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# DOE LIMITED STANDARD

# GUIDELINES FOR RISK-BASED PRIORITIZATION OF DOE ACTIVITIES

U.S. Department of Energy
Washington, DC 20585

AREA MISC

Order No. DE98001293

## FOREWORD

1. This Defense Programs (DP) standard is approved for use by all DOE Components and their contractors.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data that may improve this document should be sent to the Office of the Associate Deputy Assistant Secretary for Technical and Environmental Support (DP-45), U.S. Department of Energy, Washington, DC 20585, by letter or by using the self-addressed Document Improvement Proposal (DOE F 1300.3) appearing at the end of this document.

3. DOE technical standards, such as this standard, do not establish requirements. However, all or part of the provisions in a technical standard can become requirements under the following circumstances:

   (a) they are explicitly stated to be requirements in a DOE requirements document; or

   (b) the organization makes a commitment to meet a standard in a contract or in a plan or program required by a DOE requirements document.

   Throughout this standard, the word “shall” is used to denote actions which must be performed if this standard is to be met. If the provisions in this technical standard are made requirements through one of the two ways discussed above, then the “shall” statements would become requirements. It is not appropriate to consider that “should” statements would automatically be converted to “shall” statements as this action would violate the consensus process used to approve this standard.

4. The sponsors of this standard wish to acknowledge the very valuable contributions of numerous DOE and contractor personnel, without whom this standard would not have achieved its high level of excellence.

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**TABLE OF CONTENTS**

**PARAGRAPH** **PAGE**



**TABLES**

## 1. SCOPE

This standard describes issues that should be considered when comparing, selecting, or implementing risk-based prioritization (RBP) systems. It also discusses characteristics that should be used in evaluating the quality of an RBP system and its associated results.

## 2. PURPOSE

The purpose of this standard is to provide guidance for selecting or developing an RBP system so that when implemented, it will:

a. Improve the quality of the RBP systems employed by DOE and its contractors.
b. Improve the consistency and comparability of RBP system results.
c. Satisfy DOE requests to perform RBP.
d. Help ensure that limited resources are used efficiently and effectively.
e. Help ensure that characteristics for evaluating RBP systems are met and properly balanced.
f. Promote greater understanding, use, and acceptance of RBP systems.
g. Promote greater understanding between DOE and its stakeholders and regulators.
h. Improve the quality of resource allocation, planning, and scheduling decisions.

## 3. APPLICABILITY

This standard is applicable to any and all uses of RBP by DOE elements, including cases in which RBP is requested by DOE or is used to help allocate resources among alternatives that compete for resources.

Prioritizing alternatives that compete for limited resources encompasses many policy issues that are inherent to an RBP effort. It is the position of this standard that policy issues should be determined by the decision maker(s) requesting the prioritization. For additional information on policy issues, refer to section 10 on Application Guidance for Policy Issues.

## 4. OVERVIEW

This standard was developed using a top down approach that made it necessary to identify principles, guidelines, and requirements that should govern RBP.

4.1 Origins and Regulatory Perspectives. There are currently few contexts in which the use of RBP is formally required for DOE activities. However, because RBP can provide useful insights into decision options to achieve cost-effective risk management goals, DOE encourages its use. Further, there are a number of precedents for the use of RBP both inside and outside DOE. To address these precedents, this standard was developed from the top down using high-level documents and principles, augmented by concepts from other documents that would potentially impact the use of RBP.

The highest-level (first-tier) documents, which represented stated policy applicable to the use of RBP, had the greatest impact on the standard in that it was determined that the standard must be fully consistent with their requirements. Of primary concern was DOE's "Risk Principles: Risk Assessment, Management, and Communication and Priority Setting," issued by the Under Secretary of the DOE on January 25, 1995, under a memo entitled "Principles for Using Risk Analysis" (reference [o]). These Risk Principles were based on precepts generally applicable across Federal agencies and modified to apply more specifically to DOE programs and processes. The Risk Principles were designed as an

initial step in defining risk analysis, its purposes, and the steps to be followed to ensure that risk analysis is performed well and is credible.

A document considered to be in the first tier was Executive Order 12866, “Regulatory Planning and Review,” issued by the Office of the President on September 30, 1993, and its companion document, “Economic Analysis of Federal Regulations Under Executive Order 12866,” issued by the Office of Management and Budget on January 11, 1996 (references [j] and [k]). One reason for inclusion of this document in the first tier was that the Executive Order is specifically mentioned in the Risk Principles. However, the primary reason is that (although it is mandated only for prioritizing regulations) it represents Administration policy for analyses of this type, and it is the only Government-wide guidance that generically covers the broad range of activities encompassed by the standard. It contains basic principles and implementing guidance that go beyond environment, safety, and health (ES&H) activities to encompass all types of activities. While the Executive Order and its guidance is mandatory only for the promulgation of formal regulatory requirements by Government agencies, there is no fundamental difference between this Executive Order and the self-imposed internal DOE guidelines, procedures, and other directives since DOE is self-regulating in many of these areas. That is, there is no fundamental difference between the internal DOE decision process regarding what to do about health, safety, environment, business practices, contracting, employment practices, etc., and the promulgation of regulations in these areas by the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the Department of Commerce, the Department of Labor, and other Governmental organizations. Therefore, every effort was made to include in this standard relevant guidelines from the Executive Order and the OMB implementation document.

The second tier of documents used for development of this standard consists of documents from both the Legislative and Executive branches that have the potential to impact DOE’s use of RBP. These include:

- Executive Order 12291, Federal Regulations (reference [i]).
- U.S. EPA, “Guidelines for Performing Regulatory Impact Analysis” (reference [t]).
- U.S. NRC, “Revised Guidelines for Performing Value Impact Analysis” (reference [u]).
- S.333, U.S. DOE Risk Management Act (reference [q]).
- H.R. 1022/H.R.9, Risk Assessment and Cost-Benefit Act (reference [r]).

Unlike the first-tier documents, it was not intended that the standard be consistent with the second-tier documents since they either did not apply to DOE specifically or were only proposed. Rather, one reason for including this tier of documents was to see whether they contained any unique concepts that, if subsequently applied to DOE, could cause a problem for the guidance in this standard. In addition, other agency guidance was included in the second tier as these agencies are continuing to have a greater level of regulatory influence and responsibility over DOE. Finally, proposed legislation was included because it provides an indication of the concepts that could eventually appear in one or more Congressional initiatives, and thus was thought that the material in the standard should be compatible with those concepts to the extent possible. Ultimately, these second-tier documents had virtually no impact on this standard, as they were not found to contain any concepts that were counter to those in the first-tier documents nor did they suggest ways to materially strengthen the standard’s approach to achieving full consistency with those documents.

The third tier of documents included “think tank” reports and existing DOE risk management documents that have either no regulatory standing, or only as much standing as DOE itself established. As such, these documents serve only as a source of insight and lessons learned to provide useful concepts for the standard. These documents include:

- U. S. DOE Office of Field Management's, "Project Management Prioritization Guide" (reference [p]) and its referenced RBP approaches.
- Presidential Commission's, "Risk Assessment and Risk Management in Regulatory Decision Making" (reference [m]).
- National Academy of Science's, "Science and Judgment in Risk Assessment" (reference [e]).
- National Research Council's, "Understanding Risk: Informing Decisions in a Democratic Society" (reference [f]).
- National Research Council's, "Building Consensus Through Risk Assessment and Management" (reference [g]).
- U. S. DOE Office of Environmental Management's, "Risks and the Risk Debate: Searching for Common Ground" (Reference [s]).

These documents were reviewed to extract useful RBP insights, but only to the extent that these insights were not contrary to the concepts in the higher-tier documents.

4.2 Decision Structuring. Formulating decision options is sometimes a difficult challenge. The formulation of decision alternatives needs to be prepared and reviewed with considerable care (1) to eliminate biases and gaming, (2) to ensure that all the infrastructure implications and concomitant effects of the alternatives are appropriately factored in, and (3) to verify that the alternatives are amenable to treatment with the proposed prioritization model, e.g., to eliminate interdependencies that the model may not be equipped to account for.

Decision makers tend to take a negative view of prefabricated decisions that preempt the use of their judgment and management skills. Similarly, interested parties tend to resent decision processes that hide their priorities in an opaque analysis, even if the analysis has done a technically sound job of capturing their values. Therefore, probably the most important initial steps in RBP may be the proper up-front structuring and formulation of the problem and decision to be made, the decision objectives or goals to be reached, and the alternatives or options for reaching these goals. These initial steps may also be the most difficult steps to do well, given the existence of multiple (and sometimes competing) decision objectives, the need to make credible decisions despite potential uncertainties, and the need to accomplish goals with finite resources.

Applications of RBP tend to be most successful when they are seen to illuminate and not prejudge decisions developed in close collaboration with the decision maker or requestor of the prioritization.

4.3 Use of Multi-Attribute Utility Theory (MAUT). MAUT is a flexible, quantitative-based decision analysis technique and management tool for clearly documenting the advantages and disadvantages of policy choices in a structured framework. It merits special consideration because it provides rigorous, sound, and demonstrated ways to combine quantitatively dissimilar measures of costs, risks, and benefits, along with decision maker preferences, into high-level, aggregated measures that can be used to evaluate alternatives. Goals of MAUT are to provide a defensible framework for identifying, organizing, and displaying information needed to support complex policy issues and/or technical decisions; deriving the logical implications of such information; and providing insights and recommendations for decision making. MAUT allows full aggregation of performance measures into one single measure of value that can be used for ranking alternatives. MAUT techniques can provide a mechanism to facilitate constructive discussion and mediate potential conflict.

