U.S. Department of Energy

Office of Management, Budget and Evaluation

Engineering Support and Requirements Generation, Analysis, And Use

Initiated by: Office of Engineering and Construction Management

ENGINEERING SUPPORT AND REQUIREMENTS GENERATION, ANALYSIS, AND USE

1.0 ENGINEERING SUPPORT

In preparation for initiating procurement and construction activities (Critical Decision-3), engineering support consists of those actions that support the completion of the project design and its integration into the overall project. For example, design reviews; approved design and procurement documents; engineering support during procurement and construction; and specialty engineering. The Project Director/Project Manager (PD/PM) must plan and prepare for this support and must be sufficiently acquainted with all of the engineering support activities requested in order to fund and effectively implement and manage these efforts during the Execution phase of the project.

1.1 Basic Elements

The success of project execution and engineering management rests on five basic elements:

- *Competent People.* Those qualified, experienced, and dedicated people, who form a "team," are the key element in any field of endeavor. Successful project execution and engineering management requires people with superior competency in project management, systems engineering, accounting, and traditional engineering specialties such as process, safety, security, reliability, and maintainability. The project organization should effectively integrate staff size and qualifications. The project should also provide necessary training that provides and maintains knowledge and skills specific to the project.
- *Documented and Disciplined Processes.* Project management and technical processes should be defined, documented, and applied in a disciplined, tailored manner. Processes are tailored from proven general processes that are appropriate for the project. The responsibilities and accountabilities associated with each management and technical role are clearly identified including decision authority and change-control authority.
- *Project Structure, Methodologies, and Tools.* The project structure, methodologies, and tools are defined, documented, and included in training curricula. The project structure provides facilities, tools, and equipment, and promotes communication among the entire project team. Methods of management and engineering are identified for a project and should provide support in performing and verifying various project tasks.
- *End Product Development.* The project shall clearly define and document the end product(s) to be delivered to a user. A project defines and documents the processes and

procedures to be used, while providing the end product. Both the end product and the process must meet requirements and perform functions that satisfy mission needs.

- *User/Customer Interactions*. The project should implement user interaction techniques and processes during development, delivery, and acceptance. The user should also be assured of a continuous interface with and participation of the integrated project team.

1.2 Engineering Principles and Process

Engineering performs evaluations to identify the best design approaches that use available hardware, software, and people to meet requirements. PDs/PMs integrate the methods, techniques and processes used to communicate project procedures and engineering processes with the management, budget, and planning processes.

Project procedures that document the process to be followed throughout the Execution phase are developed by the PM prior to initiating project execution. This process should accomplish the following objectives:

- Transform mission, operational, or disposal requirements into a system architecture, performance parameters, and design details.
- Integrate technical parameters to ensure compatibility among the physical, functional, and programmatic elements of a project.
- Ensure that availability, reliability, maintainability, and operability requirements are met.
- Ensure that safety, security, environmental protection, and human factor requirements are met.
- Fabricate hardware, develop software, construct facilities, or perform remediations.
- Inspect, test, and accept components and functional units that will be used in the end products.
- Integrate components and functional units into end products.
- Verify that all mission requirements are met.
- Provide an end product that demonstrates mission needs have been met.

During the preliminary design phase, a comprehensive, final Project Execution Plan (PEP is prepared and submitted for approval at Critical Decision-2. The PEP defines how the execution phase is to be conducted. A final, approved PEP could provide information about the following project activities, depending upon the needs of the project:

- Management
  - — Roles, responsibilities, and authorities of project personnel, including design and decision authority.

— Key personnel by position, staff level, discipline, and qualifications.

— The major project activities with inputs, outputs, performance metrics, and completion criteria.

— The training curriculum and facilities necessary to establish and maintain staff qualifications, and indoctrinate all project personnel in project policies, procedures, and practices.

— Funding request documents (e.g., Project Data Sheets, Activity Data Sheets, etc.) to be submitted each fiscal year for the Congressional budget.

— Project scope, cost and schedule baselines, and planning for baseline management, including establishment of a change control process and change control thresholds.

— Contracting and procurement plans to determine the scope of work best suited for performance by contractors, in order to request and evaluate bids and select contractors.

— A construction management plan to establish a procurement-delivery system for construction of project facilities.

— A plan for monitoring, control, and oversight activities.

— A procedure for monitoring key project activities and identifying and controlling these activities to a target performance level.

— A procedure to identify and resolve new project issues, assess outcomes of project activities, and initiate corrective actions as necessary to assure acceptable results.

— Scheduled and event-driven status reporting necessary to satisfy a project's monitoring, control, and oversight needs and requirements.

- Engineering

— The engineering organization and staffing levels needed, including disciplines and qualifications.

— A plan for configuration management, records control, and records management.

— The need to include worker, public, environmental, nuclear, and industrial safety planning in all design efforts (Integrated Safety Management).

— A plan to assure public and stakeholder inputs to baseline development, maintenance and changes.

— The process to test, evaluate, and turnover the completed end products to the user, including as-built design drawings and specifications, vendor data and manuals, and procedures.

- The process to provide the information for Critical Decision-3, Authorization to Implement, and for conducting the critical decision process.
- The process to provide the information for Critical Decision-4, Approve Transition and Turnover, and for conducting the critical decision process.
- A plan for transitioning the project to the user.
- A plan for project closeout, including methods, requirements, and activities for closing out the project after the operations phase has begun.
- Appropriate plans, personnel lists, equipment lists, supplies, etc., as necessary, to demobilize the project.
- A plan to integrate the following specialty engineering into the overall engineering design effort:
  - Human factors
  - Reliability, availability, and maintainability
  - Inspectability, manufacturability, operability, and survivability
  - Safeguards and security
  - Risk management
  - Value management
  - Constructability
  - Environmental, safety, and health
  - Configuration management
  - Quality assurance
  - Outline the responsibilities of participating organizations, including independent testing
  - Include the rationale for the type, amount, and schedule of project tests and inspections
  - The relationship of these efforts to technical risks; operational and maintenance concepts and issues; performance requirements; reliability, availability, maintainability; and critical decision points.
- A plan for environmental, safety, and health (ES&H) documentation to provide information on critical statutory, regulatory, and directive requirements necessary to develop the project's ES&H milestones and schedules. ES&H documentation should include policies, organization, training, safety analyses, environmental permits, reviews and audits, reporting of unusual occurrence and remedial actions, management procedures to protect the health and safety of employees and the public, and risks from hazards to life and property.

— A plan to provide for preparing the required National Environmental Policy Act documentation (e.g., Categorical Exclusion, Environmental Assessment, Environmental Impact Statement). The plan should provide for a review of the National Environmental Policy Act documentation determination developed in the conceptual stage to determine if the impact analysis is sufficiently broad or still valid for the Execution phase.

2.0 REQUIREMENTS GENERATION

All DOE projects have a single, vital commonality: the preparation, documentation, approval, implementation, and verification of project requirements. These requirements define the framework for going forward with the detailed descriptions and design necessary to meet the project performance (products, deliverables) established in the Mission Need Statement (MNS). Requirements define and describe the extent to which a function(s) must be executed, and are generally measured in terms of quantity, quality, coverage, timelines, safety, environmental, products, deliverables, etc.

As a project progresses from Initiation to Transition/Closeout, the process of identifying and refining requirements proceeds on a continuing, developing, and more detailed basis (see Figure 1). Requirements also develop and become more detailed as a project progresses through its life cycle and through each succeeding critical decision (see Figure 2). In addition, as a project progresses and requirements develop; the requirements should always be traceable to initial project baseline documents. That is, regardless of the source, each requirement has a documented basis. Several “good practices” are suggested to assist the PD/PM in performing their project requirements responsibility:

- The earlier in a project’s life cycle project requirements can be identified, defined, and approved, the more effectively and efficiently a project will progress through the various project phases, and the greater the probability the project will meet baselines, agreements, and commitments.
- A project should document all requirements, obtain the written agreement of involved, responsible personnel and organizations (especially the user), approve and issue the requirements, and maintain the approved requirements under change control for the life of the project.
- Once approved, requirements should be issued to all project participants.
- As a project progresses and requirements are refined and developed, this information should be reflected in project documentation (see Table 1).

Tailoring should be applied when identifying project requirements. Under-application of requirements can result in not establishing effective project baselines; over-application of requirements can result in overly stringent project guidance and significant cost and schedule impacts.

