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USING THE BASELINE ENVIRONMENTAL MANAGEMENT REPORT (BEMR) TO EXAMINE ALTERNATE PROGRAM SCENARIOS

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Abstract

The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) released the first Baseline Environmental Management Report (BEMR) in March, 1995. The Congressionally-mandated report provides life-cycle cost estimates, tentative schedules, and projected activities necessary to complete DOE's Environmental Management Program. This "base case" estimate is based on current program assumptions and the most likely set of activities. However, since the future course of the Environmental Management Program depends upon a number of fundamental technical and policy choices, alternate program scenarios were developed. These alternate cases show the potential cost impacts of changing assumptions in four key areas: future land use, program funding and scheduling, technology development, and waste management configurations. Several cost and program evaluation tools were developed to support the analysis of these alternate cases. The objective of this paper is to describe the analytical tool kit developed to support the development of the 1995 Baseline Report and to discuss the application of these tools to evaluate alternate program scenarios.

INTRODUCTION

To manage the environmental legacy remaining from the Cold War production of nuclear weapons, the Department of Energy established the Office of Environmental Management (EM) in 1989. This office manages one of the largest environmental programs in the world with more than 130 sites and facilities in over 30 States and territories. EM is organized into four key mission areas: (1) the Waste Management Program; (2) the Environmental Restoration Program; (3) the Technology Development Program; and (4) the Nuclear Material and Facility

Stabilization Program. The primary focus of the Environmental Management Program is to reduce health and safety risks from radioactive and hazardous waste contamination resulting from the development, production, and testing of nuclear weapons.

The National Defense Authorization Act for Fiscal Year 1994 requires the Department to provide an annual report to Congress on the estimated total cost and complete schedules for activities under the Environmental Management Program.[1] In response to this requirement, DOE submitted the first annual Baseline Environmental Management Report (BEMR) to Congress in March, 1995.[2] The report describes the activities and potential costs required to address the waste, contamination, and surplus nuclear facilities that are the responsibility of DOE's EM Program. In doing so, it represents the Department's most comprehensive effort to date to develop a clearer picture of the "Cold War Mortgage." The report is divided into two volumes. The first volume summarizes the base case and evaluates program alternatives. The second volume presents the site-specific data used to generate the report.

Under the base case assumptions, the life-cycle cost estimate to complete the Environmental Management program ranges from $200 - 350 billion with a mid-range estimate of $230 billion. This estimate is based on a 75 year program and assumes that all existing compliance agreements are met. For the mid-range estimate, 49% is for waste management activities, 28% is for environmental restoration activities, 10% is for stabilizing nuclear material and facilities, 5% is for technology development efforts, and the remaining 8% is for Federal salaries and overall program management. The five largest EM sites represent over 70% of the total life-cycle costs: Hanford Site (21%); Savannah River Site (21%); Rocky Flats Environmental Technology Site (10%); Oak Ridge Reservation (10%); and Idaho National Engineering Laboratory (8%).

The EM program is subject to a large number of technical and policy uncertainties. The future course of the Environmental Management program depends on a number of fundamental choices in these areas. First, there are a number of significant land use decisions to be made. For example, if DOE cleans up all contaminated sites to a "green field," the cost is orders of

magnitude greater than if the land were held under institutional control with limited remediation. Second, the level of program funding can influence the pace and scheduling of program activities. For example, accelerating site closures may significantly reduce life-cycle costs by avoiding long term site landlord and other support costs. Third, life-cycle costs can be affected by the availability of new, less costly technologies. In this case, should the treatment of waste proceed with present technology or should the waste be stored while it is waiting for the development of improved technology? Finally, the economies associated with centralizing or decentralizing treatment facilities could influence the life-cycle costs. More important, these treatment facility siting decision have substantial implications for the local communities and for other communities affected by transporting the wastes.

The 1995 Baseline Report lays the foundation to engage the Nation in a broad based discussion of the risks, costs, and tradeoffs associated with different approaches. This paper presents the approach used in the 1995 Baseline Report to develop and evaluate alternate program scenarios. This discussion includes a more detailed examination of the tools developed at DOE Headquarters to assist in this analysis. In addition, the paper discusses alternate program scenarios to be examined in the 1996 Baseline Report.

