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	Environmental Quality TECHNICAL PROJECT PLANNING (TPP) PROCESS	
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31 August 1998

US Army Corps of Engineers®

ENVIRONMENTAL QUALITY

TECHNICAL PROJECT PLANNING (TPP) PROCESS

ENGINEER MANUAL

AVAILABILITY

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DEPARTMENT OF THE ARMY
U. S. Army Corps of Engineers
Washington, D.C. 20314-1000

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No. 200-l-2

31 August 98

Environmental Quality
TECHNICAL PROJECT PLANNING (TPP) PROCESS

1. Purpose. This Engineer Manual (EM) describes the Technical Project Planning (TPP) process for identifying project objectives and designing data collection programs at hazardous, toxic, and radioactive waste sites, The TPP process helps ensure that the requisite type, quality, and quantity of data are obtained to satisfy project objectives that lead to informed decisions and site closeout. The TPP process can be used from investigation through closeout at small, simple sites as well as large, complex sites. The TPP process is a critical component of the U.S. Army Corps of Engineers (USACE) quality management system that meets the American National Standard for planning the collection and evaluation of environmental data. This EM is intended for use by USACE project managers and both technical and contractor personnel for implementation of Engineer Regulation (ER) 5-1-11.

2. Applicability. This EM applies to all HQUSACE elements and USACE commands responsible for hazardous, toxic, and radioactive waste projects.

3. References. References are listed in Appendix A.

4. Distribution. Approved for public release, distribution is unlimited.

5. Discussion. The four-phase TPP process is a comprehensive and systematic planning process that will accelerate progress to site closeout within all project constraints, Project objectives are identified and documented early during Phase I of the TPP process to establish the focus required to achieve site closeout for the customer. Phases II and III provide a framework to develop data collection options for the customer's consideration during Phase IV. The project-specific data quality requirements established throughout the TPP process are then documented as data quality objectives during Phase IV. Many other documentation tools within this EM also encourage detailed data collection planning and contribute to maintaining institutional site knowledge.

FOR THE COMMANDER:

7 Appendices
(See Table of Contents)

ALBERTO J. GENETTI, JR.
Major General, USA
Chief of Staff

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Foreword

Investigating, remediating, and closing hazardous, toxic, and radioactive waste (HTRW) sites is complex. On many occasions, new people get involved in a project and site conditions or remediation progress is unknown when efforts begin. Progress at a site is iterative as more is learned about a site, and as regulatory and legal issues are identified and resolved.

This manual describes the Technical Project Planning (TPP) process for identifying project objectives and designing data collection programs at HTRW sites. The TPP process was developed to provide comprehensive planning guidance to ensure effective and efficient progress to site closeout within all project constraints. Chapters 1 through 4 describe how to conduct Phase I through Phase IV of the TPP process, respectively. Chapter 5 describes implementation and assessment of data collection programs resulting from the use of the TPP process.

The following discussions offer a uniform technical basis for the broad range of readers using this manual and the TPP process.

What is the TPP process?

The TPP process is a systematic process that involves four phases of planning activities. Phase I activities bring together a TPP team to identify the current project and to document both short- and long-term project objectives through completion of all work at a site (site closeout). Phase II efforts involve an evaluation to determine if additional data are needed to satisfy the project objectives. The data need requirements for the additional data are then identified during the balance of Phase II efforts. Phase III activities involve identifying the appropriate sampling and analysis methods for the data needed. During Phase IV, the TPP team finalizes a data collection program that best meets the customer's short- and long-term needs within all project and site constraints.

When is the TPP process needed?

The TPP process is needed when initially planning any activities at a site (i.e., investigation; design; construction, operation and maintenance; or long-term monitoring). The TPP process should be used immediately after a customer requests that a project be performed at a site and also when planning the next executable stage of site activities.

Key Terms and Concepts

Readers of this manual and users of the TPP process are encouraged to become familiar with the following key terms and concepts.

TPP Team

The TPP team is identified during Phase I, and works together throughout the TPP process and the subsequent execution of the work. The TPP process requires a multi-disciplinary team of personnel to represent the following planning perspectives.

- **Decision Makers** (i.e., customer, project manager, regulators, and stakeholders). Decision makers each have specific interests in the outcome of site-related activities. The most important responsibility of each decision maker is to participate in the team's efforts to identify and document project objectives during Phase I. As deemed appropriate by the customer, the regulators and stakeholders may also contribute to TPP activities during Phases II through IV. (The **customer** is the person representing the federal agency or sponsor, who is funding the project and responsible for completing work at the site or facility.)

- **Data Users** (i.e., risk, compliance, remedy, and responsibility perspectives). Data users are the technical and other personnel responsible for engineering, scientific, and legal evaluations that are the basis for site decisions. Data users participate throughout the TPP process. Their primary responsibilities occur during Phase I and Phase II when they identify the data needed to satisfy the project objectives that require additional data collection. Several technical disciplines typically must collaborate to adequately represent these data user perspectives:

  Risk Perspective
  (evaluates potential risks to human health and the environment);

  Compliance Perspective
  (evaluates, monitors, and ensures legal and regulatory compliance);

  Remedy Perspective
  (identifies, designs, constructs, operates, and maintains site remediation systems); and

  Responsibility Perspective
  (focuses on the customer's potential liability and the apportionment of responsibility with other potentially responsible parties).

- **Data Implementors** (i.e., sampling and analysis perspectives). Data implementors are the technical personnel who are responsible for identifying sampling and analysis methods suitable for satisfying the data users' data needs. Both sampling and analysis types of data implementors participate throughout the TPP process with their primary responsibilities occurring during Phase I and Phase III.

Site Closeout
Site closeout is achieving the "walk away goal," or final condition of a site, as envisioned by the customer. Site closeout represents achieving either an interim final condition (e.g., expedited removal, remediation with 5-year reviews) or final completion of all work at a site. During Phase I, the TPP team develops an effective site closeout statement after considering future land use of the site; the site's regulatory compliance status and issues; and the customer's preferences for the final condition of the site. A good definition of site closeout enables the TPP team to focus planning and site activities from the current site status and condition through any necessary remediation; operation and maintenance; or monitoring efforts.

Project Objectives
Project objectives must be satisfied or resolved in order to progress from the current site status and condition to site closeout. Satisfying or resolving the project objectives, based on the underlying regulations or site decisions, is the purpose of all site activities. Phase I efforts to identify and clearly document project objectives will ensure that the team establishes the focus required to successfully address the site-specific regulatory status and environmental conditions. Although many project objectives are a consequence of the applicable federal, state, and local regulations, several other customer- or site-specific project objectives may need to be documented to ensure efficient progress to site closeout. If project objectives are either vague or undefined, it is unlikely that meaningful progress can be made toward achieving site closeout. Once all project objectives have been identified, and both customer and regulator concurrence is obtained, the team works to group the project objectives in relation to current and future executable stages of site activities through site closeout.

Basic, Optimum, and Excessive

Basic, optimum, and excessive are simple terms used during the TPP process for classifying project objectives and grouping data needs. Although these terms are simple, their use is very powerful throughout the TPP process.

- **Basic** Basic project objectives and data needs are related to the current project. During the end of Phase I, the TPP team identifies the current project and the corresponding "basic" project objectives. Data need requirements for the current project, as identified by various data user perspectives during Phase II, are then grouped together as the "basic" data collection option during Phase III. During Phase IV, the project manager and technical personnel present the "basic" data collection option for the customer's consideration.

- **Optimum** Optimum project objectives and data needs are anticipated for future executable project stages. Once the current project has been identified during the end of Phase I, those project objectives associated with future executable project stages are classified as "optimum" project objectives. Data need requirements for future executable stages, as identified by various data user perspectives during Phase II, are then grouped together as the "optimum" data collection option during Phase III. (Data needs grouped within the "optimum" data collection option represent only those data needs that would be cost-effective and prudent to fulfill during the current project even though the data use(s) is related to a subsequent executable stage of site activities.) During Phase IV, the project manager and technical personnel present the "optimum" data collection option for the customer's consideration.

- **Excessive** Excessive project objectives and data needs are neither related to the current project nor future executable project stages. A project objective is classified as "excessive" when it does not lead to site closeout. "Excessive" data needs are identified during Phase II when data users realize that select data needs, imposed or mandated by others, are not required to satisfy the basic or optimum project objectives. "Excessive" data needs exceed data need requirements of data users, but are grouped together during Phase III. During Phase IV, the customer is briefed about technical and financial issues related to the "excessive" data collection option.

Data Quality Objectives (DQOs)

Preparation of DQO statements during Phase IV is the culmination of many TPP activities. DQOs become formal documentation of the data quality requirements. Effective use of DQOs yield data of known quality, document the planning process, and establish a benchmark to determine if data obtained from the site actually meet the specified data need requirements of the data users. DQOs produced as a result of the TPP process meet the U.S. Environmental Protection Agency's definition of a DQO and are project-specific statements that include these nine data quality requirements:

(1) Project objective(s) satisfied;
(2) Data user perspective(s) satisfied;
(3) Contaminant or characteristic of interest identified;
(4) Media of interest identified;
(5) Required sampling areas or locations and depths identified;
(6) Number of samples required;
(7) Reference concentration of interest or other performance criteria identified;
(8) Sampling method identified; and
(9) Analytical method identified.

Communication Strategy

This manual and the TPP process clearly advocate communication and documentation across a TPP team. Beyond using the TPP process, each TPP team should develop a communication strategy that will work for the entire TPP team. Open, timely, and effective communication between the customer, project manager, technical personnel, regulators, stakeholders, contractors, and laboratory representatives will result in a successful project, independent of the complexity of a site or a site's issues. Some considerations related to developing a communication strategy are as follows.

- How often, and by what means, does the customer want to receive updates regarding TPP efforts and project efforts?
- How will communications with regulators and stakeholders be maintained and who does the customer authorize for direct communications, if anyone?
- How will worksheets, graphics, or tables be used to improve the distribution of site information, data, and site decisions?
- How will information and resources be shared electronically (e.g., telephone facsimile, electronic mail, express mail, restricted Internet site)?
- Should communication templates be developed and included within work plans to ensure the entire team becomes involved in developing, implementing, and maintaining effective methods of communicating information?
- How will the communication strategy and communication requirements be specified within scope of work documents to ensure they are included in cost estimates?
- What, if any, decisions has the customer specifically indicated the team has the customer's authority to either make or communicate with other parties?

Tenets of TPP Process

The TPP process offers the project manager, technical personnel, customer, regulators, and stakeholders a systematic planning process for identifying project objectives and designing data collection programs at small, simple sites as well as large, complex sites. This manual and the TPP process expect a team to:

- Use the TPP process to establish an effective team, open communications, and document specific project objectives;
- Consider the consequences of unacceptable decisions or decision errors;
- Consider the data quality requirements;
- Consider data collection approaches, including when expedited site characterization and field analytical and screening methods would be appropriate;
- Decide how data needs can be balanced within project cost and schedule constraints;
- Present data collection options for the customer's consideration; and then
- Ensure that institutional site knowledge can be transferred to new people involved with a site through the use of various TPP planning documents and worksheets.

Those individuals with experience using the TPP process are expected to provide the customer, project manager, regulators, stakeholders, and other technical personnel an introduction to the TPP process and this manual, when beginning to use the TPP process for a site. In many instances, it can be useful to use the services of an independent TPP facilitator to support and guide a team's application of the TPP process.

Effective and Timely Planning

A premise of the TPP process is that each individual contributing to a project has his/her own project execution style. Some individuals begin site activities before planning, others exhibit an ideal commitment to planning, and some individuals may tend to over-plan project activities. The systematic TPP process enables a project manager to achieve an appropriate balance of project execution styles within a team and ultimately accelerate overall progress to site closeout. The entire TPP team will find that time spent planning reduces expensive time and efforts during the "do," "check," and "finish" stages of any project.

In some instances, TPP teams have learned that a series of half-day meetings are sufficient for performing segments of the TPP process. In other instances, an outside facilitator has introduced the TPP process to a TPP team and then helped the TPP team to apply the process and capture the TPP plans for a project.

Figure 1 illustrates the following benefits of effective and timely planning:

- Less time is expended to "check" and "finish" a well planned project; and
- Less overall time (and money) is expended when early efforts are focused and the team strives to optimally plan a project.

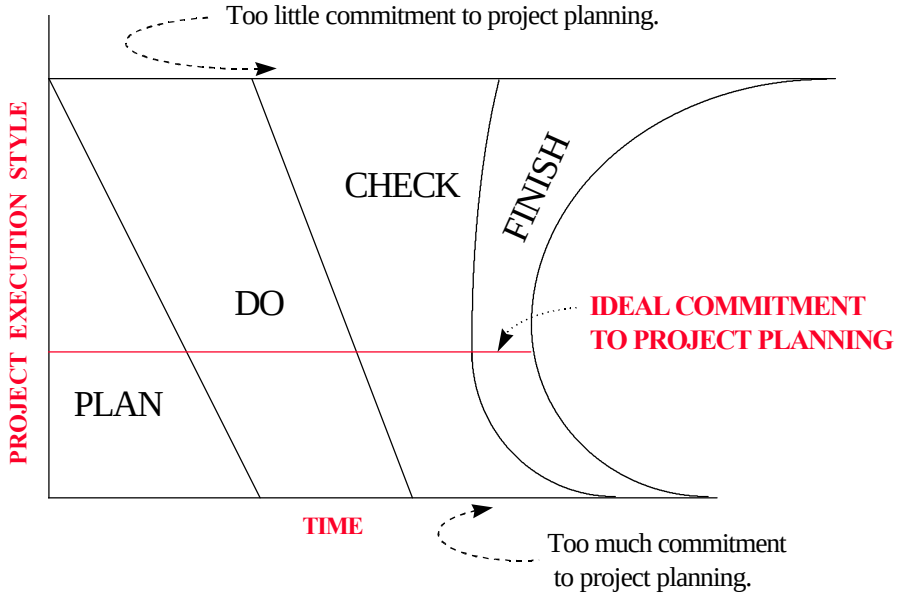

Figure 1
Effects of Optimal Planning (Nayatani 1994)

Chapter 1
Identify Current Project (Phase I)

The Technical Project Planning (TPP) process is a comprehensive and systematic planning process for identifying project objectives and designing data collection programs at hazardous, toxic, and radioactive waste sites. The TPP process is integral to the program and project management business process, the corporate management approach for managing all U.S. Army Corps of Engineers (USACE) programs and projects.

Reference and overview resources:
- Foreword (pages 1-5);
- Required and Related References (Appendix A);
- Abbreviations and Acronyms (Appendix B);
- Definitions (Appendix C); and
- Outline of TPP Activities (Appendix D).

The four-phase TPP process helps to ensure that the requisite type, quality, and quantity of data are obtained to satisfy project objectives that lead to informed decisions and site closeout. Phase IV efforts to prepare data quality objective (DQO) statements is the culmination of many TPP activities. (Appendix E presents a detailed "crosswalk" from the TPP process to the U.S. Environmental Protection Agency's (EPA's) 7-Step DQO Process, a similar planning tool.[1])

The TPP process should be used when initially planning for any activities at a site (i.e., investigation; design; remediation, operation and maintenance; long-term monitoring), and when planning the next executable stage of site activities where work is already ongoing.

