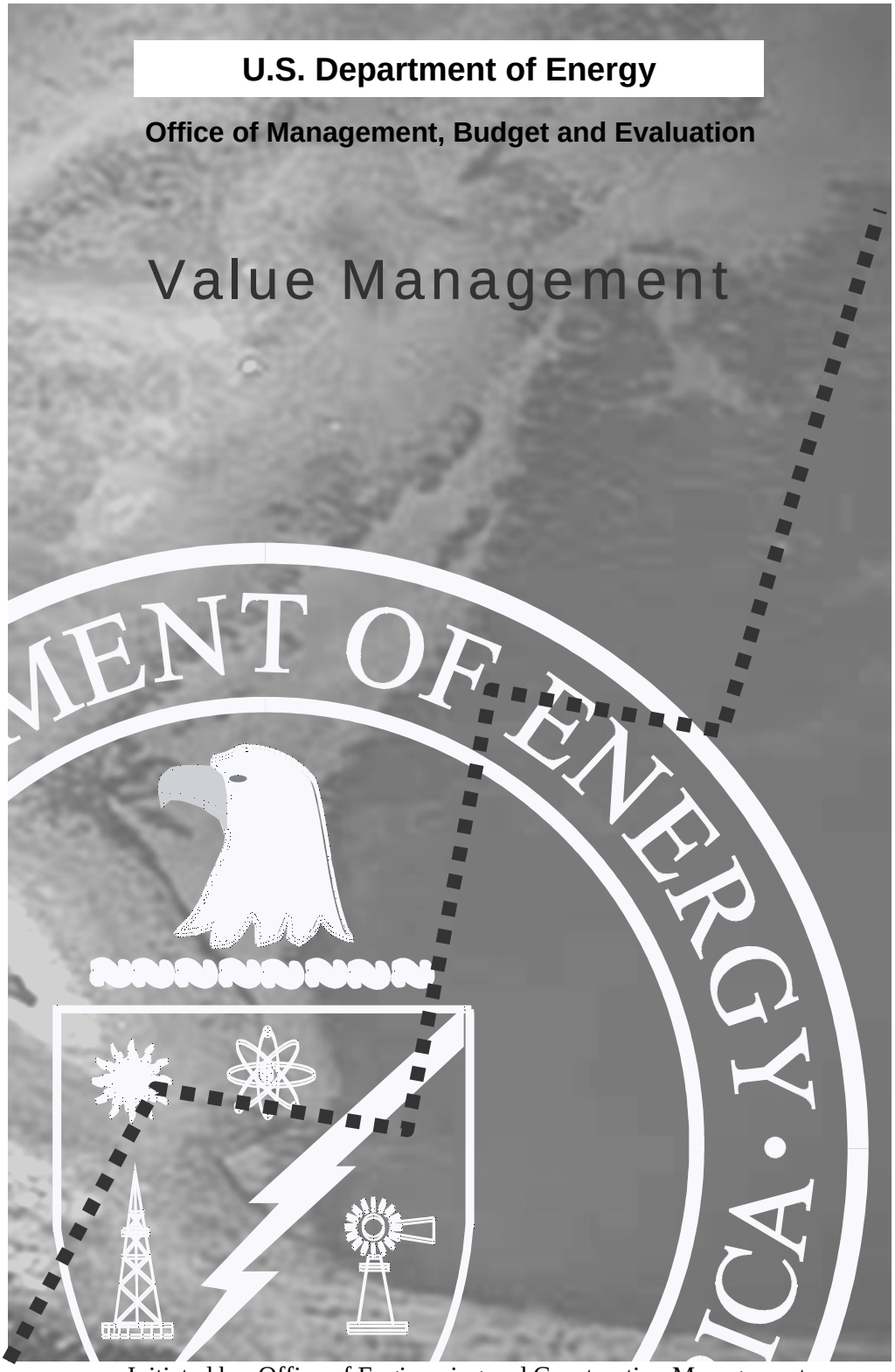
U.S. Department of Energy

Office of Management, Budget and Evaluation

Value Management



Initiated by: Office of Engineering and Construction Management

TABLE OF CONTENTS

VALUE MANAGEMENT

The Department of Energy Policy (DOE P 413.2) on Value Engineering (VE) was issued January 7, 2004. This policy commits DOE to establish a Value Management (VM) program which meets the intent and criteria set forth in Public Law 104-106 and in the Office of Management and Budget (OMB) Circular A-131, while adhering to the Federal Acquisition Requirements specific to VE. The policy assigns the Office of Engineering and Construction Management (OECM) responsibility for VM policy and for reporting results while the Under Secretary for Energy, Science, and Environment and the Administrator, National Nuclear Security Administration are responsible for VM implementation.

The requirement to use VM early in the project life cycle is addressed in the manual for "Project Management for the Acquisition of Capital Assets" (DOE M 413.3.1) approved on March 28, 2003. It states that all projects with a Total Project Cost greater than $5 Million shall have a VM Assessment submitted as part of the Critical Decision 1 package. Any decision that a formal VM Study is not justified shall be documented in the Project Execution Plan.

It should also be noted that the DOE Order for "Real Property Asset Management" (O 430.1B) states that "For real property asset acquisition, disposition, demolition, repair, and recapitalization projects where the total value of a single item of purchase or contract is expected to be greater than $5 million, VE assessment shall be performed in accordance with DOE O 413.3"

This guidance was developed by OECM as part of a series aimed at better management of projects undertaken by DOE. It includes specific information on how to plan, apply, and integrate VM processes and practices. The guide is organized to provide a general understanding of DOE's VM Program and to promote the use of VM where appropriate.

1. VALUE MANAGEMENT OVERVIEW

Value Management, when done correctly, uses a professionally applied, function-oriented, systematic team approach to analyze and improve value in products, facilities, systems, or services. It is a powerful decision making process for solving problems and/or reducing costs while improving performance and quality.