BEMR Approach to Alternate Cases

The development of alternate program scenarios is premised on a defensible and credible base case. In fact, most of the effort to develop the 1995 Baseline Report focused on the base case. The challenge facing the Department in building the base case was to provide a plausible, comprehensive estimate of the total cost and schedule for the Environmental Management Program even when the total range of problems have not been fully identified or characterized. With some guidance and a great deal of work, field personnel developed estimates of the life cycle costs, schedules, and activities to complete environmental programs at their sites. In some cases, cost and scheduling estimating tools had to be developed at headquarters to assist the field

in developing their base case estimates. Two major tools were developed or modified for this purpose. For waste management activities, the System Cost Model (SCM) was used to assist the field in estimating the cost of treatment, storage, and disposal facilities for low level, mixed low level, and transuranic wastes. This model previously had been developed for the Department's Programmatic Environmental Impact Statement (PEIS) and was modified for the BEMR project. The second tool was developed based on the U.S. Army Corps of Engineers' Micro Computer Assisted Cost Engineering System (MCACES) and was used to estimate the costs of nuclear material and facility stabilization activities.

Once these estimates were received from the field, an approach for assembling, integrating, and reviewing these data had to be developed. Once again, Headquarters had to develop a tool to accomplish this task. The Integration Tool served several roles. First, it provided a repository for the massive amount of field information. Second, it provided the ability to reschedule anticipated project start dates to meet funding limits or to match waste generation with treatment, storage, and disposal capacity. The Integration Tool was designed to assist in performing several of the steps required to develop the base case. These steps included:

1) The final set of field data representing the base case was assembled and loaded into the Integration Tool.

2) Waste volumes and cost were calculated over time and a schedule developed for low level, low-level mixed, transuranic and legacy waste loads. Environmental restoration, facility stabilization, and waste loads from other Environmental Management programs also had to be calculated over time.

3) All waste volumes were then compared to treatment, storage and disposal capacity either in existing or in planned facilities.

4) Treatment, storage and disposal needs over time were then identified and placed in five year vintages.

5) The System Cost Model was then used to calculate costs over time for new facilities where those facilities were non-existent.

6) Total cost over time was then calculated for all new facilities and added to the cost represented in the input data.

7) The total program cost was then compared to expected funding levels.

8) Some facilities and programs were rescheduled to more closely match the expected funding levels over time.

9) The "adjusted" base case was reviewed by program managers at the sites and DOE-HQ.

10) Final documentation of the base case was completed and incorporated in the 1995 Baseline Report.

Once the base case was developed, a number of alternative program scenarios were developed. Alternative cases were developed by DOE Headquarter personnel to show the potential cost impacts of changing assumptions in four key areas: land use planning, program funding and scheduling, technology development and waste management configurations. The analyses were performed using selected hypothetical situations or postulated cases where it is thought a change in schedule or technical option might have a noticeable fiscal impact. All of scenarios employed a variety of regulatory, technical and scheduling changes that might have the greatest chance for cost savings to the American taxpayer in future years.

The process for developing the costs of an alternate scenario generally followed the 10 step process identified above with some modifications. The modifications generally consisted of either changing the input data at the start of the process or assumptions at specific steps during the process. The Integration Tool proved to be more flexible than it was originally designed in that it was well suited for the alternate program funding and scheduling scenarios. Another tool developed for the Department's Programmatic Environmental Impact Statement (PEIS), the Automated Remedial Assessment Methodology (ARAM), was used extensively for the alternate land use cases. No special tools were developed for examining technology development alternatives although a spreadsheet model was used to integrate existing information. Finally, the waste configuration analysis relied on a wide variety of tools developed for the Waste Management Programmatic Environmental Impact Statement.

The process looked at fundamental questions and types of decisions likely to affect Environmental Management life cycle costs:

- Land Use - What are the range of ultimate uses for currently contaminated lands and waters at each installation?

- Funding and Schedule - How much money is spent on Environmental Management activities and how rapidly is this money being spent?

- Technology Development - What types of new technologies are available and when will they be implemented?

- Waste Management Configuration - At what installations will treatment, storage and disposal of wastes occur?

Results of the Alternate Case Analysis

The four alternative program scenarios yielded interesting results in terms of the overall life-cycle costs of the EM program. However, some care must be taken in interpreting these results. First, a great deal of uncertainty underlies the basic data (see discussion above). Second, the 1995 Baseline Report represents the first EM-wide cost analysis of these issues. The 1996 Baseline report is placing more effort on refining the assumptions, improving the data, and working with field personnel to improve the analysis. Below, the four alternative program scenarios are described in more detail.

Land Use

How land will be used after environmental remediation dictates the type and extent of certain approaches. The base case estimate is a bottoms up approach using a large amount of data and assumptions collected from the sites rather a centralized approach. Consequently, a number of varying land use assumptions were used to develop the base case estimate. To examine alternate scenarios, the Department looked at more restricted land use cases involving containment of the existing contamination at the generating site and restriction of public access thereafter as well as unrestricted land use alternatives. The least restricted cases were those that looked at removal or in-situ destruction of the contaminant in all of the environment. The five cases ranged from iron fence to maximum feasible green fields and additionally included a modified containment case, the base case, a modified removal case. The life cycle costs ranged from $175 billion to $500 billion depending on the level of cleanup.