Phase I (see Figure 1-1) activities bring together decision makers and technical personnel to identify the current project and to document both short- and long-term project objectives through completion of all work at a site. The Phase I efforts involve preparing a team information package, determining an overall site approach, and identifying the current project focus for a site.

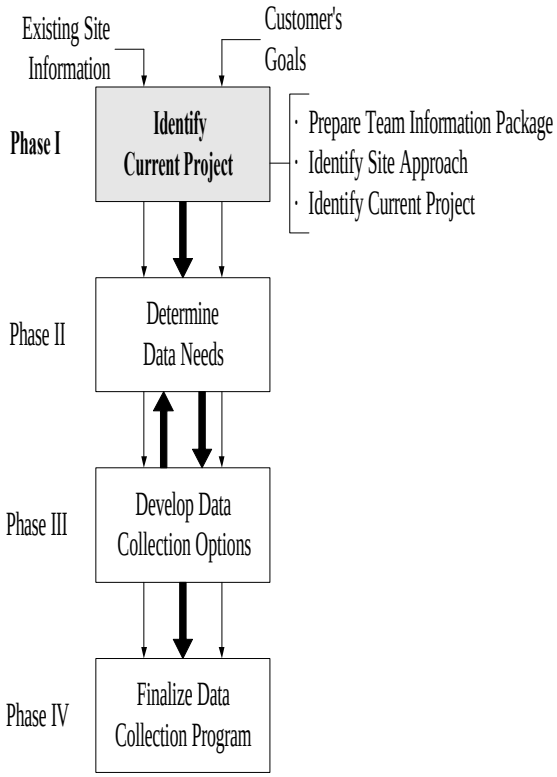

Figure 1-1
Phase I of Four-Phase TPP Process

Although Phase I activities are designed to "front-load" conflicts and decision making, the resultant project efficiency more than compensates for the early commitment to proactive planning and communication. Phase I TPP efforts will ultimately accelerate the protection of human health and the environment, while expediting progress to the desired future use conditions at a site.

1.1 PREPARE TEAM INFORMATION PACKAGE.

Preparation of a team information package should be a result of the initial Phase I activities. A team information package is an informal collection of existing site information that is compiled for reference by the entire team. Common components of a team information package include these items:

- List of individuals who constitute the multi-disciplinary TPP team for the site;
- Customer's concept of site closeout;
- Customer's schedule and budget requirements;
- All correspondence to and from regulators, including an index of the project file or administrative record, if available; and
- Existing site data, reports, illustrations, or drawings (that are available and pertinent).

1.1.1 Identify TPP Team Members.

The TPP process requires a multi-disciplinary team of personnel to represent the planning perspectives of decision-making, data use, and data implementation. The project manager (PM) is responsible for ensuring that all the TPP perspectives are represented within the multi-disciplinary team of personnel. The PM should rely on the functional chiefs or department heads for assigning qualified members to project teams, keeping commitments made in management plans, and ensuring technical processes produce the desired results.[2]

In general, several disciplines of technical personnel will collaborate to represent each of the data user and data implementor perspectives for a site. For instance, a geologist, industrial hygienist, or chemist may support the risk, compliance, or remedy data user perspectives, while also contributing to the sampling or analysis data implementor perspective. On small, relatively simple sites, personnel implementing the TPP process may perform multiple roles and support multiple perspectives.

> The TPP team concept emphasizes the need to have all appropriate technical planning perspectives represented for each project. Even on small, relatively simple sites, the team should at least obtain input from each technical planning perspective during the TPP activities.

1.1.1.1 Decision Makers.

Many perspectives of decision makers are typically associated with a site. The customer, PM, regulators, and stakeholders each have specific interests in the outcome of site-related activities. Decision maker input should be included during all TPP activities, but is most critical during Phases I and IV. The concerns of decision makers should be introduced as early in the planning process as possible, but direct input is required during TPP Phases I and IV.

The most important responsibility of the decision makers is to participate in the team's efforts to identify and document project objectives during Phase I. Other responsibilities of the decision makers include contributing to the team's efforts to do the following:

- Define site closeout;
- Gather existing site information;
- Identify project constraints; and
- Document the current executable stage.

1.1.1.1.1 Customer.

The customer is the person, representing the Federal agency or sponsor, who is funding the project and responsible for completing work at the site or facility. As such, the PM and technical personnel always recognize and respect the customer as the primary decision maker for all site decisions and activities.

Therefore, the customer is a key member of every TPP team. The PM should encourage the customer to participate throughout the TPP activities and understand relevant uncertainties associated with each project.

1.1.1.1.2 Project Manager.
Within the TPP process, the project manager (PM) is the decision maker responsible for leading the team's TPP efforts, progressing towards site closeout, and meeting the customer's expectations. Even in those instances where technical elements, contractors, or stakeholders significantly contribute to a project, the PM remains responsible for maximizing the use of the TPP process.

The PM's leadership role in the TPP process is most apparent during Phases I and IV. During Phases II and III, the PM should function more in a support role by responding to information needs of the technical personnel who are representing data user and data implementor perspectives.

The TPP process supports a PM's implementation of the following requirements of Engineer Regulation 5-1-11[2]:

- PM is primary point of contact with the customer;
- PM manages project resources, data, and commitments;
- PM provides leadership to a multi-discipline project team in accordance with the project-specific management plan developed by the PM, customer, and other team members;
- PM is responsible and accountable for successful completion and delivery of assigned project to customer within established costs, schedules, and quality parameters; and
- PM provides leadership to the multi-disciplined project team with responsibility for assuring that a project stays focused on the customer's needs and expectations; and that the team takes effective, coordinated actions to deliver the completed project.

1.1.1.1.3 Regulators.
Federal, state, and local regulators are the decision makers who may have jurisdictional authority to directly affect site closeout. Regulators may specify standards, criteria, and guidance to be followed during site characterization and remediation. Regulators may also establish schedules under Federal Facility Agreements that can stipulate penalties for missed milestone dates. Regulators with possible jurisdictional authority should be included in TPP efforts to ensure efficient progress to site closeout. In particular, regulator input is prudent during Phase I and portions of Phase IV. As deemed appropriate by the customer, regulators may also contribute during Phase II and Phase III of TPP activities.

1.1.1.1.4 Stakeholders.
Stakeholders with interests in site activities and site closeout could include current property owners, Restoration Advisory Boards, and any number of other individuals or special interest groups. Concerns and ideas of stakeholders should be considered during TPP efforts to contribute to efficient progress to site closeout. Phase I of the TPP process includes a deliberate effort to determine and consider community interests and the perspectives of stakeholders. A Phase IV activity encourages the preparation and distribution of fact sheets, when appropriate, for communicating the data collection program to interested parties including stakeholders. As deemed appropriate by the customer, various stakeholders may also participate during Phase II and Phase III efforts.

1.1.1.2 Data Users.

Data users are technical and other personnel responsible for engineering, scientific, and legal evaluations that are the basis for site decisions. Progress to site closeout requires collaborative involvement of many technical disciplines to represent these data user perspectives:

- **Risk Perspective**
  (evaluates potential risks to human health and the environment);
- **Compliance Perspective**
  (evaluates, monitors, and ensures legal and regulatory compliance);
- **Remedy Perspective**
  (identifies, designs, constructs, operates, and maintains site remediation systems); and
- **Responsibility Perspective**
  (focuses on customer's liability and apportionment of responsibility with other potentially responsible parties).

Some of the technical disciplines who support the data user perspectives include chemists; engineers (e.g., chemical, civil, cost, environmental, electrical, geotechnical, and mechanical); geologists; industrial hygienists; regulatory specialists; risk assessment specialists; and safety officers. Other personnel supporting the data user perspectives include various types of scientists and legal counsel personnel. The nature and complexity of a project dictate the skills, technical disciplines, and personnel needed. All data users participate throughout the TPP process, with their primary efforts occurring during Phase I and Phase II.

1.1.1.3 Data Implementors.

Data implementors are the technical personnel responsible for identifying sampling and analysis methods to satisfy the data users' data needs. Several technical disciplines may work together to adequately represent these data implementor perspectives during the TPP process:

- **Sampling Data Implementor**
  (identifies appropriate sampling protocols); and
- **Analysis Data Implementor**
  (identifies appropriate analytical protocols)

Data implementors participate throughout the TPP process with their primary responsibilities occurring during Phase I and Phase III.

1.1.1.4 Team Selection.

For each site, the team should include the decision makers and the necessary technical personnel to represent all of the data user and data implementor perspectives. In some situations, the PM will need to go beyond in-house resources to obtain the technical personnel experienced or available for all aspects of the work. Technical support from other offices or contractors may be required to ensure all TPP team perspectives are represented for each site. The PM should consider at least the following when identifying technical resources needed for a TPP team:

- Technical specialists from various functional elements (e.g., planning, engineering, occupational safety and health, construction, operations, counsel, contracting) may be appropriate participants for a portion of the TPP activities;
- Real estate personnel should contribute when site efforts involve property not controlled by the customer; and
- The customer may want to assign some of their technical personnel to the team.

> After the team has identified the current project by the end of Phase I, the PM should re-examine the size and capabilities of the TPP team and review both in-house and contractor support requirements.

Under the leadership of the PM, all TPP efforts should be performed by in-house personnel or some combination of in-house and contractor personnel. Once roles and responsibilities are defined, the PM should determine and document the acquisition strategy(ies) for procuring any necessary contractor support. The documentation should include the rationale supporting the acquisition strategy(ies) and the project tasks that have not yet been assigned to either in-house or contractor personnel.

1.1.2 Identify Customer Goals.

Identifying customer goals is a critical and deliberate activity within the TPP process to ensure that the customer's expectations are understood from the start of the planning efforts. A customer's goals should be identified for each site and then documented in the team information package. In order to meet or exceed the customer's expectations, the PM must then ensure that desired project activities, schedules, and budgets are consistent, and in accordance with all applicable regulations.

Customer goals are defined by future land use at the site, regulatory compliance, the customer's schedule requirements, and the customer's site budget.

> It is ultimately the PM's responsibility to understand and monitor the customer's goals and changing needs as additional site information becomes available. The PM is responsible for assessing these changing needs and their effect on project planning and execution.

1.1.2.1 Customer's Concept of Site Closeout.

Site closeout is achieving the "walk away goal," or the final condition of a site, as envisioned by the customer. The development of an effective site closeout statement involves the following considerations.

1.1.2.1.1 Future Land Use.

Future land use assumptions allow site activities to be focused on developing practical and cost effective remedial alternatives consistent with the reasonably anticipated future land use.[3] Although a customer may not have specific future use plans for a site, the PM and technical personnel should at least narrow the range of potential future uses considered for a site. In all instances, initial discussions with the customer should address anticipated future uses of a site to seek the customer's concurrence about future use scenarios (e.g., residential development, landfill construction) that can be eliminated. It is important to recognize that future land use assumptions may be different at sites where a federal agency will not, or does not, maintain control of the affected real estate. Final selection of a reasonable future land use will also require discussions with the customer, regulators, and stakeholders (e.g.; local land use planning authorities; city, state, and federal officials; the public; and current property owners), as appropriate.

1.1.2.1.2 Regulatory Compliance.

A site's current regulatory status [e.g., site/facility listed on National Priority List; Resource Conservation and Recovery Act (RCRA) permitted facility] is also critical to understanding a customer's concept of site closeout. The PM and technical personnel should determine if the customer is aware of any applicable regulatory programs or requirements and obtain copies of related regulatory

correspondence such as a Federal Facility Agreement or a RCRA permit.

1.1.2.1.3 Interim Site Closeout Goals.
An interim site closeout goal (e.g., operable unit closeout; completion of a site investigation phase; operation and maintenance of a remediation system, remediation with five-year reviews) may also be useful to the team. These interim closeout goals are only useful, however, if they are defined within the overall context of the customer's concept of final site closeout conditions.

1.1.2.1.4 Site Closeout Statement.
A site closeout statement should be documented for reference throughout the life of the project. A good definition of site closeout will focus efforts from the current site status and condition through any necessary remediation, operation and maintenance, or monitoring efforts. Site closeout statements should also be revised if the customer's vision for the site changes. A well prepared site closeout statement will increase project efficiency by ensuring:

- The team can visualize the physical appearance of the site at closeout;
- Team members can identify what actions are required to achieve site closeout;
- Phasing and timing constraints associated with site closeout are understood; and
- The customer's intent for operation and maintenance and monitoring are clear.

1.1.2.2 Customer's Schedule Requirements.
Effective project planning requires that the team know all of the customer's short- and long-term schedule milestones to site closeout. The site approach must incorporate and fulfill the customer's schedule requirements and any changes to their requirements throughout the project activities.

1.1.2.3 Customer's Site Budget.
The customer's budget constraints must also be included in project planning. In particular, the team needs to understand the customer's desired investment and the customer's perception of anticipated costs. The site approach must be developed within the customer's budget constraints. If a customer's site budget changes, the changes need to be documented and then communicated to the team.

1.1.3 Gather Existing Site Information.
Identify existing site information and gather the most pertinent data. (Appendix F provides a worksheet for listing any preliminary site information needs identified during this TPP activity.) Existing site information should be compiled and included within the team information package. Not all of the following activities will be conducted as it is dependent upon the stage of site activities and the team's experience at the site.

1.1.3.1 Conduct Preliminary Site Visit.
Technical personnel should consider conducting a preliminary site visit to identify all potential sources of site information. Current and historical photographs of site conditions and operations should be obtained. It may also be beneficial to videotape the site and specific features. Preliminary site visits should be used to obtain site maps or drawings that depict critical site features (e.g., historical land use, buildings, tanks, topography, surface water bodies, property lines, site access, existing well locations, disposal/storage/staging areas, and treatment systems).

1.1.3.2 Gather Site Data and Reports.
So that redundant data are not collected, determine and gather all existing site data and reports for reference and use by the team. Some of the most pertinent data includes:

- Site maps;
- Site and aerial photographs;
- Historical ownership information;
- Regulatory status of the site and facility;
- Facility or site-related geology;
- Hydrogeology, hydrology, climatology, ecology, and demographic information;
- Current and future land use information about areas adjacent to the site;
- Results and reports of previous site studies or investigations;
- Data quality control data (e.g., method blanks and duplicates), data usability information or evaluations, and any supporting data packages (partial or complete); and
- Known influence of other nearby sites.

1.1.3.3 Obtain Operations Records.

Obtain historical operations records about the facility or site to understand site features and possible sources of contamination.

1.1.3.4 Collect Background Literature.

Collect background literature and obtain other general information (e.g., regional geology and hydrogeology; upstream and downstream National Pollutant Discharge Elimination System effluent information; and local newspaper accounts) for use by the team as necessary. Investigations on other nearby sites can often be a source of relevant data.