Historically, government agencies have applied several different names to describe the VM process, with VE being the most commonly used. As a result, most people in government think VE is used only as a review of engineering drawings at 30% design completion and do not know of its many successful applications at other points in the life-cycle of programs projects and activities. Few realize the same VM process is commonly used to:

- Validate the best available alternative has been selected at the beginning by conducting a Value Analysis Study.
- Achieve the optimum design by conducting a Value Engineering Study.
- Resolve construction, operations and/or maintenance problems or otherwise exploit opportunities to improve baselines by conducting a Value Management Study.

(NOTE: The different applications of the VM process throughout the DOE Project Life Cycle are presented in Figure 1 in Section 4.1.)

While each of these three types of Value Studies has a historic basis and a target audience, all use the same methods and procedures and should be considered equivalent. The DOE defines all function based and value-oriented activities collectively as Value Management.

1.1 Value Management Defined

The fundamental approach of the VM process is to challenge everything and take nothing for granted; including the necessity of actually doing what is being proposed or what is currently being done. VM is defined as:

> *"an organized effort following a structured job plan that is directed at analyzing the functions of systems, equipment, facilities, services, and supplies for the purpose of achieving the essential functions at the lowest life cycle cost consistent with the delivery of required safety, performance, reliability, and quality"*

A formal and organized VM Study may be successfully and cost-effectively introduced at any time in the life cycle of the program, project, or activity under consideration. VM is also routinely used in other areas not necessarily driven by cost considerations (e.g., resolution of safety issues, risk analysis and management, and achieving stakeholder consensus).

At its most basic level, the VM Process is designed to answer the following critical questions:

1) What is it (the need or problem)?
2) What must it do (the function)?
3) What does it cost (life-cycle)?
4) What else will do it (the alternative)?
5) What will that cost (life-cycle)?

1.2 VM Fundamental Definitions

The VM Process examines the relationship between ***worth*** and ***cost*** in obtaining the required function. This relationship between worth and cost determines ***value***.

1.2.1 Function

The function is a task, action, or activity which must be performed or achieved. It is the specific purpose or intended use for something. The VM Process requires that the description of a function be reduced to the simplest and most accurate expression possible. This is accomplished by employing only two words; an active verb and a measurable noun to define the function.

1.2.2 Worth

The worth of a project, program, or activity is the quality or virtue that makes that activity or product important to the customer. Worth consists of both tangible and intangible components, including the perceived benefits obtained, the satisfaction with the product or service performance along with the quality, safety, and convenience derived in using the product or activity being paid for. In VM, worth is considered to be the least expenditure required to provide an essential function and it is established by comparison.

1.2.3 Life-Cycle Cost

Cost is the total amount of funds required to acquire, utilize, maintain, and ultimately dispose of the required functions. For the provider of the goods or services, the cost is the total expense associated with the production of the required function. For DOE the cost includes not only the initial purchase price, but also the total costs for start-up, operations, and maintenance throughout the usable life. Also included is the cost of disposal when the function no longer serves a useful purpose. The total life-cycle cost for a function includes both direct and indirect costs and contains a proportionate share of the overhead costs for the Department.

1.2.4 Value

Value is the relationship of worth to cost in accordance with the ultimate customer's needs and resources in a given situation. It is the comparison of the true cost of an activity, process, product, project, feature, or program to its worth as viewed by those involved (owners, users, and/or stakeholders).

In VM: $$Value = Worth / Cost$$

Optimum value is achieved when all criteria are met at the lowest overall cost. Although worth and cost can each be expressed in monetary units, they can also have important non-monetary components. For this reason, value is considered to be a dimensionless expression of the relationship of the two.

1.3 VM Principles and Concepts

Value Management can be viewed as a formally defined process used by a multi-disciplinary team brought together for the common purpose of improving and optimizing the relationship between

worth and cost in a project, program, or activity. There are several important principles and concepts that need to be understood and accepted in order to properly use VM. They are:

- The VM Process is built on function analysis. For this reason, if a documented function analysis has not been done, the VM Process has not been used and the DOE requirements have not been met.
- A basic VM premise is that anything providing less than the performance required by the customer, user, or stakeholder is not acceptable, while anything providing more than what is required should be avoided unless there is no cost penalty in providing it.
- The "best value" is achieved when the required basic function is performed at the appointed time and place while incurring the lowest total life-cycle cost.
- Value may be increased by (1) improving the function performance with no change in cost, (2) achieving the function desired at less cost, or (3) combining improved function performance with a decrease in cost.
- A Value Study is not a "cost-cutting" exercise in which costs are reduced by material substitutions and reducing or eliminating specific elements. This approach frequently results in reduced quality and diminished performance and a less than desirable product to reduce costs. This approach should not be confused with VM.
- The VM Process should never be used as a tool to "second guess" the people responsible for decisions and actions taken before the VM Study is undertaken.
- All incurred costs prior to the VM Study are considered "sunk-costs" and do not play a part in the analysis of alternatives in the VM Process.
- VM can be successfully applied at any point in the life-cycle of any project, program, or activity where there is reason to believe it is profitable to do so. However, experience has shown the early application of VM produces the greatest cost savings/avoidance because of the low cost to implement proposed changes.
- The most effective VM studies will include some "outside" team members who have no vested interest in the outcome of the study.
- Extensive research in group dynamics has established that a team of five to seven members is the optimum size for the most effective VM study.
- To achieve the maximum potential from a VM Study the leader/facilitator must be trained and experienced in applying the VM Process.
- Because of the unique contracting relationships within DOE, the best results from a DOE-VM effort are achieved when the responsible contractor and DOE work together with outside experts (if needed) on a cooperative basis while being led by a trained VM specialist.

- In DOE, the proposed changes from VM Studies seldom achieve the identified cost and/or schedule improvements without the full and willing participation of the contractor.
- Years of compiled data within DOE and across the Federal Government has shown using VM to achieve optimum life-cycle cost will normally produce a minimum Return-on-Investment (ROI) of greater than $20 for each $1 spent in conducting the VM Study
- Using the VM Process in non-monetary areas such as risk analysis, mitigation of safety concerns and achieving stakeholder agreement is usually very successful in achieving the study objective, but establishing a meaningful ROI is difficult.

