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Ground Water Protection Programs Implementation Guide for Use with DOE O 450.1, *Environmental Protection Program*

[This Guide describes suggested nonmandatory approaches for meeting requirements. Guides are not requirements documents and are not to be construed as requirements in any audit or appraisal for compliance with the parent Policy, Order, Notice, or Manual.]

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PREFACE

This Guide is one of a series issued to provide suggested approaches for meeting the requirements of DOE O 450.1, *Environmental Protection Program,* which requires Department of Energy (DOE) organizations to establish an environmental management system that is part of DOE's Integrated Safety Management System. This Guide provides a description of the elements of an integrated site-wide ground water protection program that can be adapted to unique physical conditions and programmatic needs at each DOE site to meet the requirements of DOE O 450.1.

This Guide is approved for use by the DOE Office of Environment, Safety and Health and is available for use by all DOE elements, including the National Nuclear Security Administration, and their contractors. Suggestions for corrections or improvements to this Guide should be addressed to—

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DOE Guides are part of the DOE Directives System and are issued to provide supplemental information regarding the Department's expectations of its requirements as contained in rules, Orders, Notices, and regulatory standards. Guides also provide acceptable methods for implementing these requirements; however, Guides do not establish or invoke any new requirements nor are they substitutes for requirements. Guides do not replace Technical Standards, which are used to describe established practices and procedures for implementing requirements.

CONTENTS

CONTENTS (continued)

CONTENTS (continued)

CHAPTER I. INTRODUCTION

1. Purpose.

The purpose of this Guide is to highlight the benefits, goals, and objectives of a successful site-wide ground water protection program (GWPP) that is consistent with the requirements for an environmental management system (EMS) in DOE O 450.1, *Environmental Protection Program.* To ensure long-term ground water protection, each DOE site should consider establishing and maintaining a GWPP as an integrating element of the site-wide EMS. A GWPP is part of an EMS and, as with the EMS, a clear declaration of management commitment to ground water protection is key to an effective and functional program. This Guide is a broad, comprehensive description of an effective GWPP which can be adapted to the site-specific issues. It links the key components of a GWPP to the four phases of an EMS and offers specific examples for application.

Throughout this implementation guide the elements of the site's EMS that relate to ground water protection are referred to as the GWPP. The term "GWPP" is used to encompass or represent all activities that support ground water protection as a "program." This is not intended to imply that DOE sites are required to have programs for ground water protection that are separate from the site's EMS programs. In fact, the GWPP should be an integral part of the EMS. Although the GWPP needs to be documented, it may be described in the site's DOE O 450.1 EMS documentation or it may be documented separately and integrated into the site's EMS by reference in the EMS program documentation.

Across the DOE complex GWPPs vary in size, maturity, and funding. This may affect a site's ability to incorporate or address the provisions of this Guide. It is not the intent of this Guide to reinvent existing GWPPs or cause unnecessary duplication or expenditures of resources. Rather, this Guide should be helpful to DOE sites and facilities that seek to implement an effective GWPP within the context of an ISMS/EMS. There may be DOE sites that are undertaking different approaches to ground water protection than the approach discussed in this Guide. Alternative approaches that effectively meet the desired level of environmental protection and that satisfy the requirements of DOE O 450.1 may be used.

2. Background.

DOE O 450.1 promotes implementation of sound stewardship practices that are protective of the air, water, land, and cultural and ecological resources impacted by DOE operations and by which DOE meets or exceeds compliance with applicable environmental, public health, and resource protection laws; regulations; and DOE requirements in a cost-effective way. As one of the largest land management agencies in the Federal government, the Department of Energy (DOE) conducts its operations in a manner that protects natural resources, including ground water. Since ground water can

be affected by any operating facility or activity, implementation of the site's EMS should ensure that all efforts to protect ground water resources are integrated within a site-wide program.

DOE O 450.1 requires DOE elements to ensure that the site integrated safety management system (ISMS) includes an EMS that (1) provides for the systematic planning, integrated execution, and evaluation of programs for public health and environmental protection, pollution prevention, and compliance with applicable environmental protection requirements; (2) includes policies, procedures, and training to identify activities with significant environmental impacts; to manage, control, and mitigate the impacts of these activities; and to assess performance and implement corrective actions where needed; and (3) includes measurable environmental goals, objectives, and targets that are reviewed annually and updated when appropriate. The integration of the EMS into an ISMS is referred to as ISMS/EMS.