1.1.3.5 Conduct Site History Interviews.

Discussions with former and current employees about previous operations and waste handling should be planned with input from those representing the responsibility perspective. Employees and personnel interviewed may include individuals involved with site operations, permitting, previous investigations, or environmental and engineering personnel associated with the facility or site. This should include all users of the property, current and past, with the potential for contaminant releases. It is also crucial for the responsibility perspective to be involved to assure proper documentation is prepared and any related substantiation is considered.

1.2 IDENTIFY SITE APPROACH.

Efforts to identify a site approach involve development of an overall strategy for managing a site from its current condition to the desired site closeout condition. These TPP efforts are critical because evolving schedule, financial, political, and other constraints affect site activities from site identification through site closeout. Without a planned site approach, the following situations can occur:

- Data collection plans are modified as a short-term solution to urgent constraints, but may not yield data of the sufficient type, quality, or quantity to enable site or project decisions to be made at required times; and
- A team will not be able to determine the impacts of modifying current project plans in the context of the entire site. This can result in site closeout delays when subsequent site activities deviate from those originally envisioned.

By performing the following TPP activities, the team can identify a site approach and be better prepared to manage and consider the effects of outside constraints and proposed changes to data collection programs. A Phase I memorandum for record (worksheet provided in Appendix F), or a series of specific TPP memoranda, should be prepared to document these critical elements of a site approach:

- Preliminary Conceptual Site Model;
- Project Objectives (worksheet provided in Appendix F);
- Stakeholder Perspectives;
- Probable Remedies; and
- Executable Stages to Site Closeout.

1.2.1 Evaluate Site Information and Data. The PM should rely on individual technical personnel to evaluate the quality, reliability, and usability of existing site information and data. Their evaluation should result in the development of a preliminary conceptual site model and the identification of potential points of compliance.

1.2.1.1 Review Site Information and Data.
Individual team members should be tasked to review all of the existing site information and data for the site. Of particular interest during this review should be the site's physical characteristics; the physical and chemical characteristics of the potential contaminants of interest; and the likely transport pathways. As these select team members begin their review efforts, the PM should clearly communicate the allotted time for conducting this preliminary review of the existing information and data. More exhaustive review and use of the data will begin during Phase II of the TPP process as technical personnel begin to determine the additional data needed at a site. These review efforts should only be preliminary and must be focused to help the team identify the site approach and the current project as described within Phase I of the TPP process.

1.2.1.1.1 Site Physical Characteristics.
Those responsible for preliminary data review will need to become familiar with the physical characteristics of the site (e.g., topographic relief, geologic and hydrogeologic features) and evaluate possible access limitations; proximity of source areas to the ground surface, groundwater, and surface water features; and proximity of a site's source area(s) to other known or potential source areas. Their visual conceptualization may involve site visits and review of site information (e.g., topographic maps, geologic cross-sections, well installation logs, soil boring logs, soil classification data, water quality information, and previous site sampling reports). As their understanding of a site's physical characteristics improve, they may also draft or sketch some initial figures approximating site features.

1.2.1.1.2 Physical and Chemical Characteristics of Contaminants of Interest.
A preliminary data review should consider the physical and chemical characteristics of contaminants of interest. Knowledge of the chemical characteristics will provide insight into their behavior in the environment and their affinity to, or solubility in, media at the site. Information such as solubility, retardation constants, Henry's Law constants, vapor pressure, and molecular weight can be used in conjunction with an understanding of the site's physical features to understand behavior of chemicals (e.g., transport, degradation, persistence) in site media. Variation in detected contamination concentrations should also be noted to preclude invalid assumptions about site contaminant homogeneity.

1.2.1.1.3 Transport Pathways.
Known and suspected source areas should be evaluated, using site characteristics, sampling data from previous studies, and chemical and physical characteristics, to predict possible contaminant transport within various media and the migration of chemicals in the environment. Typical transport pathways could include volatile organic chemical emissions, soil erosion, storm water runoff, sediment deposition, leaching into groundwater and groundwater recharge into surface water. At this point in the TPP process, review personnel may even begin to identify contaminant transport models which might be appropriate for evaluating transport features at a site.

1.2.1.2 Identify Preliminary Conceptual Site Model.

The preliminary review efforts must be sufficient for technical personnel to identify a preliminary conceptual site model (CSM) for a site. A CSM is a written or pictorial representation of the environmental system at a site and the biological, physical, and chemical processes that affect contaminant transport. EPA's Risk Assessment Guidance for Superfund (for human and ecological risk) and the American Society of Testing Materials standard guide for developing a CSM would be useful resources during this TPP activity.[4, 5, 6]

A preliminary CSM would typically be used by a team as a simple model of the relationships between chemicals detected at a site and potential exposure pathways to site receptors. In order for an exposure pathway to be complete, these four elements must be present:

- A source and mechanism of release;
- A retention or transport medium;
- A point of potential contact with the contaminated medium; and
- An exposure route (e.g., ingestion) at the contact point with a receptor.

The review personnel should quickly draw a preliminary CSM for each site. Depending upon the current site setting, it may be appropriate to prepare preliminary CSMs for both human and ecological receptors at a site. In general, the technical personnel who support the risk data user perspective are most experienced with preparing a site's CSM. Once drafted, even a preliminary CSM will help the entire team begin to visually organize all potential current and future exposure pathways at a site, and to identify whether or not they are complete. It should be evident that each distinct source area, exposure route, and receptor relationship will form a separate exposure pathway. A typical site will have numerous exposure pathways that will require further evaluation by the team.

As the team works to identify the site approach and current project, the technical personnel should evaluate what is known about potentially complete and incomplete exposure pathways at a site. If any of the four elements are missing, the pathway is not complete and likely needs no further evaluation. Those exposure pathways known, or suspected, to be complete need to be represented for the team to efficiently proceed with Phase I of the TPP activities.

A preliminary CSM could also be developed for the purposes of evaluating site compliance conditions, planning a removal or remedial action, or evaluating potential contributions to a site by other potentially responsible parties.

1.2.1.3 Identify Potential Points of Compliance.

Having prepared a preliminary CSM for a site, an attempt should be made to identify potential points of regulatory compliance at the site. With assistance from those technical personnel responsible for the compliance data user perspective, the preliminary CSM could be annotated with symbols to represent known or potential points of compliance. Knowledge of at least some potential points of compliance at a site will help the team remain focused throughout the balance of Phase I activities.

1.2.1.4 Designate Media of Potential Concern.

Another result of having prepared a preliminary CSM is that media of potential concern should be very apparent. Those site media directly affected by site contaminants, as well as the transport media and any exposure media, should each be designated as media of potential concern at a site. Knowledge of at least some

of the potential media of concern at a site will help the team remain focused throughout the balance of Phase I activities.

1.2.2 Identify and Document Project Objectives.

Project objectives are the short- and long-term site issues to be addressed and resolved at a site. Satisfying or resolving the project objectives, based on the underlying regulations or site decisions, are the purpose of all site activities. Project objectives must be documented to focus the team's thinking toward a specific set of concerns that can be addressed through the planning and completion of an executable stage(s) at a site. Although identifying and documenting the project objectives for a site can be relatively straightforward since most project objectives are a consequence of the governing statutes and applicable regulations, customer and regulator concurrence on the project objectives is critical. (Appendix F provides a worksheet for documenting and managing project objectives during the TPP process.)

Effective planning can only be accomplished when the regulatory requirements are known and understood by the team. Regulatory requirements serve to establish a framework for site activities. Any legally binding agreements (e.g., Federal Facility Agreements, Interagency Agreements, site orders, permits); applicable or relevant and appropriate requirements; and mandatory schedule compliance dates should be identified and reviewed to establish the direction of proposed site activities. Within the context of the TPP process, the legal and regulatory requirements applicable to a site should be clearly identified as project objectives. Project objectives identified by the team should include only the specific and detailed objectives that must be satisfied in order to progress toward and ultimately reach site closeout.

A TPP team may identify and document as many as 15 basic project objectives associated with the current executable stage of site activities and several optimum project objectives associated with future executable stages. Optimum project objectives will typically be more general than the specific details documented within basic project objectives for a site.

1.2.2.1 Primary Regulatory Processes.

The primary legal processes for most site activities are the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, commonly referred to as Superfund), as amended by the Superfund Amendments and Reauthorization Act, and RCRA.[7] Although CERCLA and RCRA contain similarities, data and documentation requirements are different. It is imperative that the team understand which of these laws, or which other laws (i.e., Underground Storage Tank, Toxic Substances Control Act, or State RCRA), will govern site activities to ensure that appropriate requirements are considered.

The procedural requirements of the main governing laws are the promulgated regulations in the Code of Federal Regulations (CFR).[8] Just a few specific examples of the detailed project objectives imposed by some portions of CERCLA include the following:

- *…eliminate from further consideration those releases that pose no significant threat to public health or the environment*, 40 CFR 300.420(c)(I);
- *Determine the general characteristics of the waste, including quantities, state, concentration, toxicity, propensity to bioaccumulate, persistence, and mobility*, 40 CFR 300.430(d)(2)(iii);
- *Determine applicable or relevant and appropriate requirements*, 40 CFR 300.400(g); and

- Evaluate the *degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site*,
  40 CFR 300.430(e)(9)(iii)(D).

Some states also have primacy over (i.e., can implement and enforce) certain federal requirements, such as hazardous waste management under RCRA. In those instances when state programs have more stringent requirements than the federal program, state-specific project objectives should be defined and documented to ensure the appropriate regulations are satisfied. Legal counsel personnel should also be consulted to determine the extent of state authority.

In those instances when a state has implementation and enforcement authority for the site's regulatory program(s), the team will need to determine the standards, criteria, and guidance that are required by the applicable state program. In these situations, the team should define and document the project objectives to ensure the state's requirements are satisfied for the applicable program.

1.2.2.2 Secondary Regulatory Programs. Secondary regulatory requirements include federal, state, or local regulations, and performance criteria or standards to be met during the current or future executable stages. Secondary requirements can dictate that data be collected to perform engineering, scientific, or legal evaluations.

Project objectives associated with secondary regulatory programs are also found in the CFR or other regulatory statutes.[8] A few examples of specific project objectives that are detailed in various secondary regulatory statutes include:

- Clean Air Act
  Determine the specific requirements for handling asbestos during demolition of structures containing asbestos,
  40 CFR 61.145(a);
- Clean Water Act
  Determine required effluent standards for polychlorinated biphenyls for site remedial action waste water,
  40 CFR 129.105; and
- Safe Drinking Water Act
  Determine maximum contaminant levels for inorganic contaminants in groundwater,
  40 CFR 141.11.

As with primary regulatory programs, states may have primacy over secondary federal regulatory programs. Therefore, the team needs to be aware of the potential for additional project objectives beyond federal requirements.

1.2.2.3 Other Project Objectives. Project objectives beyond the primary regulatory process and secondary regulatory programs must also be identified and documented to ensure that all issues and requirements are addressed for a project.

> If the TPP process is initiated during the execution of an ongoing project, it is essential for the team to identify and document project-specific objectives to focus subsequent project activities.

If a customer wants site activities that supplement those associated with the administrative requirements of the primary regulatory processes or secondary regulatory programs, the PM and technical personnel should manage the customer needs by designating specific project objectives for the supplemental activities.

Some data user perspectives may also determine that specific project objectives are needed for some aspects of the work. For example:

- Ecological and human health risk assessments, not adequately addressed by current regulatory programs or guidance, may necessitate that additional project objectives be identified and documented;
- Remedy-specific project objectives may be appropriate and useful for evaluating the suitability of natural attenuation at a site due to the site-specific parameters that would need to be investigated and considered in the design;
- Industry-wide initiatives to identify, collect, and evaluate cost and performance data related to the construction, operation, maintenance, and monitoring of a remedial technology; and
- The responsibility perspective at a site can involve legal counsel efforts to develop a customer's position and litigate apportionment with other potentially responsible parties at a site.[9, 10] These legal counsel considerations may result in unique project objectives for each element of responsibility determination. For example, position development for a customer may require a detailed search of ownership records or waste disposal data associated with another entity.

1.2.3 Identify Regulator and Stakeholder Perspectives.

The customer, with support of the PM and the technical or legal personnel in some cases, needs to solicit and monitor the perspectives of both the regulators and stakeholders during the TPP process to ensure their needs and concerns are understood. Both the site approach and current project should consider regulator and stakeholder perspectives that exist at a site.

1.2.3.1 Determine Regulator Perspectives.

After determining the primary regulatory process, applicable secondary regulatory requirements, and all related project objectives, the perspectives of the regulators should be obtained regarding these decisions and the related project objectives. Regulators, as possible decision makers who affect progress to site closeout, must be consulted to gain their participation in the TPP process and team and to understand and consider their expectations relative to a site. Efforts to determine regulator perspectives should not be taken lightly or overlooked. Well planned and timely meetings with the regulators early in the TPP process will contribute to the success of the planned project and the efficiency of progress to site closeout.

1.2.3.2 Determine Community Interests.

Determine the status of any current or former community interest associated with the site.[9] Community interest input can contribute to project success and efficient progress to site closeout.

1.2.4 Define Probable Remedies.

If a site is still in an investigation stage, probable remedies should be defined so the overall site approach is consistent with the most likely remedial alternative should remedial actions be necessary. The team will want to consider all remedies potentially appropriate for a site. Whenever possible, the team should consider specific remediation technologies (e.g., soil vapor extraction, landfill cover) that may be applicable to a site if remediation is necessary. However, in some instances, the team will only be able to consider a general type or category of remedial technologies (e.g., containment, collection and removal, soil treatment) when available site information and environmental data is limited.

If the customer's goal is no further action, then probable remedies likely need not be identified. In this situation, the team should document that the remedy data user perspective is not participating because of the customer's vision of site closeout.

When defining probable remedies for a site, the team should consider both presumptive remedies and innovative technologies that may be suitable for site conditions.

1.2.4.1 Presumptive Remedies.

Presumptive remedies are preferred technologies for common categories of sites, based on remedy selection and implementation experience. The team will find that a suitable presumptive remedy can do the following:

- Accelerate the planning process;
- Provide consistency in remedy selection;
- Reduce the remediation schedule and expenditures; and
- Achieve earlier site closeout.

Note that the team's consideration of a presumptive remedy should not preclude their consideration of an innovative technology, should an innovative technology prove to be as effective or superior to a presumptive remedy.

1.2.4.2 Innovative Technologies.

As stated in Section 300.430(a)(1)(iii)(E) of the National Contingency Plan, *USEPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.* Therefore, it is important that utilization of innovative technologies be considered for both site characterization and remediation during TPP efforts. Numerous sources of innovative technology are available and a team should seek input from several technical sources regarding application experience with specific innovative technologies that may be viable for a site.

1.2.5 Identify Executable Stages to Site Closeout.

All possible executable stages to site closeout should be identified by the team. The scope of an executable stage can be thought of as the site activities scheduled to occur between milestones along the critical path timeline of site activities. Executable stages should be designated from the unfulfilled administrative requirements of the applicable primary regulatory process (e.g., CERCLA, RCRA) and secondary regulatory programs (e.g., Clean Water Act, Clean Air Act). Agreements, permits, and orders should also be reviewed as they may include requirements for particular work items or data compilations, as well as consultation and schedule obligations. The team must also identify the project objectives that correspond to each executable stage through site closeout.

