made to achieve these performance measures. For example, six deployments of a technology that saves \$25,000 per deployment should not be valued at six times the value of a single technology deployment that saves \$1,000,000. Yet a performance measure of "number of deployments" could easily result in this outcome. OER proposes instead that projected life cycle savings (analyzed annually to be validated) be an evaluation mechanism. OER also believes that factors other than costs savings are important. For example, a new technology may enable accomplishment of a program objective more safely, or with less current environmental impact, or with less programmatic risk. Each of these attributes are important program measures, but none can be quantified using dollars. Therefore, OER proposes that as performance measures evolve, consideration be given to how to quantify these achievements.

For example, both the sonic Drill Rig and the Cone Penetrometer enable OER to put down boreholes faster and cheaper, and allow emplacement of instrumentation that allows real-time characterization and continuous monitoring. Although a specific cost savings can be identified from the borehole emplacement improvement, the value of real-time characterization and continuous monitoring is much more difficult to quantify.

Finally OER believes that successful technology research, development, demonstration, and deployment require a team effort. OST cannot be expected to identify and develop the needed technologies without OER input, and OER cannot be expected to deploy the new technologies without OST support. OER's successful deployment of technologies developed by OST has been the result of the close working relationship between the two organizations. For example, the In-Well Air Stripping Technology to Remediate an Off-Site Organic Plume (deployed at Brookhaven National Laboratory during FY 1998) is DOE to save \$5000,000 in life cycle costs over the baseline technology of traditional ground water air stripper. Also, the Sonic Drill Rig and the Cone Penetrometer (discussed above) were originally developed by OST and deployed with their support. OER would not have achieved these program improvements without OST's support. And program improvements like these are continually needed so OER can complete its mission and "go out of business."

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In conclusion, OER looks forward to continuing to work closely with OST as current performance measures are used to track program progress, and as new performance measures are developed to better demonstrate EM program success.+