2.0 VALUE MANAGEMENT EVOLUTION AND DRIVERS

The VM Process originated at General Electric (GE) during World War II to overcome critical wartime shortages of goods and services. Larry Miles developed what he named Value Analysis based on the examination of required functions and then developing alternatives to achieve them. He became the acknowledged "father" of VM after GE adopted the process company-wide following the war.

The first use of the VM Process in the Federal Government took place in the Navy's Bureau of Ships in 1955. It was called "value engineering" by the Navy because the program was staffed with general engineers, the most closely related position description available at the time. Although no longer exclusively the province of "engineers," the term "value engineering" has persisted as the title of the program and remains so today in most government publications.

During the 1960's several other government organizations began adopting the use of Value Engineering as policy, including the Army Corps of Engineers in 1964. While several enhancements to the VM Process have occurred since its initial development at GE, the core of the VM Process has not changed, and it remains a decision making process based on function analysis. While other problem solving tools have come and gone, VM has stood the test of time for more than six decades. By 1959, the use of "Value Analysis" had grown sufficiently to form a professional organization named the Society of American Value Engineers (SAVE) which has since become an international organization

NOTE: Additional information concerning the founding and evolution of VM can be found by going to the OECM web site home page (http://oecm.energy.gov) and selecting the Value Management link under the Communities of

Practice to access the Value Management Information Center (VMIC). In the VMIC, choose "Links" and scroll down to the "Lawrence D. Miles Foundation" and/or the "SAVE International" websites.

Because of the successes achieved in using VM in government, several steps were taken over the years to incorporate its use across all agencies. Some of the more important initiatives are still in effect today and are discussed in the following paragraphs. Additional information on these topics can be found on the OECM website as described below:

NOTE: The full text of OMB Circular A-131, Public Law 104-106, the FAR Clauses, and the DOE Policy, Orders, and Manual concerning VM can be found by going to the OECM web site home page (http://oecm.energy.gov) and selecting the Value Management link under the Communities of Practice to access the Value Management Information Center (VMIC). In the VMIC, choose "Regulations, Policy & Requirements"

2.1 Office of Management and Budget – Circular A-131

VM was used in various government organizations for several years without mandates. However, in response to the General Accounting Office (GAO), Office of the Inspector General (OIG) reports, private sector reports, Congressional queries, and Executive Interest, a major driver affecting the use of VM in government was introduced by the Office of Management and Budget (OMB).

In January 1988, OMB issued Circular A-131 – Value Engineering, which required value studies on construction related projects using $1 million dollars or more of Federal funds. The OMB requirements applied Government-wide and also encouraged the use of VM in non-construction projects.

As part of the sunset provision requiring review, OMB revised and reissued Circular A-131 again in June 1993. The requirements remain in effect today and another upgrade is planned.

2.2 Public Law 104-106

In February 1996, the US Congress passed and the President signed the National Defense Authorization Act, now known as Public Law 104-106. This made it a matter of law to establish effective programs in all executive agencies to use Value Management/Value Engineering procedures and processes for all government funded activities.

In addition, on Page 110, STAT. 186, SEC. 36., the law defined Value Engineering as follows:

> ***As used in this section, the term 'value engineering' means an analysis of the functions of a program, project, system, product, item of equipment, building, facility, service, or supply of an executive agency, performed by qualified agency or contractor personnel, directed at improving performance, reliability, quality, safety, and life cycle costs.***

2.3 Federal Acquisition Regulations

The unique mission of DOE compared to that of most other government agencies requires the Department to use contracting vehicles that do not easily allow inclusion of VM incentive clauses. As a result, the major DOE contracts do not readily allow cost sharing through the implementation of the VM clauses in the Federal Acquisition Regulations (FAR) Part 48 and Part 52 for the following reasons:

- A lack of firm cost estimates.
- Requirements covered by award fee that already require the contractor to identify and institute practices to improve performance.
- Requirements covered by a contract clause, such as the "Performance Improvement and Collaboration clause," (DEAR 970.5203-2).
- Accounting systems that do not separately track the benefits and costs of VM efforts.
- Some contracts are a composite of dissimilar work and contract types.

Because the major contracts cannot readily use the FAR provisions, the vast majority of VM effort in DOE will occur as a cooperative effort between DOE and the contractor with no expectation of sharing cost savings/avoidance achieved by conducting VM Studies. The use of VM by the contractor is instead rewarded by the normal incentive process built into most DOE contracts.

There are, however, some situations where the VM FAR clauses may allow a contractor to recover a portion of the savings that result from initiative and ingenuity in identifying and successfully challenging nonessential contract terms and provisions. These clauses are intended to foster a climate of cooperation and managed change to permit the Government to acquire better, lower-cost projects, programs, and activities.

In these cases (e.g., a fixed-price design build subcontract), the FAR clauses introduce a formal technique by which contractors or subcontractors may (1) be required to establish a program to identify and submit to the Government methods for performing more economically, or (2) voluntarily suggest methods for performing more economically and share in any resulting savings. In order to invoke the VM FAR clauses, the following conditions must exist:

- DOE or its agents have dictated the specification, design, process, etc., that the contractor is to follow.
- The contractor's cost reduction effort is not covered under award fee (or any other incentive).
- The Contracting Officer has confidence in the cost estimate for the work at issue. That is, confidence that the cost estimate is close to normal FAR pricing conditions.
- The Contracting Officer has great confidence that the contractor's accounting system can separately track costs of VM efforts based upon the contractor's assertions and confirmation from the DOE cognizant contracting officer's office. That is, confidence that the contractor accounting system is comparable to normal FAR pricing conditions.
- The proposal, if accepted, requires a change to the contract and results in overall savings to DOE after implementation.

A complete discussion of the use of the FAR VM clauses is beyond the scope of this guide. If additional information on the subject is needed, it is recommended the Contracting Officer Representative (COR) for the contract in question be consulted. More detailed information on the subject can also be gained from the OECM website as previously described.