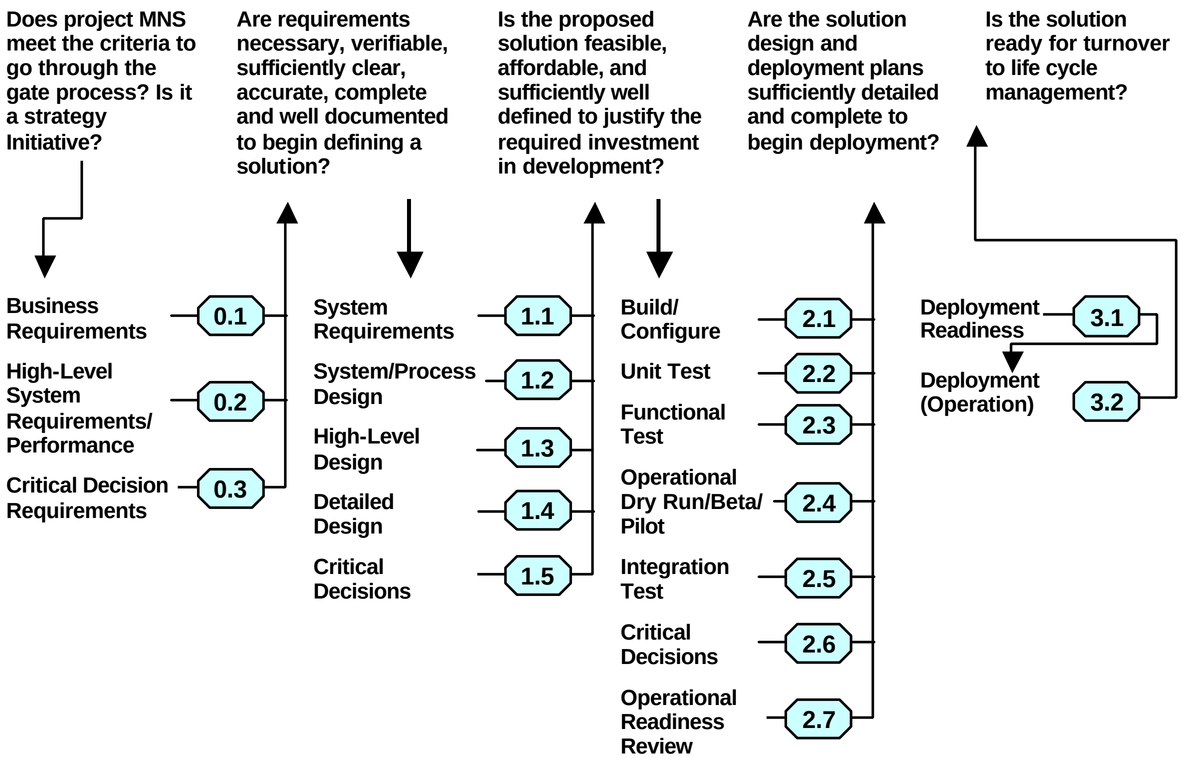


Figure 1. Requirements Generation

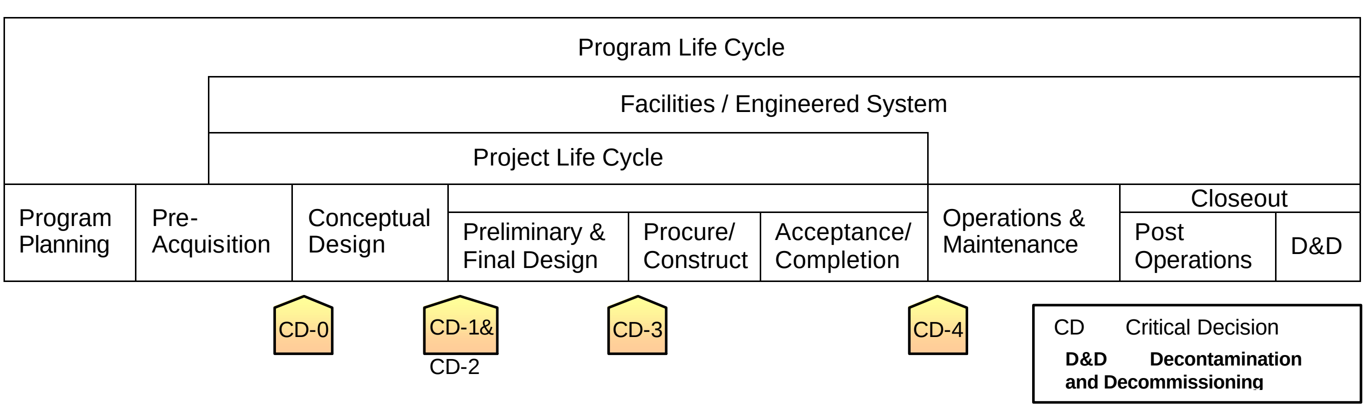


Figure 2. Typical Project Life Cycle Model

Table 1. Products by Life Cycle Phase

Life Cycle Phase	Pre-Acquisition	Conceptual	Execution, Design and Construction	Execution, Turnover	Closeout
Planning	• Pre-acquisition Devel. Plan	• Conceptual Development Plan		• PEP • Transition Plan	
Manage-ment	• Mission Need	• Project Organization Mgmt/Eng. processes • Training • Planning Documentation • Federal Budget Cycle • Monitoring/Control/ Oversight • Contract Management • Baseline Management • Intergroup Coordination • Decision Criteria • Acquisition Strategy	• Project Organization Management/Engineering processes • Training • Planning Documentation • Federal Budget Cycle • Monitoring/Control/Oversight • Contract Management • Configuration Management • Baseline Management • Construction Management • Intergroup Coordination • Decision Criteria	• Project Organization • Planning Documentation • Federal Budget Cycle • Monitoring/Control / Oversight • Contract Management • Configuration Management • Baseline Management • Construction Management • Intergroup Coordination	• Planning Docs • Federal Budget Cycle • Monitoring/ Control/ Oversight • Contract Management • Configuration Management • Intergroup Coordination
Engineering	• Functions and Req'mts • Alternative Evaluations • Alternative Selections • Safety Assessments	• Functions and Requirements • Alternative Evaluations • Alternative Selections • Design Documentation • Safety Assessments • Interface Control Docs • Test & Evaluation • Specifications	• Functions and Requirements • Tradeoff Studies • Alternative Selections • Design Documentation • Safety Assessments • Interface Control Documents • Test & Evaluation • Operations/Maintenance Requirements Documentation • Specifications	• Functions and Requirements • Alternative Evaluations • Alternative Selections • Acceptance Documentation • Safety Assessments	• Functions and Req'mts • Alternative Evaluations • Alternative Selections • Safety Assessments
Specialty Engineering Integration	• Integrated Logistics Support • System Life Cycle Cost • ES&H • Risk Management • NEPA Docs • Environ-mental, Socio-economic, and Institutional	• Integ. Logistics Support • System Life Cycle Cost • ES&H • Human Factors Eng. • Safeguards & Security • Risk Management • NEPA Documentation • Value Management • Quality Assurance • Regulatory Compliance • Environmental, Socioeconomic, and Institutional	• Integrated Logistics Support • System Life Cycle Cost • Environment, Safety & Health • Human Factors Engineering • Safeguards & Security • Risk Management • NEPA Documentation • Value Management • Quality Assurance • Regulatory Compliance • Environmental, Socioeconomic and Institutional	• ES&H • Human Factors Engineering • Safeguards & Security • Risk Management • NEPA Documentation • Value Management • Quality Assurance • Regulatory Compliance	• ES&H • Human Factors Engineering • Safeguards & Security • Risk Management • NEPA Docs • VM • QA • Regulatory Compliance
Reviews	• Design Review	• Alternative System Review • Requirement Allocation Review • System Requirements Review • Conceptual Design Review	• Req'mt Allocation Review • System Requirements Review • System Functional Review • Design Approach Reviews • Design Analysis Reviews • Preliminary Design Review • Instruction Reviews • Drawing Preparation Checks • Software Specification Review • Detailed Design Review • System Verification Reviews • Critical Design Review • Test Readiness Reviews • Physical Configuration Audits • Functional Configuration Audit • Project Completion Review	• Physical Configuration Review	• Physical Configuration Review

3.0 REQUIREMENTS IDENTIFICATION AND DEVELOPMENT

The identification and development of project requirements begins during the Initiation phase and can continue through a project's life cycle. Identification and development of requirements is a basic responsibility of the Program Manager, the PD, and the integrated project team. Attachment 1 is a sample of requirements development for an environmental restoration project in relation to project life cycle activities. Requirements identification and definition can originate from many sources, including:

- The DOE Mission Statement and requirements
- Long-range DOE plans and objectives
- Legal agreements between the DOE and individual States and the Environmental Protection Agency
- National Codes and Standards
- DOE Orders, Manuals, and Standards
- Background and knowledge of project personnel
- Lessons learned from other projects
- Research and development activities as well as pilot plant and full-scale testing
- User organization
- Industrial organizations and industry experts
- Other organizations such as the Defense Nuclear Facilities Safety Board, citizen's groups, and stakeholders

As the requirements for a specific project are identified and defined, and as a project progresses, some requirements are mandatory, others are non-mandatory.

Mandatory requirements are those resulting from Federal and state laws, legal agreements, national codes and standards, and DOE Orders and Manuals. Non-mandatory requirements are typically those that originate from development and testing, guides, past experience, lessons learned, and user organizations. Although these requirements are labeled as non-mandatory, a prudent PD/PM will carefully evaluate each non-mandatory requirement to determine its usefulness and appropriateness prior to determining whether or not it should be identified as a project requirement.

The requirements identification and documentation process begins in the project Initiation phase with the development of the MNS, in which the initial project requirements are identified. The MNS establishes the need (requirement) for a project, the capability and performance to be provided, and the approximate timeframe and cost of the proposed capability. Generally, during this same time period, necessary research and development and pilot plant testing are being identified and pursued to identify the technology requirements for the project. A Preliminary High-Level Functions and Requirements document identifies and documents project functions and requirements to provide an overview of such items as sizes, siting, capabilities, capacities, and products.

The title assigned to this early document seems to be dependent upon site practice and past history. Typical titles include Functions and Requirements, Functional and Operational Requirements, and Conceptual Design Requirements Document, System Design Description, etc. Regardless of the document title, the contents and intent is the same: to identify requirements that are essential to the success of the project and thus DOE’s mission. The initial requirement documents are high-level and are intended as top-level functions and requirements requiring higher-level approval. The document provides the basis for development of subsequent lower-level functions and requirements during the Definition and Execution phases. A sample format and a sample Requirements document are provided in Attachments 2 and 3, respectively.

Experience has shown that the better the requirements process is managed, the better a project is managed; and the better a project is managed, the better the baselines are managed; and finally, the better the baselines are managed, the better the chances of overall project success and the probability of meeting project commitments.

10.4 REQUIREMENTS GENERATION SYSTEM

The requirements generation system along with the acquisition management system and the budgeting system form the DOE’s three principle decision support systems (Figure 3). A close and effective interface among these systems is required to ensure quality products are acquired for the DOE. The requirements generation system produces information for decision-makers on the projected mission needs of the Department. These mission needs are defined in broad operational terms in an MNS. An MNS is prepared for needs that develop into a project’s operational requirements that could result in a new DOE material acquisition. Validation of the MNS confirms the fact that a non-material solution cannot satisfy the identified need, and that a new material solution is needed. Subsequently, the needs expressed in the MNS are developed into requirements in the form of numerous project documents.

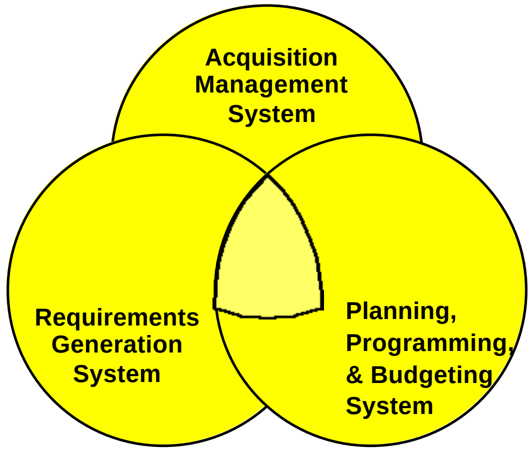


Figure 3. DOE Decision Support Systems

As a project progresses, the identification of requirements also progresses. This progression includes both the number and the specificity of the requirements. During this same time frame, a hierarchy of requirements also begins to develop. The highest level of requirements are the Key Parameters that identify a characteristic, function, requirement, or design basis that, if changed, would have a major impact on the project's performance, schedule, cost and/or risk. Key Parameters also include those requirements that have been established with DOE and the Acquisition Executive.

As a project progresses through its life cycle phases (Initiation, Definition, Execution, Transition/Closeout) additional requirements are identified and defined. Also, as a project progresses, requirements are eventually fully described and defined in one or more of the following product documents. All of these documents may not apply to every project.

- Functional and Operational Requirements
- Design Criteria
- Site Planning Documents
- Environmental Safety, Health and Quality (ESH&Q) Documents (Safety Analysis Report, Quality Assurance Plan, Environmental Impact Statement), Plans and Procedures
- Safeguards and Security Plans
- Engineering studies, including research and development
- Drawings and specifications
- Test plans and procedures, including acceptance, operational readiness review, and cold operation
- Decontamination and decommissioning plan.

Requirements are not limited to the project's technical (design, procure, construct, startup) baseline. Instead, requirements can encompass the entire spectrum of project activities including project management processes, other projects, and other organizations. For example:

- System/project interfaces
- Site planning, including location and infrastructure
- Licenses and permits
- Operations and maintenance philosophy and procedures
- Cost and schedule
- Reporting
- Contracting
- Reviews
- Change control
- Records management
- Work breakdown structure and dictionary.

In many cases, site-specific requirements already exist and must be recognized and considered where applicable. For example:

- Natural phenomena
- Temperatures
- Wind, rain, and snow loads
- Soil bearing capacity
- Frost depth
- Inclement weather
- Safety rules and regulations
- Lightning
- Flooding
- Radiation exposure guidelines, contamination control, and radiation zone entry requirements.

One additional source of "significant" project requirements is related to hazards and hazard analysis. Most of these requirements are identified and resolved in the project design effort. However, without attention and intentional effort, they could be overlooked and ignored.

- Acceleration/deceleraton

- Chemical reactions
- Ergonomics
- Explosions
- Flammability and fire
- Leaks and spills
- Radiation
- Toxicity
- Vibration
- Waste Minimization

5.0 REQUIREMENTS DOCUMENTATION REVIEW AND APPROVAL

In addition to being identified, defined, approved, issued, and resolved, requirements are also frequently reviewed, not only by project management, but also by DOE management. This occurs during the Critical Decision process when the request-for-approval data packages are submitted. A careful examination of the requirements for receiving approval for a Critical Decision shows that they include the submission of specific documents that define the status of project requirements. For example:

- Conceptual Design Report including schedules and cost estimates
- Acquisition Execution Plan
- Project Execution Plan
- Total estimated cost and total project cost
- National Environmental Policy Act documentation
- Preliminary and Final design packages
- Preliminary Safety Analysis Report and Final Safety Analysis Report
- Project Data Sheets

Thus, when a Critical Decision package is submitted for review and approval, the project requirements are also submitted for review and approval.

6.0 FUNCTIONAL AND OPERATIONAL REQUIREMENTS

The functional and operational requirements for a project are captured in Functional and Operational Requirements documents. The Functional and Operational Requirements should be developed and approved during project planning and/or the conceptual design effort. Approved Functional and Operational Requirements should be placed under change control, and used to develop a project technical baseline during the preliminary design effort. Functional and Operational Requirements are developed and finalized from the MNS, hazards analysis, authorization basis, operating and maintenance requirements, all related contractual requirements, and site-specific standards and requirements. The requirements identification and documentation process is a continuing effort throughout the conceptual design process.

Functions are tasks, actions, or activities that must be performed to fulfill a mission. Functions describe what must be done, not how. The functional analysis is used to decompose top-level functions to lower-level functions. The decomposition process continues to lower-level functions until the functions can be assigned to a major system, structure or component. In identifying top-level functions, care should be taken to assure that they are independent of any particular system or technological solutions, and are statements of capability that can potentially be met by various designs. Any constraints (i.e., limits normally from an outside source such as regulatory agencies, codes, or required standards that cannot be modified) are identified at each level of functional analysis. The level of detail of lower level functions should be consistent with the level of detail required in the conceptual design. The required sequence of functions to satisfy the project mission need and program requirements, and to analyze interfaces between functions, should be identified. The top-level project functions are defined in sufficient detail to demonstrate compliance with program requirements and mission needs.

The operational requirements describe requirements that establish the parameters for system operations and the constraints that will affect design solution. The constraints may include physical space, regulatory, legal, environmental, or specialty engineering requirements such as security and safeguards, force protection, human factors, ESH&Q, design, value management, quality assurance, energy conservation, waste minimization, operations and other life cycle considerations. The operational requirements are associated with applicable functions.

Whereas the functions establish what needs to be done, the operating requirements establish the environment in which the systems must operate and the constraints that will affect design solutions. Performance requirements establish how well the systems must perform to satisfy functions and operational requirements. The performance requirements are quantifiable and measurable.

The functions, operational, and performance requirements are collected in the project Functional and Operational Requirements. The level of detail for the Functional and Operational Requirements during the conceptual design must be sufficient to establish a valid design cost and a preliminary range for the total project cost. The Functional and Operational Requirements should be sufficient to support a resource-1oaded critical path schedule of significant activities for the project.

7.0 REQUIREMENTS ANALYSIS

Requirements analysis is conducted to identify the necessary and sufficient set of performance requirements, design constraints, and interface requirements for each activity. Generally, the PD/PM would perform this analysis for each identified activity.

Performance requirements state how well the solution should meet the requirements. Requirements may be imposed on the design solution (design constraints) or be related to interfaces between systems (interface requirements). Identified requirements may result from the functions and requirements of the next higher level, or derived from an alternative study. Regardless of the source, each requirement has a documented basis. The depth to which this type of analysis is performed on a given project is based on project risk and complexity consistent with the depth of functional analysis performed. Again, however, tailoring applies to this concept, and tailoring should include schedule and cost considerations.

8.0 INTERFACE REQUIREMENTS

A project should develop a list of the interface boundaries that the design must stay within. For example, if only 120v electrical power is available to a component, then this limitation (requirement) should be identified as an interface boundary condition. Equipment mounting and anchoring details, information concerning utility tie-in locations, and physical size constraints (requirements) are common interfaces that require definition. Other common interfaces are tie-ins to existing roads, alarm and computer systems, and interfaces with support personnel such as technical, health physics, safety, quality assurance, and security. The functions and/or services that a project provides to other projects should also be identified. All of these interfaces and services should be identified as requirements and documented as such.

9.0 REQUIREMENTS VERIFICATION

Requirements verification is the final step in the requirements process. In this case, however, final does not necessarily mean last. Rather, requirements verification can occur throughout a project's life cycle. For example, some process requirements may be validated during design. In most cases, however, the majority of requirements are verified during structures, systems, and components checkout and testing. Therefore, the checkout and testing activity is essential to the success of the project, and should be planned and performed as such.