> Once project objectives have been identified, technical personnel should evaluate and determine if the site is already eligible for closeout. If enough data of an acceptable quality already exist to satisfy all project objectives to site closeout, then the PM and technical personnel should assist the customer in petitioning the regulators for site closeout and delisting, as appropriate.

Depending on the size and complexity of the site, several executable stages may be necessary and appropriate to proceed from the current site status and condition to site closeout. Only after all executable stages for a site have been

identified can the team identify the current project for completing the first executable stage of site activities.

> Even if a customer only requests services for a single executable stage, it is appropriate to identify all executable stages and corresponding project objectives through site closeout. With knowledge of at least some future project objectives, the team may be able to offer the customer some significant cost savings by meeting data needs of subsequent executable stages when their collection can be cost effective and a good business decision for the customer.

1.3 IDENTIFY CURRENT PROJECT.

After developing the overall approach for managing a site from its current condition to the desired site closeout condition, a team can work to identify the current project for a site. By identifying the current project, a team can formulate a detailed strategy for completing the current executable stage of site activities. Identification of a current project will also focus team efforts during TPP Phases II, III, and IV.

Due to the inherent complexity of identifying the current project, the PM and technical personnel must obtain input from the customer, regulators, and other stakeholders as appropriate. The PM should consider leading some working team meetings as a means of promoting concurrence among the decision makers.

1.3.1 Recognize Site Constraints and Dependencies.

Existing site information should be reviewed in the context of the overall site approach to identify site constraints and dependencies that may affect project planning and execution. Team members involved in identifying the site approach should contribute to recognizing constraints and dependencies and their potential effects on the anticipated site activities. In particular, problems or constraints discovered during preceding work at the site should be identified. These efforts should at least include consideration of administrative, technical, legal and regulatory issues.

1.3.1.1 Administrative Constraints and Dependencies.

The PM should identify any constraints or dependencies associated with differences between the anticipated level and duration of efforts required to satisfy the project objectives and the availability of various technical personnel on the team.

The PM should also identify any funding constraints that may affect project execution. The team should be informed when funding for site activities is available and what levels are programmed for the next several years. Project execution options should be developed in line with funding obligations and within all funding limitations.

The team should consider whether site investigations or subsequent remedial actions will require access agreements, real estate easements, or acquisition of property. In instances where offsite contamination is known or suspected, the team will want to carefully research real estate acquisition needs. The team should recognize that site constraints and dependencies may be associated with the legal documents used for real estate access agreements, temporary easements, and property acquisition. For example, specific-use purposes established within a temporary permit should be recognized as site constraints and dependencies during TPP efforts.

In those instances when other potentially responsible parties may be involved, the PM should specifically request that legal counsel personnel identify which work may be performed at a site. Legal counsel should also direct the team through any legal determinations of liability, defenses, and allocation requirements.

1.3.1.2 Technical Constraints and Dependencies.
Each member of the team should consider technical aspects of site activities that could affect project execution. Unanticipated technical constraints and dependencies may result in ineffective data collection programs, misrepresentation of site conditions, and actions that are unsuccessful or even unnecessary.

The team should be proactive in its efforts to identify any occupational health and safety issues or concerns that present constraint or dependency relationships related to a site.[11] For example, site investigation and remediation activities will require both medical monitoring and health and safety planning prior to all site activities. Occupational health and safety standards must also be addressed in design of site remediation systems to ensure worker safety during both construction and operation and maintenance activities at a site.

> Involve occupational health and safety personnel to assure that any related technical constraints are identified and to properly develop and implement site safety and health plans for site activities.[11]

Examples of other technical considerations that may enable the team to identify site constraints or dependencies include the following.

- Physical considerations would include geographic location; site geology and topography; regional climatology; locations of buildings, structures, pavements, underground or overhead utilities, and streams or ponds; slope stability within a trench or excavation; site access or security restrictions; on-going site activities; and neighboring property uses.
- Temporal considerations may present several climate-related constraints at a site that experiences significant seasonal variations in weather conditions. For example, extensive surface water sampling would be difficult if typical winter weather results in frozen streams or ponds; or biota sampling during a habitat-stressed low flow condition would not be representative of typical site conditions.
- Constraints related to spatial considerations range from issues such as deep groundwater sampling cannot be performed until a deep well is installed, to identifying the presence and location of unexploded ordnance prior to intrusive site activities within areas known to have unexploded ordnance.
- Chemical considerations would include the presence of radioactivity; presence or history of chemical agent testing or disposal; presence of volatile organic chemicals; known or suspected accumulation of methane in a landfill; and oxygen deficiency or hydrogen cyanide accumulation in sanitary and storm sewers.
- Field sampling considerations would include efforts to prevent cross-contamination or the creation of a new contaminant transport pathway; compliance with height or lighting restrictions within flightline areas; sampling effectiveness limited by depth or subsurface geology; vehicle access needs when using some direct push techniques; installation of temporary electrical service to support a

mobile laboratory; and the need to earn regulator agreement for using appropriate field screening and field analytical methods.

- Analytical considerations might include the potential for matrix interferences; sample shipment measures required to meet holding times; laboratory services needed to perform the desired analytical protocols; and the data validation procedures to be employed.

> Timely and proper management of investigation derived wastes must be a constraint and dependency consideration on every site that involves intrusive sampling or remediation activities.

1.3.1.3 Legal and Regulatory Milestones and Requirements.

Legal counsel and a regulatory specialist, either on the team as compliance data users, or supporting the team, should identify site constraints and dependencies related to legal and regulatory milestones and requirements. The most significant regulatory constraints and dependencies will typically involve the primary regulatory process for a site; the applicable or relevant and appropriate requirements; and any agreement, permit, orders, or record of a notice of violation. Schedules and compliance dates established within RCRA permits, Federal Facility Agreements, and other types of compliance agreements; as well as state-specific regulations and guidance; must also be considered when identifying a site's regulatory milestones and requirements. The team must be sure to review any agreements, permits, or orders as they may include requirements for particular work items or technical evaluations, as well as consultation and schedule obligations.

1.3.2 Define Courses of Action for Achieving Site Closeout.

At this step in the TPP process, the TPP team may find a brainstorming meeting very useful for defining options for achieving site closeout. Although the discussions that follow provide examples of typical project execution options, it is important to recognize that several options to achieve site closeout may be combined into a single executable stage. For example, it may be beneficial to simultaneously start investigation and remediation activities at a site. In these instances, two options for achieving site closeout (i.e., investigation and removal action activities) are combined into a single executable stage of site activities. Efforts to define project execution options should consider at least these following typical project execution options.

1.3.2.1 Operable Units/Exposure Areas.

Designation of operable units or exposure areas at a site can be very useful for managing a complex site. Operable units are typically associated with suspected source areas or affected media at a site. Exposure areas are typically areas at or adjacent to a site that include a related group of exposure pathways, involve a common receptor, and can be easily identified on the preliminary CSM. The team's designation of operable units or exposure areas will typically promote more focused site activities and accelerate progress to site closeout for both the operable units or exposure areas and an entire site.

1.3.2.2 Expedited Removal.

Given that significant volumes of data now exist at many sites, expedited removal is another execution option that warrants serious consideration. Removal actions (time critical or non-time critical) and interim remedial actions, or interim corrective measures, can be taken anytime during the CERCLA or RCRA process.

Removal activities include source reduction or removal; access control (e.g., capping, fencing); provision for an alternative water supply; or even temporary relocation of residents. Regulator participation in both considering and planning removal actions, interim remedial actions, and interim corrective actions is critical during TPP efforts.

> A well designed removal action or interim remedial action can end up being the final remedial action at a site if all legal requirements are satisfied and the work is adequately protective.

1.3.2.3 Phasing (Series or Parallel).
A common project execution option to be considered by the team is phasing site activities concurrently or consecutively. Each stage of project execution, whether planned in series or parallel, corresponds to several specific project objectives selected for each executable stage. Multiple phases can also be combined or conducted in parallel if the team believes that it can satisfy the project objectives of multiple project phases during a single executable stage. Parallel phasing of project activities involves planning for concurrent activities at a site. For example, a team may consider a removal action concurrent with remedial investigation sampling.

1.3.2.4 Field Screening and Field Analytical Methods.
Field screening and field analytical methods can be a useful tool to characterize site contaminants while reducing analytical costs. The team could plan to conduct some field screening activities concurrent with TPP efforts during Phases I, II, or III to refine their understanding of a site prior to design of a data collection program for the current executable stage of site activities.

1.3.2.5 Expedited Site Characterization.
Expedited site characterization (ESC) is an execution option that also merits consideration during the TPP process. Use of an ESC approach utilizes in-field decision making, dynamic work plans, and real-time data acquisition and interpretation.[12] ESC expects a multi-disciplinary team to plan a data collection program and then the same key personnel implement the program in the field.

Dynamic work plans used by the team in the field offer some decision logic in advance of field activities, including sampling that is directly contingent on the findings of earlier sampling. Dynamic work plans empower the team to decide on-site to modify field efforts as site conditions are better understood during data collection efforts. Dynamic work plans can only be successful if the entire team agrees with the plans and the plans include when and how communications will occur between field personnel and the customer, regulators, and stakeholders, as appropriate.

ESC approaches can be effectively used at both small and large sites; involve any media of interest at a site; and for all types of investigations, removal actions, and remedial actions that. For example, an ESC approach involving a site with potentially contaminated groundwater would first typically focus on the hydrogeologic portion of a site's conceptual site model. A second phase of ESC field work then focus on the chemical contaminant portion of the conceptual site model.

> Although ESC has several similarities to the TPP process, the entire TPP process should be used to develop a data collection program that uses ESC approaches where appropriate.

1.3.3 Document Current Executable Stage. Within the TPP process, the current project that the team focuses on consists of at least the first executable stage of site activities and the corresponding project objectives. In order to select project objectives for the current project, each project objective must first be correlated with an executable stage of planned site activities (see Project Objectives Worksheet provided in Appendix F). Project objectives should be listed in chronological order and then grouped in relation to desired executable stages of site activities. The team should designate project objectives for each executable stage by grouping them so that they can be achieved within site constraints and dependencies. By grouping project objectives relative to executable stages of site activities, the team will understand the sequence and timing of project objectives to be satisfied through site closeout.

Once the team has selected project objectives for the first executable stage, they have completed identification of the current project and can document the current executable stage by listing the corresponding project objectives as the "basic" project objectives. The team should document the current executable stage by renumbering all project objectives to represent the planned sequence as well as clearly differentiate between those project objectives associated with current and future executable stages at the site. The project objectives associated with future executable stages are classified as the "optimum" project objectives. Project objectives that do not lead to site closeout are classified as "excessive," unless clarified and then adequately related to either the current or future executable stages.

In all instances, obtaining the customer's and regulators' concurrence on all project objectives is critical before proceeding with TPP activities.

Efforts to document the current executable stage of site activities may be iterative. As a team works to sequence and group the project objectives, it may need to further refine the project objectives and possibly identify additional project-specific objectives to ensure that all issues are addressed during the project.

> The current executable stage of site activities may involve satisfying as many as 15 project objectives. Future executable stages will typically involve satisfying optimum project objectives that are more general than those documented as basic project objectives for a site.

1.4 COMPLETE PHASE I ACTIVITIES.

1.4.1 Finalize Acquisition Strategy. A step in completing Phase I is finalizing the acquisition strategy(ies) that will be implemented to obtain the technical personnel needed to perform the balance of the TPP activities. Although the acquisition strategy must be finalized to proceed with the TPP process, the acquisition strategy should also be reviewed, refined, and modified as appropriate during the life of the project.

The PM should update the acquisition strategy identifying the most suitable contracting option for performing the TPP activities based on the scope; schedule; manpower constraints; availability and accessibility of in-house or contractor resources during subsequent project activities at a site; and other technical considerations related to the site. At this step in the TPP process, the PM should be able to confirm that the acquisition strategy(ies) is appropriate or revise it as necessary.

Note that the PM should also refer to other guidance for specific information regarding the procedures for developing, implementing, and revising the acquisition strategy(ies).

1.4.2 Initiate Scope of Work Sections.
The PM should rely on support from technical personnel to initiate introductory-type scope of work (SOW) sections, or work plan components, as appropriate. In general, PMs should consult applicable SOW guidance and rely on input from technical personnel. Typical SOW sections to initiate during completion of Phase I TPP activities include:

- Site Background (e.g., site location and history; previous studies and results; regulatory history and authorities);
- Project Planning Overview and Objectives (e.g., site approach, current project description, project objectives for the current executable stage); and
- Project Management (e.g., schedules, submittals).

1.4.3 Prepare Phase I Memorandum for Record.
At this step in the TPP process, a Phase I memorandum for record (MFR) should be prepared to document the team's findings and decisions during Phase I (see Appendix F for a Phase I MFR worksheet). The PM and technical personnel should reference portions of the previously prepared team information package, preliminary conceptual site model, and listed project objectives as components of the MFR. The MFR should clearly document the current project and associated project objectives within the context of the overall site approach for the current executable stage of site activities. The MFR should clearly indicate the customer's goals (i.e., concept of site closeout, schedule requirements, and site budget), as well as site constraints and dependencies.

In accordance with the applicable quality management plan, the PM should have independent technical or management personnel review the Phase I MFR to ensure it is effective and complete.

The PM should distribute a MFR to all team members after completing Phase I activities. A well developed MFR can be used to document project planning objectives and focus the team's efforts throughout TPP Phases II, III, and IV. The Phase I MFR should be a stand-alone document attached to the site-related Project Management Plan. A complete Phase I MFR can help to ensure that institutional site knowledge is transferred to new people involved with a site.

Chapter 2
Determine Data Needs (Phase II)

Phase II (see Figure 2-1) of the Technical Project Planning (TPP) process is designed to ensure that all data needed to satisfy a site's project objectives are identified. This chapter offers guidance to data users for the detailed level of planning required to determine and document data needed for the current project, and subsequent executable stages. Data users will find guidance in this chapter to help them document their data quality requirements for the intended use(s) of each data need.

Data users must also continue to use their experience, input from others, findings within lessons learned systems, and other technical resources to determine data needs for each site.

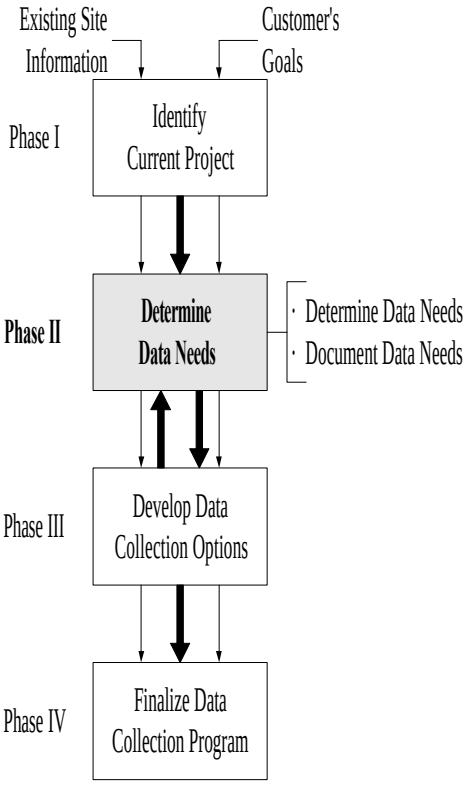

Figure 2-1
Phase II of Four-Phase TPP Process

Data needs determined should include:

- Environmental data needed **from** a site (obtained on-site or by laboratory analysis of a sample from the site); and
- Site information data needed **about** the site (e.g., "as-built" drawings; weather information; water and electrical supply sources; utility conflicts; site access limitations).