The ISMS/EMS approach, as described in DOE G 450.1-1, *Implementation Guide for Use with DOE O 450.1, Environmental Protection Program*, dated 2-18-04, emphasizes continual improvement of each environmental management program. The ISMS/EMS is structured around four phases—(1) planning and aspects identification, (2) implementation and operation, (3) checking and corrective action, and (4) management review and system maintenance—for ensuring continual improvement as time passes and site conditions change. DOE G 450.1-1 provides examples of how different DOE sites currently define organizational scope (the set of facilities or activities covered by an ISMS/EMS) and notes that the ISMS/EMS should include all activities that occur within that scope, including DOE field offices, contractors (with appropriate flow-down to subcontractors), and other tenant organizations. DOE G 450.1-1 also contains guidance related to implementation of an ISMS/EMS at sites with multiple, semi-autonomous divisions.

A successful site-wide ISMS/EMS program can provide the framework for managing efforts to protect ground water in a cost-effective manner and for integrating specific DOE program responsibilities such as compliance with applicable regulatory requirements, active remediation of contaminated ground water, prevention of future ground water contamination, ongoing program activities and facilities and site-wide landlord responsibilities, and ground water and vadose zone monitoring activities.

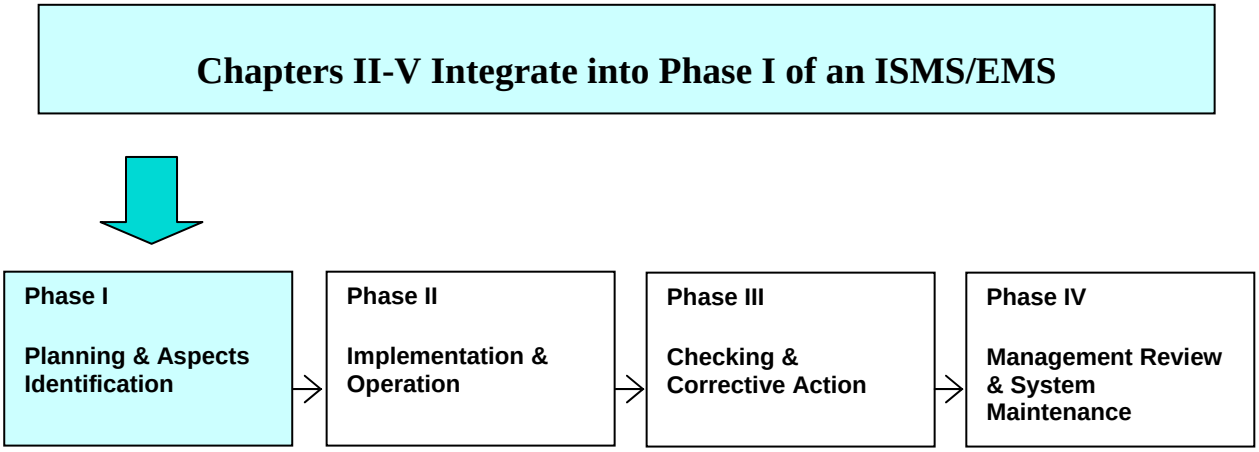
3. Benefits and Elements of a Site-wide GWPP.

As part of the integration of an EMS into an ISMS, DOE O 450.1 requires that DOE elements (1) consider implementation of a site-wide approach for ground water protection; (2) promote the long-term stewardship of a site's natural and cultural resources throughout its operational, closure, and post-closure life cycle; (3) reduce or eliminate the generation of waste, the release of pollutants to the environment, and the use of Class I ozone-depleting substances; and (4) ensure the early identification of, and appropriate response to, potential adverse environmental impacts associated with DOE

operations, including as appropriate, preoperational characterization and assessment and effluent and surveillance monitoring.

Implementing a GWPP will facilitate planning, implementation, and management review of site-wide protection activities. The site-wide GWPP should enable cost-effective protection of ground water and allow for a flexible approach that is tailored to each DOE site's unique features (e.g., physical setting, history, current missions, and local or regional cultural characteristics). Although the unique features at each DOE site may be addressed differently, certain elements of a successful site-wide GWPP are common to DOE sites and should be reflected in each site's ISMS/EMS. A successful GWPP includes elements of all four phases of an ISMS/EMS to ensure that—

- possible sources of current and future ground water contamination are identified, and the potential for future contamination is evaluated;
- all applicable Federal, State, and DOE requirements are met;
- appropriate ground water protection goals are established for all affected or potentially affected ground water consistent with the water quality and current or likely future use;
- strategies for predicting and preventing future contamination and for controlling existing contamination are developed;
- the history of GWPP activities is documented for future site management;
- the quality of ambient ground water and vadose zone conditions at the site are documented;
- environmental monitoring with surveillance program elements for the ground water and the vadose zone, including ambient subsurface conditions, is described; and
- the way the monitoring program provides the information needed to predict and respond to potential contamination associated with significant site aspects and to achieve ground water protection goals is described.