The results of a MAUT analysis should not normally be used as the sole or principal basis for decision making. It will always be necessary to take into account factors that cannot be readily quantified or monetized, for example, factors like equity. Formal methods, such as MAUT, can provide an estimate of the costs and benefits of alternatives but can never be more than a simplification of a complex reality. Further, no technique can eliminate the need to rely heavily on sound knowledge, data, and judgments, nor the need for a critical appraisal of results.

4.4 Use of RBP Models Other than MAUT. The user should consider other tools and techniques appropriate to the particular prioritization issue, and may apply other decision structuring methods that meet the quality characteristics discussed in section 8 of this standard. References (b), (c), and (d) provide additional information about decision analysis methods. Additionally, the Office of Field Management's "Project Management and Prioritization Guide" provides guidance for applying prioritization methodologies (reference [p]).

4.5 Documenting Results. Thorough and precise documentation of RBP applications is essential and should clearly identify in an easily understandable form why and how the priority rank came out as it did, how reliable the resulting preferences are, and to what inputs they are sensitive.

## 5. BACKGROUND ON INTENDED USES AND USERS

5.1 Risk-Based Prioritization (RBP). For the purposes of this standard, RBP denotes a structured decision process to prioritize alternatives that compete for limited resources. This prioritization is based on an analysis of the predicted costs, risks, and benefits of those alternatives as a method to aid decision makers with their resource allocation, planning, and scheduling decisions.

5.2 Value in Using RBP and Its Role in Decision Making. In practice, the insights gathered during the RBP process are often more useful to the decision maker than the final result. That is, most of the value added by the use of RBP derives from the discipline, objectivity, and rigor its use brings to bear upon each step of the decision analysis, e.g., the careful formulation of the decision options; the systematic evaluation of the decision objectives and underlying values; the care taken to identify decision implications; the disciplined assessment of costs, benefits, and risks; the rigorous modeling of competing values and preferences; and the potential to measure the effect of particular factors or uncertainties upon the preference ranking of the decision alternatives.

The use of RBP can be of substantial benefit even if the bottom-line ranking of alternatives is not intended to be decisive or is not expected to be sufficiently discriminating—given the uncertainties—to be of much assistance to the decision maker. It is not uncommon for RBP to plant the seeds for new and better decision alternatives or ways of framing the problem that prove to be clearly preferable to the ones envisioned at the outset, even in cases in which the ranking of bottom-line decision alternatives proves to be of little prescriptive worth. Thus, although there is a wide-spread misconception that the value of RBP lies entirely in identifying the preferable decision alternative, decision makers need not surrender their judgment to a formula in order to make effective use of RBP.

5.3 Intended Users. This standard should serve as a quality assurance tool for experienced users of RBP. It is not intended as an introduction to the subject for decision makers nor as a how-to guide for those with little prior RBP experience.

5.4 Implementation by Teams. A premise of this standard is that the individuals who are experts in the decision options and decision context will work in close partnership with experts in RBP, with each educating the other and collaborating in the application.

The standard generally assumes that the individuals who commission the use of RBP are the decision makers, and they are commonly referred to in the text as “decision makers.” However, the standard is fully applicable to cases in which those commissioning the prioritization are responsible for evaluating the alternatives rather than those with the authority to make the final decision.

The standard also covers the question of whether or not RBP should be selected, and if so, which of the many RBP approaches are appropriate to the context. Those seeking to evaluate whether RBP should be selected as a method to illuminate a decision at hand are encouraged to work with experts in RBP to help resolve such questions.

5.5 Variety of Applications. There are a wide variety of contexts in which RBP may be warranted and useful, including: (1) cases where many projects are competing for limited funding; (2) the preparation and justification of budgets; 3) the prioritization of remediation initiatives; (3) the selection among competing designs for fulfilling a particular mission; (4) the regulatory analysis of proposed major Federal rules as mandated by Executive Order 12866; (5) the allocation of staff resources; (6) the allocation of time to activities, such as the development of “living schedules” for complex facilities or enterprises; and (7) selecting among many suggestions for upgrading troubled facilities, operations, or organizations.

5.6 Variety of RBP Methods. This standard may be used in the selection, application, and documentation of a wide variety of prioritization methods. It encourages, but does not demand, a quantitative approach. Among quantitative RBP methods, this standard encourages, but does not demand, the use of MAUT. Some of the specific guidelines presume that a method within the MAUT class of RBP methods will be employed. These guidelines and this preference have been included because the class of methods known as MAUT is among the most rigorous, systematic, demanding, and powerful of quantitative RBP techniques. However, it is not intended to imply that MAUT is always the method of choice for DOE applications or that MAUT must be employed to adhere to this standard. This standard may be applied fruitfully to other quantitative or semi-quantitative methods of risk-based prioritization.

## 6. REFERENCES

**Books**

a. Arrow, K. J. et al., “Benefit-Cost Analysis in Environmental, Health, and Safety Regulation,” American Enterprise Institute, the Annapolis Center, and Resources for the Future, 1996.

b. Keeney, R. L. and H. Raiffa, “Decisions with Multiple Objectives: Preferences and Value Trade-Offs,” Cambridge University Press, New York, NY, 1993.

c. Keeney, R. L., “Value-Focused Thinking, A Path to Creative Decision-making,” National Research Council, 1993.

d. Morgan, M. G. et al., “Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis,” Cambridge University Press, New York, NY, 1995.

e. National Academy of Science, “Science and Judgment in Risk Assessment,” National Academy Press, Washington, DC, 1994.

f. National Research Council, “Understanding Risk: Informing Decisions in a Democratic Society,” 1996.

g. National Research Council, “Building Consensus Through Risk Assessment and Management,” 1994.

h. Winterfeldt, D. von and W. Edwards, “Decision Analysis and Behavioral Research,” Cambridge University Press, 1986.

**US Government Articles, Orders, Notices**

i. Executive Order 12291, Federal Regulations, February 17, 1981.

j. Executive Order 12866, Regulatory Planning and Review, September 30, 1993.

k. Office of Management and Budget (OMB), “Economic Analysis of Federal Regulations Under Executive Order 12866,” January 11, 1996.

l. OMB Circular A-94.

m. Presidential/Congressional Commission on Risk Assessment and Risk Management, “Risk Assessment and Risk Management in Regulatory Decision-Making,” 1997.

n. U.S. Department of Energy, “Effective Public Participation Under the National Environmental Policy Act,” Office of NEPA Policy and Assistance, December 1994.

o. U.S. Department of Energy, “Principles for Using Risk Analysis,” Memorandum from Under Secretary C. Curtis, Washington, DC, January 25, 1995.

p. U.S. Department of Energy, “Project Management Prioritization Guide,” Office of Field Management, February 1996.

q. U.S. Department of Energy Risk Management Act of 1995, S.333, March 29, 1995.

r. H.R. 1022/H.R.9, Risk Assessment and Cost-Benefit Act of 1995, March 3, 1995.

s. U.S. Department of Energy, “Risks and the Risk Debate: Searching for Common Ground,” Office of Environmental Management, 1995.

t. U.S. Environmental Protection Agency, “Guidelines for Performing Regulatory Impact Analysis,” December 1993.

u. U.S. Nuclear Regulatory Commission, “Revised Guidelines for Performing Value Impact Analysis,” May 7, 1982.

## 7. DEFINITIONS

Affected Parties. People, groups, or organizations that may experience benefit or harm as a result of an activity, or of the process leading to prioritization of activities, or of a decision about performing activities. They need not be aware of the possible benefit or harm to be considered affected. (Reference [f]).

Aggregation Equation. An equation specifying the rules used by an RBP system to combine value judgments and measures to yield an overall measure of the value of decision options. The

aggregation equation must be consistent with the independencies and dependencies that exist in decision-maker preferences.

Benefit. An increase in the achievement of a decision objective as a result of implementing a decision option. For comparison of benefits across decision objectives, benefits for individual decision objectives will have to be normalized. For any given decision objective, benefits may increase (desirable), decrease (undesirable), or remain the same following implementation of a decision option.

Characteristic. A distinguishing trait, quality, or property desired for selection, development, or comparison of RBP systems.

Cost. The outlay or expenditure made to achieve a decision option. Cost of implementation should not be confused with monetized equivalents of benefits.

Decision Objective. An explicit statement of a desired goal of implementing decision options. Decision objectives provide a basis for defining performance measures for RBP systems and then defining decision options. To be technically complete, the specification of a decision objective requires specifying the object of value, its context, and direction of preference.

Decision Option. Alternative activities or sets of activities that are evaluated and prioritized by RBP systems.

Interested Parties. People, groups, or organizations that decide to become informed about, and involved in, an RBP process. Interested parties may or may not also be affected parties. (Reference [f]).

Performance Measure. A quantitative measure for characterizing the effects on risk or benefits of performing an activity. Performance measures are often specified in terms of scales that indicate the relationship between decision option characteristics and the corresponding quantitative measure. For example, maximum individual risk, defined as the probability of a fatality to a maximally exposed individual, is a performance measure of human health risk.

Performance Result. A numerical value (score), as determined by the application of an RBP system, of the outcome of performing an activity.

Risk. A concept used to give meaning to things, forces, or circumstances that pose harm or benefit to people, groups, or organizations, or to what they value. Descriptions of risk are typically stated in terms of the likelihood of harm or benefit from an activity and usually include an identification of what is “at risk” and may be harmed or benefitted (e.g., health of human beings or an ecosystem, personal property, quality of life, ability to engage in an economic activity); the activity that may occasion this harm or benefit; and a judgment about the likelihood that harm or benefit will occur. (Reference [f]).