2.1 DETERMINE DATA NEEDS.

Determining data needs is an iterative thought process. As presented in this manual, many technical personnel must collaborate to define what is required to satisfy the project objectives.

2.1.1 Review Phase I Memorandum for Record (MFR).

The PM should distribute the Phase I MFR and any project objective worksheets to technical personnel involved in Phase II. Data users' efforts to determine data needs should begin with their review of the Phase I MFR. Review of Phase I information is particularly critical for those personnel not involved in Phase I efforts and for the entire team when some time has passed since Phase I efforts were completed.

2.1.2 Establish Data User's Roles.

Project objectives identified during Phase I should be reviewed to ensure technical personnel understand each project objective. Technical personnel must also be aware of both the "basic" project objectives associated with the current project and those "optimum" project objectives associated with future executable stages. Efforts to establish data user's roles will help focus all technical personnel on their responsibilities and what is required to satisfy the site's project objectives.

In most cases, the project manager (PM) should meet with the data users to discuss the preliminary conceptual site model and provide leadership as they discuss what is required to satisfy each project objective. While convened, the TPP team should confirm that they share a common understanding of the preliminary conceptual site model and which data users have a role in determining the data needed to satisfy each project objective.

The PM should also reinforce the premise that data users must work to identify "basic" data needs of the current project; "optimum" data needs that are cost-effective and prudent to fulfill during the current project for a future executable phase; and any "excessive" data needs specifically requested by someone besides the data users, but not needed by the data users.

"Excessive" type data needs should not be created, but identified as a result of data users realizing that some data needs, imposed or mandated by others, are not required to satisfy the basic and optimum project objectives. In some cases, data users will learn that the intended use of the mandated data is actually appropriate, but simply lacked a sufficiently documented project objective. In other cases, data users may realize that the "excessive" data needs imposed by others represent differences in professional opinion or technical judgment as to what data is needed to satisfy a project objective.

> Application of the data user perspectives of risk, compliance, remedy, and responsibility will ensure planning is sufficiently detailed to identify the range of data typically required for satisfying project objectives and progressing to site closeout.

2.1.2.1 Risk Data User Perspective.

Risk data users evaluate human health and ecological risks at a site. Technical personnel who collaborate to determine risk-related data needs typically have the following roles at a site:

- Evaluate potential risk-based screening levels to ensure appropriate quantitation limits are established for environmental analyses;
- Perform preliminary determination of hazard or risk to support the decision as to whether further action is warranted;
- Prepare a baseline risk assessment or quantitative evaluation of risk to support a determination of the degree of risk and whether remediation is required;
- Develop remedial action objectives and cleanup levels, as well as detailed analyses of risk reduction provided by remedial alternatives;
- Evaluate suitability of site controls for mitigating short-term risks associated with remediation;
- Verify safety of working conditions for personnel during treatment system construction and operation and maintenance efforts; and
- Evaluate monitoring data to determine the site no longer poses risk and long-term site monitoring can be discontinued.

2.1.2.2 Compliance Data User Perspective.

Compliance data users evaluate and monitor satisfaction of legal and regulatory requirements at a site. Personnel who collaborate to determine legal or regulatory-related data needs typically have the following roles at a site:

- Determine a site's regulatory compliance with each applicable or relevant and appropriate requirement (ARAR) and later compliance with ARARs;

- Properly manage remediation and investigation derived wastes;
- Contribute to development of remedial action objectives, as well as evaluate remedial alternatives for compliance with each ARAR;
- Verify that implementation of remedial action systems will be compliant with each ARAR;
- Complete procedural requirements under the law governing the response actions (usually CERCLA or RCRA);
- Adhere to the obligations of any agreements, permits, or orders controlling the response actions;
- Determine whether certain comments, requests, or demands from non-federal entities (including regulators), require adherence;
- Predict legal or regulatory issues that will drive response and other regulatory actions; and
- Comply with specific sampling requirements of federal and state programs.

Contaminant fate and transport data needs vary by data user perspective. Therefore, the TPP process encourages each data user perspective to determine their specific fate and transport data needs.

2.1.2.3 Remedy Data User Perspective.

Remedy data users identify possible alternatives for response actions and design all response action components. The role of the remedy data users involves evaluating the feasibility, implementability, or effectiveness of remedies at a site. Remedy data users must also consider potential process interferences and the secondary technologies required to successfully implement a remedial technology at a site. Technical personnel who collaborate to determine remedy-related data needs typically have the following roles at a site:

- Perform preliminary determination of chemical and physical characteristics of the wastes to begin to determine potential site remedies;
- Identify and screen technologies potentially suitable for mitigating site risks to acceptable levels, as well as perform the detailed analysis necessary to support remedy selection;
- Prepare engineering design and construction plans for response actions, including alternative analysis;
- Optimize operation and maintenance activities and long-term monitoring; and
- Gather cost and performance data needed for life-cycle assessments, evaluation of the technology on similar sites, and incorporation of lessons learned and improvements on future designs.

2.1.2.4 Responsibility Data User Perspective.

Responsibility data users attempt to define what federal or non-federal entity has responsibility for the site's conditions in the event that any response actions are required. Responsibility-related data needs are typically related to determining federal liability at a site, developing a legally defensible position, creating a cost allocation strategy, defining settlement terms with other potentially responsible parties, or presenting or defending in legal proceedings related to responsibility. Some responsibility perspective data needs have elements in common with other data user perspectives (e.g., site history and characterization), and many responsibility perspective determinations are dependent on conclusions of the investigation and design process at a site (e.g., baseline risk

assessment will establish need for response and affect the need for a responsibility determination). Several elements of a responsibility evaluation (e.g., liability determinations, cost allocations) are unique to the responsibility perspective.

2.1.3 Evaluate Use of Existing Data.

Before defining new data needs for a project, data users and data implementors should evaluate the usability of existing data to determine whether additional data are required. Experience has shown that some, if not most, existing data may be suitable for qualitative and for quantitative uses. Detailed usability reviews can determine existing data quality and potential need(s) for additional data to satisfy the project objectives.

The question of whether and how existing data can be used (e.g., in a risk assessment calculation or to support a clean closure) will require specific evaluations of their usability for each intended use. Technical personnel must remember that some existing data may be of an unacceptable quality for one use, but yet of an acceptable quality for another unrelated use at the site.

> Review of existing data is a fundamental and critical TPP activity that must occur prior to determining the additional data needed at a site. However, prior to eliminating any data needs from further consideration, the team should be sure that the data user(s) concur that existing data is usable for the intended use(s).

2.1.4 Define Data Needs.

During this TPP activity, technical personnel representing each data user perspective define the data needed to satisfy the project objectives.

> Efforts to define data needs must focus on establishing data need requirements for each media type, including sampling areas and depths; chemical concentrations of interest; and the number of samples necessary to satisfy the project objectives.

To identify and organize the data needed, technical personnel should take every advantage of tools such as the preliminary conceptual site model; decision trees or flowcharts; and process diagrams. These tools can provide a logical basis and offer technical personnel a visual prompt for reviewing available site information and defining additional data needs. Other potential tools include data need checklists provided in other technical references. However, data need checklists should not be used as standard lists of data to collect, but as checklists to prompt data users to identify the site-specific data needed to satisfy project objectives at a site. While defining data needs, data users should:

- Consider the consequences of unacceptable decisions or decision errors throughout completion of the work at the site;
- Consider how much data is required;
- Consider data collection approaches, including expedited site characterization and field screening approaches;
- Consider the cost of additional data collection in dollars and time; and then
- Decide how data needs can be balanced within project cost and schedule constraints.

2.1.4.1 Probabilistic/Non-Probabilistic Decisions.

As data users define data needs and the number of samples required, they must recognize that both probabilistic and non-probabilistic data needs should be identified, as appropriate based on intended data uses and the project objectives.

When a data user defines a probabilistic-type data need during this TPP activity, the data user should use Steps 5 and 6 of the U.S. Environmental Protection Agency's (EPA's) 7-Step Data Quality Objective (DQO) Process to determine the number of samples required for the intended data use.[1] (Appendix E presents a detailed "crosswalk" to EPA's 7-Step DQO Process from the TPP process.)

> Although powerful, obtaining concurrence among decision makers regarding probabilistic decisions can be difficult. Application of probabilistic methods can only be accomplished when these three conditions exist:
> (1) A precise study question is defined;
> (2) The customer and lead regulator are willing to and successful in establishing tolerable limits on decision errors; and
> (3) The support of a qualified environmental statistician is available to work on the project.

When probabilistic methods are either inappropriate or cannot be employed for a data need because the three conditions do not exist, data collection planning can be judgmentally based on the expertise of the technical personnel representing the applicable data user perspective.

2.1.4.2 Number of Samples.

Each data user is responsible for identifying the number of samples, or decision logic, required for each data need based on the intended data use(s) and the project objectives.

When non-probabilistic or judgmental sampling is appropriate, the number of samples may be designated by guidance or technical literature specific to the data user perspective. In some cases, the number of samples needed to satisfy an objective (e.g., determining if a contaminant is present) may be based on experienced judgment of the technical personnel representing the data user perspectives for each specific site.

In some instances, data needs should be fulfilled using probabilistic or random sampling where the number of samples required to make the related site decision should be calculated. For example, project objectives that have specific data needs (e.g., determining if the contaminant levels detected are sufficiently different from the background levels of the constituent at the site) may provide a suitable opportunity to use a statistical basis to establish the number of samples to be collected. In any case, it is important that data users recognize that use of statistical techniques as the basis for designing environmental sampling plans can reduce the number of unnecessary samples taken in the field, and improve the sampling representativeness by quantifying the statistical uncertainty of the sampling design. Inappropriate application of statistics for probabilistic data needs can also result in either the collection of too many or too few samples.

When necessary, in accordance with recommendations within EPA's Guidance for Data Usability for Risk Assessment, risk assessment personnel should indicate the number of samples in terms of classical

statistics.[13] The remedy perspective, on the other hand, typically uses engineering judgment or other performance criteria as a means to designate the number of samples required to support a remedy-related data need.

Decisions to use classical statistics methods or geostatistical methods must also be based on the intended data use(s) and known or anticipated variability of the data in the environment. This is the case because randomly distributed variables or data are suited for classical statistics applications and spatially related or regionalized variables that have continuity from point to point present opportunities to use geostatistics.

2.1.4.2.1 Applications of Classical Statistics. Classical statistics tools (e.g., random, stratified random, or systematic random sampling designs) can be used to determine the number of samples required to support various probabilistic decisions. Classical statistics can be used to determine the number of samples required to define representative concentration values (e.g., background soil concentrations) or evaluate trends (e.g., waste pile sampling, chemical concentrations in soils) over an area of interest. Classical statistics are most appropriate for mean concentrations; however, other methods may be more appropriate or suitable for comparing populations or identifying "hot spots." Classical statistics methods can be used to determine the number of samples needed from each medium (or each stratum within a medium) to provide sufficient data to support project objectives.

2.1.4.2.2 Applications of Geostatistics. Geostatistics are a specific branch of statistics used to optimize the co-variance of a variable of interest and can involve classical (or simple) random, stratified random, or systematic random sampling designs. Geostatistical techniques are appropriate for environmental sampling programs intended to define or evaluate the distribution of contamination at a site or within an area of interest. Geostatistics are particularly useful for identifying "hot spots" and calculating the reasonable maximum exposure for risk assessments. It can also be used to produce probability estimates of a variable of interest based on recognized geostatistics methods (e.g., semivariogram analysis, cross-validation, and data kriging). Data users and data implementors should seriously consider the use of geostatistical methods since they can provide considerable support to the development of data collection programs and result in significant cost savings. Potential applications of geostatistics include:

- Contour mapping and interpolation;
- Identification of sample locations;
- Optimization of sampling existing monitoring devices;
- Risk assessment/probability estimation; and
- Remedial design.

2.1.4.3 Data Collection Considerations. While defining data needs, each data user should re-evaluate earlier considerations of using either field screening or expedited site characterization (ESC) approaches for collecting site data. As discussed in Paragraph 1.3.2.4, the team may chose to conduct some field screening activities concurrent with Phase I, II, or III TPP activities to refine their understanding of a site. Use of an ESC approach typically expects data users to first establish a site's physical setting before contaminant investigations are conducted as discussed in Paragraph 1.3.2.5.

When data users have identified appropriate opportunities to use field screening or ESC approaches, they should advise the PM and data implementors which data needs are candidates for using either approach. In those instances

where field screening or ESC approaches will be used, it will even be more critical for the data users to provide the decision logic information that can be incorporated into the corresponding dynamic work plan for the site. Data users will also need to provide a description or decision flowchart of the rationale that should be used for making field decisions contingent on the results of previous samples.

Data users must also recognize that data needs identified during this TPP activity should include both site information and environmental data. Appendix F provides a site information worksheet and several data need worksheets that are recommended for documenting the data needs of the data users.

When defining each data need, data users are responsible for communicating whether a data need is a "basic" data need that contributes to satisfying a current project objective, an "optimum" data need that would be cost-effective and prudent to fulfill during the current project, or an "excessive" data need specifically requested by someone other than the data users, and not needed by the data users. (Paragraph 3.2 further describes the data collection options of "basic," "optimum," and "excessive".)

2.1.4.4 Risk Data Needs.
Using the preliminary conceptual site model developed during Phase I, the risk data users should conceptualize and identify the data needed to address each of the pathways that will be part of the risk assessment for the site. In assessing risks to human and environmental receptors, one must be able to show a relationship between potentially exposed populations (for both current and future site use) and the chemicals detected onsite. This relationship is evident in the elements of a risk assessment (e.g., conceptual site models; data evaluation and chemical of potential concern identification; exposure assessment; toxicity assessment; and risk characterization).

Future land use pathways (if different from current pathways) will require data to support transport models suited for evaluating spatial and temporal behavior of the chemical(s) at the site over time. Therefore, the risk perspective must determine the most appropriate models to satisfy the project objectives since data requirements vary by model.