10.0 MULTI-SITE ACQUISITIONS

Some large Major System DOE projects can involve multiple systems that are more than a single DOE site, Field Office, or Program Secretarial Office. In these cases, additional planning and effort must be given to capturing (identifying and documenting) the overarching requirements that apply to these "special case" acquisitions. The purpose in identifying these requirements is to guide the various DOE components in developing mission need and operational requirements applicable to these large acquisitions. This will facilitate development of inter-site acquisitions through validated performance-based capabilities.

A second purpose in developing overarching requirements that apply to all acquisitions is to assure that all participants provide input to the requirements, understand the requirements, agree with the requirements, and perform their portion of the acquisition based on a common set of requirements.

10.1 Applicability

The overarching requirements identified for an acquisition apply to all DOE components involved in identifying and further articulating requirements for all applicable MNSs and requirements documents. Generally, for large acquisitions, DOE-Headquarters will identify a lead organization. The lead organization is responsible for coordinating development of the requirements, including documentation and distribution. Once prepared, the lead Program Secretarial Officer/Acquisition Executive approves the requirements.

10.2 Definition

The overarching requirements can include operational concepts, overarching capabilities, mission need, and the scope of individual systems envisioned to comprise the acquisition. The requirements document should also identify criteria against which various combinations of systems and the contribution of individual systems can be evaluated.

The requirements document expands upon the capabilities and deficiencies identified in a MNS, or ties together requirements identified in multiple MNSs. The analysis used in developing the requirements document should take into account appropriate results and insights from previous assessments, operational experience, lessons learned, exercises, test and evaluation, experimentation, technology demonstrations and other sources that can identify the capabilities required. The requirements document should also identify the factors that drive the timing of the requirements such as retirement of existing systems or expected timing of a new capability.

10.3 Documentation

The requirements document includes a description of the operational capability, shortcomings of existing systems, and new capabilities required. This document could also define the degree to which the proposed systems supporting the mission can be satisfactorily fielded, operated, and sustained while meeting collective performance parameters.

The requirements document should identify the operational requirements that articulate the capabilities required for conducting operations within the mission area. An operational requirement is a system capability or characteristic required for accomplishing mission needs that have been approved. The requirements should have appropriate criteria and rationale for each, and be stated in thresholds/objectives if appropriate. A single overarching requirement transcending all other requirements and all systems must be inter-operable. Timing of requirements should specify the time-based nature of the need and the events that are driving that need. Requirements other than interoperability that must be flowed down exactly, or with some specific limits, will be included and clearly stated. One method to identify requirements is to list all the required capabilities for each DOE operational element.

10.4 Validation

Validation is the formal review process of the requirements document by all involved organizations. Generally, each organization will only validate that portion of the document that applies to their scope/mission.

10.5 Approval

Following a validation review, the requirements document is forwarded to the lead Program Secretarial Officers for approval.

11.0 STANDARDIZATION PROGRAM

In 1994, the Secretary of Defense directed reform of military specifications and standards. The Secretary directed the Department of Defense to make greater use of performance and commercial requirements in the acquisition process. Performance specifications are performed over detailed specifications.

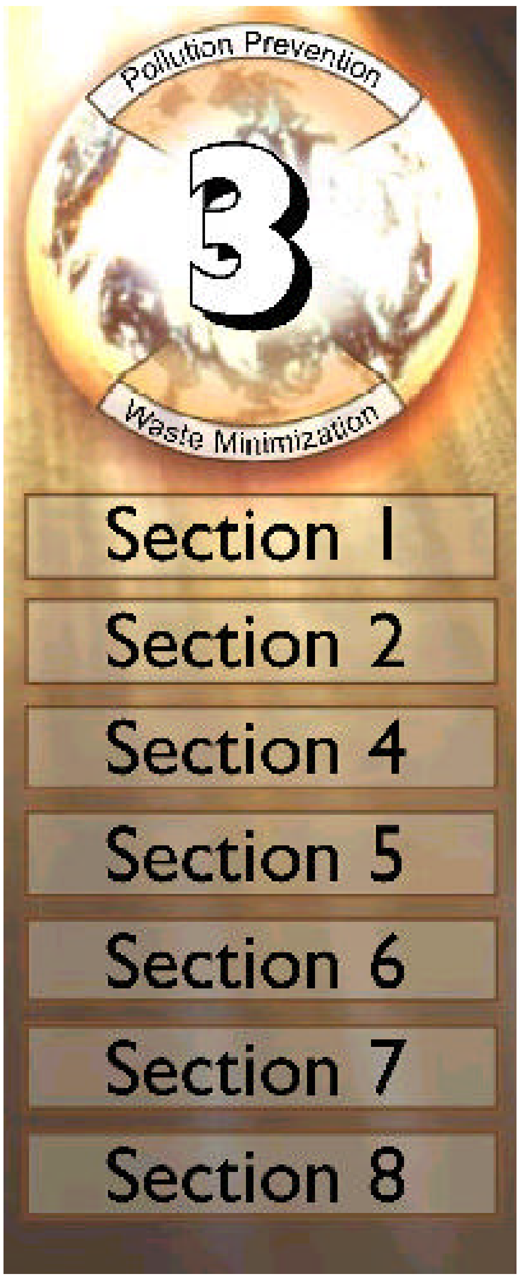
The DOE has not taken a formal position on the Department of Defense approval. However, the DOE uses both performance and detailed specifications depending upon the situation.

The Department of Defense Performance Specification Guide is being including with this guide for informational purposes only (Attachment 4), and its use is neither encouraged nor discouraged. It does, however, provide a structured approach to the use of performance specifications.

ATTACHMENT 1

SAMPLE –P2/Wmin: USERS GUIDE FOR ER PROJECTS
DECOMMISSIONING AND REMEDIAL ACTIONS

Section 3: Project Planning and Integration



Project Planning and Integration

Home	Top of Guide	Case Studies	Discussions

Section 3 identifies the primary project activities from conceptual design through field activities and provides guidance to project personnel in using the Guide and incorporating P2/WMin opportunities into the project planning process.

Determine what stage you are in with your ER project. Take a few minutes to look at Section 3 and identify which P2/WM in opportunities apply to the project planning effort. Determine which procedures and guidance documents apply to your project planning and integration efforts.

Section 3

Project Planning and Integration

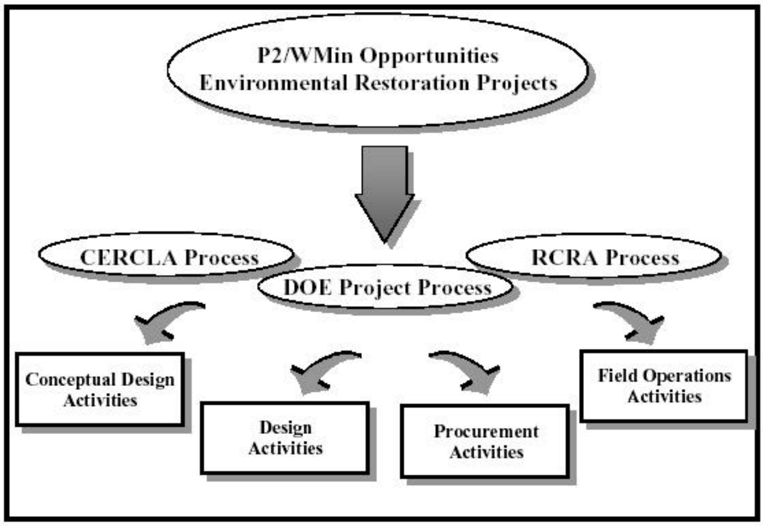


Figure 3-1. The incorporation of P2/Wmin opportunities into the four project phase activities of the CERCLA, RCRA, and the DOE Project processes.

The following project planning approach is a management tool to facilitate the integration of P2/WMin opportunities into ER projects that can reduce cost and schedule. Section 3 focuses on the activities within the four key project phases that include conceptual design, design (preliminary and definitive), procurement, and field operations. This section also illustrates the parallel relationship among Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Resource Conservation Recovery Act (RCRA) and the DOE project processes for each of these activities. This project planning approach slightly deviates from the standard DOE approach, as detailed in DOE Order 4700, in order to make the Guide more user friendly and still meet the needs for CERCLA, RCRA, and DOE projects.

This section focuses on four key project phases that include conceptual design, design, procurement, and field operations.

This section provides 27 opportunities to incorporate P2/WMin practices into your project. ***Worksheet 2*****,** at the end of this section, provides the user with an assessment tool to determine the applicability of each of these 27 opportunities The user is also cross-walked to case studies where P2/WMin practices have been successfully incorporated into an ER project. The number of P2/WMin opportunities will increase as more case studies are identified. Each user can modify individual approaches described in the case studies to meet the specific needs of their project. **Be creative...there may be more opportunities than you realize!**

This section provides 27 opportunities to incorporate P2/Wmin practices into your project.

Each subsection identifies specific P2/Wmin opportunities that are correlated directly to specific project activities.

each of the four project phases. Each project phase contains a number of specific project activities which are identified in the Project Management Overview diagrams (Figures 3-2 through 3-5). P2/WMin opportunities are then described for individual project activities. The user is guided to the Project Planning Guide (Table 3-1) at the end of Section 3, that identifies the project activities impacted and provides recommendations or actions for incorporating P2/WMin opportunities into the project. The Project Planning Guide also provides the user with:
(1) (1) A crosswalk to the appropriate case studies (e.g., Web Sites), lessons learned, and project-planning guidance,
(2) A crosswalk to the associated worksheets providing project-specific guidance to assist with the implementation of P2/WMin initiatives.

NOTE: All four subsections have a consistent format which allows the user to access any project phase independently or any activity within each phase as detailed in Figures 3-2 through 3-5.

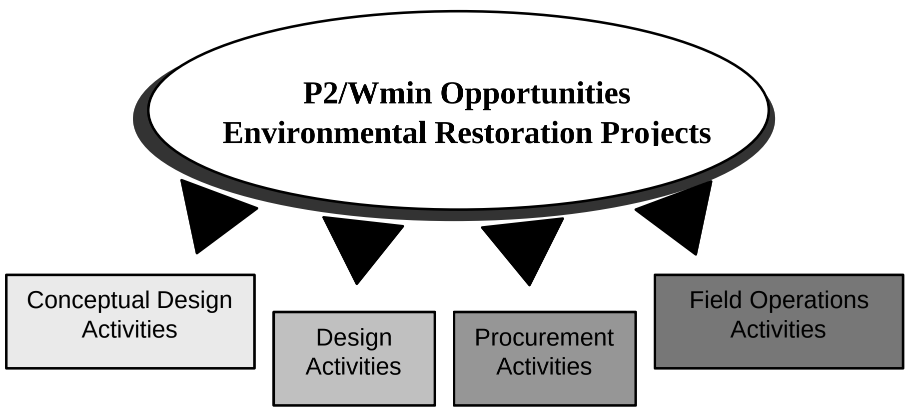
This section identifies the primary P2/WM in opportunities for each phase of a project and is designed to walk the user through a series of steps that will ultimately provide the project-specific information necessary for effective implementation. Each step below will be referenced in each of the subsections to guide the user through the planning and integration approach:

Step 1 ☞

Step 1: Identify P2/WMin opportunities that correlate to your project activity

Step 2 ☞

Step 2: Use the Project Planning Guide (Table 3-1) for recommendations, actions and crosswalk references to case studies to implement P2/WMin opportunities.



3.1 Conceptual Design Activities

Conceptual design activities include: (1) The CERCLA Remedial Investigation and Feasibility Study process; (2) The RCRA Facility Assessment and Investigation process; (3) Initiation of the Corrective Measures Study; and (4) Initiation of the DOE project design for the Functional Requirements and Conceptual Design.

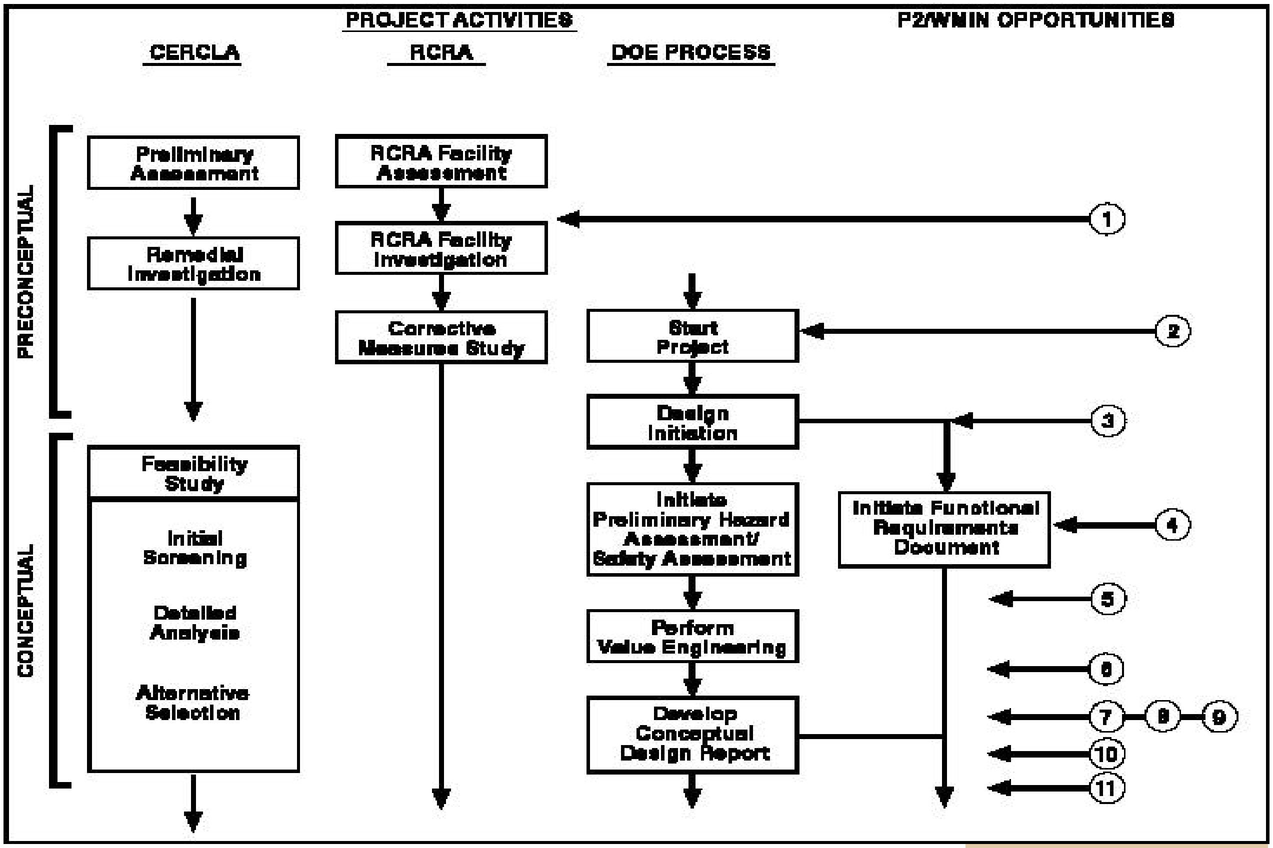


Figure 3-2. Project management overview for conceptual design activities

Figure 3-2 details the general sequence of activities for the **conceptual design phase** of the project. This figure illustrates the interrelationships between the P2/WMin opportunities and the general sequence of activities directed by the DOE and the regulatory agencies. The P2/WMin opportunities, numbered in the right margin of the figure, correlate to the project timeline necessary for successful integration into the project. A brief description of each P2/WMin opportunity is provided following Figure 3-2, and is identified by number in the margin. The numbering system facilitates the crosswalks to specific Web Sites and the associated worksheets.