Risk-Based Prioritization. A process that uses quantification of risks, costs, and benefits to evaluate and compare decision options competing for limited resources. The function of RBP is to aid allocation and planning decisions.

Risk-Based Prioritization System. The collection of procedures, models, and other components used to conduct RBP.

Scaling Function. A functional relationship that translates a level of performance, as expressed by a performance measure, into a number that indicates the value or desirability of performance. A scaling function is provided for each performance measure. Mathematically, a scaling function has the form v=S(m), where “m” is the performance measure, “S” is the scaling function, and “v”

is the measure of value. The more preferred the level of performance, the higher the value "v." Furthermore, the differences in the values of "v" produced under various levels of performance "m" indicate by how much the higher levels of performance are preferred.

Scoring. The process of determining the input parameter values required by the RBP model to yield the performance result for each activity. These parameters are used in the aggregation equation inputs, specifically those associated with measuring risk (i.e., probability and consequence).

Stakeholders. Interested or affected parties. (Reference [f]).

## 8. CHARACTERISTICS FOR EVALUATING, IMPLEMENTING, AND/OR COMPARING RISK-BASED PRIORITIZATION SYSTEMS

Eight characteristics shall be used for the purpose of evaluating the quality of a prioritization system: (1) logical soundness, (2) completeness, (3) accuracy, (4) acceptability, (5) practicality, (6) effectiveness, (7) defensibility, and (8) quantification of costs and benefits. These characteristics are described below.

The degree to which a prioritization system must achieve each of the eight characteristics depends on the application. For example, some situations demand highly accurate results, while rough approximations are acceptable in others. Ensuring the adequacy of an RBP system requires:

a. Determining necessary and desired levels of system performance with regard to each of the characteristics.
b. Evaluating the capabilities of candidate RBP system designs with respect to those characteristics.
c. Choosing a system design that achieves necessary levels of performance and desired levels of performance with regard to each characteristic.

Guidelines are provided in section 9 to assist with meeting and properly balancing these criteria. Some of the guidelines support more than one characteristic, so it may be useful to think of the guidelines as a single set.

8.1 Logical Soundness. The system should be able to produce results and insights via a defensible decision rule that adheres to the basic principles of logic. Such a rule should be justifiable in terms of theoretical arguments or empirical evidence, sensitive to the various aspects of the problem, unbiased, and reliable in the sense that independent applications to the same problem would produce the same results.

8.2 Completeness. The RBP system should strive to account for all relevant and important decision objectives that discriminate among potential alternatives. The system should allow for inclusion of additional decision objectives that may arise during implementation of the process. Objectives important to interested parties in the decision process (e.g., stakeholders, participants) should be addressed by the system. Users of the RBP system should ensure that these objectives are included in the implementation of the system and the documentation of the results.

8.3 Accuracy. The RBP system should minimize the potential for cognitive and motivational biases that could inappropriately skew the results in favor of particular decision options. It should be possible to demonstrate that any reasonable team with the same input data would produce a similar result.

8.4 Acceptability. The RBP system should be able to function within existing institutions, operations, and processes. Of particular importance is whether the system is consistent with the attitudes and perceptions of decision makers and stakeholders as interested or affected parties and that it is clear and understandable to the users and stakeholders.

8.5 Practicality. The RBP system should be employed in a pragmatic, decision-making environment. Important considerations include the level of expertise required to develop and use the system, the availability and quality of data needed as system inputs, the personnel needed, and the time and costs involved in applying the system. The RBP system should demonstrate the usefulness of the system in action, rather than its theoretical elegance or rigor.

8.6 Effectiveness. The RBP system should be able to produce results useful for decision making. The key consideration is whether the results support discrimination among potential alternatives. Other considerations include whether the results support important tasks or decisions, the scope of applicability, whether insights and conclusions may be generalized to other problem areas, and whether the RBP system complements related systems (i.e., Activity Data Sheets, Construction Project Data Sheets, Working Capital Fund, and the Strategic Management System) employed by the user.

8.7 Defensibility. The purposes, inputs, design, assumptions, models, and outputs of an RBP system should be consistent with formal theory and be readily documented and available for review.

8.8 Quantification of Cost and Benefits. Presentation of monetized benefits and costs is preferred where acceptable estimates are possible. When monetized, benefits and costs should be expressed in discounted constant (i.e., not inflated) dollars. Reference (k) provides additional information on monetization. Where monetization is not possible for certain elements of the benefits or costs that are essential to consider, other quantitative and qualitative characterizations of these elements should be provided.

## 9. GUIDELINES FOR EVALUATING, IMPLEMENTING, AND/OR COMPARING PRIORITIZATION SYSTEMS

The guidelines described in this section provide additional detail to judge whether an RBP system meets the specific characteristics described in section 8. In addition, this section provides further detail on issues that should be considered when developing, implementing, or comparing RBP systems.

The guidelines provided in this section are grouped according to the characteristic with which they are most strongly associated. The guidelines may apply to more than one characteristic; this should be kept in mind during the actual use of the information presented here.

9.1 Guidelines Primarily Associated with Logical Soundness.

9.1.1 Guideline 1.1—Verify Decision Objectives. To the maximum extent practical, the set of decision objectives should be:

a. comprehensive,
b. relevant,
c. mutually exclusive,
d. independent, and
e. minimal in number.

Discussion. Comprehensiveness ensures that important considerations or points of view will not be ignored. Relevance ensures that evaluation criteria will reflect appropriate program scope. Mutual exclusiveness means that the decision objectives do not overlap, and double counting is prevented. Independence of decision objectives (in the sense that the value or importance of achieving any one objective does not depend on the degree to which other decision objectives are achieved) promotes mathematically simpler RBP models that are easier to understand. Sometimes, the statements of decision objectives should be limited for pragmatic reasons and should be addressed by decision makers outside the RBP process. A minimum number of decision objectives should reduce the difficulty of implementation.

9.1.2 Guideline 1.2—Clarity Test. Performance measures should be as unambiguous as possible, such that given sufficient data, it would be possible to specify a level of performance for each performance measure and for each decision option.

Discussion. For illustration, consider the risk measure “number of people receiving excessive exposure.” This measure fails to pass the clarity test. The terms "excessive" and "exposure" would have to be clarified before “meaningful estimates” could be associated with specific alternatives. A proper measure could be “number of people receiving a whole body radiation dose in excess of 200 rem committed effective dose equivalent.”

9.1.3 Guideline 1.3—Consistency with Principles of Rationality. The prioritization logic should produce a ranking of decision options that does not violate any basic principles of rationality. In particular,

a. Activities with identical benefits and costs should be ranked identically.
b. If the activity is changed for the better, the ranking should not decline.
c. The ranking of an activity should be insensitive to the addition or removal of independent activities.
d. The ranking of an activity should be insensitive to previously committed costs (sunk costs).

Discussion. Some prioritization models, while appearing at first glance to be perfectly logical, can produce results that are inconsistent with what might be considered basic axioms for rational decision making. Therefore, it is important to verify that the chosen model conforms with the basic principles of rationality. As an example, suppose activities have been labeled and ranked A, B, C, D, and E, and sufficient funds are available to conduct only the top three ranked activities. Assume that A, B, and C turn out to be the top-ranked activities, and activities D and E are determined to fall below the cutoff line. If the availability of activity D were determined to be irrelevant to the choice of the top three activities (i.e., Guideline 1.4 was followed), removing activity D from the prioritization should not alter the relative ranking of the remaining activities. A system that did not ensure this result would lack credibility even if it was never used in situations where activities were added or subtracted.

9.1.4 Guideline 1.4—Independence of Decision Options. Decision options should be defined in a manner that maximizes their independence. Dependencies occur if the cost, risk, or benefit of performing any decision option depends on whether or not any other alternative is conducted.

Discussion. If two decision options proposed for evaluation are determined to be dependent, they should be combined into a single independent composite decision option to facilitate prioritization. For example, if decision options A and C share the use of capital investments or each affect overlapping risks, the option of selecting both

should be prioritized separately from the option of selecting either one by itself. If no adequate set of independent decision options can be defined, a prioritization logic that explicitly models decision option interdependencies should be employed, and the effects of the interdependencies discussed in the final report.

9.2 Guidelines Primarily Associated with Completeness.

9.2.1 Guideline 2.1—Identification of Decision Objectives. DOE management has identified high-level decision objectives for the Department, which are listed in Table I. These decision objectives should be considered candidates for RBP implementation.

TABLE I. DOE High-Level Decision Objectives

- Maximize Accomplishment of Mission
- Minimize Adverse Effects upon Public Health and Worker Safety
- Minimize Adverse Effects upon the Environment
- Maximize Compliance with Regulations
- Minimize Adverse/Maximize Desirable Socioeconomic Impacts
- Maximize Safeguards and Security Integrity
- Maximize Cost Effectiveness
- Maximize Public Trust and Confidence

Discussion. The decision objectives listed above constitute the broad range of considerations for prioritizing DOE decisions. The end objectives that need to be achieved should be specified by providing resources for the activities in the DOE program or problem area. Objectives are important because they define the type of consequences (impacts) of activities that must be evaluated within the RBP effort. When specifying the subset of these objectives for use in a particular prioritization effort, the decision options to be prioritized should be compared to these objectives. If any objective is shown to be irrelevant to the decision options (i.e., implementing any of the decision options will not affect the degree to which a particular objective is met), that objective should be excluded from the scoring. However, a case should be made and documented as to why such exclusions are valid. It should be kept in mind that it may be necessary to further refine an objective to fully address all the important aspects of achieving that objective. In that case, lower tier objectives should be identified. Some examples are provided in Table II.

