APPENDIX A
DIRECTED PLANNING APPROACHES

A.1 Introduction

There are a number of approaches being used for directed planning of environmental operations. Some of these approaches were designed specifically for data collection activities; others are applications of more general planning philosophies. Many variations to these approaches have been made for specific applications. The following are some of the approaches being used:

- Data Quality Objectives (DQO);
- Observational Approach (OA);
- Streamlined Approach for Environmental Restoration (SAFER);
- Technical Project Planning (TPP);
- Expedited Site Characterization (ESC);
- Value Engineering;
- Systems Engineering;
- Total Quality Management (TQM); and
- Partnering.

Employing any of these approaches assures that sufficient planning is carried out to define a problem adequately, determine its importance, and develop an approach to solutions prior to spending resources.

This appendix discusses some elements that are common to direct planning processes (Section A.2) and provides in Sections A.3 through A.11 very brief descriptions of the planning approaches listed above. References are listed at the end of the appendix on each of the approaches to provide sources of more detailed information.

Several directed planning approaches have been implemented by the federal sector for environmental data collection activities. Project planners should be aware of agency requirements for planning. MARLAP does not endorse any one planning approach. Users of MARLAP are encouraged to consider all the available approaches and choose a directed planning process that is appropriate to their project and agency.

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A.2 Elements Common to Directed Planning Approaches

To achieve the benefits desired from directed planning, all of these approaches address the following essential elements:

1. *Defining the problem or need*: Identifying the problem(s) facing the stakeholder/customer that requires attention, or the concern that requires streamlining.

2. *Establishing the optimum result*: Defining the decision, response, product, or result that will address the problem or concern and satisfy the stakeholder/customer.

3. *Defining the strategy and determining the quality of the solution*: Laying out a decision rule or framework, roadmap, or wiring diagram to get from the problem or concern to the desired decision or product and defining the quality of the decision, response, product, or result that will be acceptable to the stakeholder/customer by establishing specific, quantitative, and qualitative performance measures (e.g., acceptable error in decisions, defects in product, false positive responses).

4. *Optimizing the design*: Determining what is the optimum, cost-effective way to reach the decision or create the product while satisfying the desired quality of the decision or product.

To most problem solvers, these four elements stem from the basic tenets of the scientific method, which *Webster's* defines as "principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses."

Each approach requires that a team of customers, stakeholders, and decision makers defines the problem or concern; a team of technical staff or line operators have the specific knowledge and expertise to define and then provide the desired product; and both groups work together to understand each other's needs and requirements and to agree on the product to be produced. The approaches represent slightly different creative efforts in the problem-solving process. All are intended to facilitate the achievement of optimum results at the lowest cost, generally using team work and effective communication to succeed.

A.3 Data Quality Objectives Process

The Data Quality Objectives (DQO) process was created by the U. S. Environmental Protection Agency to promote effective communications between decisionmakers, technical staff, and stakeholders on defining and planning the remediation of environmental problems.

The DQO process consists of seven basic steps:

1. State the problem;
2. Identify the decision;
3. Identify inputs to the decision;
4. Define the study boundaries;
5. Develop a decision rule;
6. Specify limits on decision errors; and
7. Optimize the design.

Applying the DQO steps requires effective communication between the parties who have the problem and the parties who must provide the solution. Additional information about the DQO Process is provided in Appendix B.

A.4 Observational Approach

The Observational Approach (OA) emphasizes determining what to do next by evaluating existing information and iterating between collecting new data and taking further action. The name "observational approach" is derived from observing parameters during implementation. OA was developed by Karl Terzaghi (Peck, 1969) for geological applications. In mining operations, there may be substantial uncertainty in the location of valuable geological formations. Information on soil and mineral composition would help to identify such formations. Application of OA utilizes the sampling information on soil and mineral composition to direct the digging locations. OA should be encouraged in situations where uncertainty is large, the vision of what is expected or required is poor, and the cost of obtaining more certainty is very high.