Step 1 ☞ ***Identify P2/WMin opportunities that correlate to your project activity***

The specific P2/WMin opportunities identified in Figure 3-2 are briefly described below.

1. ***Evaluate waste streams and quantities*** - project-specific data on the waste streams and quantities generated during the ER project. This data will need to be identified early in the project. The waste stream data should be consistent with the category/types identified in Section 4 and accompanied by the best available estimates of quantities.

Opportunity 2

2. ***Evaluate project management and site procedures*** - procedures will require continued evaluation beginning at the initiation of each project to incorporate any necessary revisions or modifications to facilitate the incorporation and implementation of P2/WMin opportunities.

Opportunity 3

3. ***Establish generic ER specifications*** - generic specifications should be developed and adopted for implementation at each site. These specifications should provide a greater level of consistency between projects and sites by integrating effective P2/WMin language into the evolving, real-time process.

Opportunity 4

4. ***Life Cycle Decision Methodology*** - Phase I, the initial screening phase of the methodology, reduces the number of alternatives which are ultimately subjected to the final two phases of the methodology.

Opportunity 5

5. ***Evaluate technologies promoting P2/WMin*** - technologies that promote recycling and beneficial reuse should be evaluated during the conceptual design phase. P2/WMin should be integrated into the technology evaluation process as a design criteria for an ER project.

Opportunity 6

6. ***Evaluate secondary waste generation*** - consideration must be given to minimizing the waste streams generated as a direct result of the ER activities. This evaluation will be highly dependent upon the remediation strategy and/or technology selected for ER and should be considered during the preliminary design and design criteria stages.

Opportunity 7

7. ***Incorporate project-specific lessons learned into design*** - an evaluation of the effectiveness of the site ER projects, with respect to P2/WMin initiatives, should be conducted. Integrate the most recent and applicable project-specific lessons learned from close-out meetings and ER subcontractors' effectiveness evaluations into the design phase of the project.

Opportunity 8

8. ***Incorporate project-specific lessons learned from other site coordinators*** - the establishment of P2/WMin site coordinators will facilitate sharing and communication of applicable case studies and lessons learned between Ohio Field Office (OFO) sites and ultimately between DOE sites complex wide. This type of input would be most valuable during the functional requirements and conceptual design phases of the project.

Opportunity 9

9. ***Evaluate segregation options*** - the conceptual design phase should evaluate technologies and implementation strategies that promote segregation of materials based on activity levels and material type or classification.

Opportunity 10

10. ***Project team input during design*** - input from the project team, particularly field or construction management, will provide a valuable resource for developing an effective design package that reflects the site-specific experience gained from similar ER projects.

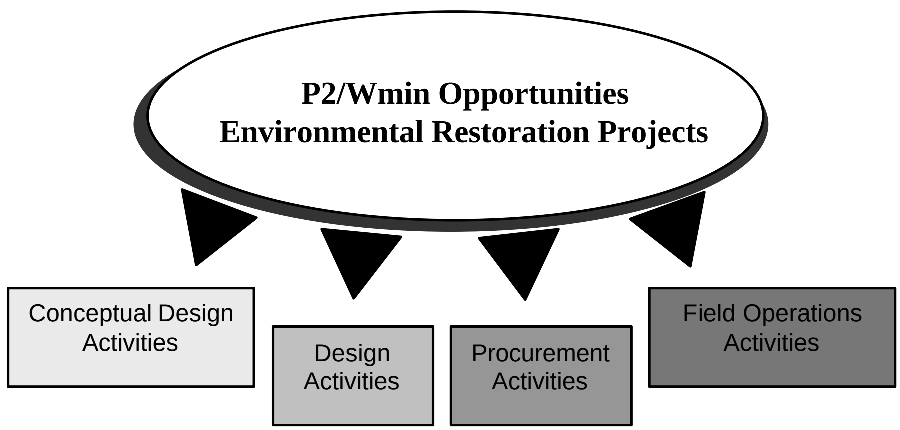
11. ***Life Cycle Decision Methodology*** - Phase II, the life-cycle analysis phase of the methodology, identifies and evaluates all categories of benefits and costs that result from a course of action over the entire period of time.

Opportunity 11

The project planning guide (Table 3-1) has been formatted to provide the user with a method for identifying the project-specific documentation or actions necessary for the successful integration and implementation of the P2/WMin opportunities. The project planning guide provides the user with the following information:

- Listing of the general DOE and EPA remedial project activities impacted by the implementation of a specific P2/WMin objective,
- Listing of recommendations or actions available to the user to facilitate implementation of the P2/WMin objectives,
- A crosswalk to Web Sites for each P2/WMin objective providing case studies, lessons learned, project planning guidance,
- A crosswalk to the associated worksheets to assist the user in project planning.

Step 2 ☞ ***Use the Project Planning Guide (Table 3-1) for recommendations, actions and crosswalk references to***



case studies to implement P2/WMin opportunities.

3.2 Design Activities

Design activities include: (1) The CERCLA Proposed Plan, public comment, Record of Decision, and initiation of the Remedial Design Work Plan; (2) Completion of the RCRA Corrective Measures Study, public comment period, and development of the RCRA Permit; and (3) Completion of the DOE Functional Requirement and Design Criteria documents, and initiation of the Title I/II design.

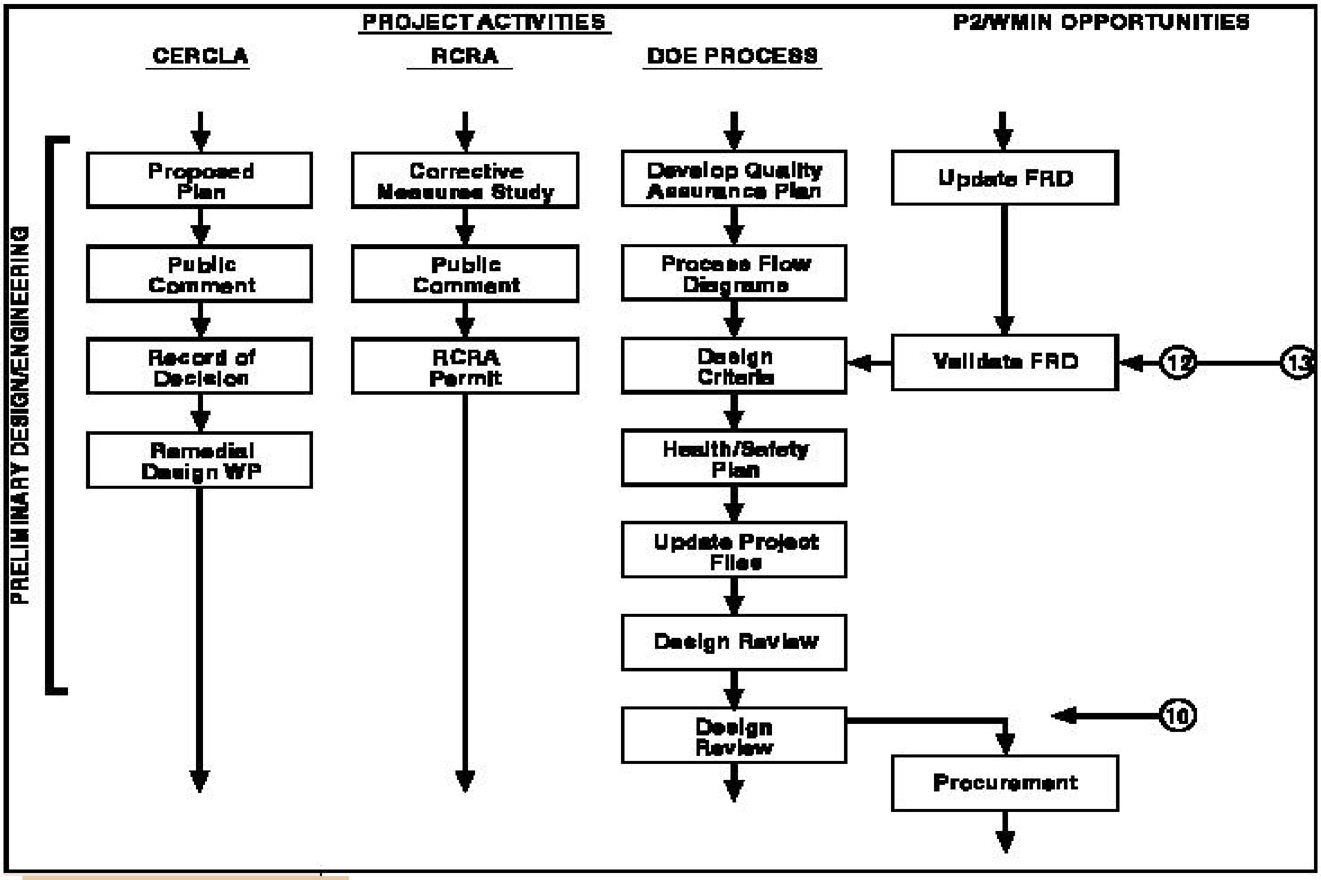


Figure 3-3. Project management overview for design activities

Figure 3-3 details the general sequence of activities for the **design phase** of the project. This figure illustrates the interrelationships between the P2/WMin opportunities and the general sequence of activities directed by the DOE and the regulatory agencies. The P2/WMin opportunities, numbered in the right margin of the figure, correlate to the project timeline necessary for successful integration into the project. A brief description of each P2/WMin opportunity is provided following Figure 3-3, and is identified by number in the margin. The numbering system facilitates the crosswalks to Web Site addresses and the associated worksheets.

Step 1 ☞ ***Identify P2/WMin opportunities that correlate to your project activity***

The specific P2/WMin opportunities identified in Figure 3-3 are briefly described below.

Opportunity 12

12. ***Life Cycle Decision Methodology*** - Phase III, decision phase of the methodology, ranks alternatives using the scores and data presented in the decision summary matrix and weighting factors from the performance measures, and select a preferred alternative.

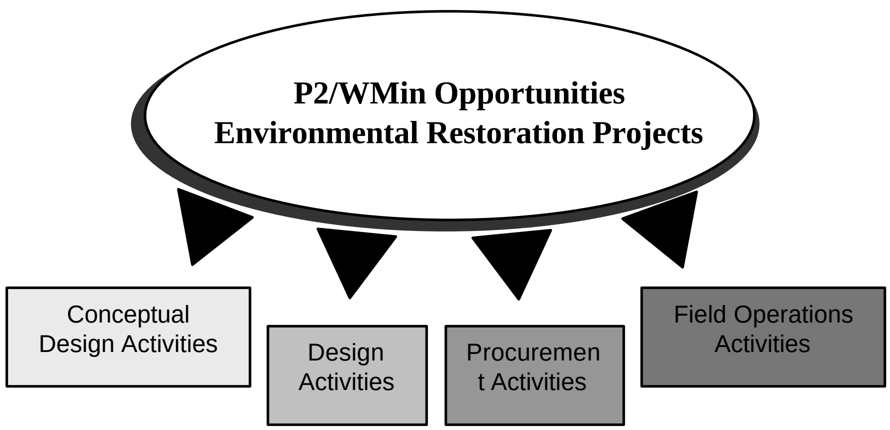
13. ***Evaluate packaging and reuse options*** - the design phase of the ER project should evaluate alternatives for packaging and reuse of waste stream materials and secondary wastes generated during ER versus disposal options. Examples may include use of material as void space filler or barrier material for shielding.

Opportunity 13

The project planning guide (Table 3-1) has been formatted to provide the user with a method for identifying the project-specific documentation or actions necessary for the successful integration and implementation of the P2/WMin opportunities. The project planning guide provides the user with the following information:

- Listing of the general DOE and EPA Remedial project activities impacted by the implementation of a specific P2/WMin opportunities,
- Listing of recommendations or actions available to the user to facilitate implementation of the P2/WMin opportunity,
- A crosswalk to Web Sites for each P2/WMin opportunity providing case studies, lessons learned, project planning guidance,
- A crosswalk to the associated worksheets to assist the user in project planning.

Step 2 ☞ ***Use the Project Planning Guide (Table 3-1) for recommendations, actions and crosswalk references to case studies to implement P2/WMin opportunities.***



3.3 Procurement Activities

Procurement activities include: (1) Completion of CERCLA Remedial Action Work Plan and initiation of the remedial action; initiation of RCRA corrective measures; and (2) Completion of the DOE Title I/II Design and initiation of the bid package development and the pre-bid meetings.