9.2.2 Guideline 2.2—Statement of Decision Objectives. Statements of decision objectives should specify the object of value, context, and direction of preference.

Discussion. To be useful, statements of decision objectives should indicate the object that is valued, define the context or relevant scope, and be specified such that preferences are a monetized function of some measurable aspect of the object of value. For example, an objective might be stated as “minimize adverse health effects to workers engaged in cleanup activities.” This statement conveys the object of value “human health and safety protection,” the context “effects to workers engaged in cleanup activities,” and the direction of preference “minimize.”

The statement, "optimize activities," for example, is not an adequate statement of an objective because it fails to identify the context and the direction of preference.

9.2.3 Guideline 2.3—Statement of Performance Measures. The RBP system should (1) specify the performance measures to be used for evaluating and comparing decision objectives and (2) identify the relationship between the performance measures and their associated decision objectives (i.e., the decision objectives whose achievement the performance measures are meant to quantify).

TABLE II. Examples of Lower-Tier Objectives

| Primary Objectives | Lower-Tier Objectives |
|---|---|
| Health and Safety | Minimize adverse effects upon public health and safety<br>Minimize adverse effects upon site personnel health and safety<br>Minimize population risk<br>Minimize individual risk<br>Minimize risk urgency |
| Mission Impact | Maximize achievement of mission objectives<br>Minimize missed milestones<br>Minimize uncertainty<br>Maximize workforce knowledge, skills, and abilities<br>Maximize facility/equipment capabilities and quality |
| Efficiency | Maximize workforce motivation<br>Maximize (minimize) cost savings (losses)<br>Maximize worker productivity<br>Maximize return on investment |
| Societal Impact | Minimize public concern<br>Minimize cultural impacts<br>Maximize economic benefit to local community<br>Maximize public acceptance of risks |
| Environmental Impact | Minimize risk to water resources<br>Minimize risk to land resources<br>Minimize risk to air resources |

Note: The objectives identified above are representative only. The listing is neither complete nor mandatory. The selection of objectives is dependent upon the specific application of the RBP process.

Discussion. The success of an RBP application hinges upon the performance measures accurately representing and quantifying the level of achievement of the decision objectives. To evaluate and compare decision objectives, it is helpful to provide clear statements of the intent and limitations of the performance measures. Such statements promote RBP system quality and facilitate peer review. For each performance measure, a scale that defines the range of interest for each decision objective should be provided. A scale can be based on either natural or surrogate

measures. Where surrogate measures are used, however, it is especially important to identify and document the differences between such measures and the decision objectives they represent.

9.2.4 Guideline 2.4—Risk Measures. Risk measures should account for relevant parameters critical to distinguishing between decision options. To accomplish this, the following parameters should be considered:

a. Relevant hazards and contingent outcomes.
b. Likelihood of occurrence and severity of consequences.
c. Timing and duration.

Discussion.

a. Relevant Hazards. Risk measures should consider relevant hazards or contingent outcomes associated with the decision options. The following list indicates some typical risk measures considered by RBP systems—risk measures may be added or removed as determined by the end-user objective:
   1. Public health and safety (i.e., acute and chronic risks, including cancer risks).
   2. Worker health and safety.
   3. Environmental impacts.
   4. Security and safeguards.
   5. Regulatory risks.
   6. Implications for and risks to public assessment/perception.
   7. Implications for and risks to science and technology capabilities.
   8. Implications for and risks to science and technology scope/mission.

   In addition to considering the full population at risk, attention should be directed to subpopulations (including future generations) that may be particularly susceptible to such risks and/or may be more highly exposed.

b. Likelihood and Severity. Risk measures sensitive to likelihood and severity may be needed to properly distinguish high risks from low risks. Generally, risk is the likelihood of an adverse event with respect to impact on a decision objective and the consequence of that event. The risk of an adverse event may be high because (1) the likelihood of the event's occurrence is very high, (2) the consequence of the event is very high, or (3) both likelihood and consequence are very high.

c. Timing and Duration. Several issues pertaining to risk timing and duration may be important in distinguishing between decision options. First, some decision options may be viable only when implemented within a limited time window; in contrast, other decision options may be implemented at any time. For example, a decision option intended to limit the spread of contamination into an aquifer may be technically much simpler if it is quickly implemented; thus, a potentially limited window of opportunity exists before the nature and magnitude of the risk associated with the decision option is fundamentally changed. Second, performance measures should distinguish between (1) decision options that

produce benefits that accrue over time and (2) decision options that must be repeated or extended to produce lasting benefits.

9.2.5 Guideline 2.5—Treatment of Uncertainty. The RBP system should include a means to address uncertainties in the prioritization results. Documentation should include a discussion of how uncertainties affect the prioritization results. The sophistication of the method chosen to address uncertainties and the level of effort devoted to assessing the impact of uncertainties should be commensurate with the value of the information as well as the scale of the effort.

Discussion. When addressing uncertainty, it is important to ensure inclusion of a range of technical interpretations and viewpoints, and avoid forcing technical consensus where it does not exist. An example helps to illuminate many of the issues involved. Defense-in-depth is a common practice in limiting the risks of hazardous operations that could threaten public health and safety. A prioritization model that captures only known accident risks would value the prevention or mitigation of these accidents but would accord little or no value to defense-in-depth. To capture fully the value of defense-in-depth, it is necessary to undertake the difficult task of evaluating all the uncertainties: some kinds of accidents may have been missed, evaluations of the reliability of safety provisions may have been unduly optimistic, or some accidents might proceed down paths not anticipated. Defense-in-depth is intended to protect the public from risks that remain unmitigated due to just such regulatory limitations.

The treatment of uncertainty may—at its simplest—be entirely qualitative. In many cases, a mix of quantitative and qualitative methods are employed, with the qualitative treatment reserved for those kinds of uncertainty that are difficult to evaluate quantitatively, such as those that give value to defense-in-depth. It is also possible to attempt a fully quantitative treatment of all uncertainties, though doing so for our ignorance of all risk contributors inevitably entails a highly subjective approach. It is not uncommon to be able to develop bounding estimates of what might have been missed or distorted in a risk assessment, and these bounds are often useful in illuminating the potential range of values that defense-in-depth strategies might warrant.

There are four key aspects of uncertainty in prioritization. A discussion of each is provided below.

a. Variability and Uncertainty. Some inputs to the RBP system are predictable only in a statistical fashion, i.e., there is a stochastic or random component. For example, the RBP system may consider a risk due to accidents that affect public health and safety. The number of individuals affected by such accidents is a variable quantity (in the mathematical sense, a random variable that is described by a probability distribution) that depends on the nature of the accidents considered, the weather at the time of the accident, and individual response to such accidents. A common way of expressing variabilities in risk assessments is through the use of complementary cumulative distribution functions. In the above example, one could

express the variability by graphing accident frequency, likelihood, or probability as a function of the number of fatalities, the number of cancer occurrences, or another measure of accident consequences. Such variabilities are not typically considered to be uncertainties; rather the term “uncertainty” refers to the fact that either the risk model is not exact (modeling uncertainty) or that the parameters of the input probability distributions are not exactly known (parameter uncertainty). The RBP system and its underlying risk assessments should normally address variabilities.

b. Types of Uncertainty. Two basic types of uncertainty within the RBP system should be recognized:
   1. Modeling uncertainty. The RBP system may produce inaccurate results if important performance measures have been omitted from the aggregation equation or if important dependencies among performance measures have not been considered. Modeling uncertainty is difficult to assess quantitatively and is frequently addressed by ensuring that the model is as complete as possible. Bounding and/or subjective modeling techniques can be employed, when warranted, to explore the quantitative implications of model limitations in the more sophisticated applications of RBP. Documentation of a prioritization project should explain the basis for selecting the decision analysis process used in the project, including a rationale for including each performance measure.
   2. Parameter Uncertainty. The RBP system may produce inaccurate results if the underlying data and information supplied to the aggregation equation is itself uncertain. For example, the benefits or costs associated with a particular decision option may not be exactly known; such information may be communicated by providing (a) a range of values (that is, a minimum and a maximum value) or (b) a probability distribution function.

c. Assessing the Impact of Uncertainty on Prioritization. It is important to understand that the results of a prioritization (that is, an ordered list of decision options) may be impacted by uncertainties and how they may be affected. It is desirable that the treatment of uncertainties in the bottom line priority measures reflect all sources of variability and uncertainty, to avoid misleading the user by reporting only some contributors to the uncertainty of the bottom line. However, distinguishing causal contributors to variability or uncertainty is often illuminating to inform the user about the dominant factors limiting our ability to discriminate the optimum decision alternative. When assessing uncertainty, it is recommended that the guidance provided by the OMB be followed (References [k] and [l]). Typically, the assessment of uncertainties has focused on understanding the impacts of parameter uncertainty. The basic methods for assessing the impact of parameter uncertainty include:

   1. Sensitivity Analysis. A sensitivity analysis is performed by varying parameters within the aggregation equation over a range of values and by observing the effect on the prioritization results. Usually, the parameters are considered

individually as it is difficult to interpret the results if combinations of parameters are simultaneously varied. Sensitivity analysis is typically used as an initial step in understanding uncertainties to indicate how the parameters within the aggregation equation affect the prioritization results.