The philosophy of OA when applied to waste site remediation is that remedial action can be initiated without fully characterizing the nature and extent of contamination. The approach provides a logical decision framework through which planning, design, and implementation of remedial actions can proceed with increased confidence. OA incorporates the concepts of data sufficiency, identification of reasonable deviations, preparation of contingency plans, observation of the systems for deviations, and implementation of the contingency plans. Determinations of performance measures and the quality of new data are done as the steps are implemented.

The iterative steps of site characterization, developing and refining a site conceptual model, and identifying uncertainties in the conceptual model are similar to traditional approaches. The concept of addressing uncertainties as reasonable deviations is unique to OA and offers a qualitative description of data sufficiency for proceeding with site remediation.

A.5 Streamlined Approach for Environmental Restoration

The Streamlined Approach for Environmental Restoration (SAFER) is an integration of the DQO process and OA developed by the U. S. Department of Energy (DOE). The planning and assessment steps of SAFER are the DQO process. The implementation steps of SAFER are the Observational Approach. The approach emphasizing team work between decisionmakers and technical staff reduces uncertainty with new data collection and manages remaining uncertainty with contingency plans. The labels in each SAFER step are slightly different from the DQO and OA steps, but the basic logic is the same. The SAFER planning steps are:

- Develop a conceptual model;
- Develop remedial objectives and general response actions;
- Identify priority problem(s);
- Identify reasonable deviations and possible contingencies;
- Pursue limited field studies to focus and expedite scoping;
- Develop the decision rule;
- Establish acceptable conditions and acceptable uncertainty for achieving objective; and
- Design the work plan.

A.6 Technical Project Planning

Technical Project Planning (TPP) (formerly Data Quality Design), developed by the U. S. Army Corps of Engineers, is intended for developing data collection programs and defining data quality objectives for hazardous, toxic, and radioactive waste sites (HTRW). This systematic process (USACE, 1998) entails a four-phase planning approach in which a planning team—comprised of decisionmakers, data users, and data providers—identifies the data needed to support specific project decisions and develops a data collection program to obtain those data. In Phase I, an overall site strategy and a detailed project strategy are identified. The data user's data needs, including the level of acceptable data quality, are defined in Phase II. Phase III entails activities to develop sampling and analysis options for the data needed. During phase IV, the TPP team finalizes a data collection program that best meets the decisionmakers' short- and long-term needs within all project and site constraints. The technical personnel complete Phase IV by preparing detailed project objectives and data quality objectives, finalizing the scope of work, and preparing a detailed cost estimate for the data collection program. The TPP process uses a multi-disciplinary team of decisionmakers, data users, and data implementors focused on site closeout.

A.7 Expedited Site Characterization

Expedited Site Characterization (ESC) was developed to support DOE's Office of Science and Technology's Characterization, Monitoring, and Sensor Technology (CMST) program

(Burton, 1993). The ESC process has been developed by American Society for Testing and Materials (ASTM) as a provisional standard for rapid field-based characterization of soil and groundwater (ASTM D585). The process is also known as QUICKSITE and "expedited site conversion." ESC is based on a core multi-disciplinary team of scientists participating throughout the processes of planning, field implementation, data integration, and report writing. ESC requires clearly defined objectives and data quality requirements that satisfy the needs of the ESC client, the regulatory authority, and the stakeholders. The technical team uses real-time field techniques, including sophisticated geophysical and environmental sampling methods and an on-site analytical laboratory, to collect environmental information. Onsite computer support allows the expert team to analyze data each day and decide where to focus data collection the next day. Within a framework of an approved dynamic work plan, ESC relies on the judgment of the technical team as the primary means for selecting the type and location of measurements and samples throughout the ESC process. The technical team uses on-site data reduction, integration and interpretation, and on-site decisionmaking to optimize the field investigations.

Traditional site investigations generally are based on a phased engineering approach that collects samples based on a pre-specified grid pattern and does not provide the framework for making changes in direction in the field. A dynamic work plan (Robatt, 1997; Robatt et al., 1998) relies—in part—on an adaptive sampling and analysis program. Rather than specify the sample analyses to be performed, the number of samples to be collected and the location of each sample, dynamic work plans specify the decisionmaking logic that will be used in the field to determine where the samples will be collected, when the sampling will stop, and what analyses will be performed. Adaptive sampling and analysis programs change or adapt based on the analytical results produced in the field (Johnson, 1993a, b; Robatt, 1998).