2.1.4.5 Compliance Data Needs.
Compliance data users should compare site conditions or activities with legal and regulatory requirements and standards to establish the governing laws and regulations and to determine what is required for site compliance. They must also compare possible site conditions or activities that are regulated (e.g., treatment, storage, and disposal) with applicable regulatory standards. Potentially applicable regulatory standards are defined by the primary regulatory program and may specify chemical analysis requirements and point(s) of compliance (location and type of samples) used to assess compliance. Compliance data user efforts to define compliance data needs should involve:

- Review of the project objectives identified from the primary governing statutes (e.g., CERCLA Sections 104, 120, 121; RCRA Sections 3004u and 3008h) and the applicable regulations;
- Identification of activities or conditions that give rise to certain standards, requirements, or criteria that must be satisfied (e.g., treatment, storage, and disposal; drinking water contamination; surface water discharge);
- Consideration of potentially affected media (i.e., air, surface water, sediment, soil, groundwater);

- Identification of chemical-, action-, and location-specific ARARs;
- Identification of point(s) of compliance (e.g., drinking water aquifer, effluent discharge, stack emissions);
- Compilation of documents, reports, data, correspondence, etc., that demonstrate satisfaction of procedural requirements arising from laws, regulations, agreements, permits, or orders; and
- Identification of community relations and public involvement activities for outreach to interested stakeholders.

Compliance data needs will be both qualitative and subjective (point of compliance), as well as quantitative (environmental data needs).

2.1.4.6 Remedy Data Needs.
Remedy data users define data needed to identify, screen, and analyze possible response action alternatives at a site. The efforts to define remedy data needs will depend on the phase of a site's progress to site closeout. Remedy data needs become more complex as the alternative evaluation process proceeds from technology identification to remedy selection and design, and finally operation and maintenance of treatment systems.

During the early stages of a site's progress to site closeout, technical personnel should begin to consider possible general technologies that may be applicable to the site (e.g., containment; excavation and disposal; in-situ treatment). Site information type data needs are typically sufficient to support these evaluations (e.g., contaminant characteristics, physical characteristics of the site, and physical features of the site). The next level of evaluation includes identification of common technologies (e.g., soil washing, incineration, capping) that relate to the general technology type(s) previously identified for a site. The remedy data needs for technology screening are typically environmental type data needs (e.g., soil moisture content, pneumatic permeability, and cation exchange capacity). Based on technology screening results, only a few alternatives for remedy selection and design are further considered. While constructing, operating, maintaining, and monitoring a remedy, ongoing efforts will be expended by the remedy data users to obtain cost and performance information for optimizing the treatment system and for similar systems in the future. The remedy data needs to support these later evaluations will be more complex and require both site information and environmental data (e.g., treatability studies, soil compaction, and available water sources).[14]

> Remedy design-type personnel should contribute to TPP efforts beginning with the earliest stages of site assessment and investigation. Remedy construction-type personnel should begin to contribute to TPP efforts when site remedy selection and design activities begin.

2.1.4.7 Responsibility Data Needs.
The technical and legal counsel personnel responsible for defining responsibility data needs will not only be concerned with determining the legal basis for a response action, but also with defining responsibility at a site. Responsibility data users must rely on legal counsel to identify the phase of execution and specific position and negotiation strategies that will affect the identification of responsibility data needs.

For example, one emphasis would be to obtain data for determining a site's eligibility under the Formerly Used Defense Site program and identifying the potential for another potentially

responsible party (PRP).[10] In this case, responsibility data would need to be collected toward the goal of settling with the other PRP. In another instance, responsibility data needs would involve collecting past disposal records for position development purposes that ultimately contribute to developing a cost allocation formula during negotiations with other PRPs.

Background and historical site information will make up much of the responsibility data needed to develop a negotiation position. This includes articles of incorporation; facility ownership records; contract documents; lease agreements; historic process and operations information; federal and industry information on standard practices related to the chemicals of concern; manifests; disposal logs; and aerial photos. The site characterization data can focus the historical research toward the use and disposal of specific chemicals at specific locations based on observed contamination. Historical information should guide site characterization work by narrowing the list of analyses and general sampling locations. These two investigations should be done in parallel to be successful.

2.2 DOCUMENT DATA NEEDS.

Personnel representing data user perspectives are responsible for communicating their data needs so the needs can be incorporated within data collection options developed during Phase III activities. Communicating or documenting data needs are critical TPP activities that lead to successful project execution. Documenting data needs, as discussed here, is the recommended means for technical personnel to communicate their data needs.

This manual offers several options for documenting data needs given the wide range of data needs and data uses. Appendix F offers a site information worksheet and a series of data need worksheets for documenting data needs of the risk, compliance, remedy, and responsibility data user perspectives. Use of standardized data need worksheets will allow quick and easy quality assurance/quality control review of the data need planning.

The critical aspects of documenting data needs can be reduced to the following.

- What data is needed (e.g., contaminant or characteristic of interest, and media)?
- Who needs the data (i.e., risk, compliance, remedy, or responsibility data user perspective)?
- What is the intended data use(s) (e.g., contaminant fate and transport; baseline risk assessment; remedial design; operation and maintenance plan) to satisfy project objectives?
- What number of samples are required to satisfy the intended use(s), including whether the number of samples is fixed, somehow contingent upon field screening results, or is the minimum anticipated by the dynamic decision logic approach defined by the data user?
- What is reference concentration of interest or other performance criteria (e.g., action level, compliance standard, decision level, design tolerance)?
- Where is area of interest or desired sampling location(s) and depth(s)?

> Site information worksheets and data need worksheets are comprehensive lists of the data needs at a site. Information presented on the worksheets identify additional data needed by each data user perspective to satisfy the project objectives.

2.3 COMPLETE PHASE II ACTIVITIES.

The technical personnel should review the data need worksheets to ensure that each project objective has been considered and related data need considerations have been made by each applicable data user perspective. In accordance with the applicable quality management plan, the PM should also have independent technical resources review the data need worksheets. (The data need worksheet examples provided in Appendix F may be useful during independent review efforts.) In any case, all projects will be periodically evaluated by the project team to ensure baseline requirements of scope, schedule, and cost are being met.[2]

If it appears that some project objectives have no associated data needs, the PM should meet with the technical personnel and confirm that no additional data is needed to support the particular project objectives. The PM or technical personnel should document in the project file why specific project objectives require no additional data. The PM should also meet with the technical personnel to understand any instances when no "optimum" data needs have been identified during Phase II activities.

The PM should review any site information worksheets or lists of site information data needs that have been identified by the data users. It is the PM's responsibility, working with the technical personnel, to decide how and when site information needs will be fulfilled (e.g., discussions with the customer, site visits, incorporated within appropriate scope of work or work plan sections).

The PM should then distribute copies of all data need worksheets and any attached illustrations to all appropriate TPP team members.

Chapter 3
Develop Data Collection Options (Phase III)

This chapter offers guidance to sampling and analysis data implementors for their detailed planning efforts. Phase III (see Figure 3-1) of the Technical Project Planning (TPP) process is designed for planning sampling and analysis approaches that will satisfy the data needs identified during Phase II. Data collection options are also developed during Phase III to ensure the customer has adequate information during Phase IV for business decisions related to a project's data collection program.

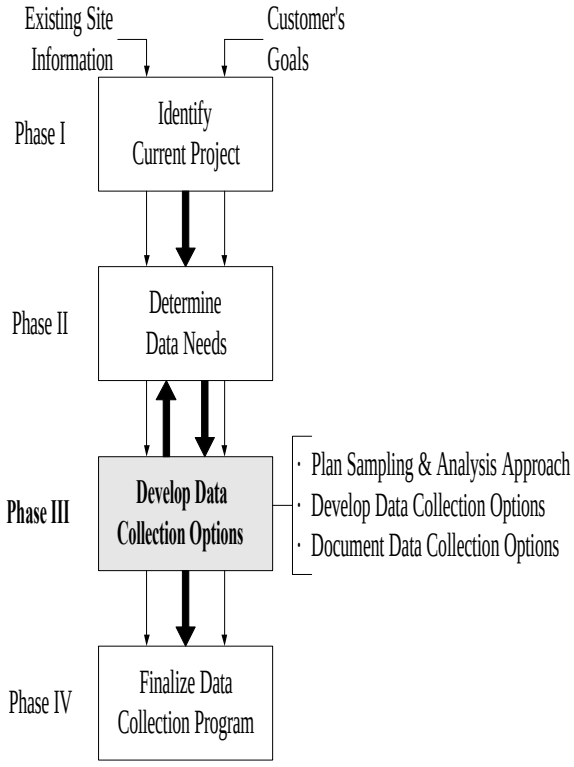

Figure 3-1
Phase III of Four-Phase TPP Process

> The PM and technical personnel will find that Phase III activities are iterative with Phase II activities as data needs tend to be clarified and refined. Therefore, data implementors will find communication with the data users to be invaluable during this phase of TPP activities.

Data implementors will find guidance in this chapter to help them document both the appropriate sampling and analysis methods and the data collection options. Although this chapter supports efforts to plan sampling and analysis approaches, it is not an exhaustive reference or resource.

3.1 PLAN SAMPLING AND ANALYSIS APPROACH.

Planning the most appropriate sampling and analysis approaches for a site is an iterative thought process. As presented in this manual, many technical personnel must collaborate to determine suitable sampling and analysis methods and develop data collection options for a site.

3.1.1 Review Phase I and Phase II Information.

The project manager (PM) should distribute copies of the Phase I memorandum for record (MFR) and any corresponding project objective worksheets, and Phase II data need worksheets to all personnel involved in Phase III. Efforts to plan sampling and analysis approaches should begin with review of the earlier TPP information. Review of Phase I and Phase II information is particularly critical for those personnel not involved in those efforts, and for the entire team when some time has passed since Phase I and Phase II efforts were completed.

3.1.1.1 Review Phase I MFR.

Review of the Phase I MFR and any project objective worksheets will refresh technical personnel of the site approach, project objectives, current project focus, and any site constraints and dependencies.

Although the data implementors may have been involved in Phase I activities, the Phase I MFR may contain revised constraint information including the finalized acquisition strategy, a modified budget, and updated schedule information. For example, schedule and site physical constraints may now preclude use of a proposed sampling method, while new budget and regulatory constraints may dictate the selection of analytical options. The MFR may also contain or reference useful site background information including analytical data from previous studies, site physical characteristics, aerial photographs, topographic maps, site cross-sections, site boring logs, etc. The preliminary conceptual site model prepared during Phase I can also acquaint data implementors with the physical and chemical features of a site in relation to possible sampling strategies.

3.1.1.2 Review Phase II Data Needs.

Data implementors should review the range of data needs identified during Phase II by the data users. Documentation prepared at the end of Phase II should communicate the intended data uses, the required number of samples, the contaminant concentrations of interest, and the necessary sampling areas or locations and depths. The Phase II documentation should also designate each of the data needs as "basic," "optimum," or "excessive," as well as any opportunities for use of field screening or field analytical methods and expedited site characterization approaches.

As data implementors review the Phase II data needs, they should begin to recognize both similar and unique data needs to ensure that all of the data needs are understood. Although data implementors may have been consulted during Phase II by data users, data need worksheets or other Phase II documentation may introduce new or refined data needs developed by each data user perspective. Data implementors will probably find it necessary to contact data users when trying to interpret data needs or to obtain additional information regarding data quality requirements.

3.1.2 Plan Sampling and Analysis Approaches.

The sampling data implementor should generally lead efforts to first sort and then combine the data needs prior to developing and documenting sampling strategies. The analysis data implementor should then proceed to develop and document field and laboratory analysis strategies. And finally, technical personnel representing both the sampling and analysis data implementor perspectives should refine their plans within cost and schedule constraints of the project. Data implementors will find Step 7 of the U.S. Environmental Protection Agency's 7-Step Data Quality Objective Process useful during these TPP efforts.[1]

While planning sampling and analysis approaches, data implementors are expected to consider both analytical and field sources of error to ensure the data will be useable for the intended data use(s). Detailed planning by data implementors can further minimize analytical error and significantly reduce potential sources of field error. Proper management of analytical and field sources of error requires that both the sampling and analysis data implementors employ the most current accepted methods for sampling and analyzing all types of media.[15, 16]

Data implementors must address site-specific sampling and analysis requirements rather than merely planning to implement sampling or analysis activities that were developed for a previous project or similar site.

3.1.2.1 Sort and Combine Data Needs. Data implementors should first sort and then combine data needs by media and location. It is important to identify overlapping data needs at a particular location and unique data needs from common locations at a site. Similar data needs should be combined to the extent possible to ensure sampling and analysis efforts are minimized. The efforts of data implementors to carefully sort and combine data needs can make a project very successful and efficient. When sorting and combining data needs, it is intended that some of the efforts include the following.

- **Balancing Sensitivity Requirements**
  When combining similar data needs, data implementors are cautioned to only apply the most stringent or lowest concentrations of interest requirements to those locations designated by the data users based on the intended data use. Typically, data used to characterize risk must meet more stringent sensitivity requirements than data used to evaluate, design, implement, and operate remedial technologies. The data required to identify potentially responsible parties may also require a greater degree of confidence, or number of samples, than other data needs. An example of overlapping data needs is a risk perspective data need for groundwater contaminant concentrations from an existing drinking water well and a remedy perspective data need for groundwater contaminant concentrations from the same vicinity. Both data needs could be satisfied simultaneously as long as the analytical sensitivity meets the more stringent of the two requirements. In this case, the risk data need requirements for lower analytical quantitation limits is likely the most stringent requirement. However, if additional groundwater contaminant concentration information was required from adjacent wells for only the remedy perspective, the more stringent risk sensitivity requirements should not be applied. When balancing sensitivity requirements, data implementors must be sure to effectively communicate and involve the appropriate laboratory personnel to prevent misunderstandings during sample analysis.

- **Meeting Sampling Depth Requirements**
  Data implementors may recognize similar data needs in a particular area of a site or even overlapping data needs at a common site location. In those instances where some data needs directly overlap each other in location and depths, data implementors should be sure to meet the discrete sampling depth requirements of any data users with unique sampling depth needs.

- **Evaluating Data Need Trade-Offs**
  Data need trade-off situations may be discovered where an alternate adjacent sampling location may be acceptable and representative for several data user perspectives instead of merely collecting data from several individual but adjacent sampling locations. After consultation with data users, they may agree to reduce the number of samples or increase their concentrations of interest on some data needs to help meet project cost or schedule constraints. Such trade-offs may enable the

data implementors to decrease the overall uncertainty of site decisions by using the available funds for conducting other required field screening or field analytical work at a site. Still another data need trade-off may involve the use of composite sampling where it can be appropriate for the intended data use(s). This trade-off may help to meet project constraints while decreasing the uncertainty of some site decisions.

Although the greatest cost savings can be achieved when the data needs of several data user perspectives overlap (e.g., contaminants of concern, soil chemical or physical characteristics), overlooking a unique data need from a common site location could result in costly remobilization to the site to re-sample the location. Another common opportunity for cost savings is ensuring that management decisions regarding investigation and remediation derived wastes can be made using the analytical results from corresponding matrix sampling locations.

3.1.2.2 Develop and Document Sampling Strategies.

Developing the sampling strategy requires a thorough understanding of a site, and all the information generated during TPP Phases I and II. In particular, the sampling data implementor should understand the team's preliminary conceptual site model and consider its use while developing sampling strategies for a site. Data implementors should also be sure to follow any state-specific guidance on sampling design that is applicable to a site. Based on initial efforts to work with this information, the sampling data implementor may consider involving some of the other technical personnel to determine the best sampling strategy to meet the data needs, develop the data collection options, and apply field screening or field analytical and expedited site characterization approaches whenever appropriate.