2. Uncertainty Analysis. An uncertainty analysis is performed by developing probability distribution functions for the parameters within the aggregation equation, and subsequently propagating these distributions through the aggregation equation. The most difficult part of performing any uncertainty analysis is the formulation of the underlying parameter distributions. A variety of techniques have been developed to propagate the parameter distributions through the aggregation equation (such as Monte Carlo analysis, meta-analysis, discrete probability distributions, and the method of moments).

d. Developing Data and Information About Uncertainties. Historical data should be used to gain insight about the extent of parameter uncertainties; such information can be analyzed, interpreted, and communicated using standard statistical methods. If no relevant historical data exist, expert opinion may be solicited and processed using a variety of methods. There are a variety of formal methods for eliciting and combining expert judgments of data distribution characteristics, such as Delhi methods, that should be considered for use as appropriate. Limited historical data may be combined with expert opinion using Bayesian statistical methods. The information should be documented for peer review and for future modeling use.

9.2.6 Guideline 2.6—Development of Performance Measurement Scales. The RBP system should be developed in such a way that each performance measure can reflect either a benefit increase (desirable) or a benefit decrease (undesirable).

Discussion. The implementation of a given decision option can create either an increase or a decrease in the benefit and/or cost associated with each performance measure; accordingly, each performance measure scale should be capable of reflecting either effect. Within a prioritization system, the only way to accurately assess the net benefit of a decision option is to properly account for both the aspects of an activity that move one closer to meeting a decision objective and those that move one farther away. For example, consider an RBP system containing a performance measure related to public health and safety that is used to assess two decision options. Implementation of the first decision option may greatly reduce the risk to worker health and safety (a large increase in benefit associated with this objective), while it also may somewhat increase the risk to public health and safety (a small decrease in benefit associated with this objective). The RBP system must be capable of reflecting these effects, which is achieved through proper construction of the performance measure scales.

Therefore, the performance measurement scales should reflect both direction (increase or decrease in benefits) and magnitude (how much increase or decrease in benefit). A simple way to achieve this need is to assign positive performance

measurements to benefit increase, and negative performance measurements to benefit decrease (e.g., “number of individual members of the public who have expressed support for the activity” or “number of individual members of the public who have expressed opposition to the activity”). Alternatively, an absolute scale can be developed that allows the difference between the baseline and each decision option to be assessed (e.g., “before— there is 1 chance in 100 that a fatality will occur” and “after—there is 1 chance in 1,000 that a fatality will occur, a benefit increase probability of -0.009 lives lost [0.009 lives saved]” or “after—there is 1 chance in 10 that a fatality will occur, a benefit decrease probability of 0.09 lives lost [-0.09 lives saved]”).

9.3 Guidelines Primarily Associated with Accuracy.

9.3.1 Guideline 3.1—Establishment of Baseline. The benefits and costs of each decision option should be measured against a baseline. The baseline should be the best assessment of the way the world would look if the decision option is not implemented, and it should correspond with the assumptions used to estimate decision option costs.

Discussion. To calculate value without the decision option, assumptions for estimating performance without the decision option are required. Generally, the baseline should represent the conditions that would exist in the absence of the activities specified in the decision options. However, when the decision option is to eliminate or modify ongoing activities, the baseline should reflect no change to ongoing activities. When more than one baseline appears reasonable, or when the baseline is very uncertain and the estimated benefits and costs of the proposed decision options are likely to vary significantly with the baseline selected, benefits and costs may be measured against multiple alternative baselines as a form of sensitivity analysis.

9.3.2 Guideline 3.2—Establishing Decision Options. The RBP system should be capable of (1) assessing a broad range of decision options and (2) suggesting new decision options.

Discussion. RBP systems can be employed in two distinct ways. First, an RBP system can be used to assess a predefined set of decision options (specified perhaps by the end user). In this usage, the set of decision options is determined independently of the team of decision analysts conducting the prioritization project through the conduct of engineering analyses, financial analyses, etc. Second, an RBP system can be used in an iterative fashion to help identify new decision options. In this usage, the decision analysts conducting the prioritization project work as a team with other engineers and analysts to help postulate viable decision options. The RBP system can be applied to a preliminary set of decision options; the results of this preliminary prioritization can then be studied to identify the dominant factors that discriminate among decision options (for example, the performance measures that drive the results can be identified). Based on this information, new decision options may be identified for further consideration.

9.3.3 Guideline 3.3—Aggregating Performance Measures. Performance measures should be appropriately weighted, scaled, and aggregated to produce a quantitative measure of the total incremental net benefit obtained from conducting the decision options, or other measures of value as defined for the specific RBP application. Efforts should be taken to minimize the potential for cognitive and motivational scoring biases in developing the performance measures.

Discussion. Weights should reflect the relative values of obtaining improvements on the various performance measures by the different decision options. Scaling functions should account for any nonlinearities in the relative value of achieving various levels of improvement against the corresponding performance measures. The method of aggregation should be consistent with the dependent/independent relationships among performance measures. Specifically, if uncertainties in performance measures are not explicitly considered, then the method of aggregation should normally be a measurable value function. Otherwise, if uncertainties are considered, a von Neuman-Morgenstern utility function (reference [d]) should be used unless a compelling case can be made that it is unnecessary or inappropriate to the role assigned to the RBP. Value judgments are subjective and likely to differ among different stakeholders. It is important that such values accurately reflect the preferences of the decision maker, not the system designer.

9.3.4 Guideline 3.4—Consistency in Scoring. The scoring process should be designed to ensure that scorers make consistent assumptions in the assignment of scores.

Discussion. All prioritization methods require that decision options be rated or scored against the objectives. There are three aspects of scoring that, if controlled, can do the most to ensure consistency. These are discussed below.

a. Scoring Teams. The direct approach to achieving consistency is to have a single team evaluate all decision options. In addition to a large time commitment, it may be difficult to assemble a single team with an appropriate range of expertise. If multiple teams of individuals are assembled to share the scoring responsibility, it is essential to include a quality assurance mechanism to ensure that evaluations are comparable across scoring groups.

b. Judgments and Biases. The guidance provided by OMB (reference [k]) is instructive in dealing with judgments and biases. This guidance states that the assessment should generate a credible, objective, realistic, and scientifically balanced analysis, presenting the information used in scoring, such as dose response and exposure (or analogous material for non-health assessments); and, explain the confidence in each assessment by clearly delineating strengths, uncertainties, and assumptions, along with the influence of these factors on the scoring. These data and assumptions should not reflect unstated or unsupported preferences for protecting public health and the environment, or unstated safety factors to account for uncertainty and unmeasured variability. If systematic biases are identified, adjustments can be made to counter these biases. If scores have been collected over the course of several applications within a specific area,

scores from previous applications may be used to provide baseline scores for a current application.

c. Facilitator. Regardless of how the scoring process is formulated, it is important that scoring teams be facilitated by an individual who thoroughly understands the RBP system. The facilitator should understand principles of group facilitation. The facilitator should also understand potential cognitive and motivational scoring biases and the techniques that are available for countering these biases.

9.3.5 Guideline 3.5—Training of Participants. Participants in RBP applications should be trained to perform their assigned roles to ensure that they are adequately qualified (also see Guideline 7.1). They should also be cognizant of the roles of other participants and the overall purpose and goals of the prioritization.

Discussion. Participants in RBP applications need sufficient depth of understanding, skills, and knowledge of their roles and the roles of other participants to effectively support the prioritization. Training should be performed commensurate with the size and complexity of the RBP application.

9.4 Guidelines Primarily Associated with Acceptability.

9.4.1 Guideline 4.1—Establishing Weights and Other Value Parameters. Weights and other value parameters (e.g., scaling functions) should be understood by the decision makers and other stakeholders, and accurately reflect their value judgments. Since equal or no weights necessarily imply value tradeoffs, weight assessment cannot be avoided in an acceptable RBP system.

Discussion. The values represented by the RBP system, which are unavoidably subjective, can have a significant impact on the prioritization results. Therefore, it is important to reflect accurately the preferences of the decision makers and, to the extent it can be done coherently, those of other stakeholders. Representing the values of multiple stakeholders to the decision-making process poses additional complications because preferences are likely to differ among stakeholders. Unfortunately, there is no theoretically “correct” way to combine divergent stakeholder views. However, sensitivity analyses may be conducted to test which system outputs are robust and which depend on alternative value judgments. In any case, values inherent in the RBP system should be made explicit, established as parameters, and documented to help justify their selection. It is important that the weights be chosen based on precise definitions of the objectives to be weighted and of the impact ranges spanned by the objectives. Weights should not be chosen based on some ill-defined concept of the relative importance of objectives. As an example, assigning a higher weight to health and safety than to future costs based on the simple statement that “health and safety is more important than future cost,” while appealing on the surface, is in reality too vague for proper weight assessment. While certain aspects of health and safety are more important than certain costs, all aspects of health and safety are not more important than any cost. Therefore, a clear statement that describes what

health and safety objective is being weighed (e.g., risk of death, risk of permanent injury, risk of prolonged illness) is required before assigning weights. For example, suppose one was asked to make tradeoffs between costs of pollution abatement and the destruction of trees from acid rain. Without consideration of how much cost should be traded off against how many trees, a stakeholder might say, "Trees are more important than costs." Such a statement would be considered absurd by most people if it turned out that saving two or three trees cost billions of dollars. This is why the ranges spanned by the objectives must be considered in setting weighting factors.[1]

The weights assigned to a performance measure should be chosen such that the aggregation equation produces the correct increment to aggregate value when the performance measure improves from its worst value to its best value. Therefore, the weights change depending on the range of the performance measure scale over which the scaling function is defined. Weights properly defined with the above property are referred to as "ratio scaled." The usual method for obtaining ratio-scaled weights is to use an assessment method known as "swing weighting." Swing weighting derives weights from decision makers by exploring the "swings" in value as each performance measure moves from its least desirable level to its most desirable level. Decision analysis texts should be consulted for details on such weight assignment methods.