3.0 THE DOE VALUE MANAGEMENT PROGRAM

Congress, the Administration, and the Secretary of Energy have placed increased emphasis on limiting the overall expenditures of the Department to the minimum necessary to complete the mission. With the issuance of Policy 413.2 in January, 2004, VM has become recognized as an effective contributor in meeting our objectives by making more effective use of our diminishing resources. The following paragraphs discuss the VM Program to be used to implement the new policy.

3.1 DOE VM Program Objectives

The primary goal of the Department VM Program is to reduce the Government's acquisition or ownership costs (operational costs, maintenance costs, training costs, etc.) while maintaining the necessary level of performance. This objective can be best achieved by securing the support and cooperation of the contractor community in adopting the VM Process as a best business practice which benefits both parties.

The Department recognizes the contribution of other best-business practices (e.g., Six Sigma, Total Quality Management, Lean Manufacturing, and others) that may currently be in use by DOE contractors. Based on experience in government and industry, the VM Program is expected to be compatible with other methodologies and will make there use even more effective.

Implementing VM across the Department has the following key objectives:

- To help DOE live up to its responsibility to deliver capital assets on schedule and maintain real property, within budget. The capital assets and real property must be fully capable of meeting mission performance needs, and must satisfy all environmental, safety, and health standards.
- To conform to Public Law 104-106, National Defense Authorization Act For Fiscal Year 1996 and OMB Circular A-131.
- To not unduly impede the efficient and effective delivery of projects and activities while meeting DOE objectives to obtain quality products, ensuring timeliness of performance, controlling costs, and mitigating adverse events.

The statutory and regulatory definitions require a VM Program which will encompass analysis of functions by a team of qualified personnel. The VM effort will be directed at improving performance, reliability, quality, safety, and life cycle costs of products, systems or procedures. The study of functions will achieve “best value” for resources extended by improving the relationship between worth or utility to monetary and/or non-monetary cost.

As a minimum, the DOE-VM Program will include all of the following items:

- Identified initiatives
- Invested resources
- Implementable recommendations
- Identifiable return on investment.

The goal of VM is to ensure that the owner, user, and other stakeholders receive a product that provides the greatest “value” or return on the investment made. The VM Program considers return on investment in terms of life cycle costs from the point where the study was performed with “sunk costs” not considered.

3.2 Roles and Responsibilities

In DOE, the OECM, within the Office of Management, Budget and Evaluation (ME), is responsible for establishing the Department’s VM policy and for monitoring and reporting on DOE VM Program performance.

Implementation and execution of the VM policy, by establishing a VM program, is the responsibility of the Department’s Under Secretary and the Administrator of NNSA. The required VM program will include a defined set of policies and responsibilities to ensure that the VM discipline is integrated into all elements of the organization.

A successful VM program requires top management involvement. In addition, each functional project or acquisition manager needs to cooperate and participate to ensure an effective program. Ultimately, line management is both responsible for and will benefit from using VM.

3.3 DOE Value Management Program Requirements

OMB allows Federal departments and agencies to apply VM where the organization determines it is most appropriate. The DOE requires a formal VM Study for all capital acquisition and real property management activities having a total project cost greater than $5M unless a specific exemption is granted. For maximum benefit, VM should be employed as early as possible in the project development/design process so valid VM recommendations can be implemented without delaying the progress of the project or causing significant rework of completed designs.

Additionally, it is the responsibility of the Department's Under Secretary and the NNSA Administrator and their respective organizations to develop criteria and guidelines that conform to Public Law 104-106, National Defense Authorization Act for Fiscal Year 1996, and OMB Circular A-131. Both DOE personnel and contractors should actively seek to identify programs/projects with the most potential for savings from the application of VM techniques.

In order to be effective and sustainable, the DOE VM program must have:

- Top management involvement to ensure implementation and continuing emphasis by middle management.
- A key individual to manage the VM program. This individual should be well versed in VM principles, techniques, and appropriate acquisition regulations.
- A "master plan" to ensure actions that may effectively contribute to a successful program are considered and acted upon.
- VM objectives, policies, responsibilities, and reporting requirements firmly established and implemented.
- The funds necessary for administrative and operating expenses.
- A comprehensive training and orientation program to acquaint personnel with policies, procedures, and benefits.
- "Cross-feed" mechanisms to communicate information about successful application to others who can benefit.
- Close coordination with contract administration to ensure proper VM contractual participation and follow-up.

4.0 VALUE MANAGEMENT APPLICATION

Like any profitable venture, a successful VM Program is based on producing an adequate return on investment. Normally, a business decision is made on the basis of an anticipated contribution to

profit. Similarly, the selection of subjects for VM Study should be based on the potential yield for the time, talent, and cost that will be invested in the study.

The Value Methodology consists of six phases performed in a specific sequence. It is a decision process that, for more than sixty years, has been optimized by many people and used in many different applications. VM uses a function and logic approach that inspires people to ask all the key questions, thereby strongly reducing the potential that a key need or issue will be missed. The use of a value-based, decision-making approach helps assure that resources (e.g., time, money, and expertise) are directed toward the solutions that have the highest potential for meeting customer needs at optimum cost. Further, VM attempts to obtain the largest number of creative solutions to widen the potential for better value. When the process is complete, the optimum solution that obtains the best value for the customer is generated.

Some people believe they are using the VM Process when they simply examine alternative solutions to solve the problem at hand. However, there is a major difference between these efforts at "simply brainstorming for new ideas" and "performing VM." VM practices and processes have proven to be one of the most powerful tools available to the professional manager, but successful VM application is still dependent on Project Directors and Project Managers understanding it and making sure it is used. They must identify opportunities to initiate VM Studies, ensure the studies are performed properly, and see that the proposed alternatives agreed to are implemented.

4.1 Criteria for Selecting When to Conduct a VM Study

Early in a program, project, or process life-cycle, the cost to enact a change is normally negligible and the potential benefits available due to a change are very great. As the activity progresses, choices are made, data are collected, resources are obligated and expended, and customer and regulatory buy-offs are attained. For these and other reasons, the cost to change the project or activity goes up and the potential benefits due to making a change decline. At some point, the cost to change may exceed the benefits derived.

