

A PRIORITY SYSTEM FOR DOE ENVIRONMENTAL RESTORATION

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ABSTRACT

The U.S. Department of Energy (DOE) is developing a risk-based priority system to assist in the process of formulating and allocating the budget for its Environmental Restoration (ER) program, aimed at cleaning up contaminated sites at over 80 installations in some 20 states. The system combines an initial screening process (based on the urgency of proposed cleanup activities) to ensure that emergency and other time-critical activities are funded promptly, with a quantitative analysis (using multiattribute utility analysis) to determine the value of alternative total ER funding levels and the optimal allocation of ER funds among installations. The quantitative analysis focuses on the effectiveness of proposed solutions to environmental problems, rather than just on the severity of those problems, to help ensure that available funds will have the greatest beneficial impact. An initial version of the system was applied in the Fiscal Year 1992 budget process, and the current, revised version is being applied for the Fiscal Year 1993 budget. A final version will be developed after external stakeholder and technical peer review.

INTRODUCTION

For over 40 years, DOE and predecessor agencies have managed a broad range of missions, including primarily the production of nuclear materials and weapons for national defense, and energy research and development. The DOE complex has involved facilities in some 20 states. Operations at these facilities have produced hundreds, perhaps thousands, of contaminated sites.

DOE is committed to cleaning up these sites over a 30-year period. The cleanup could cost tens of billions of dollars. Even if the budget were unlimited, the sites could not be studied and cleaned up in significantly less time. The limitations of technical and management expertise and the physical realities place a ceiling on the rate at which progress can be made. DOE must reconcile these limitations with the individual desires of numerous States, Tribes, EPA regions, interest groups, and local communities to obtain the fastest possible action at their respective sites. Given these competing desires and DOE's obligation to use public resources in a wise and effective manner, a systematic, rational, open approach to budgeting for environmental cleanup is necessary. In response to this need, DOE is developing a risk-based priority system to assist in budget decisions concerning the cleanup of its contaminated sites.

Specifically, the priority system will aid two types of budgeting decisions. The first concerns the identification of funding levels sufficient to achieve DOE objectives, including, but not limited to, the objective of complying with regulatory requirements. The priority system is expected to help determine, defend, and document the level of funds that should be requested. This capability will be useful in helping DOE formulate and justify a budget request to the Office of Management and Budget (OMB).

The second type of budget decision concerns the allocation of available resources among competing demands. Allocation decisions that the system is likely to support include the division of funds among programs, installations, and activities after Congress has approved the appropriations for cleanup activities. A logical and systematic rationale for making such decisions is needed, especially in view of the program magnitude (billions of dollars in the out-years) and intense public scrutiny. The ability to defend the logic of these choices will be particularly important if the funds requested by OMB or appropriated by Congress are insufficient to fund all desirable activities. The DOE believes that a formal priority system will help ensure that the allocation of cleanup funds among facilities and regions of the country is technically defensible and even-handed, and seen to be so by the affected parties and their elected representatives who must approve the annual budgets for the program.

The priority system is being developed to apply to a subset of the activities that are now managed together under DOE's "Environmental Restoration and Waste Management Five-Year Plan"(1). The Plan covers four types of activities: corrective activities, waste management operations, environmental restoration, and technology development. This priority system is being designed for environmental restoration (ER) activities. The applicability of the approach described in this paper to waste management operations and technology development is currently being studied.

Environmental restoration, dealing with the assessment and cleanup of inactive waste sites and surplus facilities, includes characterization, analysis of cleanup alternatives, site closures, and remedial actions for the major nuclear-related program areas of Defense Programs, Nuclear Energy,

and Energy Research. It involves cleanup work on the 26 major Defense Program, Nuclear Energy, and Energy Research sites (e.g., Hanford and Oak Ridge) included in the Onsite Remediation Program, the 24 sites in the Uranium Mill Tailings Remedial Action (UMTRA) project, and the 31 privately owned sites in the Formerly Utilized Sites Remedial Action Project (FUSRAP). It also involves Decontamination and Decommissioning (D&D) of surplus nuclear facilities currently included in Defense Programs, Nuclear Energy, and Energy Research.

The ER priority system is being developed in consultation with a wide range of outside parties, including State and Tribal governments, national environmental group representatives, the Environmental Protection Agency, and independent technical experts. DOE also plans to consult outside parties during implementation of the completed priority system.