9.4.2 Guideline 4.2—Fairness. The scoring process should include a fair and equitable process for resolving differences of opinion.

Discussion. One potentially useful approach is to include within each scoring team an individual, referred to here as an arbitrator, who has authority and responsibility to make final scoring judgments based on the (potentially conflicting) input from other participants. The arbitrator should (1) have an appropriate level of management authority; (2) be generally objective regarding the ultimate allocation of resources across the activities being evaluated to decision options, or the organizational elements that have responsibility for those decision options; and (3) have familiarity with the degree and scope of expertise of each expert providing input so that he/she can appropriately weigh their individual judgments.

9.4.3 Guideline 4.3—Stakeholder Involvement. In developing and applying RBP systems, an appropriate group of stakeholders should be involved in the prioritization. The selection of stakeholders should be based on the purpose and decision objectives of the prioritization.

Discussion. There is no universally applicable set of stakeholders and no hard and fast rule for their selection. It is not necessary or desirable to include every possible

[1]Example taken from Detlof von Winterfeldt and Ward Edwards, Decision Analysis and Behavioral Research, Cambridge University Press, 1986.

stakeholder in each RBP application. The selection process for stakeholders should consider the specific RBP application and those individuals either impacted or interested in its results. Detailed discussion of stakeholder involvement is provided in references (n) and (m), but some special considerations regarding stakeholders in an RBP process include:

a. Decision makers involved in the outcome of the RBP system application, as the results may influence their actions, and they may have to defend decisions that are not consistent with prioritization results.
b. Project managers who may see their projects funded or not funded.
c. Individuals who expect to conduct or participate in the RBP system application have a stake in prioritization outcomes.
d. Personnel involved with organizational finances or budgets may also have a stake in how RBP is used as a budget tool.
e. Site workers whose work conditions could be affected by the decisions resulting from the prioritization.
f. Federal, State, and local regulatory bodies whose jurisdiction includes activities that will be prioritized.
g. Public interest organizations who have expressed interest in activities that will be prioritized.
h. Local civic, cultural, religious, or ethnic organizations representing individuals or groups of individuals whose “quality of life” (e.g., financial status, beliefs, practices) may be impacted by the decision resulting from the prioritization efforts.

9.5 Guidelines Primarily Associated with Practicality.

9.5.1 Guideline 5.1—Timeliness. The RBP system should be capable of providing a timely answer; therefore, it should be chosen with consideration of the scale and urgency of the decision to be made.

Discussion. An RBP system is not practical if it does not provide an answer within the time frame required to support the decision-making process. For major programmatic decisions effecting long-term funding plans, the lead time between the definition of the program and the decision to proceed is usually quite long, often involving environmental impact statements (EISs). In these cases, the development and implementation of an RBP system to evaluate the program, its options, and its individual activities can be accomplished over a long period to allow for the level of sophistication required to defensibly support such a major decision. Alternatively, the yearly prioritization of funding for continuing activities is a process that takes on the order of just weeks from the development of budget justification material to the selection of activities for funding. In this case, compromises must be made in the sophistication of the approach to allow the results to be available in time to support that selection. Ultimately, timeliness is one of the most important guidelines in RBP use.

9.5.2 Guideline 5.2—Flexibility. The RBP system should have the flexibility to allow its application to a broad range of prioritization projects while maintaining its completeness and effectiveness.

Discussion.

a. Range of Applicability. It is desirable to use the same RBP system in many prioritization projects to promote consistency, thus allowing meaningful comparisons of results. This standard recognizes that prioritization projects often have unique requirements and needs and that it is unlikely that any single RBP system will have the capability to effectively address all prioritization projects. To the extent possible, the set of RBP systems used should all originate from a common basis (similar assumptions, similar sets of performance measures, etc.).

b. Adaptability. An RBP system should be readily adaptable so that the insights gained from its application can be incorporated. It is noted that insights about the RBP system's efficacy and efficiency may be gained (1) from lessons learned during previous prioritization projects or (2) during the conduct of an ongoing prioritization project. For example, preliminary results from a prioritization project may indicate that the RBP system used cannot sufficiently discriminate among decision options. It is preferable that the current RBP system be modified (for example, through the addition, deletion, or modification of certain performance measures) to allow greater discrimination among decision options rather than developing a new RBP system.

9.5.3 Guideline 5.3—Graded Approach. In order to ensure that the RBP process is both an effective and efficient use of resources, it is important that the depth and rigor with which the guidelines are applied be carefully tailored to the problem being worked. This tailoring of an approach to the nature of the decision problem is known as a graded approach. In general, it requires that the sophistication of the method selected, the depth and rigor of analysis, and the thoroughness of documentation should be commensurate with:

a. The importance of the decision(s) to be made.
b. The difficulty of resolving the associated priorities.
c. The need to communicate the prioritization results and their basis to interested parties.

Discussion. Many DOE decisions tend to focus on complex problems, often involving uncertainty, multiple conflicting objectives, controversial tradeoffs, far-reaching consequences, and multiple stakeholders. The many guidelines provided in this standard are intended to aid in making difficult decisions well. However, it should be noted that not all DOE decisions are this complex and, further, the development of a RBP system that is consistent with these many guidelines is a significant undertaking, and should not be approached lightly. The idea of a graded approach is to recognize that only in unusual circumstances will it be necessary to rigorously implement all of the guidelines. In general, activities with significant costs or those with health, safety, and/or environmental risks will have greater data needs than those with less

significance. For example, the data needs for prioritizing inexpensive, single-year activities will be considerably less than those for expensive, multi year programs. The heavy use of judgment for assessing risk parameters in the former case should be sufficient. Therefore, the information sources might be limited to facility records and/or personnel. However, evaluation of expensive, multi-year programs should rely on information from detailed technical studies, such as facility hazards assessments and safety analysis reports (SARs), where available. The most significant and controversial programs, such as major environmental remediation activities, should use formal risk assessment methods, where available, as input to the scoring process. The extent and quality of the information should also be based on the need for highly accurate prioritization results. For example, a prioritization in response to regulatory requirements will probably require more accurate results than that needed for a budget estimate.

9.6 Guidelines Primarily Associated with Effectiveness.

9.6.1 Guideline 6.1—Decision Options Definition. An explicit definition should be provided of the types and nature of “decision options” the RBP system is intended to evaluate and prioritize.

Discussion. The intended function of the RBP system depends on specifying appropriate decision options. RBP systems designed to support budget decisions will typically use activities or sets of activities as decision options. Therefore, specifying the nature of the decision option includes determining the unit of work that will be evaluated by the system, including what options will be considered. For example, decision options might be specified as “yes-or-no decisions for all independent, separately costed activities proposed for the coming year.”

9.6.2 Guideline 6.2—Decision Option Size. The “size” of decision options should be appropriately defined for the prioritization effort. Specify the size of decision options in terms of their range of costs and scope of work. Activities should not be defined so large as to provide insufficient advice for “fine-tuning” decision making, nor should they be so small and detailed that they force an overly burdensome and costly evaluation.

Discussion. Activities to be evaluated using an RBP system should represent a decision option that is sufficiently detailed to support key decision-making needs. If it is important for the system to support independent funding decisions about two tasks, then those tasks should be defined as separate activities for prioritization. However, the smaller the decision option (i.e., the lower the level at which activities are distinguished and defined), the greater the scoring burden will be on those who should provide the prioritization system inputs. There is no single “best” approach to balancing these two considerations. Instead, the approach should reflect a managerial value judgment as to what kinds of decisions should be analyzed using the prioritization system versus what types should not be analyzed.

9.6.3 Guideline 6.3—Cardinal Measure of Preference. The method of aggregating performance measures should produce a cardinal measure of preference rather than an ordinal measure of preference, unless it can clearly be demonstrated that the use of an ordinal measure will not alter or otherwise invalidate the results.

Discussion. Cardinal measures distinguish the benefits on an absolute scale, specifying the amount by which a given benefit differs from another. Ordinal measures, however, only distinguish more benefit from less, and allow items to be ranked, but they do not specify the amount by which something is preferred. For example, if an aggregated value of “1” is assigned to one activity and a value of “2” is assigned to another activity, the second activity is preferred to the first. However, the conclusion that the second activity produces twice the benefit of the first can only be drawn if the aggregate measure is a cardinal one.

9.7 Guidelines Primarily Associated with Defensibility.

9.7.1 Guideline 7.1—Qualification of Participants. Participants in RBP applications should have demonstrated education, experience, or training to properly perform their assigned roles.

Discussion. There is little value in completing a prioritization only to have the results challenged because of unqualified participants. It is important that the participants have the needed expertise in developing the model, eliciting values, defining decision objectives, scoring activities, estimating costs, and providing risk estimates. To minimize challenges of the prioritization results, the qualification of all participants should be identified and documented.

9.7.2 Guideline 7.2—Level of Detail. Proposed activities should be clearly defined. The work to be conducted and the expected consequences of that work should be described and documented. A sample checklist is presented in Table III.