While the VM Process can be successfully used at almost any point in the life-cycle, early use tends to produce greater savings or "cost avoidance" for two reasons. First, more activities are affected by the savings actions, and second, earlier changes are much more easily implemented and at a reduced cost. However, later VM studies should only be precluded when it is believed the cost of the VM effort are greater than the potential savings.

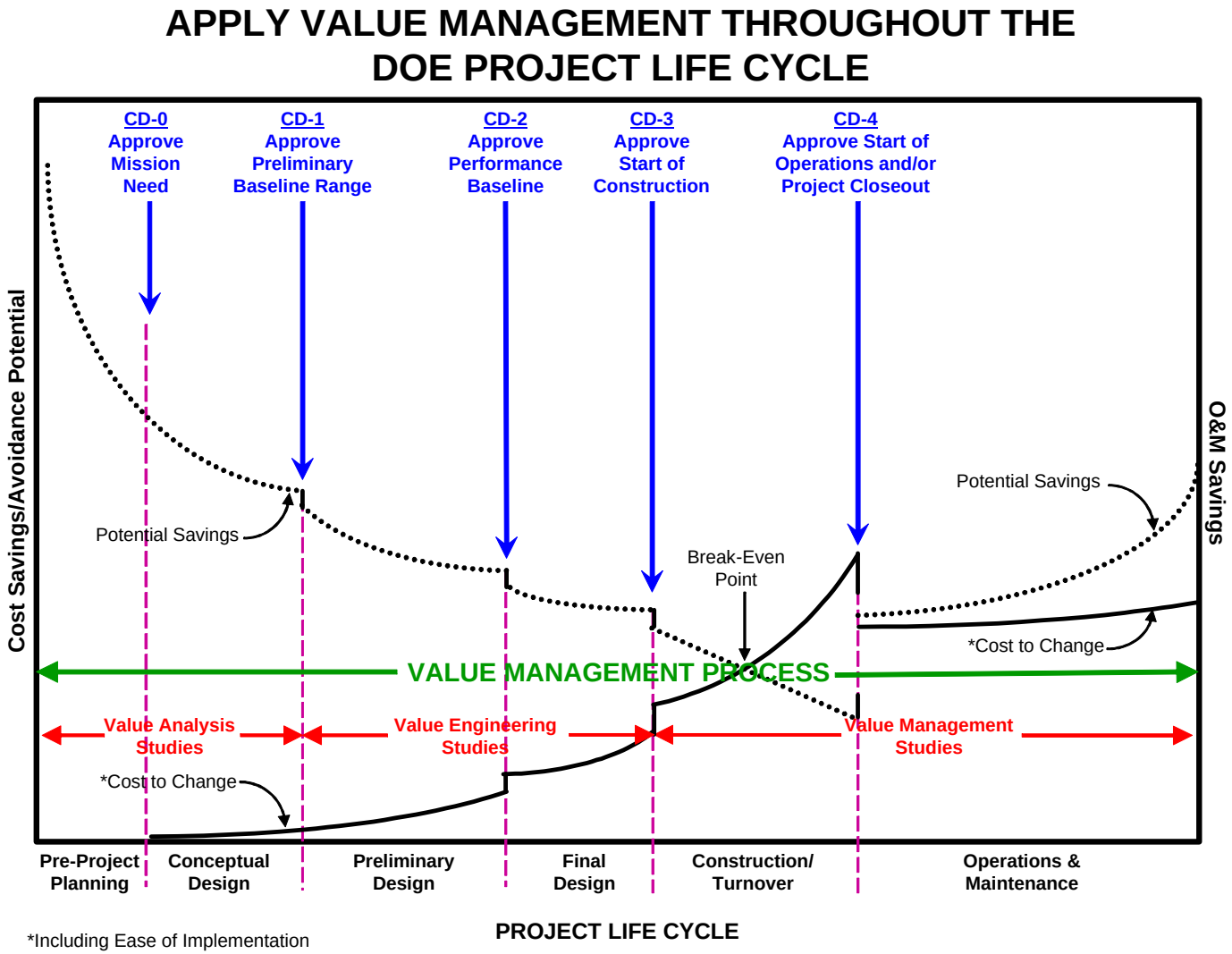
The decision to use VM is influenced by many factors, the two most important of which are the magnitudes of the expected benefits, and the ease or difficulty of implementing any recommendations resulting from the VM Study. In the early stages, benefits are difficult to measure and the resulting "cost avoidances" are simply approximated. VM studies conducted later in the process can forecast more accurate savings once the cost and schedule baselines are established. The relationship between the potential cost savings/avoidance and the point in the project life cycle where the VM Study takes place is presented in Figure 1 on the following page.

The relationships depicted in Figure 1 on the following page were derived from experience in both private industry and government. This combined experience has shown that conducting VM studies in the feasibility/planning stage of a project can produce cost avoidance estimates ranging from 20% to 50% of the original estimate for the scope being studied. This same experience has also shown that VM studies conducted later during the final design / construction or during start-up/operations can expect to produce cost savings ranging from 3% to 10% of the baseline for the scope being studied.

The Department, as part of the Critical Decision–1 (CD-1) submission, requires each project with a total project cost greater than $5 million to conduct a VM Assessment as part of the conceptual design process. The assessment determines whether a formal VM Study is required and any decision to not perform a formal VM Study must be documented in the Project Execution Plan. However, it is recommended that a Value Analysis Study be done between CD-0 and CD-1 to validate the best alternative has been chosen before extensive design effort is undertaken. Avoiding the costs associated with picking a less than optimum concept to design to can easily be accomplished at this early stage of the project.

The other end of the project life-cycle after turnover for operations offers some additional opportunities for value improvements because the useful project life and total requirements are not fully known. Unless there is an accurate way to estimate the total quantity to be purchased, many items can be re-procured indefinitely. Some examples are: on-going waste management activities, on-going maintenance activities, infrastructure improvement efforts, etc. Many items were previously entered into the Department's inventory without being value managed. These items often benefit to the same extent as items previously subjected to a VM Study, and the potential for savings is great. Advances in technology or changes in user requirements provide another basis for potential savings greater than the cost of the study and subsequent implementation.