3.1.2.2.1 Sampling Strategy Constraints.

The total sampling time and costs should be estimated based on site access considerations, proximity of multiple sampling locations, seasonal weather conditions, mobilization/ demobilization efforts, equipment decontamination measures, sample management activities, concurrent site operations, and the total number of samples associated with each data collection event. The sampling data implementor should work to ensure that the entire field sampling activity can be conducted within the time allotted on the project schedule and within the project's budget constraints.

Because it is often necessary to sample property adjacent to a customer's property, the team should be proactive to obtain an access agreement and sensitive to minimizing disruption to the properties of adjacent owners. It can also be very time consuming to get appropriate site access agreements in place. Therefore, a common sampling strategy is to develop a sample collection design that involves only a one-time offsite sampling effort, rather than multiple or periodic sampling events that may require a costly real estate acquisition.

For each sample collection design alternative, the sampling data implementor should select the optimal number of samples and the most resource-effective data collection design that satisfies all of corresponding data needs. Sampling design approaches for designating sampling locations include both probabilistic and

non-probabilistic methods and must correspond to the type of decision to be made as discussed in Paragraph 2.1.4.1.

> When evaluating sample collection designs, the sampling data implementor must remember to include appropriate quality assurance/quality control measures.

3.1.2.2.2 Probabilistic Sampling.
If decision error quantification is required, probabilistic sampling must be performed. For those investigations when litigation with another potentially responsible party is anticipated, a probabilistic or random sampling approach may be desired for extrapolating results from a set of samples to larger portions of a site. By combining an efficient probabilistic sampling design with a statistical hypothesis test, data implementors can optimize resources (e.g., personnel, equipment, funding, site access, temporal constraints) and provide data of an acceptable quality for the intended data use(s). Planning for statistical analysis before sample collection is crucial so data support the intended data use(s). Other guidance should be used for establishing tolerable limits on decision errors and statistically determining the number of samples to be collected based on the hypothesis test and random data collection design.[1]

3.1.2.2.3 Non-Probabilistic Sampling.
Non-probabilistic or judgmental sampling locations are selected by the data user based on site knowledge of contaminant distribution and the intended data use. With judgmental sampling, it is not possible to quantify decision errors related to the number of samples, and the sample is only as good as the conceptual model used to define the target population.

3.1.2.2.4 Field Screening and Analysis.
Field screening and field analytical methods can be useful tools for satisfying some data need requirements while reducing costs. Data implementors could also plan to conduct some field screening or field analytical activities during these Phase III TPP efforts to refine the team's understanding of the site prior to designing a data collection program for the current executable stage of site activities. Further discussion about the use of field screening methods is provided in Paragraph 3.1.2.3.1.

3.1.2.2.5 Expedited Site Characterization (ESC) Techniques.
Another sampling and analysis execution option that should be considered and re-visited at this step in the TPP process is the use of ESC techniques. ESC is a methodology that utilizes in-field decision making, dynamic work plans, and real-time data acquisition and interpretation.[12]

In the case of the TPP process, ESC encourages the data users and data implementors to plan a data collection program in the office and then those same key personnel implement the data collection program in the field. In instances where the data users and data implementors believe ESC techniques are appropriate, dynamic work plans should be used by the team to provide some decision logic in advance of field activities. It will also provide sufficient flexibility for field modifications based on on-site decision making. By having established decision logic and providing on-site decision making authority, field work can be suspended whenever conditions deviate from what was planned or anticipated.

If at this step in the TPP process the team believes some ESC techniques should be applied at a site, the team should review Phase I TPP activities to ensure ESC is appropriate within the site approach and the current project. As the team proceeds with integrating ESC techniques, the technical personnel should also review Phase II TPP activities to identify and redefine the data needs that could be adequately fulfilled using ESC techniques.

> The sampling data implementor should not hesitate to obtain clarifications from the data users to ensure the sampling methods will meet Phase II data needs.

3.1.2.3 Develop and Document Analysis Strategies.
The analysis data implementor should evaluate the testing requirements, media to be sampled, and chemical and physical characteristics of the contaminants to select the analytical strategy. By involving the appropriate laboratory personnel during these efforts, the analysis data implementor will be more successful in identifying and communicating project specific analytical requirements.

The analysis data implementor must incorporate a comprehensive and multifaceted approach to quality assurance/quality control in order to achieve and document that data quality requirements have been attained for the intended data usage.[16] They should also refer to Engineer Manual 200-1-6 concerning compliance monitoring activities that may be applied to ensure adequate chemical data quality management is achieved on a project.

The anticipated analytical costs and turnaround time associated with each analytical method and the related quality assurance/quality control requirements must be considered. In all cases, the costs and turnaround times should be compared to the project's analytical budget and schedule, and the analytical strategies adjusted to fit within the project constraints.

The generation of screening data versus definitive data should always be considered. Whenever appropriate or potentially viable, performance based measurement systems should also be evaluated. By being less prescriptive about the laboratory analysis to be performed, performance based measurement systems can be tailored for application at a site and can enable optimization of cost and schedule expenditures.

3.1.2.3.1 Screening Data.
Field screening activities can be used during the TPP process (e.g., during a site visit) to refine sampling and analysis approaches or to provide additional site characterization data to data users. Various types of field screening analyses should be considered to gather preliminary information, reduce errors associated with spatial heterogeneity, or to prepare preliminary maps as guides for further sampling. Field screening analyses can be conducted to determine worker protection levels; extent of contamination or hot spots; presence of underground contamination; and the potential applicability of presumptive remedies or innovative technologies. For many sites, field screening analyses can also provide useful data for a risk assessment because they can be used quantitatively if confirmed with definitive data. In general, field screening data intended for quantitative use should be confirmed with at least 10 percent replicate samples analyzed using definitive methods.

Effective planning for the use of field measurement technologies involves consideration of at least the following factors:

- Knowledge of site contaminants and what may be encountered that could affect performance of the field measurement technology;
- Determining whether the measurement sensitivity is sufficient for the contaminant concentration(s) of interest;
- Understanding exactly what the field analysis technology measures;
- Understanding the factors controlling the performance of the field analysis technology; and
- Establishing a site-specific correlation between the screening and definitive measurement techniques.

Data users must be consulted for their concurrence regarding the use of field screening methods to meet their intended data uses. Collaboration between the analysis and sampling data implementors is crucial when the team plans to use field screening and field analytical methods. The team also needs to establish how field decisions will be made and communicated across the team.

3.1.2.3.2 Definitive Data.

Definitive data are generated using rigorous, analyte-specific methods where analyte identifications and quantitations are confirmed, and quality assurance/quality control requirements are satisfied. Definitive data can be generated from standardized analytical methods (e.g., EPA reference methods) or non-standardized methods in which the analytical or total measurement error has been determined. The potential analytical methods should be selected based upon the intended data use(s). Analytical method selection should be based on the chemicals of concern, the anticipated range of concentrations for the individual chemical contaminants and the media type and complexity. Other critical, site-specific considerations include regulatory agency method preferences and quantitation limit requirements; chemical quantitation and identification requirements; cleanup capabilities; quality assurance/quality control requirements; and turnaround time needed. There may also be a need for future proof of data results for compliance, responsibility, or cost allocation disputes.

The analysis data implementor should not hesitate to obtain clarifications from the data users to ensure the analytical methods will meet Phase II data needs.

3.1.2.4 Refine Plans Within Project Constraints.

Data implementors should generate order-of-magnitude cost estimates to determine if the proposed sampling and analysis scheme can be executed within the budget constraints. Data implementors may find that the number of samples, sampling methods, or analysis methods need to be changed to remain within budget constraints. Archiving samples for subsequent analysis may also contribute to balancing the sampling design within project constraints.

Data implementors should also evaluate effects of schedule and any temporal constraints that apply to site activities. An extremely short schedule may require some sampling events to be concurrent rather than phased activities. The level of effort associated with the entire data collection plan could exceed the scheduled duration of field activities. Temporal conditions may be such that some data needs could only be fulfilled during a seasonally dry or warm period of time.

In all instances, data implementors should be careful to recognize and develop data collection strategies for obtaining "basic," "optimum," and "excessive" data needs.

3.2 DEVELOP DATA COLLECTION OPTIONS.

After planning sampling and analysis activities, data implementors should work with data users to group the data needs into data collection options for consideration during Phase IV activities. Data collection options provide a simple mechanism to document the "basic" data needed for the current project; "optimum" data that is cost-effective and prudent to collect for future executable stages; and any "excessive" data that is imposed or mandated by others in excess of the data needed by data users.

3.2.1 Basic Data Collection Option.

The "basic" data collection option is the data set needed to satisfy the current project objectives (e.g., remedial investigation data). The data collection efforts would produce data that generally meets all the data quality requirements of the data users for only the current project.

If data quality requirements cannot be met for the data users, the technical personnel need to clearly communicate this information to the PM. For example, the PM should be advised if planning compromises have been incorporated by the technical personnel when existing sampling or analysis methods cannot achieve action levels or concentrations of interest required by the data users. If all the basic data needs for the current project cannot be obtained within budget or schedule constraints, technical personnel should prioritize the data needs within this basic group of data needs, but not eliminate data needs at this step in the TPP process.

3.2.2 Optimum Data Collection Option.

The "optimum" data collection option highlights opportunities to collect data needed to satisfy future project objectives at the site, during the current project. This grouping includes the portion of data needed for future executable stages that would be cost-effective and prudent to obtain during the current project. The optimum data collection option includes only those future data needs that technical personnel believe are good current investments toward future executable stages at a site.

A typical optimum data collection option would be to include the feasibility study and remedial design data that can be cost-effectively obtained during the remedial investigation at a site. Even if the current project budget cannot afford optimal data collection, data implementors should still develop an optimum data collection option to be considered by the customer during Phase IV.

3.2.3 Excessive Data Collection Option.

This unique group of data needs are those data needs that data users believe are excessive for the purposes of satisfying both current and future project objectives. The data needs classified as "excessive" will be those specifically requested, imposed, or mandated by others and not needed by the data users.

Examples of excessive data collection options would include planning to have full suite laboratory analysis of all samples when full suite analysis of select samples would meet the project objectives; or planning to install additional groundwater monitoring wells when the data users can use the existing monitoring wells for meeting the project objectives.

All data needs within the excessive data collection option exceed the data needs or data quality requirements of the data users for the current and future executable phases of the project. The excessive data collection option should not be misused to represent the data needs that cannot be collected within cost or schedule constraints of the project.

Development or recommendation of all three types of data collection options may not be possible or appropriate on some sites. For example, if no data needs were requested, imposed, or mandated above the data need or data quality requirements of the data users, then the excessive data collection option is not necessary. Although development of an optimum data collection option should always be pursued, recommendation of an optimum data collection option may be deemed inappropriate if the data needed to satisfy current project objectives already exceeds project cost and schedule constraints.

3.3 DOCUMENT DATA COLLECTION OPTIONS.

Data implementors are responsible for communicating data collection options for further consideration during Phase IV. Data implementors' efforts to document project specific requirements for the basic, optimum, and excessive data collection options are critical for the success of TPP activities and continued progress to site closeout. Data implementors should consider recording the appropriate sampling and analysis methods and the data collection options using the sampling and analysis planning worksheet and the summary table of data collection options provided in Appendix F or similar methods. Use of standardized worksheets and tables will allow quick and easy quality assurance/quality control review of the data collection and analysis plans.

Critical aspects of documenting the appropriate sampling and analysis methods and data collection options are as follows:

- What data needs are being met;
- What project objectives will be satisfied;
- How many samples need to be collected;
- Where do the samples need to be collected;
- What sample collection methods need to be used (e.g., discrete or composite samples; sampling equipment and technique; quality assurance/quality control samples);
- What sample analysis methods need to be used (e.g., sample preparation; laboratory analysis; method detection limit and quantitation limit; laboratory quality assurance/quality control); and
- What technical limitations, cost benefits, and imposed requirements are associated with each applicable data collection option.

Data implementors should also develop order-of-magnitude costs for preliminary estimates and prepare draft figures representing planned sampling locations or areas. The data collection tables, preliminary cost estimates, and draft figures will be used during Phase IV activities.

Sampling and analysis planning worksheets offer a concise yet complete means of communicating the sampling and analysis methods to obtain data that satisfies the data requirements associated with the intended data uses. Well prepared sampling and analysis worksheets can be inserted directly into appropriate scope of work or work plan sections.

3.4 COMPLETE PHASE III ACTIVITIES.

The technical personnel should review the sampling and analysis planning worksheets to ensure that all data needs were appropriately incorporated within a data collection option. In accordance with the applicable quality management plan, the PM should also have independent technical resources review the sampling and analysis planning worksheets. (An example of a sampling and analysis planning worksheet is provided in Appendix F and may be useful during independent review efforts.) In any case, all projects will be periodically evaluated by the project team to ensure baseline requirements of scope, schedule, and cost are being met.[2] If it appears that some data needs were omitted from grouping within a data collection option, the PM should meet with the data implementors to correct the apparent omission. After the technical personnel complete quality control confirmation that the data collection tables are complete, they should document in the project file if any data needs were not grouped within the data collection options to be considered during Phase IV.

The PM should review any site information worksheets or lists of site information data needs that were identified by the data implementors. It is the PM's responsibility, working with the technical personnel, to decide how and when the additional site information data needs will be fulfilled (e.g., discussions with the customer, site visits, incorporated within appropriate scope of work or work plan sections).

At the conclusion of Phase III, the PM should distribute copies of all sampling and analysis planning worksheets and attach related illustrations to all appropriate TPP team members.

Chapter 4
Finalize Data Collection Program (Phase IV)

During Phase IV (see Figure 4-1) of the Technical Project Planning (TPP) process the customer, project manager (PM), and appropriate technical personnel discuss data collection options and finalize a data collection program that best meets the customer's short- and long-term goals for a site. This chapter also offers guidance for documenting the data collection program with a project specific data quality objective (DQO) statement for each data need, final scope of work or work plan, detailed cost estimates, and fact sheet(s).

Communication and interaction with both the customer and the regulator are strongly encouraged during Phase IV efforts.