A.8 Value Engineering

Value methodology was developed by Lawrence D. Miles in the late 1940s. He used a function-based process ("functional analysis") to produce goods with greater production and operational efficiency. Value methodology has evolved and, depending on the specific application, is often referred to as "value engineering," "value analysis," "value planning," or "value management." In the mid-1960s value engineering was adopted by three federal organizations: the Navy Bureau of Shipyards and Docks, the U. S. Army Corp of Engineers, and the U. S. Bureau of Reclamation. In the 1990s, Public Law 104-106 (1996) and OMB Circulars A-131 (1993) and A-11 (1997) set out the requirements for the use of value engineering, as appropriate, to reduce nonessential procurement and program costs.

Value engineering is a systematic and organized decision-making process to eliminate, without impairing essential functions, anything that increases acquisition, operation, or support costs. The techniques used analyze the functions of the program, project, system, equipment, facilities, services, or supplies to determine "best value," or the best relationship between worth and cost.

The method generates, examines, and refines creative alternatives that would produce a product or a process that consistently performs the required basic function at the lowest life-cycle cost and is consistent with required performance, reliability, quality, and safety.

A standard job plan is used to guide the process. The six phases of the value engineering job plan are:

- Information;
- Speculation (or creative);
- Evaluation (or analysis);
- Evolution (or development);
- Presentation (or reporting); and
- Implementation (or execution).

Value engineering can be used alone or with other management tools, such as TQM and Integrated Product and Process Development (IPPD).

A.9 Systems Engineering

Systems engineering brings together a group of multi-disciplinary team members in a structured analysis of project needs, system requirements and specifications, and a least-cost strategy for obtaining the desired results. Systems engineering is a logical sequence of activities and decisions that transforms an operational need into a preferred system configuration and a description of system performance parameters. Problem and success criteria are defined through requirements analysis, functional analysis, and systems analysis and control. Alternative solutions, evaluation of alternatives, selection of the best life-cycle balanced solution, and the description of the solution through the design package are accomplished through synthesis and systems analysis and control.

The systems engineering process involves iterative application of a series of steps:

- Mission analysis or requirements understanding;
- Functional analysis and allocation;
- Requirements analysis;
- Synthesis; and
- System analysis and control.

A.10 Total Quality Management

Total Quality Management (TQM) is a customer-based management philosophy for continuously improving the quality of products (or how work is performed) in order to meet customer expectations of quality and to measure and produce results aligned with strategic objectives. TQM grew out of two systems developed by Walter Shewhart of Bell Laboratories in the 1920s. Statistical process control was used to measure variance in production systems and to monitor consistency and diagnose problems in work processes. The "Plan-Do-Check-Act" cycle applied a systematic approach to improving work processes. The work of Deming and others in Japan following World War II expanded the quality philosophy beyond production and inspection to all functions within an organization and defined quality as "fit for customer use."

TQM has been defined as "the application of quantitative methods and the knowledge of people to assess and improve (a) materials and services supplied to the organizations, (b) all significant processes within the organization, and (c) meeting the needs of the end-user, now and in the future" (Houston and Dockstader, 1997). The goal of TQM is to enhance effectiveness of providing services or products. This is achieved through an objective, disciplined approach to making changes in processes that affect performance. Process improvement focuses on preventing problems rather than fixing them after they occur. TQM involves everyone in an organization in controlling and continuously improving how work is done.

A.11 Partnering

Partnering is intended to bring together parties that ordinarily might have differing or competing interests to create a synergistic effect on an outcome each views as desirable. Partnering is a team building and relationship enhancing technique that seeks to identify and communicate the needs, expectations, and strengths of the participants. Partnering combines the talents of the participating organizations in order to develop actions that promote their common goals and objectives. In the synergistic environment of partnering, creative solutions to problems can be developed. Like TQM, partnering enfranchises all stakeholders (team members) in the decision process and holds them accountable for the end results. Each team member (customer, management, employee) agrees to share the risks and benefits associated with the enterprise. Like the other approaches, partnering places a premium on open and clear communication among stakeholders to define the problem and the solution, and to decide upon a course of action.

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