In discussions with outside parties during the early stages of development of the system, it was suggested that DOE develop a "Straw Man" design to show how the priority system would work. In response, DOE developed a preliminary conceptual design to enable interested parties to recommend revisions while the priority system was still in the design stage. As background for developing this preliminary design, the DOE design group reviewed existing prioritization and budget allocation systems and methodologies. These included budgeting systems such as the program, planning, and budgeting system (PPBS) and zero-based budgeting (ZBB)(2); general decision methodologies such as multiattribute utility analysis and cost-benefit analysis; and various priority systems already in use within and outside the DOE, such as the DoD installation restoration program's system, the DOE Environment, Safety, and Health risk-ranking methodology (MEPAS), priority systems developed by DOE Field Offices and by state cleanup programs, and the earlier Program Optimization System, which was developed several years ago in response to direction from the House Armed Services Committee to develop a priority system for cleanup of Defense Programs sites. This review made it clear that no single existing system met all of DOE's design objectives.

After evaluating several alternative conceptual designs from an initial list of 12 options, the design team developed a hybrid approach combining elements of several alternatives. This preliminary design was used in two ways during 1990. First, those parts of the design that could be developed in time were used as an interim system to provide input to the Fiscal Year (FY) 1992 budget process. Second, the conceptual design report (3) was used to focus further discussions with outside parties during the continued development of the priority system. Both the comments received on the conceptual design report and the experience from

the FY1992 interim application contributed to the revised priority system design described in this paper.

OVERVIEW OF THE PRIORITY SYSTEM

The priority system operates in two broad stages, a local stage and a national stage. The local stage deals with a basic question related to site-specific planning -- what to do with the money that is made available for environmental restoration activities at a specific installation. This stage takes into account local knowledge and preferences, including negotiated agreements with host states and regulatory agencies. This stage involves two phases: (I) activity classification and ranking, and (II) budget case generation. It is conducted primarily by field offices with stakeholder input.

The national stage deals with the two national-level budget questions:

1. What is the maximum value, in terms of ER objectives, that can be obtained for different possible levels of funding for all ER activities? The answer to this question helps in formulating and defending DOE's budget request.
2. What is the most effective way to allocate available ER funds among the different installations in the complex? The answer to this question helps in determining how much money will be made available for ER activities at each installation.

The national stage also involves two phases: (III) budget case evaluation, and (IV) funding and budget allocation analysis. Phase III is conducted by the field offices, but with central review of the evaluations conducted by DOE-HQ. Phase IV is conducted by DOE-HQ.

To maximize compatibility with the existing DOE budget process, the system deals separately at the Field Office level with the four programs that have been combined under the DOE Environmental Restoration Program: D&D, the Onsite Remediation Program, FUSRAP, and UMTRA. During the first three phases, these four programs are treated separately; that is, the first three phases are separately but simultaneously implemented four times, once for each program. In phase IV, an individual budget analysis will first be developed for each program. These analyses will then be combined into one overall ER budget analysis. This aggregated ER analysis will be used as the basis for determining the initial budget request and for assessing the implications of changes in the total ER budget in terms of the four major programs.

PRIORITY SYSTEM DESIGN

Local Stage

The local stage determines the priorities for the use of funds at the installation level, i.e. the order in which cleanup activities will be undertaken at a particular installation as

additional funding becomes available for that installation. This is a budget contingency analysis to determine what would be done at various possible budget levels at an installation, and as such is consistent with OMB directives that require each agency to analyze budget cases other (and lower) than the agency's preferred case.

The priority system allows local considerations to play a large role in establishing the priorities for use of funds at each installation. In general, the system does not impose a new set of national priorities on those that have been negotiated at the installation level in environmental compliance agreements involving DOE, the states, and the EPA.

PHASE I: Activity Classification and Ranking. DOE field offices classify and rank the full range of ER activities for each installation to be considered for funding in the fiscal year in question. Budget constraints are not considered at this stage.