Figure 1. VM and the Project Life Cycle.



5.0 THE VALUE MANAGEMENT PROCESS

In the past, DOE mainly used VM in the classic fashion during construction of individual fixed capital asset facilities. VM usage has been expanded and is now used during the planning phase to develop conceptual alternatives and during design or construction to support cost reduction or problem resolution efforts. More recently, the VM Process has been used to improve work processes, organization structures, systems, and programs. Another successful use of the VM Process involves risk planning and mitigation.

The criteria for initiating a VM Study should be based on Program, Project or process need, and management approval and support should be clearly evident before committing to a major VM effort. Any formal VM Study effort should follow the guidance of the SAVE International. The SAVE Value Methodology Standard requires use of a structured, systematic "Job Plan" approach comprised of three stages (pre-study, Value Study, and post-study). The focus of the Value Study is on functions and requirements and incorporates various techniques to complete a comprehensive analysis. A VM Study should be led and/or facilitated by a properly trained person experienced in using VM. A Certified Value Specialist (CVS) or Associate Value Specialist (AVS) as recognized by SAVE International is recommended for optimum results.

> **Note:** Information on the SAVE Job Plan and the Value Methodology Standard can be found by going to the OECM home page (http://oecm.energy.gov) and selecting the Value Methodology link under the Communities of Practice to access the Value Management Information Center (VMIC). In the VMIC, select "Resources" and scroll down to Value Methodology Resources.

5.1 The Value Management Job Plan

The VM Job Plan is the crucial component in guiding each step of the VM Process. Although many different job plans are used, they mainly differ in terminology or emphasis placed on the various steps. Generally, the Federal Government and DOE have adopted the most commonly used SAVE six-step job plan for conducting VM Studies. In addition to the six steps of the actual study, an additional Pre-Study Phase identifies the most appropriate subjects for VM Study and a Post-Study Phase supports the implementation of the approved value study change recommendations. A listing of the various phases and a short list of activities in each step/phase is present in Figure 2 on the following page.

Figure 2. VM Job Plan

5.1.1 Pre-Study (occurs before value study)

The Pre-Study phase involves collecting and defining user/customer wants and needs, gathering a complete data file of the project, determining evaluation factors, scoping the specific study, building the appropriate models and determining the team composition.

5.1.2 Information Phase (occurs before and during the value study)

The Information Phase is to complete the value study data package started during Pre-Study work. All relevant information within the scope of the study for the program, project, or activity is collected, disseminated, as needed, and analyzed.

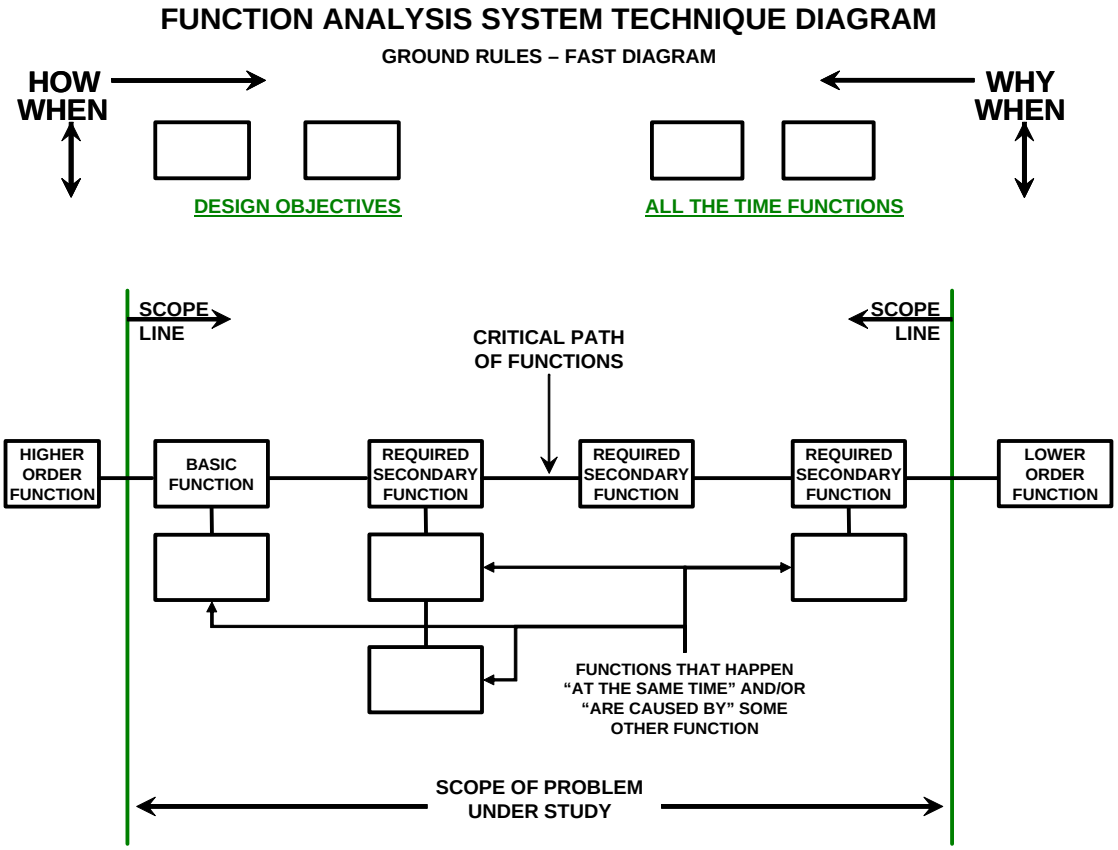
5.1.3 Function Analysis Phase

Function definition and analysis is the heart of the Value Methodology. It is the primary activity that separates VM from all other "improvement" practices. Functions are identified and classified as either basic or secondary. The components are examined in terms of their function. A functional logic diagram (referred to as a Function Analysis System Technique [FAST] diagram) is generated to analyze the functions within the scope under study. The FAST diagram shows the "why" and "how" something is done.