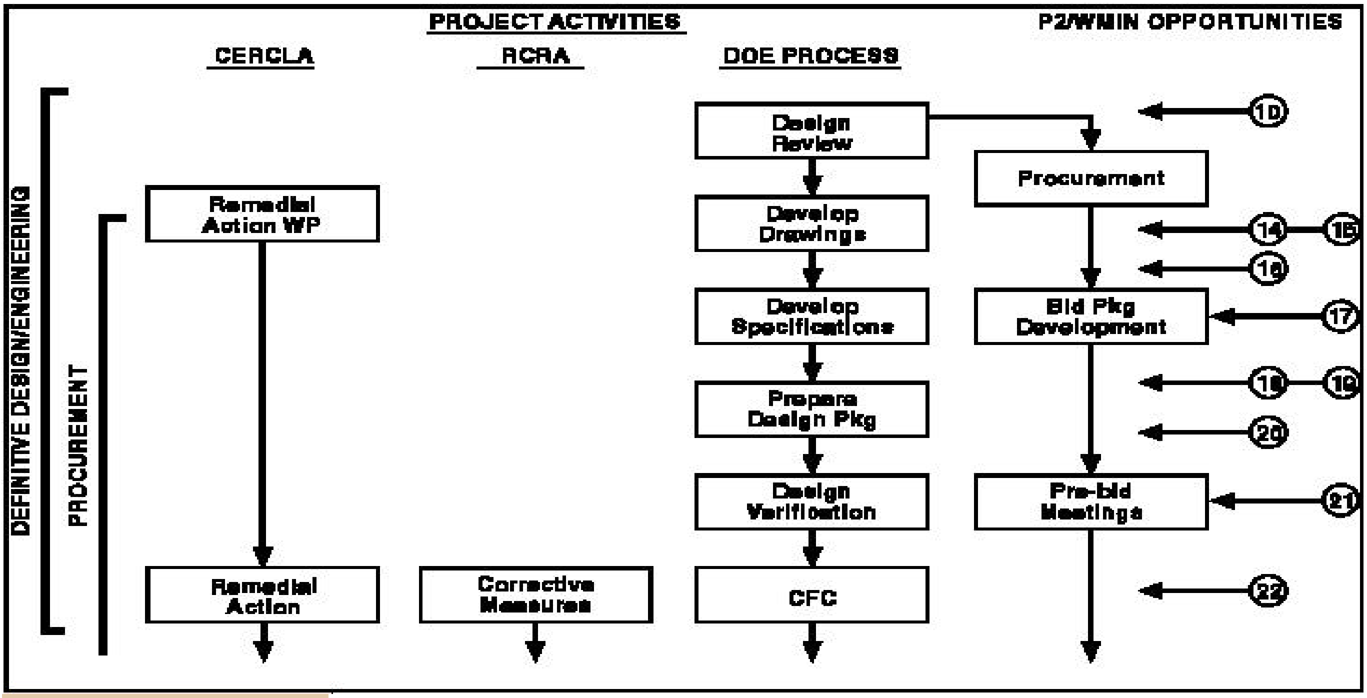


Figure 3-4. Project management overview for procurement activities

Figure 3-4 details the general sequence of activities for the **procurement phase** of the project. This figure illustrates the interrelationships between the P2/Wmin opportunities and the general sequence of activities directed by the DOE and the regulatory agencies. The P2/WMin opportunities, numbered in the right margin of the figure, correlate to the project timeline necessary for successful integration into the project. A brief description of each P2/WMin opportunity is provided following Figure 3-4, and is identified by number in the margin. The numbering system facilitates the crosswalks to web sites and the associated worksheets.

Step 1 ☞ ***Identify P2/WMin opportunities that correlate to your project activity.***

The specific P2/WMin opportunities identified in Figure 3-4 are briefly described below.

Opportunity 14

14. ***Evaluate segregation options*** - the design phase should evaluate technologies and implementation strategies that promote segregation of materials based on activity levels and material type or classification. The design phase overlaps the procurement phase at this early stage and should feed into the overall project strategy.

Opportunity 15

15. ***Evaluate secondary waste generation*** - consideration must be given to minimizing the waste streams generated as a direct result of the ER activities. This evaluation will be highly dependent upon the remediation strategy and/or technology selected for ER and should be considered during the design and procurement stages.

16. ***Incorporate P2/WMin opportunities into decommissioning specifications*** - generic P2/WMin opportunities/language should be incorporated early in the design specifications for the ER project. Input from the project team during the preliminary design review cycle is also essential for effective implementation.

Opportunity 16

17. ***Evaluate subcontractor incentives*** - establish feasibility and cost considerations associated with implementation of P2/WMin practices. The ER subcontractor should play an active role during the pre-bid discussions, if the procurement strategy allows, in order to provide input and facilitate the ultimate structure of the bid package incentive language.

Opportunity 17

18. ***Incorporate project-specific lessons learned*** - an evaluation of the effectiveness of the site ER projects, with respect to P2/WMin practices, should be conducted. Integrate the most recent and applicable project-specific lessons learned from close-out meetings and ER subcontractors' effectiveness evaluations into the early procurement phase of the project.

Opportunity 18

19. ***Incorporate project-specific lessons learned from other site coordinators*** - the establishment of P2/WMin site coordinators will facilitate the sharing and communication of applicable case studies and lessons learned between OFO sites and ultimately between DOE sites complex wide. This type of input will be a valuable resource during the procurement and design phases of the project.

Opportunity 19

20. ***Project team input to bid package development*** - input from the project team, particularly field or construction management, will provide a valuable resource for developing an effective bid package which reflects the site specific experience gained from similar ER projects

Opportunity 20

21. ***Evaluate procurement strategies*** - procurement options should be tailored to meet the specific requirements of the project (refer to Section 7). Selection of a procurement strategy should allow for flexibility to incorporate subcontractor incentives where applicable and appropriate.

Opportunity 21

22. ***Implement subcontractor incentives*** - final structure of the bid package should incorporate subcontractor incentives for effective implementation of P2/WMin opportunities geared at reducing the overall project cost.

Opportunity 22

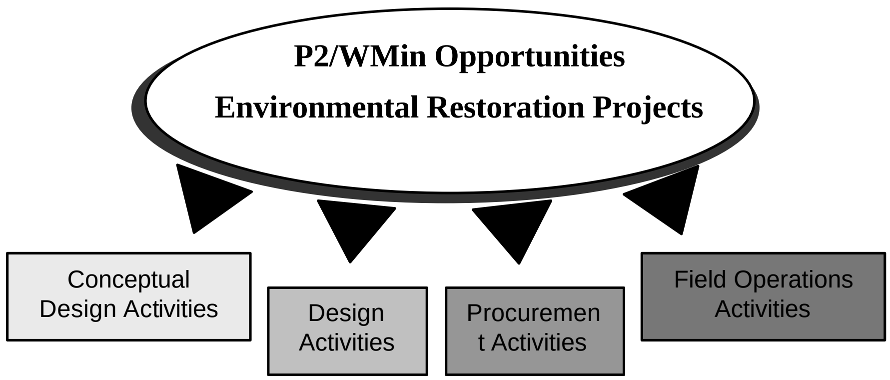
The project planning guide (Table 3-1) has been formatted to provide the user with a method for identifying the project-specific documentation or actions necessary for the successful integration and implementation of the P2/WMin opportunities. The project planning guide provides the user with the following information:

- Listing of the general DOE and EPA remedial project activities impacted by the implementation of a specific P2/WMin opportunity,
- Listing of recommendations or actions available to the user to facilitate implementation of the P2/WMin opportunities,

- A crosswalk to Web Sites for each P2/WMin opportunity providing case studies, lessons learned, project planning guidance,
- A crosswalk to the associated worksheets to assist the user in project planning.

Step 2 ☞ ***Use the Project Planning Guide (Table 3-1) for recommendations, actions and crosswalk references to case studies to implement P2/WMin opportunities.***

3.4 Field Operations Activities



Field operations include: (1) Completion of the CERCLA remedial action, operation and maintenance, and delisting from the National Priority List (NPL); (2) Completion of RCRA corrective measures and closeout; and (3) the remaining DOE project activities through decommissioning and close-out.

Figure 3-5 details the general sequence of activities for the **field operations phase** of the project. This figure illustrates the interrelationships between the P2/Wmin opportunities and the general sequence of activities directed by the DOE and the regulatory agencies. The P2/WMin opportunities, numbered in the right margin of the figure, correlate to the project timeline necessary for successful integration into the project. A brief description of each P2/WMin opportunity is provided following Figure 3-5, and is identified by number in the margin. The numbering system facilitates the crosswalks to web sites and the associated worksheets.

Step 1 ☞ ***Identify P2/WMin opportunities that correlate to your project activity.***

The specific P2/WMin opportunities identified in Figure 3-5 are briefly described below.

Opportunity 23

23. ***Housekeeping practices*** - effective waste management or housekeeping practices by an ER subcontractor will minimize the potential for clean streams to be mixed with contaminated streams, reducing the overall volume of material to ultimately be dispositioned.

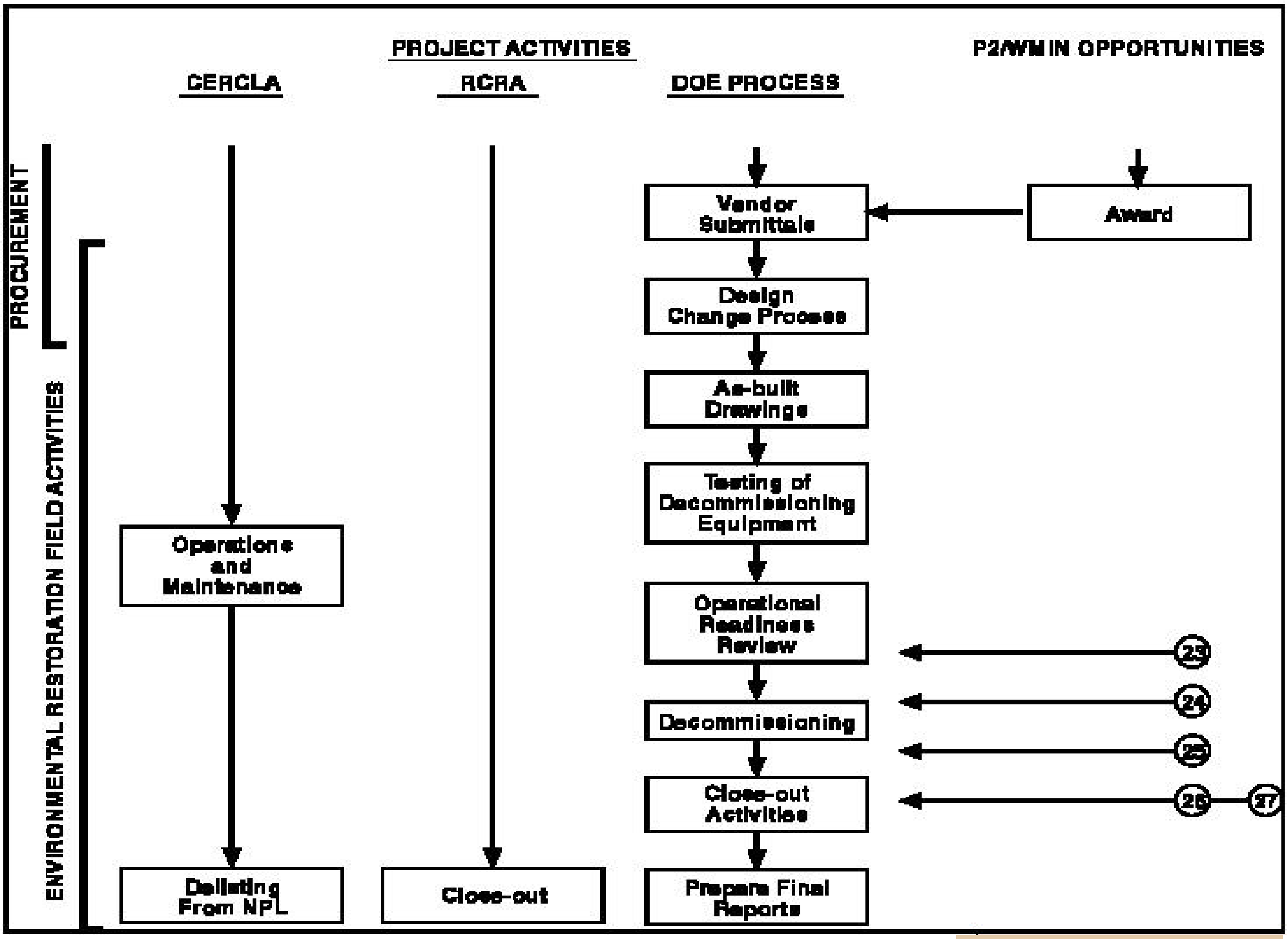


Figure 3-5. Project management overview for field operations activities

24. ***Evaluate secondary waste generation*** - refer to P2/WMin Opportunities 6 and 15; this aspect of the project will require monitoring of the subcontractor to effectively evaluate the performance of the contract and the overall project strategy in meeting the P2/WMin goals.

Opportunity 24

25. ***Evaluate segregation options*** - refer to P2/WMin Opportunities 9 and 14; this aspect of the project will also require monitoring to effectively evaluate the performance of the contract and the overall project effectiveness. Monitoring is a critical element to the reporting and documentation aspects of the project.

Opportunity 25

26. ***Evaluation of project and subcontractor effectiveness*** - in order to evaluate the effectiveness of the ER subcontractor to implement P2/WMin opportunities, it is necessary to understand the problems and obstacles experienced throughout the ER field operations phase. Members of the project team will evaluate the overall effectiveness of the project and the ability of the ER subcontractor to achieve the P2/WMin goals.