All ER activities under consideration for the installation are first grouped into three classes, based on the urgency with which they need to be undertaken. The three classes of activities are:

1. Emergency activities -- remedial actions or studies needed to prevent a serious threat of significant and immediate human exposures hazardous to public health. These activities address problems that are or will be creating significant human exposures before the fiscal year under consideration. Such actions will be accorded the highest possible priority. They will be exempted from further evaluation in the system, and funds to initiate them will be sought immediately.
2. Time-critical activities -- certain specified types of remedial actions or studies that are necessary to avoid unacceptable, irreversible consequences. One important category of actions in this priority class is actions required to stabilize known deteriorating situations, including both remedial actions to eliminate or stabilize a deteriorating situation, and Remedial Investigations/Feasibility Studies (RIFs) that must be completed before such actions can be started. Also included are studies of areas that are suspected, but not known, to pose immediate health or environmental risks, or the risk of rapid deterioration. The priority system will definitely recommend funding of all time-critical activities.
3. Other high-benefit and time-sensitive activities -- activities required by regulations or otherwise needed to achieve environmental restoration objectives in a timely manner. This class includes, for example, situations involving potential future risks, for which urgent action is not needed. DOE managers rank and group activities in this category for later quantitative evaluation in the national stage of the system.

In recognition of the wide variety of circumstances existing at different installations, the priority system does not specify a particular formal process to be used by the field offices in ranking the priority three activities. It does require that the evaluation of these activities consider whether they will contribute to achieving the national program objectives, but leaves it to each field office to develop a process that is appropriate to local circumstances. For an installation with few activities, a simple qualitative ranking system might suffice. For a large, complex installation with many activities, a more formal and quantitative system might be needed. In any case, the priority system will not require that the national objectives and weights used in the national stage (described below) also be used to establish priorities among activities at the local level. These priorities can be determined instead by existing agreements and other regulatory requirements, if appropriate. While the system does require that top priority be assigned to activities falling in priority classes 1 and 2, it is not expected that this requirement would cause any conflict with local priorities.

PHASE II: Budget Case Generation. Phase II generates the basic options for evaluation by DOE-HQ. At the HQ level, the focus of analysis is the "budget case," i.e. a set of activities that a Field Office proposes to undertake at an installation if given a specified funding level. This consolidation of individual activities into budget cases is necessary to reduce to a manageable level the number of items that are considered and evaluated at HQ, and is a common practice in budgeting systems. However, the system will retain the detailed activity information in a data base, and will have the ability to display the implications of alternative funding decisions in terms of the specific activities that would be added or dropped at each installation as a result of those decisions.

The initial activity classification and priority list forms the basis for development of the budget cases, with appropriate allowance for dependencies among activities and the possibility of partially funding an activity rather than dropping it entirely if funds are limited. This phase will generate at least three budget cases for each of the four ER component programs for each installation:

The maximum case includes all the activities that the field office managers think could realistically be accomplished at an installation during the year, given unlimited funds.

The minimum case includes the absolute minimum set of activities that must be conducted at an installation to protect public health and produce some progress toward program goals. Any time-critical activities (priority class two) must be included in the minimum budget case. Its cost is not to exceed 70% of the budget of the year preceding the year being analyzed, unless the number of time-critical activities requires a larger amount. The priority system

always recommends funding the minimum case for each installation, to ensure that all time-critical activities are funded and that each installation continues to make progress.

Intermediate cases are sets of activities that could be conducted at funding levels between the maximum and the minimum. More intermediate cases will be developed when the difference in cost between the maximum and minimum cases is large.

In total, there will be several hundred alternative budget cases for all of the installations involved. If the total funds are constrained, then the various budget cases "compete" with one another to determine the share of the available funds that is allocated to each installation.

National Stage

The purpose of the priority system is to help DOE make budget decisions about how much funding to request for cleanup activities and how to allocate the funds that are made available. An objective and consistent basis for evaluating activities at many different installations across the nation is a necessary basis for such decisions. The national stage of the system is designed to enable nationally-consistent evaluation of proposed expenditures at different installations in terms of their ability to achieve clearly stated national program objectives. This evaluation considers not only the severity of environmental problems, but also the extent to which ER program activities can reduce those problems. That is, it focuses on the effectiveness of proposed solutions to problems, to help ensure that available funds will have the greatest beneficial impact.