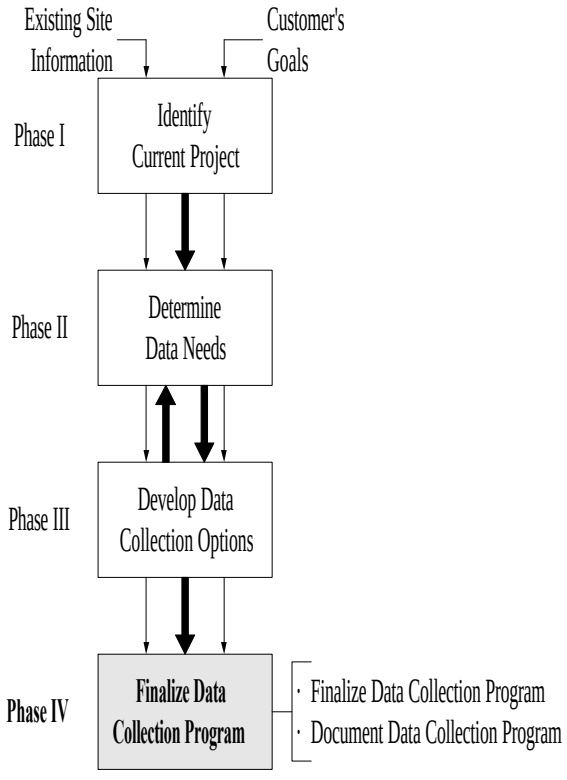

Figure 4-1
Phase IV of Four-Phase TPP Process

This chapter and the entire TPP process supports efforts to prepare project specific DQO statements that meet the definition of a DQO as provided within the U.S. Environmental Protection Agency's 7-Step DQO Process.[1]

4.1 FINALIZE DATA COLLECTION PROGRAM.

The PM, key data users and data implementors, and customer should work together to design the data collection program. In many instances, the customer and PM will also decide to involve the regulators and stakeholders, as appropriate, to design the data collection program. Design of the data collection program will be based on the customer's preferred combination of meeting current project objectives ("basic" data needs), obtaining data cost-effectively for future executable stages ("optimum" data needs), and including any "excessive" data needs the customer chooses to retain.

Finalizing the data collection program requires review of the customer's goals, the project objectives, the intended data uses, the data collection options, and key risk management considerations (e.g., feasibility, cost, schedule, uncertainty, and political concerns).

4.1.1 Prepare Customer Communications.

If the customer was not directly involved in determining the data needs (Phase II) and developing the data collection options (Phase III), then summary information should be provided. The PM should consider utilizing input from both the data users and data implementors to ensure the summary information is precise about both the data needed and the data collection options available. Illustrations representing the site or data

collection activities and flowcharts or decision trees may also be useful when communicating the data collection options and recommendations to the customer.

In some instances, a summary table of data collection options and a series of sampling and analysis planning worksheets, would provide sufficient detail. (Appendix F provides a summary table of data collection options and an example.) However, in most cases, it is more appropriate to add a simple overview description that summarizes the important attributes and characteristics of each option. A well prepared overview supplements a summary table of data collection options and describes potential effects of design decisions on quality, schedule, and cost. Not only will this assist the customer in understanding the benefits and limitations of various data collection options, but it will also provide the basis of subsequent design discussions or presentations.

> The PM and technical personnel should communicate to the customer the uncertainty; cost and technical benefits; and regulatory perspective associated within each data collection option.

4.1.2 Encourage Customer Participation. Efforts to design the data collection program should include obtaining input from the customer. The customer should always be invited and encouraged to participate in design of the data collection program for their site. Regardless of a customer's level of technical expertise related to the site work, the customer's participation at this time will facilitate a design that provides maximum customer satisfaction within the schedule, budget, technical, and regulatory constraints associated with a site.

The PM or an assigned technical team member should lead the team through this sequence of activities to obtain the customer's input and to support the customer's considerations.

- The PM and technical personnel should recommend to the customer the basic data collection option and present all elements of the optimum data collection option.
- The uncertainty, costs, and benefits associated with the basic and optimum data collection options should be explained and discussed. Primary considerations should include schedule, budget, technical constraints, regulatory perspective, and site precedents.
- The PM and technical personnel should present and explain all elements of the excessive data collection option. Technical personnel should be prepared to be responsive to the customer's questions regarding technical details and rationale; cost and schedule implications; and site precedent concerns related to each element of the excessive data collection option. Elements of the excessive data collection option should only be included in the data collection program when explictedly desired by the customer.
- The TPP team should finalize design of the data collection program by combining the customer preferred components of the basic, optimum, and excessive data collection options, as appropriate.

When designing the data collection program with customer input, technical personnel must be sure that the customer understands the effects of any reductions in the number of samples or adjustments to the sampling or analysis methods. Although the customer may initially be satisfied with resulting schedule and cost reductions, the increased uncertainty of the findings may not satisfy the intended data uses

or related project objectives. It is the responsibility of both the PM and the technical personnel to remind the customer of any regulatory requirements, technical constraints, and stakeholder perspectives that should be factored into the customer's decisions.

In some instances, the PM may ask that data users and data implementors re-examine portions of their Phase II and III efforts to fully understand and communicate consequences of refining the data collection program. In other instances, the project objectives corresponding with the current project may need to be revised, or the number of project objectives may need to be reduced or increased depending upon a customer's interests and needs while finalizing design of a data collection program. Changes to grouping of the project objectives should involve some revision to the Phase I Memorandum for Record or the applicable project objective worksheet. Since there is no one correct answer for what belongs in a site's data collection program, a team will typically iterate back into Phase II and Phase III while finalizing design of a data collection program.

4.1.3 Suggest Regulator Participation.
Regulator involvement at this time during the TPP process will enhance acceptance of the final design. Regulator participation in the TPP activities can reduce the number of technical comments received from the regulators, reduce the time expended to plan and execute work, and increase opportunities for the entire team to be flexible and creative in resolving site problems.

After discussions with the customer, but prior to final scoping, regulators should be included in a consensus decision process. However, it is always the customer's decision as to whether or when regulators participate in the TPP process. In order to achieve regulator acceptance of the data collection program, their input and concerns should be considered. Depending upon the customer's preference and experience with the regulators, the customer may be better served by meeting with the regulators after DQOs have been written and provided to the regulators for their review and comment. In any case, regulator desired refinements to the data collection program should ultimately be incorporated only when explicitly agreed to by the customer.

> The Phase I Memorandum for Record, project objective worksheets, data need worksheets, and sampling and analysis planning worksheets can be very useful to the PM, customer, and technical personnel when working with regulators during consensus decision efforts.

4.1.4 Consider Participation of Others.
In many cases, stakeholder interests and concerns can have a significant effect on decisions made by both the customer and regulator at a site. If stakeholders are actively interested in site activities, some level of their participation is likely appropriate during this step in the TPP process. The team may want to offer stakeholders an opportunity to provide written comments regarding site plans. Or the team may consider using some community or public relations techniques and offer a special forum for stakeholders to learn more about the rationale for the planned site activities. The concerns and issues of stakeholders can typically be addressed and managed through a comment and response exchange or by conducting a special meeting tailored to their understanding of the site. However, it remains the customer's decision as to whether, when, and how stakeholders participate in this TPP activity.

4.2 DOCUMENT DATA COLLECTION PROGRAM.

The PM and technical personnel must document the decisions made during the TPP efforts to contribute to institutional knowledge at a site, and for presentation directly in related sampling and analysis plans and work plans. Documentation should include project-specific DQOs, the final scope of work, a detailed cost estimate, and a fact sheet(s) when appropriate.

4.2.1 Prepare Data Quality Objective Statements.

The preparation of DQO statements is a culmination of many of the TPP activities. Similar guidance for preparing DQOs is provided in the U.S. Environmental Protection Agency's (EPA's) 7-Step DQO Process and in American Society of Testing Materials.[1,17] (Appendix E presents a detailed "crosswalk" from EPA's 7-Step DQO Process to the TPP process.) The DQOs become the formal documentation of the data quality requirements. (Appendix F provides a DQO worksheet for documenting the nine data quality requirements of a DQO.) Effective use of DQOs yield data of known quality, documentation of the planning process, and a benchmark to determine if the data meet specified objectives. (Appendix G provides a DQO attainment verification worksheet.)

4.2.1.1 Definition of a DQO.

As defined by EPA, DQOs are *qualitative and quantitative statements derived from the DQO Process that clarify study objectives, define the appropriate type of data, and specify the tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.* [1]

DQOs produced as a result of the TPP process meet EPA's definition of a DQO. The DQOs documented during this TPP activity should be project-specific statements that describe the intended data use(s), the data need requirements, and the means to achieve them. DQOs documented as a result of the TPP process should be comprehensive and include each of the following data quality requirements.

- **Intended Data Use(s):**
  (1) Project objective(s) satisfied.

- **Data Need Requirements:**
  (2) Data user perspective(s) (i.e., risk, compliance, remedy, or responsibility) satisfied;
  (3) Contaminant or characteristic of interest identified;
  (4) Media of interest identified;
  (5) Required sampling areas or locations and depths identified;
  (6) Number of samples required (e.g., fixed number or dynamic estimate; probabilistic or non-probabilistic basis); and
  (7) Reference concentration of interest or other performance criteria (e.g., action level, compliance standard, decision level, design tolerance) identified.

- **Appropriate Sampling and Analysis Methods:**
  (8) Sampling method (e.g., discrete or composite sample; sampling equipment and technique; quality assurance/quality control samples) identified; and
  (9) Analytical method (e.g., sample preparation, laboratory analysis method detection limit and quantitation limit, laboratory quality assurance/quality control) identified.

4.2.1.2 Team Preparation of DQOs.

A DQO statement should be prepared for each data need within a data collection program. This manual recommends that key data users and data implementors share the responsibility of preparing the DQO statements to ensure each is correct and complete. Technical personnel should find this effort to involve merely compiling the information from the project objective worksheets, the source data need worksheets, and the sampling and analysis planning worksheets. (Appendix F provides several worksheets and tables useful for documenting TPP planning decisions.)

> Even on small projects, DQO statements produced as a result of the TPP process should be reviewed by either project or independent personnel to ensure each DQO is complete and implementable.

4.2.2 Prepare Final Scope of Work or Work Plan.

The PM should consult applicable scope of work (SOW) and work plan guidance, and rely on technical personnel, to prepare and finalize the SOW or work plan for the project. In accordance with applicable guidance, the SOW or work plan must include at least the project objectives, site-specific DQO statements, and the related technical requirements.

4.2.3 Prepare Detailed Cost Estimate.

The PM should coordinate the efforts of various technical personnel to prepare detailed cost estimates for all components of the data collection program. For contracted services, an Independent Government Estimate is required. The PM will find that estimates are best prepared immediately after data collection program design, while technical personnel can easily recall data collection program details. Technical personnel will need to reference other guidance and resources in order to prepare the detailed information and cost estimates for the planned site activities.[18]

4.2.4 Prepare Fact Sheet(s).

The PM and technical personnel's TPP efforts may involve providing the customer with community relations or public affairs assistance to communicate information about the data collection program. Although preparation of DQOs, the project SOW or work plan, and a detailed cost estimate are successful methods of communicating some of the pertinent information to parties involved in site planning and implementation activities, preparation of a fact sheet(s) for presentation to regulators and other interested parties may be necessary or helpful.

In instances where a fact sheet will be prepared for presentation, the TPP team should carefully plan the fact sheet for the receiving audience. Objectives of typical fact sheets include:

- Prepare customer to brief superiors, regulators, other potentially responsible parties, or other stakeholders;
- Negotiate with regulators with, or on behalf, of the customer;
- Inform interested citizens or other parties (e.g.; introduce public to a site; obtain public participation in planning process; establish public concurrence with planned activities; or address public resistance or concerns as a handout at a public meeting or as a direct mail brochure); and
- Provide an outline of key project planning information to include within a site's community relations plan.

The team should consider the potential communication value of some of the following TPP products when planning to prepare a fact sheet:

- Site history and site background information excerpts from the Phase I Memorandum for Record, if confirmed to be accurate;
- Project objective worksheets prepared during Phase I;
- Conceptual site model figures or descriptions, including planned sampling locations;
- Data need worksheets prepared during Phase II;
- Sampling and analysis planning tables prepared during Phase III;
- Site-specific summary tables of data collection options prepared during Phase III;
- DQO statements; and
- Final SOW or work plan.

4.3 COMPLETE PHASE IV ACTIVITIES.

The PM should distribute copies of all data collection program components (e.g., Phase I Memorandum for Record; project objective worksheets; data need worksheets; sampling and analysis planning worksheets; summary tables of data collection options; DQOs; final SOW or work plan; detailed cost estimates; and fact sheets) to the customer and technical personnel, as appropriate. (The customer should decide what TPP components, if any, will be provided to the regulators or stakeholders.) These items will aid preparation and review of subsequent sampling and analysis plans and work plans related to the current project activities.

The PM should also store all the TPP products for the project together for future reference. Many of the TPP products should also be attached to the management plan for the project (e.g., sampling and analysis planning worksheets; DQO statements; final SOW; work plans, and related cost estimates).

Chapter 5
Implement and Assess Data Collection Program

This EM offers the Technical Project Planning (TPP) process as a systematic planning process for identifying project objectives and designing data collection programs. This chapter provides some discussion about implementing and assessing data collection programs that have been designed using the TPP process.

5.1 IMPLEMENTATION OF DATA COLLECTION PROGRAM.

At the completion of Phase IV, sampling and analysis plans and work plans should be finalized and field work should begin. It may also be beneficial for contractors and laboratory personnel, responsible for implementing the plans, to meet with some members of the TPP team to discuss any questions and refer to the related TPP products.

When issues arise during execution of the site activities, the TPP team should be consulted and the TPP products should be reviewed to quickly resolve many issues and provide related background planning information (e.g., project objectives worksheet, data needs worksheet, sampling and analysis planning worksheets).

5.2 AMENDMENTS TO DATA COLLECTION PROGRAM.

Amendments to project plans tend to be unavoidable due to any number of the following circumstances:

- External events (e.g., change in regulations);
- Improvement in technologies (e.g., sampling, analysis, remediation);
- Inadequate or poorly defined requirements;
- Discovery of incorrect technical assumptions; and
- Flaws in the initial plan or design.

When project plans need to be amended, the PM should obtain input from the appropriate TPP perspectives to ensure that any additional data collection is done as effectively and efficiently as possible. In some instances, it may be beneficial to reconvene key TPP team members to consider what TPP products should be further reviewed or revised as a result of changed circumstances.

5.3 VERIFICATION OF DATA QUALITY OBJECTIVE ATTAINMENT.

Efforts to evaluate and verify attainment of data quality objective (DQO) statements enable data users to understand any data usability limitations associated with project data. Efforts to verify DQO attainment can be thought of as follow-up TPP activities that should be conducted before other data quality assessments are performed. Appendix G provides additional guidance regarding verification of DQO attainment and a related worksheet.

5.4 ASSESSMENTS OF TPP EFFORTS.

After completing data collection activities at a site, the TPP team should perform an evaluation of the effectiveness of the TPP planning and implementation efforts. Assessments and evaluations should be done to improve future TPP planning efforts and to prevent recurring problems.

One assessment should be regarding the expenditures of cost and time for implementing the TPP process, and the resulting benefits. Of particular interest is an evaluation of how cost and schedule savings, attributed to use of the TPP process or concepts, compare to the approximate expenditures of cost and time to assemble a TPP team and use the TPP process.

5.5 PLANNING SUBSEQUENT DATA COLLECTION PROGRAMS.

When beginning to plan the next executable stage of site activities, the current TPP team or a subsequent TPP team should begin at Phase I by first updating the site approach and identifying the next current project. The TPP process is iterative and should be repeated each executable stage until site closeout is achieved for the customer.