TABLE III. Checklist for Characterizing Decision Options

| |
|---|
| • Statement of Work<br>• Cost<br>• Schedule<br>• Expected Impact<br>• Uncertainties |

Discussion. It is impossible to meaningfully estimate the costs and benefits of ill-defined activities. Thus, the work to be conducted should be clearly specified prior to being evaluated in an RBP process. Documentation should include a clear, concise description of the scope of work, necessary resource requirements, motivations for conducting the activity, and impacts that the activity is expected to produce.

9.7.3 Guideline 7.3—Defining Acceptance Criteria. The quality assurance (QA) and validation criteria applied to the RBP system should be documented.

Discussion. The QA and validation criteria applied to an RBP effort should be commensurate with the scale of the effort. The general goal is to ensure that the RBP system has been properly applied and yields results that meet the original purposes defined by the user. The QA and validation checks should verify that (1) assumptions have been documented, (2) the significance of assumptions and values of parameters used in the RBP system have been adequately examined and described, (3) there are no significant signs of bias, and (4) any interdependencies among decision options have been defined and properly handled.

9.7.4 Guideline 7.4—Assuring Quality. Documentation of the prioritization model, input data (work packages), and the preliminary RBP prioritization results should be subject to QA and other validation checks before further use of the preliminary results. Deficiencies should be corrected prior to proceeding with the remainder of the RBP process.

Discussion. The QA and validation checks provide confidence that the prioritization model was properly implemented and that the model produced results that pass tests for reasonableness before the results are compiled for presentation to the decision makers who requested the RBP. If scores were generated by a “scoring team,” some subset of that team can be used as the quality assurance team provided that individuals do not review their own work. To counter and minimize “gaming,” peer review or other such techniques should be pursued. Peer review can ensure that the highest professional standards are maintained. Therefore, procedures should be developed to maximize the use of quality assurance and validation checks.

9.7.5 Guideline 7.5—Documentation. The report produced at the conclusion of an RBP effort should thoroughly define the original user requirements (purpose statement and decision options), the RBP process applied, the input data used, and the results derived. The results should be presented in a form that meets the original requirements specified by the user.

Discussion. There are two key aspects to documentation. One is to provide the necessary documentation to allow the decision maker to have confidence in using the results as a basis for decisions. The second is to defend the results to a broad audience of peer reviewers and interested parties.

a. Documentation to Support Decision Makers. An RBP system is useful only to the extent that its outputs are relevant in the context of an actual decision-making effort. A well-designed RBP process allows a wide range of potentially useful outputs to be generated for decision makers. Specific user needs are defined at the start of the RBP process and are captured in the decision options defined by the end user. The RBP results should be selected and presented to maximally achieve the purposes for which the system was developed. Thus, the purpose

statements should be referred to frequently when preparing and presenting the results of the RBP process.

b. Documentation to Promote Communication. Reporting and interpreting the results should involve the open, two-way exchange of information between professionals, including both policy makers and "experts" in relevant disciplines, and, as appropriate, other stakeholders. To maximize understanding, RBP reporting should:

1. Present results in terms of the decision option specified by the end user.
2. Explain the basis and limitations for significant assumptions, input data, and inferences used or relied upon in the assessment.
3. Describe the sources and magnitude of significant uncertainties.
4. Describe the implications of the sensitivity analysis.
5. Provide traceability to relevant supporting documents.
6. Provide a reasonable opportunity for end user comments and a mechanism for incorporating such comments into the final report.
7. Explain enough of the process to permit an understanding of the data by management.

Standardizing the format and content of this information can help the end user assimilate this information and compare results of several RBP efforts (i.e., multiple DOE sites).

## 9.8 Guidelines Primarily Associated with Quantification of Cost and Benefits.

### 9.8.1 Guideline 8.1—Units of Value.

Unless there are reasons to the contrary, the scaling functions and aggregation equation should express value in dollars. When dollars are not used, the substitute should allow for an explicit and objective expression of the tradeoffs between objectives and should be geared to the particular audience.

Discussion. As discussed elsewhere in this standard, RBP systems usually generate a composite value for each decision option that indicates the net effect of implementing that decision option. Note, in MAUT, this composite measure is termed the "utility." The composite value represents a combination of associated costs and benefits; accordingly, all costs and benefits need to be expressed in a common unit of measurement. Typically, costs and benefits are monetized (i.e., the common unit of measurement is dollars). However, this standard recognizes that it is difficult to monetize certain types of costs and benefits. The most important aspect of assessing the composite value is that the tradeoffs be explicit, not that they be monetized. The standard encourages monetization since it is a key concept of the implementing guidance for Executive Order 12866. When deciding on whether to monetize certain units of value in an RBP system, the following points should be considered:

a. It may not be necessary to monetize costs and benefits if the RBP system is such that monetization would not alter any resulting decisions.

b. An RBP system may be employed in a graded manner so that monetization of certain costs and benefits can be deferred until later stages of the analysis and conducted in a more targeted fashion for a more limited subset of the decision options.

If the decision is made not to monetize, the basis and justification for such action should be fully documented. The justification should address how the absence of direct expression of the cost effectiveness of any activity does not impact the supportableness, usefulness, or relative ranking of the prioritization results.

Monetizing should be performed in accordance with the guidance provided by the OMB, reference (k). This guidance states that presentation of monetized benefits and costs is preferred where acceptable estimates are possible, but recognizes that this is often difficult. Where monetization is not possible for certain elements of the benefits or costs that are essential to consider, other quantitative and qualitative characterizations of these elements should be provided. The principle of "willingness-to-pay" captures the notion of opportunity cost by providing an aggregate measure of what individuals are willing to forgo to enjoy a particular benefit, and OMB considers this valuation methodology to be the conceptually superior approach. In the area of health and safety, OMB suggests that for nonfatal effects, the use of either the willingness-to-pay approach or valuations based on the expected direct costs avoided by changing such risks is appropriate. Changes in fatality risks as a result of Government action are best monetized according to the willingness-to-pay approach. It should be made clear that in this context, the terms "value of statistical life" or "value of life," if used at all, refer to the willingness-to-pay for reductions in risks of premature deaths. Valuation of certain environmental and cultural amenities may be difficult to accomplish using a willingness-to-pay approach. Where this is a problem, OMB suggests that for many such goods, particularly goods providing "non-use" values, contingent-valuation methods may provide the only analytical approaches currently available for estimating values. A schedule of monetized benefits should be included that would show the type of benefit and when it would accrue, expressed in constant undiscounted dollars (discounting is addressed in Guideline 8.2). Any benefits that cannot be monetized (some examples might be an increase in the rate of introducing a more productive new technology or an increase in the risk of extinction of endangered species) should be presented and explained. Even if not monetized, these benefits should still be quantified (if at all possible) or fully characterized qualitatively.

It is often much easier to defend a range of values for statistical deaths or injuries averted than it is to defend a particular value, e.g., it is worth spending precisely $X million to avert a premature fatality. One can more easily defend the notion that it would be irresponsible to forgo safety improvements if lives could be saved for as little as $Y a piece, but it would also be an unsound use of resources to spend more than $Z per life saved, so the value that should be accorded to averting fatalities should fall between $Y and $Z. Since many factors in RBP are uncertain, adding a few additional uncertainties in the monetization of adverse effects averted usually does not

weaken the resolving power of the RBP method appreciably, and the use of ranges makes the RBP far less vulnerable to a hostile public relations assault. This was the approach taken by the NRC when it went on record with a monetary assessment of the value of lowering nuclear power plant risks in the Indian Point Special Proceeding before the Atomic Safety Licensing Board in 1983.

9.8.2 Guideline 8.2—Use of Discount Rates.. The total costs and benefits associated with decision options should be based on net-present-value estimates developed through an appropriate model of discounting. The discount rate should be clearly defined and treated as an adjustable parameter in the RBP system.

Discussion. Implementation of a given decision option may yield a sequence of costs and benefits that accrue long after the decision has been implemented. When costs and benefits occur at different points in time, it is not appropriate to simply calculate the benefits and costs. Discounting takes into account the fact that resources available in a given year are worth more than identical resources available in a later year. Discounting should be performed in accordance with the guidance in reference (k).

a. Nonmonetary Costs and Benefits. Even those benefits that are hard to quantify in monetary terms should still be discounted. For example, when effects are measured in units that accrue later than when the costs are incurred, such as the reduction of adverse health effects that occur after a long period of exposure, the annualized cost per unit should be calculated after discounting for the delay between accrual of the costs and the effects.

b. Source for Discount Rates. Basic guidance for determining discount rates to be used is provided in reference (l), OMB Circular A-94. In general, the discount rate should not be adjusted to account for the uncertainty of future costs and benefits; rather, uncertainties in costs and benefits should be addressed by conducting uncertainty and/or sensitivity analyses.

9.8.3 Guideline 8.3—Ranking Decision Options.. If the prioritization system is designed to rank activities, and those activities are independent, the ranking of activities should be based on the ratio of incremental benefit to incremental cost. If significant dependencies among activities exist, then portfolio effects should be taken into account.

Discussion. The ranking of independent activities by the ratio of incremental benefit to incremental cost generally ensures that the rule of top-down funding will produce the greatest total benefit for the available budget. OMB cautions, however, that benefit-cost ratios should be used with care, since in many cases the alternative with the highest benefit-cost ratio will not yield the highest net benefits. Interdependencies among activities (e.g., situations wherein the costs or benefits of conducting an activity depend on whether another activity is conducted) can cause this rule to be violated. Therefore, the presence of significant interdependencies requires more sophisticated evaluation principles that take into account portfolio effects. To the

extent practical, interdependencies should be minimized by carefully defining activities subject to prioritization.