Opportunity 26

Opportunity 27

- 27. ***Documentation of lessons learned*** - conduct a project close-out/lessons learned meeting with the project team and the subcontractors. The project team members are responsible for documentation and communication of P2/WMin implementation data back to the design team members for consideration in future ER design packages and to P2/WMin coordinators at other sites. The project planning guide (Table 3-1) has been formatted to provide the user with a method for identifying the project-specific documentation or actions necessary for the successful integration and implementation of the P2/WMin opportunities. The project planning guide provides the user with the following information:
- Listing of the general DOE and EPA Remedial project activities impacted by the implementation of a specific P2/WMin opportunity,
- Listing of recommendations or actions available to the user to facilitate implementation of the P2/WMin opportunities,
- A crosswalk to Web Sites for each P2/WMin opportunity providing case studies, lessons learned, project planning guidance,
- A crosswalk to the associated worksheets to assist the user in project planning.

Step 2 ☞ ***Use the Project Planning Guide (Table 3-1) for recommendations, actions and crosswalk references to case studies to implement P2/WMin opportunities.***

This page is intentionally blank.

ATTACHMENT 2

SAMPLE ENGINEERING PROCEDURES

FC1> WVNSCO West Valley Nuclear Services Company

ENGINEERING PROCEDURES

TITLE: Design Basis Documentation

GENERAL REVISION

1.0 PURPOSE

This procedure provides instructions for the documentation of the design basis. This documentation is used to define the requirements needed to ensure that systems and facilities are designed to meet the customers' needs, protect worker health and safety, public health and safety, and the environment, including pollution prevention and waste minimization. The documentation of the design basis defines the codes, standards, regulations and other requirements that the design must comply with and serves to communicate this information to the designer(s). Design basis documentation can, with the concurrence of the Cognizant System Design Manager (CSDM), be written for items that do not fit the category of systems or facilities, such as, components or subsystems of systems or facilities.

This procedure also provides responsibilities for assignment and initiation of detail design activities.

2.0 RESPONSIBILITIES

The responsibilities listed are unique to this EP. Standard responsibility descriptions can be found in WVDP-332.

2.1 Cognizant System Design Manager (CSDM) - Determines scope and format to be used for the design basis and assigns an author for the document.

NOTE The Cognizant System Engineer, the Cognizant Engineer for design basis, the Cognizant Engineer for detail design tasks and the Author may be the same person.

2.2 Cognizant System Engineer (CSE) - Ensures the determination of the appropriate "Hazards Classification" or "Hazard Categories" (per WV-365, "Preparation of WVDP Safety Documents"), "Safety Class" (per QM 3, "Design Control"), and "Quality Level" (per QM 2, "Quality Assurance Program") for the design. Performs a Hazards Analysis and incorporates the resulting requirements into the design basis document. Provides input by defining the system requirements and assures technical adequacy of the design basis. For detail design activities, the CSE provides input to the Cognizant Engineer (CE) for system requirements.

2.3 Cognizant Engineer (CE) for design basis - Provides input by defining the detail design requirements.

NOTE The design basis document can be prepared by the CE or the CSE.

2.4 Author - Determines the appropriate HLW designation per EP-2-001, "Determination of Required HLW Designation". Prepares the documentation of the design basis and resolves all review comments. For projects, verifies with the Project Manager that authorization to proceed has been obtained.

2.5 Records and Information - Assigns the unique document identification number for engineering released design basis documentation, enters design basis documentation information into the Design Document Report, and distributes and files the document in accordance with WVDP-257.

2.6 Cognizant Manager (CM) - Assigns a CE for a design task. This assignment takes into account the requirements of the task and the CM's determination that the CE is qualified to develop adequate design details based on experience, training and education. For projects, verifies with the Project Manager that authorization to proceed has been obtained.

2.7 Cognizant Engineer (For Detail Design Tasks) - is responsible to develop the design to meet the requirement of the design basis. Utilizes the checklist on the LAN at S:\WPFORMS\LISTS\DESREVCK.WPD as a guide to determine the design aspects to be considered. The CE also is to consider requirements for layout drawings, general arrangements, clearance drawings, etc. to assure correct form, fit, and function.

2.8 Project Manager - provides authorization to proceed with the development of the design basis documents in support of a project via the project approval process per WV-127.

2.9 DEFINITIONS

The definitions listed are unique to this EP. Standard definitions can be found in WVDP-332.

2.10 Design Basis Documentation (DBD) - Documentation which sets the requirements that bound the design of systems, facilities, subsystem, structures or components. These design requirements include consideration of hazards analysis results, safety, plant efficiency, reliability and maintainability (e.g., Design Criteria (DC), Summary Design Criteria (SDC), Functional Requirements Document (FRD)).

2.11 Design Criteria (DC) - A comprehensive technical document that describes the functional requirements of a system or facility; defines the applicability of specific codes, standards, and regulations; identifies bounding parameters; consolidates design input from testing or analyses; states specific engineering requirements; and provides the basis for design verification and interface control. For instructions on the format of design criteria, see Attachment A.

2.12 Summary Design Criteria (SDC) - A form that includes an outline for filling in design criteria requirements in an abbreviated fashion and provides the basis for simplifying the preparation of an acceptable design basis document, see Attachment B (Form WV-3501).

2.13 Functional Requirements Document (FRD) - An interim document (see Attachment E), created during the definition phase of a project or task, which clearly defines the problem and the customer's need, and lists all functions and requirements of the project or task. The FRD is to be used as a tool during the early stages of the design process, to assist in the creation and evaluation of alternatives, and in the approval of a conceptual design.

2.14 System Description Document (SD) - A comprehensive technical document that includes the complete description of the system design features.

2.15 Verification Test - A test that demonstrates adequacy of design.

FC1> Design Traveler (DT) - A package which plans, documents, collects and provides for approval of all aspects of a particular design from initial planning through final approval.

2.16 GENERAL

2.17 For work scopes which are designated as projects, authorization to proceed must have been received via the project approval process per WV-127 prior to creation of the design basis document.

2.18 Design basis shall be documented according to the following:

2.18.1 A Design Criteria (DC) document shall be prepared according to the Design Criteria format shown in Attachment A for systems or facilities that:

2.18.1.1 Have an estimated value $ $10 million
OR
2.18.1.2 Are classified as a high-hazard or a moderate-hazard non-nuclear facility per WV-365
OR
2.18.1.3 Are categorized as a Hazard Category 1, 2, or 3 nuclear facility per WV-365 (see 10 CFR 830.206(b)(1).)
OR
2.18.1.4 Include Quality Level "A" or "B" components.

A DC document may be prepared for other systems or facilities or for components or subsystems if the CSDM so chooses.

FC1> **NOTE** *Hazard classifications are provided only at the facility level, not at the component or subsystem level. If A and D of 4.2.1 do not apply, the following methods of Section 4.2 may be used for components or subsystems of any facility or system.*

2.18.2 Section 1 of a system description (SD) document (EP-3-025) may be used to provide design criteria for the design engineer to use as the basis for the design for the systems listed in Section 4.1.2 of EP-3-025.

2.18.3 The Summary Design Criteria (SDC) form WV-3501 shall be completed for Quality Level C systems, facilities, components or subsystems by referencing input requirements listed in Attachment G, Summary Design Criteria - Considerations. When form WV-3501 has been completed, it must be signed by the author and Cognizant System Design Manager (CSDM) before initiating the detailed design.

2.18.4A Functional Requirements Document (FRD), Form WV-3526, is prepared during the definition phase of a project or task as one of the tools to administer the design process per WV-127. The FRD is a document whose contents are revised as needed and is eventually released.

2.18.4.1 As a minimum, a FRD should include the following:

2.18.4.1.1 Any requirements which the project or task will be required to meet, including performance requirements, constraints and interfaces.

2.18.4.1.2 Any functions which the system is expected to perform, concentrating on the "what," without regard to "how." All modes of operation need to be considered, including normal operation, start-up, shutdown, accident conditions and maintenance.

2.18.4.2 In general, the FRD shall be issued by the CE and approved by the Facility Manager or his designee. Additional reviewers may be added as required.

FC1> 0.0.1 Design basis documentation may also be included:

- $ in a construction specification (C-Spec) per EP-7-001
- $ in an equipment specification (E-Spec) per EP-3-004
- $ on drawings (EP-3-005) and sketches (EP-3-029)
- $ in design verification documentation (EP-3-003) (e.g., verification tests or calculations).
- $ in a Design Traveler (EP-3-028)

If used, these documents must include applicable information as identified in Attachment A.

2.19 Design basis documentation shall be prepared or updated whenever:

2.19.1 A new system or facility design is required.

2.19.2 An existing system or facility must be upgraded.

2.20 At the time that the need for a new or modified system or facility is established, a review of the existing Q-List (WVDP-204) shall be performed by the CSDM and the Q-List shall be upgraded as required.

2.21 If the DC or SDC is being written for a component rather than a system or facility, the screening process as defined in EP-2-001 is to be used to determine whether the item or activity must be designated as High Level Waste (HLW). Attach completed HLW Screening Form, if required, to the completed DBD prior to performing a Design Review per EP-3-003.

2.22 Criteria that are not verifiable are of little value. For example, "the design should be conservative" is a criterion that has little value. Whereas, stating that "one-fifth of the ultimate strength should be used as the maximum allowable stress for the design of lifting bails" is a very useful criterion.

2.23 Engineers shall consider hazards, possible accidents, and the affected populations including: the public, environment (including waste minimization and pollution prevention), nearby work force and facility work force when developing design basis documents. Attachment F provides a set of hazards that might be associated with a system, structure or component. This list is to be used as a guide identifying hazards that shall be considered during the development of designs. Appropriate prevention and/or mitigation shall be specified in a design basis document and used during design development. This may take the form of accident prevention or mitigation, or it could be reflected in altering the original design to eliminate hazards or reduce/eliminate wastes. Engineered solutions are generally preferred to procedural, training or personal protective equipment. The cognizant facility manager shall be consulted if methods other than engineered controls are being proposed.

Design Basis Documentation (DBD) shall consider the identified hazards, and specify those design features and design standards to be incorporated to prevent or mitigate any accidents associated with the hazards.

2.24 Criteria required to remain within the boundaries stated in applicable safety analysis reports, environmental checklists, and environmental permits must be incorporated into the design basis document.

2.25 In general, the author should review previously released DC or SDC for applicable criteria. Group activities, such as brainstorming and value engineering, are also very beneficial in establishing criteria.

2.26 The author should review Lessons Learned, event fact sheets, and occurrence reports (WVDP-242) relating to design inputs. The author should contact Safety Analysis and Integration for assistance on gathering this information.

2.27 The DBD should define the codes, standards, and regulatory requirements that are to be adhered to in the design. The applicability of the codes, standards, and regulatory requirements must be very specifically stated.

2.28 <u>Records Maintenance</u>

2.28.1 Records generated as a result of this procedure are identified as follows:

2.28.1.1 Design Criteria (DC) - per Attachment A to this procedure

2.28.1.2 Summary Design Criteria (SDC), WV-3501

2.28.1.3 Functional Requirements Document (FRD), WV-3526

2.28.2 Records are identified on the Records and Information Department=s Records Inventory and Disposition Schedule (RIDS).

2.28.3 Records shall be prepared, maintained, and transferred to Records and Information for storage in accordance with WVDP-262, "WVNS Manual for Records Management and Storage."

2.29 PROCESSING

2.30 Design Basis Documents

Responsibility		Action
2.30.1 CSDM	A.	Determines the scope of the DBD.
	B.	Assigns a person to prepare the DBD and determines format to be used.
	C.	Concurs with HLW Screening by signature on the HLW screening form (only if a CSE does not exist for the system).
2.30.2 CSE	A.	Ensures that the hazard classification, safety classification, and system requirements are defined and performs a hazards analysis.
	B.	Concurs with HLW screening by signature on the HLW screening form.
2.30.3 CE	A.	Defines detail design requirements. If there is no CSE - perform hazards analysis, defines hazard classification, safety class, etc.
2.30.4 Author	A.	If the DC or SDC is being written for a component - determines the appropriate HLW designation.
	B.	For projects, verifies with the Project Manager that authorization to proceed has been obtained.
	C.	Obtains a DC, SDC or FRD number from Records and Information.
	D.	Prepares a draft of the DC per Attachment A or SDC per Attachment B including determining the

safety class and quality level and attaches completed HLW Screening Form (if required)

E. Design reviews and obtains approval of the DC or SDC per EP-3-003 and releases per EP-3-011.

F. Sends the original HLW Screening Form to HLW Operations Technical Support at engineering release.

G. Reviews Lessons Learned, event fact sheets and occurrence reporting received from Safety Integration and Analysis relating to design inputs.

2.30.5 Records and Information	A. Assigns DC, SDC or FRD Document Identification number(s).
	B. Enters Design Basis Documentation Information into the Design Document Report.
	C. Distributes per WVDP-257 and files.

2.31 Detail Design Tasks

Responsibility	Action
2.31.1CE	A. Review DBD for design requirements.
	B. Reviews Attachments C and D for codes and standards and site specific design values.
	C. Reviews EP-3-003 Attachment E for design aspects to be considered.
2.31.2CSE	A. Provides system requirements.
2.31.3CE	A. Develops design, prepares D-spec per EP-3-005 for drawing preparation. Considers the requirements for layout drawings, general arrangements, clearance drawings, etc. to assure correct form, fit, and function.
	B. Prepare the design package for design review per EP-3-003.