The two overarching national ER objectives are "uncertainty reduction" and "impact reduction," in recognition of the fact that some ER activities are intended to improve our knowledge about the nature and severity of contamination problems, while others are intended to reduce the impacts of those problems. To aid in distinguishing among the budget proposals, detailed lower-level objectives necessary for implementing the top-level objectives were identified. These objectives involve consideration of the following factors for each budget case that is evaluated in the system:

1. the baseline level and timing of human health risks and the health risk reductions that would be achieved under each case,
2. the baseline level of environmental risk and the environmental risk reductions that would be achieved under each case,
3. the level of any adverse socioeconomic impacts under each case,
4. the extent to which each case responds to regulatory requirements,
5. the cost impacts of each case, including:

costs in the fiscal year under consideration

-- the remaining costs (to be funded in subsequent years) necessary to complete the remedial actions and/or characterization studies initiated or continued in the fiscal year under consideration

-- the impacts on costs of future activities caused by programmatic inefficiencies or by delaying activities on deteriorating sites,

6. the uncertainties in baseline risk and cost estimates and the extent to which each case includes effective studies to reduce these uncertainties, and
7. whether each case is sufficient to achieve long-term DOE/HQ policy milestones, such as the 30-year goal for installation cleanup.

PHASE III: Budget Case Evaluation. The costs and benefits for each budget case are determined in two steps. In the first steps, field office personnel estimate the costs of each budget case and then score each case on performance scales that measure achievement on each of the principal ER objectives. In the second step, a panel or panels composed of representatives of all field offices and HQ reviews and, if necessary, revises the field office cost estimates and performance scores. The final costs and scores are combined using value judgments made by DOE-HQ to determine the overall costs and a single measure of overall benefits, or "utility," for each budget case. DOE is developing a process for eliciting value judgments from external parties so that it understands the range of opinions held by stakeholders outside of the Department.

Evaluation of budget cases is done using multiattribute utility analysis (MUA), a quantitative technique specifically designed to handle decision problems involving multiple, possibly competing, objectives. MUA was selected as the aggregation technique because it has a solid theoretical foundation, is well-documented in the professional literature, and has been used in many other applications, including applications by the DOE. (4)

PHASE IV: Funding and Budget Allocation Analysis. DOE-HQ will use the cost and benefit, or utility, values developed in Phase III to generate and analyze alternative budget levels and options for allocating funds among programs and field offices. The funding level necessary to achieve all regulatory requirements and other commitments will be identified and will provide an important input to the budget formulation process.

An important step in this phase is sensitivity analysis of alternative policies and technical judgments. One significant sensitivity study that will be conducted is an analysis of the implications of a constrained budget. To permit investigating the consequences of constrained budgets, the sensitivity study will remove the constraint (used for analysis of overall funding needs) that requires each installation to

receive a level of funding that enables all regulatory requirements to be met. Allocations that maximize benefits under constrained funding will be identified and the adverse implications of the constrained budget (i.e., missed regulations and adverse impacts on health and the environment) will be highlighted. The result will be used to make clear to decision makers the minimum adverse consequences associated with a failure to provide necessary resources for cleanup.

NEXT STEPS

The priority system described in this paper is being applied in the FY1993 budget process. In parallel with this application, DOE will conduct a broad review of the revised system design. Both internal DOE and external groups (stakeholder groups and technical peer review groups) are being asked to review the system design. Criteria for evaluating the design include logical soundness, completeness, accuracy, practicality, and acceptability. Based on the results of the external review, a final system design will be developed.

CONCLUSIONS

The DOE believes that the priority system will provide a logical, defensible, auditable, and flexible system for aiding budgeting decisions concerning environmental cleanup. By clearly identifying the criteria to be applied uniformly and consistently in evaluating alternative uses of ER funds, the system will promote the development of ER programs that achieve DOE objectives for the ER budget. It also will allow the DOE field offices necessary flexibility in the design of programs to deal with the unique conditions at each installation, and will give them an incentive to plan the most cost-effective mix of activities for each possible budget level.

At the same time, the proposed system has limitations. It is more complicated than the traditional budget process. Yet it is still a simplification of a complex reality. Additional judgment will be required to take into account those site-specific considerations that cannot be captured in a model.

On balance, DOE believes that the system will provide a valuable information base for supporting budget requests, for evaluating the impacts of budget changes, and for helping to allocate appropriated funds most effectively. We believe that the proposed system represents an important step forward in increasing the real and perceived soundness and even-handedness of the ER budget process, and that it is fully responsive to the desire expressed by Congress and others that DOE have a priority system that would assure that ER funds are put to the best use.

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