Figure 3 on the following page depicts the basic structure of a FAST diagram. (A more complete description of function analysis is presented in Section 6 of the guide.)

The results generated by the function analysis are assigned costs and/or other measurement criteria. Items that have high potential for added value are identified for further consideration during the creative phase.

Figure 3.



5.1.4 Creative Phase

The objective of this phase is to develop a large quantity of ideas for performing each function selected for study. Creativity methods such as "focused brainstorming" or the "Delphi technique" are two examples of methods used to generate the maximum quantity of ideas for consideration. There are two keys to successful creativity: first, the purpose is not to conceive of ways to design a product or service, but to develop ways to perform the functions selected for study. Second, creativity is a mental process to form new combinations. The purpose is to create new combinations which will perform the desired function at less total cost and improved performance than was previously attainable using the existing strategy. The guiding principle in the Creative Phase is that judgment/evaluation is suspended. Free flow of thoughts and ideas – without criticism – is required.

The team synergism resulting from this step will normally generate more than one hundred ideas for improvement in most VM Studies.

5.1.5 Evaluation Phase

Ideas generated in the creativity phase are ordered, collected into concepts with similar features, solidified into potential alternatives for recommendation to management, and then ranked using one of a variety of techniques such as "paired comparison." The resulting potential alternatives are then evaluated against each other and the baseline approach with regard to their perceived benefits, advantages, and risks.

5.1.6 Development Phase

The objective is to select and prepare the "best alternative(s)" for improving value. The team members are assigned to develop the selected alternatives for further evaluation and then transform them into viable, efficient, and cost-effective proposals.

The development process includes, but is not limited to: using team member expertise; consultation with the project staff; experts and outside vendors; polling others by survey or other means; and review of other information resources (libraries, catalogs, and other materials). Every attempt is made to fully develop the life cycle cost model to determine the impact of each proposed alternative on the project cost and schedule. An implementation plan, including proposed schedule of all implementation activities, plus team assignments and management requirements is produced.

5.1.7 Presentation Phase

In this phase, the VM study team presents its recommendations to the decision making body. Through the presentation and its interactive discussions, the team obtains either approval to proceed with implementation, direction for collecting additional information, or rejection of some or all of the recommended alternatives by management.

Each team member participates in a formal presentation of the study results to management, client representatives, and the project team. In some cases, a draft written report is presented to attendees at the end of the presentation.

5.1.8 Post Study

Following the VM study, the VM specialist completes the final written study report and sends it to the team members and management. The staff coordinating the Value Study activities, and if needed, the VM Team members assist and monitor the evaluation to help all

parties in implementing the added value features. The final estimates of the value of proposals are established.

While the VM team leader may track the progress of implementation, in all cases the project manager is responsible for the implementation. Each alternative must be independently designed and confirmed, including contractual changes, if required, before its implementation into the product, project, process or procedure.

Statistics and value study activity results are generated and compiled. The results are used to determine overall effectiveness of the VM activity and to identify potential process improvements. Value Program performance is dependent on how well the studies are performed, the extent of management support, project personnel support, and a variety of other factors. Successful VM activities are to be entered into the DOE VM database, and the cost savings and other benefits are to be captured in the DOE VM Annual Report.

6.0 FUNCTION AND COST ANALYSIS – THE KEYS TO VALUE MANAGEMENT

An in-depth knowledge and understanding of both function analysis and cost analysis and their relationship to one another is crucial in applying VM. For this reason, the following discussion of both subjects is included in this guide.

6.1 Function Analysis

The most important element of the VM Job Plan is the performance of the function analysis. A function is defined as a task, action, or activity that must be performed. It may require one or more inputs and may produce one or more outputs. A function is generally described using a verb/noun combination (e.g., demolish building, ship waste, pour foundation, etc.,) and has an interface with at least one other function. A function describes what must be done, not how.

Function analysis is the foundation upon which the entire study effort is based. It is the one discipline that separates VM from the many other problem solving techniques that continue to come and go. The primary objective of function analysis in VM is to facilitate the discovery of alternative means of achieving the desired performance. It is also one way to identify areas offering likely opportunities for value improvement.

Function descriptions stated in the simplest terms offer the greatest potential for the development of alternatives. This simplicity of expression is accomplished by using only two words: an active verb and a measurable noun. The verb describes the action and the noun defines the object of that action.

Using a two-word abridgement to completely describe a function is a very difficult undertaking even though it appears simple. Describing functions in two words is critical to the Value Methodology because it creates a format which allows people with diverse backgrounds and experiences to communicate in a common language. The reasons for imposing this rigorous approach are:

- To focus on function rather than the item.
- To avoid confusion caused by combining functions.
- To encourage creativity.
- To free the mind from specific configurations.
- To reveal unnecessary cost.
- To facilitate comparison.

The two word function description results in a clear and concise definition which can be agreed upon by the team to describe the function being examined. The verb should be an active verb (e.g., adjust, decrease, hold, etc.) to describe an action, occurrence of state of being of the item under study in such a way as to facilitate comparison. The noun should be quantifiable or measurable (e.g., current, pressure, weight, etc.) for the same reason.

Functions are categorized as either basic or secondary. An item's basic function is defined as anything that makes the product work or sells. Secondary functions, are also called supporting functions and describe the manner in which the basic function(s) are implemented. A basic function cannot change without changing the product delivered, while secondary functions can be modified or eliminated without affecting the end product. Secondary functions are considered to make no direct contribution to worth, but do add directly to cost. Consequently, value improvement efforts aim to minimize the impact of secondary functions.

A major improvement in the VM Process occurred when the FAST diagram was developed in the 1980's (see Figure 3 in Section 5.1.3). FAST diagramming uses a systems approach to link simply expressed random functions in order to describe complex systems.

The VM Process places the results of the function analysis into a FAST diagram created by closely examining each function and answering two questions: ***"how"*** and ***"why."*** The two word functions are placed on the diagram and worked into an acceptable order until the complete logic is agreed to by all members of the team. Only after this agreement is reached (everyone is working the same problem) is the VM Study allowed to proceed to the creativity of problem solving in Phase 3.