2.32 REFERENCES

2.33 EP-2-001 – “Determination of Required HLW Designation”

2.34 EP-3-003 – “Design Verification and Review”

2.35 EP-3-004 – “Preparation of Equipment Specification”

2.36 EP-3-005 – “Preparation of Drawings”

EP-3-011 – “Engineering Release of Documents”

2.37 EP-3-029 – “Preparation and Control of Sketches”

2.38 EP-3-021 – “Preparation and Review of Engineering/Scientific Calculations”

2.39 EP-3-025 – “Preparation of System Description”

FC1> 0.1 EP-3-028, “Design Traveler System”

2.40 EP-7-001 – “Preparation of Construction Specification”

2.41 EP-11-003 – “Experimental and Developmental Test Control”

QM-2 – “Quality Assurance Program”

2.42 QM-3 – “Design Control”

2.43 WV-100 – “Integrated Safety Management and Control of Documents”

2.44 WV-127 – “Project Definition and Control”

2.45 WV-365 – “Preparation of WVDP Safety Documents”

2.46 WV-918 – “Waste Minimization Pollution Prevention Awareness Program”

2.47 DOE Order 420.1 – “Facility Safety”

2.48 DOE Order 430.1 – “Life Cycle Asset Management”

2.49 DOE G 450.4-1 – “Integrated Safety Management Guide”

2.50 DOE P 450.4 – “Safety Management System Policy”

2.51 WVDP-087 – “Waste Minimization/Pollution Prevention Awareness Plan”

2.52 WVDP-204 – “WVDP Quality List (‘Q’ List)”

2.53 WVDP-242 – “Event Investigation and Reporting Manual”

2.54 WVDP-257 – "WVNS Manual for the Preparation, Review, Approval, Distribution, and Revision of Controlled Documents"

2.55 WVDP-262 – "WVNS Manual for Records Management and Storage"

2.56 WVDP-227 – "WVDP Facility Identification and Classification Matrix"

2.57 ATTACHMENTS

Attachment A - Design Criteria (DC) Format

Attachment B - Summary Design Criteria (SDC), Form WV-3501 (Latest Revision)

Attachment C - Set of Building Codes and Standards

Attachment D - Site Specific Design Values

Attachment E - Functional Requirements Document

Attachment F - Hazards Identification List

Attachment G - Summary Design Criteria - Considerations

Attachment A - Design Criteria (DC) Format

The following sections are recommended to be included in the DC document.

PRELIMINARY PAGES

Document Sign-Off Sheet - Form WV-1816 (with HLW Designation Block)
Record of Revision & Continuation Sheets - Form WV-1807

The preliminary pages are provided by Records and Information. Document Sign-Off Sheet will list document title, number, revision, date, ER number, check off block for High Level Waste designation, and signatures required for approval ONLY.

1.0 SCOPE

Section 1.0 should provide a brief description of the system or facility covered in the DC and the application of the system or facility relative to the overall project. The document that specifies the need for the system, or facility encompassed by this DC should be specified in this section.

2.0 FUNCTIONAL REQUIREMENTS

Section 2.0 shall define the basic functional requirements of the system or facility. This includes overall performance requirements such as capacity, rating, input, and output. Process or flow diagrams can be referred to or included in this section. The intended functional life and the degree of reliability of the permanent system or facility should be specified in this section.

3.0 OPERATIONAL REQUIREMENTS

Section 3.0 should define the maximum/minimum environmental conditions for the public, plant personnel, operators and maintenance personnel (e.g., temperature, humidity, radiation exposure, physical exertion limits, lighting, etc.). If these conditions change during plant emergency operation, special or infrequent operation, or system abnormal or emergency operation, then the limit changes should be clearly defined. Section 3.0 should also define alarm requirements, instrument indication restrictions, configuration status requirements, and other system (or component) to operator communication requirements. Any special requirements that affect or limit the communications of the operator to the system (or component) should be clearly described in this section. Some examples are: lock and tag requirements, required operation or repair from a remote location, interlocks, system response time to a specific safety incident, and/or frequency requirements (or limitations) for operator to system (or component) interaction. Plant, system or component security requirements such as access or password control should be specified in this section. Requirements for calibration, in-service inspection, or periodic checkout that require special design features should be defined. If operator training limitations constrain the design, then the limitations should be specified.

4.0 DESIGN REQUIREMENTS

Section 4.0 should define the specific design requirements. DOE 420.1 (per 10 CFR 830.206(b)(1)) and DOE 430.1 adherence is required for any building, new facility, or facility addition alteration including preengineered buildings, plant-fabricated modular buildings, and temporary facilities. This section should contain the required information to efficiently use DOE 420.1 and DOE 430.1. The following is a general list of the type of requirements that may appear in this section:

See Attachment C for set of building codes and standards and Attachment D for site specific design values.

a. Design conditions such as pressures and temperatures.

b. Loads such as seismic, wind, thermal, and dynamic.

c. Material requirements including such items as compatibility, electrical insulation properties, coating, radiation resistance, and corrosion resistance.

d. Mechanical requirements such as vibration, shock, and reaction forces.

e. Structural requirements covering such items as equipment foundations and pipe supports.

f. Hydraulic requirements such as pump net positive suction heads (NPSH), allowable pressure drops, viscosity, and allowable fluid velocities.

g. Process requirements such as provisions for sampling, flow rate, temperature, pressures, chemical reactivities, and feed and product compositions.

h. Electrical requirements such as source of power, voltage, raceway requirements, electrical insulation, and motor requirements.

i. Layout and arrangement requirements or restrictions.

j. Redundancy, diversity, and separation requirements of structures, systems, and components.

k. Failure effects requirements of structures, systems, and components.

l. Transportability requirements such as size and shipping weight limitations and ICC and DOT regulations.

m. Fire protection and/or resistance requirements.

n. Handling, storage, and cleaning requirements.

o. Requirements for access and periodic inspections, when applicable, shall be provided.

p. Any unique maintenance requirements for the system and provisions incorporated into the design to accommodate the operation.

q. Safety requirements developed as a result of hazards analysis, including those for preventing personnel injury including such items as radiation hazards, shielding, restricting the use of dangerous materials, escape provisions from enclosures, grounding of electrical systems, barriers and railings, fire and explosion prevention and mitigation, chemical storage and handling, etc.

r. Decommission and decontamination considerations.

s. Uniformity or standardization guidelines.

t. Requirements, including those for environmental compliance, relating to waste streams including liquid waste streams, exhausts, consumables, scrap material and by-products.

5.0 INTERFACE REQUIREMENTS

Section 5.0 should provide a list of the interface boundaries that the design must stay within. For example, if only 5 GPM of cooling water is available to a component, then this limitation should be listed as an interface boundary. Mounting details, information about an inlet or outlet flange, and physical size constraints are common interfaces that require definition. Other common interfaces are tie-ins to existing utilities and ventilation systems and interfaces with support personnel such as Analytical Lab personnel, R&S personnel, QA personnel, etc. The functions and/or services that this component, system, or structure must provide to other components, systems or facilities should also be listed in this section. Simple drawings and tables are often the easiest way to document the information required in this section.

6.0 QUALITY ASSURANCE REQUIREMENTS

Section 6.0 should specify any special quality assurance requirements that apply to the design, fabrication, construction, or testing. For quality level determinations for systems and facilities see QM-2, for safety class determination see QM-3 and for a controlled list refer to WVDP Quality List ("Q-List") WVDP-204. If the system or facility has components with different quality levels and safety classes, the multiple levels are to be stated separately

7.0 APPLICABLE CODES AND STANDARDS

Section 7.0 should identify documents with their revision levels referenced in the text of the DC. See Attachment C for set of building codes and standards.

The following general guidelines apply:

! All documents which are listed must be mentioned in the text.

! Do not include supporting or required output documents such as design documentation, analyses, reports, etc.

! Do not include administrative documents such as WVNS procedures, purchasing documents, etc.

! Do not list documents unless the number and title have been assigned.

! Group documents by type: drawings, standards, specifications, etc.

SUMMARY DESIGN CRITERIA

If the Summary Design Criteria is being developed for a component rather than a system or facility, see EP-3-002, Section 4.5 before proceeding. If HLW designation is "YES" this form cannot be used.	High Level Waste Designation? Yes	NA	No

PROGRAMMATIC INFORMATION			
WVNS-SDC-	Rev. No.:	Revision Date:	ER/ECN No.:
Project Name:			
System Name & Number:			
Proposed Location:			
Statement of Problem or Description of Need:			
Project Completion Date:			
Pertinent Milestone Dates:			
DESIGN INPUTS (If a specific category listed below is not applicable, insert "NA" and explain why it is not applicable)			
Functional Requirements (List all functions, except as listed below, that the finished system, structure or component must satisfy):			
Operational Requirements (List all operational requirements that will be needed by the completed system, structure or component):			
Performance Requirements (List all performance requirements that will be needed by the completed system, structure or component):			
Identifiable Hazards (See Attachment F) and Necessary Controls as can be determined at this stage of design:			
Regulatory Requirements (List all regulatory requirements that must be met by the completed system, structure or component):			
Codes and Standards (List all codes and standards that govern the design of the system, structure or component):			
DOE Directives (List all DOE Directives that govern the design of the system, structure or component. See list at S:\WPFORMS\LISTS\DIRECTIV.WPD):			
Interfaces w/ New or Existing Equipment (List interface conditions between the system, structure or component & new or existing equipment):			
Radiological Requirements (List all radiological requirements the system, structure or component must satisfy):			
Fire Protection Requirements (List all Fire Protection requirements the system, structure or component must satisfy) (Refer to WVDP-177):			
Applicable Limitations stated in applicable SARs, EAs or Permits:			
Other Requirements (See Attachment G for other Requirements to Consider):			

SYSTEM, FACILITY, COMPONENT or SUBSYSTEM CLASSIFICATION Note: If the system or facility has components with different Quality Levels or Safety Classes, the multiple levels are to be listed separately.
Hazard Classification or Hazard Category:
NOTE: For systems or components that are part of an existing facility, see WVDP-227 for facility classifications. For new facilities, see WV-365 and consult Safety Analysis & Integration.
Safety Class per QM-3:
Rationale:
Quality Level per QM-2:
Rationale:

REFERENCE OR INTERFACE DRAWINGS			
Drawing No.	Sheet No.	Rev.	Title

Will the Q-List (WVDP-204) have to be Reviewed and Updated?		Yes	No
	Printed Name	Signature	Date
Prepared By:			
Cognizant System Design Manager:			

Attachment C - Set of Building Codes and Standards

The following is the default list of codes and standards, which apply to design work performed by WVNS, unless modified by an approved Design Criteria document. It is not necessary to list these documents in the Design Criteria other than to note exceptions.

The proper use of these codes and standards will support compliance with the requirements of DOE 420.1, which mandates the use of appropriate national standards for design work at DOE facilities.

In general, these codes govern the engineering process leading to calculations and design drawings. Codes and standards which primarily influence material specifications or subcontractor field activities would normally be incorporated into Specifications or drawings for design review at a later time, not as part of the Design Criteria.

This list is considered to include also, where applicable, those additional codes and standards which are referenced in the listed documents.

CAUTION

The use of this list was initiated in the interest of adhering to normal commercial design practices for facilities of relatively low hazard potential. Do not apply this list to existing facilities which are governed by other design basis documents, as these may carry more stringent requirements. This list does not include requirements stated in the Industrial Hygiene Manual, the Radcon Manual, the Conops Manual, the Fire Protection Manual and the Hoisting and Rigging Manual.

1.0 STRUCTURAL DESIGN

- 1.1 UBC - 1994
- 1.2 AISC Steel Manual
- 1.3 ACI 318 Building Code Requirements for Reinforced Concrete
- 1.4 ASCE-7-95 Minimum Design Loads for Buildings and Other Structures
- 1.5 AWD D1.1 Structural Welding Code - Steel

2.0 FIRE PROTECTION

- 2.1 NFPA 101 Life Safety Code
- 2.2 NFPA 13 Sprinkler Systems

3.0 <u>ELECTRICAL/INSTRUMENTATION</u>

3.1 NFPA 70 National Electrical Code

3.2 New York State Energy Conservation Code

3.3 Applicable standards by these organizations: (a detailed list is maintained by Electrical and I and C Engineering)

3.3.1 IES Illumination Engineering Society

3.3.2 ANSI American National Standards Institute

3.3.3 ISA Instrument Society of America

3.3.4 ICEA Insulated Cable Engineers Association

3.3.5 UL Underwriters Laboratory

3.3.6 NEMA National Electrical Manufacturer's Association

4.0 MECHANICAL

4.1 National Standard Plumbing Code

4.2 ASME B31.3 Chemical Plant Piping

4.3 ASME B31.9 Building Services Piping, for non radiological facilities

4.4 ASME Boiler and Pressure Vessel Code

4.5 New York State Energy Conservation Code

4.6 10-States Standards for Wastewater Facilities

4.7 ASHRAE 62 Ventilation for Indoor Air Quality

4.8 NFPA 90A Air Conditioning and Ventilation Systems

4.9 NFPA 54 National Fuel Gas Code, for gas piping

4.10 National Fuel Gas Company Installation Standards, for natural gas at over **2** psig

Attachment D - Site Specific Design Values

The following engineering design values are considered to govern design work at WVNS except where modified by approved Design Criteria documents.

[sources indicated in brackets]

CAUTION

The use of this list was initiated in the interest of providing consistent design values for facilities of relatively low hazard potential. Do not apply this list to existing facilities which are governed by other design basis documents, as they may carry different requirements. This list does not replace any values listed in existing SARs.

1.0 WIND CONDITIONS

Basic wind speed of 70 mph, to be applied as detailed in UBC-1994 equation 18-1. Use exposure condition B normally, investigate for condition C when very open on a 90E arc or more. No tornadic winds

[UBC]

2.0 TEMPERATURES

2.1 Design winter temperature +3 degrees F. Represents 97.5% value. For 100% outdoor air ventilation systems, use median of annual extremes -7 degrees F and provide for equipment protection to -20.