Where monetization is not performed for certain elements of the benefits or costs that are essential to consider, cost-effectiveness analysis should be used to evaluate alternatives. While not generally yielding an unambiguous choice, such analysis is useful for determining a "break-even" value for the unmonetized benefits.

## 10. APPLICATION GUIDANCE FOR POLICY ISSUES

DOE decision maker(s) should retain ultimate authority regarding resolution of policy issues that arise in the context of risk-based prioritization. Policy issues concerning ES&H activities, reprioritization, and use of a threshold have traditionally been the most controversial in prioritization activities. The decision maker(s) should develop a very clear understanding of how policy issues will be addressed in structuring their prioritization efforts. Some policy issues that frequently arise in applications of RBP follow.

### 10.1 Environment, Safety and Health (ES&H) Activities.

Issue. Tradeoffs between safety or environmental protection and cost, schedule, or mission priorities tend to be very controversial. There are two schools of thought relating to ES&H activities, namely whether to integrate ES&H activities with activities not related to ES&H or keep the activities separate by functional area.

Discussion. In some applications of RBP, it is the goal of the prioritization to weigh ES&H priorities against other priorities such as economic impact. In other applications, co-mingling ES&H values with other values is unnecessary. However, in some contexts, it is a choice open to those framing the decision whether to trade off ES&H values with other values, and it is in these contexts that the policy problem arises. Integrating ES&H activities with other competing activities can provide a comprehensive and consistent framework to compare results. The integrated approach has the advantage that it furnishes a rational basis for an optimum allocation of resources, but the disadvantage is that it may draw hostile criticism from those who advocate safety or environmental protection above all else. Separating ES&H activities by functional area could occur if activities are independent in that the importance of addressing any one activity does not depend on whether any other activity is or is not addressed. Although the latter methodology may be easier to accomplish than a full integration of all activities, the effectiveness of the purpose at hand should always be strongly considered. It is difficult to capture all of the motivations for activities and there always exists the possibility that intangible or more difficult to measure benefits will be underestimated. For this reason, comparisons of similar activities are generally more reliable than comparisons of dissimilar activities. Consequently, it may make sense to prioritize ES&H activities separately, so long as the purpose of the priority system is not to help make decisions about the level of funding between ES&H and other activities. The guidelines in this standard can be used by decision makers to help determine whether to fund, by dollars, person/hours or other measure, either (1) those activities that are the most cost effective overall

(i.e., integrate the ES&H and non-ES&H activities in the same prioritization and use the total budget of resources to fund the highest ranked activities), or (2) the most cost-effective ES&H activities and the most cost-effective non-ES&H activities (i.e., keep the budgets separate and rank the activities in separate groups, funding ES&H activities from one budget and non-ES&H activities from another). The separation of budgets assures that a set amount of funding goes to ES&H activities, even if some non-ES&H activities are more cost effective. The decision maker(s) may need to justify how and why particular normalization and/or weighting parameters were chosen, but it should be remembered that the prioritization effort is intended to help inform the decision maker(s), not to make the decision.

Recommendation. The decision maker(s) should determine whether it is desirable to utilize a methodology to understand what may be the best use of limited resources across all competing activities or determine the optimal use of resources in a given functional area. If a decision has been made to integrate ES&H activities with others, it is suggested to normalize to a common attribute when comparing results. Person/hours or dollars are good normalization parameters, however, ultimate responsibility for making this determination is retained by the prioritization decision maker(s).

10.2 Reprioritization of New Information.

Issue. All decision makers are confronted with a need to decide whether to reprioritize each time new information is introduced. That is, as new information becomes available about a subject, should the decision maker(s) reopen/review past decisions?

Discussion. In planning the prioritization effort, consideration should be given to reprioritization in light of new information, as it is probable that new information will be revealed when performing a prioritization effort. The new information is usually one of four types: (1) identification of new activities that were not previously considered; (2) a desire to improve a process based on an enhanced understanding; (3) a methodology is challenged, requiring a reexamination of the effort based on the challenge, and (4) changes in the condition of the facility or in external constraints such as budget or mission. Experience has shown that encountering one or more of these forms of new information is likely, and the decision maker(s) should prepare a conceptual approach outlining how new information will be incorporated.

Recommendation. In planning for and implementing a risk-based prioritization, the decision maker(s) should consider two alternatives to performing a snapshot prioritization using only then-current information. One alternative is to prepare contingency plans for the eventuality that the factors driving the preferred decision might change before the decision is fully carried out, perhaps warranting a reprioritization and an altered plan of action. The other alternative is to plan for a “living schedule” in which new information is routinely processed in an ongoing prioritization, so that the scheduled activities or resource allocations always reflect the most up-to-date information on constraints, incentives and preferences that is reasonably achievable.

10.3 Threshold for Utilizing Risk-Based Prioritization.

Issue. Consideration should be given whether or not to have a threshold and a determination of a threshold value for the prioritization effort.

Discussion. Generally, formal RBP requires considerable resources to implement. Such methods are usually not warranted if the expected value of its result is less than the cost of implementation. The standard calls for a graded approach in which the depth and rigor with which the guidelines are applied is carefully tailored to the problem being worked. However, there may be a need for threshold guidance as to when RBP should be utilized.

When RBP has been applied to illuminate the choice among many competing major capitol projects or project variants, it commonly can identify a preference that achieves the objectives for 10 percent to 30 percent less cost than the plausible alternatives that might have been selected with less rigorous decision aids. Economies in using RBP can often be achieved when a tailored approach to RBP is routinely applied to many specific applications, such as living schedules for nuclear power plants.

Recommendation. The prioritization decision maker(s), working in collaboration with advisers expert in RBP, should make a determination of the threshold guidance as to whether RBP and the standard should be implemented, and how the graded approach should be employed for the kinds of decisions to be made, tailored to the decision context. Customer needs should be analyzed throughout the initiative. A number of issues should be considered in determining the need for, and degree of, prioritization effort. The following are indicators that RBP may be warranted:

a. When the activity has extensive oversight and public interest to warrant a substantial investment in exploring and documenting the pros, cons, and bases for the decision.
b. When the identification of the optimum decision is particularly difficult because the decision involves selecting among a large number of alternatives, the decision involves weighing many disparate pros and cons for each alternative, or the implications of the decision options are particularly complex.
c. When the RBP application can be performed for no more than 10 percent of the budget for implementing the decision options.
d. When economies of scale can be realized by applying the RBP to many future applications or by utilizing an off-the-shelf RBP methodology.
e. When the benefit received through proper planning on activities that have a relatively long life cycle. Proper planning early in the life cycle can return substantial cost savings over the life of the activity.

It is often the case that a large part of the cost of using RBP are fixed costs associated with preparing the team and the application of RBP methods. In such cases, the incremental costs of prioritizing all, rather than just some of the decision options may be too small to warrant selective application. However, when this is not the case, there may be merit in some additional approaches to cost and schedule control:

a. When the activity has a total cost over a certain threshold value for other decisions, It consider utilizing a threshold value of 10 percent of the capital asset management program. For example, if 50 million dollars is the value for the capital asset management program, then groupings of activities of $5 million should be considered for prioritization.
b. Consider formal prioritization of 20 percent of the decision options that utilize 80 percent of the resources. The prioritization effort is based on the cost of the activities with consideration given to a graded approach.
c. Consider formal prioritization of 20 percent of the decision options that utilize 80 percent of the person hours. The prioritization effort is based on the person hour cost of the activities with consideration given to a graded approach.

10.4 Limits on Use of This Standard for Major Policy Issues.

Issue. The use of risk-based prioritization to illuminate national policy decisions or to tradeoff resource allocations among program offices and DOE sites can be controversial. Its use in such contexts may be warranted, but requires special considerations beyond those indicated in this standard.

Discussion. While theoretically possible to use the quantitative approach suggested by this standard for decisions at any level, practical considerations obviate against such use for national level decisions with broad policy implications.

As the level of the decision elevates, the dominant influences on the decision become more and more the intangible objectives. Politically driven and/or programmatically broad, these objectives are frequently difficult to measure and quantify. Examples of such objectives include implementation of administration policy or legislative resolutions, impacts on national or global economies and treaty obligations.

Formal decision aids such as RBP can be technically capable and highly useful in such contexts, but run the risk of serving as lightning rods for interested parties. National level decisions with broad policy implications also involve the participation of a large number of stakeholders, presenting difficulty in reaching consensus on objectives and values. In the absence of a consensus, using statistically generated “consensus” values is possible. However, the statistical aggregation of a large, diverse set of opinions tends to mask the individual values of the stakeholders. Thus, the resultant values are so “blended” that they do not accurately reflect the values of any particular stakeholder.

On the other hand, some national issues, such as military base closings, tend to be so politicized that the only way of achieving a consensus is for all parties to agree to utilize a formal, disinterested decision process such as that afforded by formal risk-based prioritization. However, the decision to adopt RBP as a decision aid in such contexts requires careful consideration of the implications for stakeholder acceptance.

Recommendation. This standard normally should be applied to prioritize activities within established programmatic line item budgets and budgets established for a given

DOE site. Its use for major resource allocations is likely to be least controversial if applied after budget legislation has been approved. This standard may, in special cases, find application in matters of national policy or tradeoffs between sites or budget line items, but these applications warrant particular care in gaining a consensus among key decision makers on the standard's role and acceptability.

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## CONCLUDING MATERIAL

**Review Activity:**

DOE
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Princeton Area Office
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**Preparing Activity:**

DOE-DP-45

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