CHAPTER II. IDENTIFYING POTENTIAL SOURCES OF CURRENT AND FUTURE GROUND WATER CONTAMINATION

As part of planning and aspects identification, sites should identify potential sources of current and future contamination of ground water by DOE activities. During this phase, to identify "environmental aspects," DOE sites identify and list existing and new or proposed activities, products, and services and how these interact with the environment. (Environmental aspects are the attributes of a site's activities, products, and services that can interact with the environment. An environmental aspect signifies the possibility of an environmental impact, whether good or bad). Within the context of the ISMS/EMS, it is important to assess the potential for future contamination of the ground water by any DOE activity involving radioactive materials or other hazardous substances. The GWPP should include a process for determining the location and magnitude of the concentration of pollutants and should identify potential exposure pathways and site-specific parameters to estimate exposures and doses to members of the public.

The following should be considered in the GWPP.

1. Current or Potential Sources, Locations, and Uses of Ground Water.

   Identify current and potential uses of ground water. Describe the method used for identifying ground water use and tabulate these uses. Consider the following information:

   - well locations,
   - aquifer from which wells obtain water,
   - withdrawal rates and volumes,
   - well-head protection,
   - well sample collection and analysis, and
   - well custodian/owner.

2. Potential Sources of Ground Water Contamination.

DOE sites should identify activities, services, and products that are potential sources of contamination.[1] To the extent that DOE sites or facilities have identified potential sources of contamination in response to other existing requirements and plans (e.g., a Storm Water Pollution Prevention Plan, composite analyses, or low-level waste performance assessments) such materials should be used and referenced or integrated into the GWPP to avoid duplication of effort or unnecessary expenditures of resources. Potential sources of contamination may include, but are not limited to, the following:

- current or future radioactive or hazardous waste treatment, storage, and disposal sites;
- solid waste (sanitary) landfills;
- liquid waste disposal facilities;
- past-practice waste sites, including inactive soil columns;
- radioactive material storage sites;
- underground and above ground storage tanks and associated piping;
- miscellaneous waste streams, including wastewater; drainage, and run-off; condensate; cooling water; and investigation-derived wastes, including well purge water and drill cuttings;
- irrigation systems;
- sanitary sewage systems;
- industrial wastewater systems;
- storm-water runoff systems;
- motor pool and vehicle repair facilities;
- injection wells;
- abandoned or closed wells;

[1]Although sources of contamination are the focus of this section, consideration should also be given to activities that can change or degrade ground water at the site even when they do not have the potential to "contaminate" ground water directly. For example, an activity that withdraws or replenishes significant volumes of ground water can affect the water table and vadose zone in other areas of the site where ground water is, or may become, contaminated.

- improperly constructed wells;
- production or research reactors;
- chemical processing or materials fabrication or storage areas;
- existing areas of contaminated soils;
- decontamination and decommissioning (D&D) operations;
- fuel storage areas; and
- any other site operating facility where potentially hazardous materials may be managed.

In identifying potential sources of contamination, consideration should be given to the consequences of upsets or plausible accidents that could result in ground water contamination.

3. Inventory of Class V Miscellaneous Injection Wells.

To support aspect analysis and assessment of potential ground water impacts, it is recommended that the GWPP include a process for inventorying and prioritizing Class V miscellaneous injection wells for closure, where appropriate. The process description should include the following:

- both the method for performing such inventories on an ongoing basis and the method for determining whether a well should be closed (these wells should be closed if they are located in source water areas for existing drinking water systems and are likely to cause violations of the National Primary Drinking Water Regulations or adverse health effects),
- best management practices for operating wells in a protective manner, and
- a summary of the current status of operating or closed Class V injection wells at the site.

4. Locations of Potential Contaminants Relative to Particularly Valuable Ground Water or to Ground Water That Is Highly Vulnerable to Contamination.

Identify the locations of potential contaminants in the following general areas:

- vadose zone;
- abandoned or inoperable former production, materials handling, or operations areas; and
- previously unknown areas of contamination discovered by reviewing historical records.

Particular attention should be paid to certain classes of chemicals known as dense, nonaqueous-phase liquids (DNAPLs). These chemicals may be found in waste products, especially wastes produced by environmental restoration activities. Potentially more significant are management practices and uses of these chemicals in routine operations where environmental protection requirements for waste management may not be applicable. Storage and handling of such DNAPL chemicals as trichloroethylene (TCE) or perchloroethylene (PCE) could become a significant potential source of future contamination as a result of leaks, spills, or other releases to the subsurface. This could be particularly serious in areas where the ground water is vulnerable to contamination from surface activities because of subsurface geologic conditions. The storage of TCE, PCE, or other industrial solvents in or near the recharge area of an unconfined aquifer used as a drinking water source would be an example of a serious potential future source of contamination.