[ASHRAE Fundamentals and ASHRAE 90.1]

2.2 Design summer conditions 85 db / 70 wb. Represent 2.5% value. Condensing unit ambient temperature 93.

[ASHRAE Fundamentals and ASHRAE 90.1]

2.3 Indoor design conditions when occupant comfort is primary factor:

2.3.1 72 degrees F winter

2.3.2 78 degrees F summer when cooling is provided

[NYS Energy Code]

3.0 SEISMIC ACCELERATION

Apply UBC-1994 equation 28-1, using Z=0.075 and C=2.75 for structures. For component anchorage, use equation 30-1 with Z=0.075. This is more conservative than the site-specific ground acceleration from SAR 001 of 0.07, but is more easily applied through UBC static design procedures. [UBC]

4.0 SNOW LOAD

40 psf on ground [NYS Building Code]

5.0 LIVE LOADS

5.1 Flat Roofs: 20 psf

5.2 Floors in process areas and operating aisles: 100 psf

5.3 Floors in office areas: 50 psf [WVNS]

6.0 FROST DEPTH

42 inches [NFPA 24]

7.0 SOIL BEARING CAPACITY

1600 psf at depth of 4 feet. Represents conservative "type CL soil" value from UBC-1994 Table 18-I-A. Limit application to structures of under $50,000 in value and column loads of less than 10 kips, as more detailed study will be cost effective in larger structures. [UBC]

8.0 RAINFALL INTENSITY

8.1 Use 10-year storm data for most runoff applications:

8.1.1 3.5 inches/hr for 15 minutes, or

8.1.2 2.5 for 30, or

8.1.3 1.5 for 60 minutes

8.2 Use 25-year storm data when storm drain backup will be objectionable:

8.2.1 4.0 inches/hr for 15 minutes, or

8.2.2 2.8 for 30, or

8.2.3 2.0 for 60 minutes

[WVNS for return periods]
[US Weather Service Buffalo airport data]

Attachment E - Functional Requirements Document

FUNCTIONAL REQUIREMENTS DOCUMENT

WVNS-FRD
REV. NO.
REV. DATE

TITLE:

FUNCTIONAL REQUIREMENTS:

(NOTE: This section can be tailored to suit the requirements, i.e. bullets or other breakdown.)

THE ABOVE ARE THE AGREED FUNCTIONAL REQUIREMENTS FOR THE PROJECT/TASK/ACTIVITY INDICATED IN TITLE.

____

COGNIZANT ENGINEER DATE

____

FACILITY MANAGER/FACILITY DESIGNEE DATE

Attachment F - Hazards Identification List

Hazards Identification

The following list provides a set of hazards that might be associated with a system, structure or component. This list is to be used as a guide in identifying hazards that must be considered during the development of designs.

Acceleration/Deceleration
(uncontrolled -- too much, too little)
- Inadvertent motion
- Sloshing of liquids
- Translation of loose objects
- Impacts (sudden stops)
- Failures of brakes, wheels, tires, etc.
- Falling objects
- Fragments or missiles

Chemical Reaction
(non-fire, can be subtle over time)
- Disassociation, product reverts to separate components
- Combination, new product formed from mixture
- Corrosion, rust, etc.
- Impurities/unanticipated reactions or precipitates

Electrical
- Shock
- Burns
- Overheating
- Ignition of combustibles
- Inadvertent activation/deactivation
- Explosion, electrical

Ergonomics
- Heat Stress
- Wind Chill
- Fatigue
- Elevated Work Locations
- Cramped Work Locations

Explosions
- Explosive gas
- Explosive liquid
- Explosive dust

Flammability and Fires
- Presence of fuel -- solid, liquid, gas
- Presence of strong oxidizer -- oxygen, peroxide, etc.
- Presence of strong ignition force -- welding torch, heaters

Heat and Temperature
- Source of heat, nonelectrical
- Hot surface burns
- Very cold surface burns
- Increased gas pressure caused by heat
- Increased flammability caused by heat
- Increased volatility caused by heat
- Increased activity caused by heat

Mechanical
- Sharp edges or points
- Rotating equipment

Reciprocating equipment
- Pinch points
- Weights to be lifted
- Stability/toppling tendency
- Ejected parts or fragments

Pressure & Fluid Flow
- Compressed/high pressure gas
- High Temperature Gas/Steam
- Compressed air tool
- Pressure system exhaust
- Accidental release
- Objects propelled by pressure
- Water hammer
- Flex hose whipping
- Erosion

Static
- Container rupture
- Overpressurization
- Negative pressure effects

Leak of Material
- Flammable
- Toxic
- Corrosive
- Slippery
- Radioactive
- Criticality

Radiation
- Ionizing radiation
- Ultraviolet light
- High intensity visible light
- Infrared radiation
- Electromagnetic radiation/interference
- Microwave
- Laser radiation

Toxicity
- Gas or liquid
  - Asphyxiant
  - Irritant
  - Systemic poison
  - Carcinogen
  - Mutagen
- Biological
- Combination product
- Combustion product
- Radioactive material

Vibration
- Vibrating tools
- High noise level
- Metal fatigue
- Flow or jet vibration
- Supersonics
- Cavitation

Waste Minimization/Pollution Prevention
- Solid Waste Prevention/Minimization
- Liquid Waste Prevention/Minimization
- Gas Waste Prevention/Minimization
- Energy Utilization and Minimization

Attachment G - Summary Design Criteria - Considerations

1.0 Each section of the Summary Design Criteria Form WV-3501 may be expanded as required to provide adequate space for required input.

2.0 Addition Design input requirements that the system, structure or component must satisfy are to be added, as appropriate, considering but not limited to the following:

- Environmental Conditions
- Maintenance Requirements
- Structural Requirements
- Process Requirements
- Hoisting and Rigging Requirements
- Emergency Preparedness Requirements
- Geotechnical Requirements
- Hydrologic Requirements
- Engineering Mechanics Requirements
- Industrial Safety & Hygiene Requirements
- Interfaces with new or existing structures
- Radiological Monitoring Requirements
- Radioactive Material Handling Requirements
- Hazardous Material Handling/Packaging/Storage/Transportation Requirements
- Electrical Requirements
- Heating and Cooling Requirements
- Utility Services
- Communication Requirements
- Alarm Requirements
- Waste Minimization Requirements
- Recycled Products Usage Requirements
- Contaminated Soil Disposal Requirements (Contact Waste Characterization Services for an evaluation of soil disposal alternatives)

WVNS RECORD OF REVISION

Rev. No.	Description of Changes	Revision On Page(s)	Dated
13	General Revision. Procedure modified to include projects as follows: Sections 2.1, 2.4, and 2.6 modified responsibilities to address projects, added responsibility for project manager (2.8), added 4.1, modified 5.1.4 and 5.2.1. Updated conditions requiring DC document IAW DCIRs 0121074, 0121419 & 0121708(4.2.1). Departmental titles updated. Numerous editorial changes were made for clarification, completeness and compliance with WVDP-257. Removed PCDocs number throughout. Project Operations and Services are affected by these changes.	All	10/09/01
FC1	Procedure was updated to reference the Design Traveler as a means of documenting design bases as requested by DCIR 0122351. Detailed changes are as follows:		01/31/02
	Logo updated.	1	
	3.7 - added definition of Design Traveler.	3	
	4.2.2NOTE – added “of 4.2.1” for clarity	4	
	4.2.5 - added Design Traveler bullet.	5	
	6.0 - added EP-3-028 to references.	9	
	Repaginated to allow for FC.	All	
	This change has no direct affect on any organization.		

ATTACHMENT 3

SAMPLE REQUIREMENTS DOCUMENT

REQUIREMENTS DOCUMENT

FOR:____

Date:____

1. *General Description of Capability*

- Summarize the mission need. (If a documented Mission Need Statement did not precede the Requirements Document, explain the process that investigated alternatives for satisfying mission need).
- Describe the overall mission area.
- Describe the proposed system.
- Describe the analysis that supports the proposed system.
- Define the missions that the proposed system will be tasked to accomplish.
- Describe the operations and support concepts summarizing the system's place in the Departments Strategic Plan, its employment/operation, its organizational setting, and its sustaining and support interfaces.
- Describe the benefits of evolutionary acquisition for the proposed system (if appropriate). Requirements should be specified in terms of reasonable increments of capability described in the timeframes that will support an evolutionary acquisition approach. The requirements must be time-based with the initial capability targeted for a an Initial Operating Capability (IOC) as early as feasible. Requirements beyond the initial IOC must be specified in a time-phased manner. Only those initial requirements that can be validated by the user as needed within the strategic plan should be defined for the initial acquisition. Subsequent requirements would take into account achievements in capability from preceding blocks.

2. *Shortcomings of Existing Systems.* Describe why existing systems cannot meet current or projected requirements.

3. *Capabilities Required*

- Identify the operational performance parameters (capabilities and characteristics) required for the proposed system.
- Articulate the requirements in output oriented, and measurable terms. Use Threshold/Objective format, and provide criteria and rationale for each requirement. Rationale should include the mission-unique environment for the system.
- Timing of requirements should specify the time-based nature of the need and the events that are driving that need.
- Key Performance Parameters. Develop the Key Performance Parameters and a matrix between the requirements and performance parameters.

a. System Performance

— Describe mission scenarios in terms of mission profiles, employment strategies, and environmental conditions (natural and man-made)

— Identify system performance parameters such as accuracy, payload, speed, reliability, interoperability, etc. Recommend which parameter will be considered a Key Performance Parameter.

b. Logistics and Readiness

— Include measures for mission-capable rate, operational availability, frequency and duration of preventive or scheduled maintenance actions, etc.

— Describe in terms of mission requirements considering all operations

— Identify support requirements including expected maintenance levels, required sparing and calibration requirements.

c. Environmental, Safety and Health (ES&H) and Other System Characteristics. Characteristics that tend to be design, cost, and risk drivers. Address environmental, safety and health considerations.

— Effects, and contamination issues.

— Natural environmental factors (such as climatic, terrain, and oceanographic factors).

— Unplanned stimuli (such as outgassing, fast cook-off, unplanned impacts, and sympathetic detonation).

— Address safety issues regarding radiological, chemical, biological, and other hazards.

— Define the expected mission capability (e.g., full, percent degraded) in the various environments. Include applicable safety parameters such as those related to system, nuclear, explosive, and other safety.

— Identify physical and operational security needs.

4. *Program Support*. Establish support objectives for initial and full operational capability. Discuss interfacing systems (at the system/subsystem, platform, and force levels), specifically those related to control, communications, computers, and intelligence; transportation and basing; disposal and storage, and standardization and interoperability.

   a. Maintenance Planning. Identify maintenance tasks to be accomplished and time phasing for all levels of maintenance. Include programmed maintenance and surveillance inspections such as nuclear and radiological safety. Describe the envisioned planning approach for contract versus organic repair.

   b. Support Equipment. Define the standard support equipment to be used by the system.

   — Describe the test and fault isolation capabilities desired of automatic test equipment at all levels, expressed in terms of realistic and affordable probabilities and confidence levels.

   c. Standardization, Interoperability, and Commonality

   — Describe how the system will be integrated into the existing architecture command, that is forecast to exist at the time the system will be fielded. Include impact on current/planned infrastructure, including methodology for assessment.

   — Identify data and data fusion requirements (data, voice, video), computer network support.

   — Identify unique intelligence information requirements, including intelligence interfaces, communications, and data base support pertaining to target and mission planning activities, threat data, etc.

   — Identify procedural and technical interfaces, protocols, and standards required to be incorporated to ensure compatibility and interoperability with other systems and architectures.

   — Address energy standardization and efficiency needs for both fuels and electrical power as applicable.

   d. Computer Resources

   — Identify computer resource constraints (examples include language, computer, database, architecture, or interoperability constraints).

   — Address all mission-critical and support computer resources, including automated test equipment.

- Describe the capabilities desired for integrated computer resources support.
- Identify any unique user interface requirements, documentation needs, and special software certifications.

e. Human Systems Integration. Address HSI domains to include:

- Establish broad manpower constraints for operators, maintainers, and support personnel.
- Identify requirements for manpower factors that impact system design (utilization rates, and maintenance ratios).
- Establish broad cognitive, physical, and sensory requirements for the operators, maintainers, or support personnel who contribute to, or constrain, total system performance.
- Establish requirements for human performance that will achieve effective human-system interfaces. Identify requirements for combining, modifying, or establishing new military occupational specialties.
- Describe the training concept to include requirements for the training support package (e.g., simulators, training devices, embedded training) and training logistics. Include safety or health and critical errors that reduce job performance or system effectiveness given the operational environment. Determine objectives and thresholds for the above requirements, as appropriate.

f. Other Logistics and Facilities Considerations.

- Describe the provisioning strategy for the system.
- Specify any unique facility, shelter, supporting infrastructure, environmental compliance requirements, and associated costs and availability milestone schedules in support of the requirement.
- Identify special packaging, handling, and transportation considerations.
- Define unique data requirements such as engineering data for support and technical orders for the system.

g. Transportation and Basing. Describe how the system will be moved if appropriate. Identify any lift constraints. Detail the basing requirements and associated facilities needed for training.

h. Natural Environmental Support. Identify the standard and unique weather, oceanographic, and astrogeophysical support required. Include data accuracy and forecast requirements.

5. *Schedule*. Define what actions, when complete, will constitute attainment of initial and lull operational capability (leave flexible for these to be revised as the program is progressively defined and trade-off studies are completed).

   Clearly specify the operational capability or level of performance necessary to declare initial and full operational capability. Include the number of operational systems, operational and support personnel, facilities, supporting infrastructure and organizational, intermediate, and depot support elements that must be in place. If availability in a specific timeframe is important, specify an objective for initial operational capability. Describe the impact if this objective is not achieved and identify a window of acceptability if appropriate.

6. *Affordability*. Cost will be addressed in the requirements document. Inclusion of cost allows the program to emphasize affordability early in the proposed project. The cost figure should be stated in terms of a threshold and objective and not included in the Performance Baseline updated in order to provide flexibility to allow for evolution and trade studies. Once the final estimate is complete, that cost will be included in the Performance Baseline.

This page is intentionally blank.