Program Funding and Scheduling

Another set of analyses address the impacts of more or less available funding for the program. Assuming additional funding, the impacts of accelerating stabilization activities and early closure of sites were analyzed. In addition, cases examined reduced funding and the impacts associated

with a reduced scope. Some of the results of this analysis found that surveillance and maintenance could be reduced to $500 million from $4 billion if pre-stabilization surveillance maintenance could be reduced from 10 years to 1 year. Furthermore, almost $5 billion could be saved if the Department closed the Rocky Flats, Oak Ridge K-25 Plant and the Fernald sites earlier (20-40 years). Further savings could be realized if funding were significantly reduced beyond the year 2000. This "minimal action case" would require $170 billion or almost 27% lower than the base case through 2070. The minimal action case would not include environmental restoration, decontamination and dismantlement, future treatment and disposal of low-level, low-level mixed and transuranic wastes. However, annual surveillance and maintenance costs would be $500 million, which is much greater than the cost in the base case.

Technology Development

An in-depth analysis of 15 technologies that could be applied to high-cost remediation projects found that potential savings could range from $9 - $80 billion (on a life-cycle basis). The large variation in potential cost savings is driven by future land use decisions and assumptions regarding the availability of the technologies before 2010.

Waste Management Configuration

Using the results of recently completed configuration strategies for the Waste Management Programmatic Environmental Impact Statement, the life cycle costs could increase the base case by $9 billion or decrease it by $5 billion. These differences mainly result from the added economies of centralizing facilities. However, a great deal of uncertainty surrounds these estimates and further analysis is underway using 1996 Baseline Report information.

Looking Forward to BEMR II

A data call was issued in late July 1995 to all sites to develop the base case for the 1996 Baseline Report. To gather the site EM activity, cost, and schedule data, each program area developed extensive guidance and a supporting computer database application. To accelerate the process, the database was seeded with data from existing sources. For waste management activities, the database was seeded with the 1995 Mixed Waste Inventory Report (MWIR) information. The environmental restoration and the nuclear material and facility stabilization application seeded information from the 1995 Baseline Report and from other sources. The database was then distributed to the sites for revision and addition of missing data. More attention is being placed on the integration of site activities for the 1996 Baseline Report. In several cases, the Integration Model is being used by the sites to assist in the site integration process. All integrated and reviewed base case information should be received at DOE Headquarters by December 15, 1995.

One of the goals of the 1996 BEMR is to improve the alternate cases that were included in the 1995 BEMR. This year's report will focus on three alternate cases: program scheduling, land use, and minimum effort. This year's cases will be analyzed in more detail for the five largest sites: Hanford Site; Savannah River Site; Rocky Flats Environmental Technology Site; Oak Ridge Reservation; and Idaho National Engineering Laboratory. For each alternate case, four program outcomes will be evaluated: program cost, duration, risk and end state. In addition to the alternate cases, sensitivity analyses will be conducted to assess the results of varying levels of funding on pollution prevention and technology development.

In the 1996 Baseline Report, health and environmental risk will be evaluated as an outcome of the various alternate cases. Sites will be requested to assess risk at sites were existing tools and data are available. The analysis will include an evaluation of risk before, during and after an activity is complete. Potential impacts to on-site personnel, the public and the environment will be assessed; cultural risk will be included where appropriate. The focus of the risk analysis will be to estimate how risks may change between the base case and each alternate case.

The 1996 Baseline Report will expand upon and improve the program scheduling and land use cases developed for the 1995 Baseline Report. The objective of the minimum effort case is to develop a scenario that will minimize the total cost of the EM program over the next 75 years without increasing risk to off-site population, on-site workers, or the environment. This scenario will require strategies for implementing the EM program which differs significantly from those outlined in the base case. The minimum effort scenario combines elements of urgent risk reduction, mortgage reduction, minimum action, regulatory relief, good management practices and institutional controls into an overall strategy aimed at stabilizing and safely containing waste and surplus material on site and minimizing the cost of safeguarding these materials in the future.

The 1996 Baseline Report is due to Congress within 30 days of the submittal of the President's budget. The 1996 Baseline Report will continue the work started in the 1995 Baseline Report to develop a timely, credible, and effective analytical capability for evaluating program alternatives.

References

1. U.S. Congress, "National Defense Authorization Act for Fiscal Year 1994," Section 3153, Baseline Environmental Management Reports, Public Law 103-160, November 30, 1993.

2. U.S. Department of Energy, Office of Environmental Management, "Estimating the Cold War Mortgage: The 1995 Baseline Environmental Management Report," DOE/EM-0232, March 1995.