A complete description of VM Function Analysis and FAST diagramming is beyond the scope of this guide. Primarily because of the difficulty of mastering the seemingly simple concept of functions and their diagramming, it is strongly recommended that a trained and experienced VM Specialist be used to lead and/or facilitate VM Studies for best results.

6.2 Cost Analysis

All VM efforts normally include some type of economic analysis. The objective largely determines the type and degree of the analysis undertaken. Economic analysis is used to identify areas of VM opportunity and provide a monetary base from which the cost impact of the effort can be determined. The prerequisite to ensure an accurate economic analysis is reliable and appropriate cost data. At the start of the VM Study, the available cost data may not be sufficiently accurate, sufficiently detailed, or arranged in a manner which facilitates its use. Consequently, the VM effort must include one or more individuals who are skilled in estimating, developing, and analyzing cost data. The cost of the original or present method of performing the function is determined or estimated as carefully and precisely as is possible given the data available.

Structuring the available cost data in a manner which permits identification of high-cost elements will aid in determining the priority of effort within individual studies. High-cost areas may be indicative of poor value, and therefore, are prime candidates for initial investigation.

One of the most used tools in VM is “Pareto’s Law,” also know as the 80/20 Rule. The law is based on the observation of Vilfredo Pareto that “In any series of elements to be controlled, a selected small fraction, in terms of numbers of elements, always accounts for a large fraction in terms of effect.” In VM, the “Pareto analysis” is a commonly used method of separating the major causes (the “vital few”) of a problem, from the minor ones (the “trivial many”). The analysis is used in both function analysis and in cost modeling to quickly prioritize and focus resources where they are most needed by showing where initial effort should be placed to produce the most gain.

Experience has shown that costs are usually distributed in conformance with the 80/20 Rule which holds that 20% or less of the items in a project program or activity will account for 80% or more of the cost. VM makes extensive use of such cost models to express the distribution of costs associated with a specific VM effort. Cost models range from those attempting to break down total cost to those which cover only one area of cost such as production or construction.

Normally a VM cost model consists only of those cost elements which can be directly affected by VM actions. Dollars already spent (sunk cost) are usually set apart because they cannot be reduced by the output of a VM Study. Cost elements may be thought of as unit building blocks which can be combined to equal the total cost of the subject of the study. As

the VM Study progresses to completion, the cost model is refined. Target costs may be added to the cost model or the entire structure may be altered as a result of new information or new insight regarding VM opportunities. The final model may include savings developed during the VM effort as progress is made toward achieving the targets.

7.0 VALUE MANAGEMENT OUTPUTS

The primary product of a VM Study is the value recommendation(s). When a VM Study is complete, the recommended alternative(s) should be prepared and presented to the authorizing management in a timely manner to assure probability of implementation and to enable execution of other related work without interruption.

7.1 Value Study Alternative Recommendations

As a minimum, recommendation(s) presented to management by the VM Team should include the following:

- Current Method (baseline): verification of the current scope of work, cost, and schedule to be impacted by the recommendation(s).
- New Method (revised baseline): verification of the scope of work, new cost, and schedule, and how the new recommendations(s) will be accomplished.
- Feasibility assessment: assessment should include major differences (such as benefits, risks, and other related impacts of implementation) between the current baseline and the new method.
- Assurances that no adverse safety or environmental consequences will occur due to the recommended change(s).

7.2 Value Study Reports

Information in the Final VM Report should be complete, technically accurate, easily understood, and consistent with information provided to the study team by the official authorizing the VM Study. VM Study reports generally should include the following:

- Document number and date
- Names of sponsoring company and performing Value Specialist
- Value Study General Information (list of team members and facilitator, study dates and location, total time spent on the project, etc.)
- Subject matter scope
- Executive summary
- Background Information
- Function Analysis (including FAST diagram)

- Life Cycle Cost Analysis (unless inappropriate)
- Evaluation Criteria
- Developed VM Proposals
- Quantitative, Qualitative, and Intangible Results (value or worth to be measured in dollars if possible and appropriate)
- Implementation Options.

The VM Study Report should be submitted in a consistent format and should include cost saving or cost avoidance and the return on investment. It should also include, on a separate attachment, appropriate supporting documentation sufficient to permit a technical and financial assessment of the implemented improvement.

7.3 Measuring Results

VM practice has been historically measured in terms of cost savings or cost avoidance. These measurements tend to be absolute and may not always reflect whether improvement or desired results are happening; using other metrics may more accurately depict the benefits to be gained. Since efficiency and cost-effectiveness are intrinsic to value, the following table of general objectives, measures, and expectations are presented for consideration by those involved.

Objectives	Measures	Expectations
Use VM as a process tool to improve efficiency and cost effectiveness in acquiring and managing fixed assets.	A VM program is in place or value methodology has been applied to a project, system, or item. 1. Return-on-investment for value studies 2. Number of value studies conducted over number of studies planned	Annual report to DOE-HQ required for VM. Demonstrates VM practices and processes have resulted in improved life cycle fixed asset management.
Use VM as a process tool to improve efficiency and cost effectiveness in programs, systems, and processes.	VM methodology has been identified by management as critical contributor to best management practice.	Opportunities for VM practices and processes are actively sought.

7.4 Lessons Learned

Sharing of lessons learned will provide an opportunity for the exchange of successes and missed opportunities. For instance, if a regulatory driver or perception impacted the acceptance of a value proposal, this could be noted and shared with other locations. This

would allow others to share in that knowledge, thus reducing the potential for committing funds and effort to provide solutions that are unacceptable.

A section for providing lessons learned will be included on the annual feeder reports for submission to DOE Headquarters and it is recommended that the complex-wide lessons learned process will be used for innovative and corrective action items.

7.5 Self-Assessment

Each Department Element Self-Assessment Program should include an examination of the VM Program. This assessment should focus on the management effectiveness of this program and the relative returns being received from the Program's utilization. Appropriate measures should be taken for the continual improvement of the VM Program.