CHAPTER III. IDENTIFYING AND ACCESSING LEGAL AND OTHER REQUIREMENTS

Because DOE sites must comply with all applicable statutory and regulatory requirements, permit or compliance agreement conditions, and DOE Order requirements, DOE sites should establish and maintain procedures to identify and access legal and other requirements.

Ground water remediation at DOE sites must be conducted in compliance with applicable statutory and regulatory requirements and needs to be consistent with DOE's long-term responsibilities for protection of property, the general public, workers, and the environment from radiological hazards under authority of the Atomic Energy Act of 1954, as amended (AEA); the DOE Organization Act (DOA); and other related laws. Resource Conservation and Recovery Act (RCRA) hazardous waste permits contain provisions that require monitoring of ground water for hazardous contaminants and for ground water remediation should contaminants be present. The design, operation, location, monitoring, closure, and maintenance of a waste disposal unit will be completed in the short term, but the potential threat can continue into the future—for centuries or more. Therefore, it is critical that ground water protection goals which contain targets for both the short and long term be established and implemented to provide a basis for waste management decisions.

Additionally, DOE P 455.1, *Use of Risk-Based End States,* dated 7-15-03, commits each site to developing effective cleanup goals that are based on anticipated future land use and the level and types of potential risks to human health and the environment when cleanup activities are completed. DOE P 455.1 seeks to integrate Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), RCRA, and AEA requirements with future land use and DOE commitments to long-term stewardship. In addressing the provisions of DOE P 455.1, each DOE site should develop ground water protection goals that guide specific program activities and decisions toward adequate protection of ground water resources, including considering potential pathways of exposure associated with anticipated future land use. If institutional controls are part of the goals, they should be planned, implemented, and documented consistent with DOE P 454.1, *Use of Institutional Controls,* dated 4-9-03.

Effective ground water protection as part of an ISMS/EMS is particularly critical in the area of waste management. Many DOE sites are managing disposal units for radioactive wastes under DOE O 435.1 *Radioactive Waste Management,* dated 7-9-99. The wastes include wastes generated through environmental restoration activities, wastes generated through accelerator operations, and naturally occurring radioactive material. Additionally, many sites have received RCRA permits to dispose of hazardous wastes, RCRA mixed wastes, and other types of nonhazardous waste onsite. These disposal sites must be designed and operated to ensure that ground water is protected. Ongoing and future operations at DOE sites, including weapons production and research, will result in the generation of additional waste, which will be managed, and in most cases permanently disposed, at a DOE site. DOE O 435.1 requires that radioactive waste be managed to protect the environment, the public, and workers and to comply with applicable Federal, State, and local laws and regulations; applicable Executive orders; and other DOE directives. This would include requirements applicable to ground water protection.

The GWPP should be implemented to ensure that ground water resources are appropriately managed and protected for all onsite low-level waste units. The design of radioactive waste management facilities, authorized by the Department under DOE O 435.1, should be planned consistent with the GWPP site-wide program to ensure adherence to consistent ground water protection goals. The Department's Order DOE 5400.5, *Radiation Protection of the Public and the Environment*, dated 2-8-90, contains specific and general requirements for protection of ground water. To comply with the provisions of DOE 5400.5 related to control and release of property containing residual radioactive material, DOE sites must address applicable ground water protection standards and should consider GWPP goals and targets for ground water.

The site-wide GWPP should contain strategies for predicting, preventing, and controlling contamination to comply with applicable Federal and State laws and regulations and DOE requirements. Such control strategies could include, but are not limited to, monitoring and surveillance activities, institutional control requirements, and remedial action activities which are an integral part of the site environmental protection program. The GWPP should also include a site-wide ground water contamination prevention element to ensure that measures designed to protect ground water resources are incorporated into all site-wide planning, construction, and operating activities. For example, minimization of the generation of new waste is considered one of the most important steps towards preventing future ground water contamination, and minimization of the volume of remediation wastes generated at the site also is desirable. Therefore, remediation strategies that comply with RCRA or CERCLA requirements should be selected to minimize the volume of waste that would need to be managed as a hazardous or radioactive mixed waste. Emphasis should be placed on pollution prevention for ensuring ground water protection. Implementation of the requirements of RCRA, DOE 5400.5, and DOE O 435.1 should be considered a major objective of the GWPP.

In the context of a DOE-wide policy objective, it should be understood that the phrase "preventing ground water contamination" is an appropriate goal for all GWPPs but that absolute assurance of "zero release" of contaminants to the subsurface is not always practical. For example, "zero release" from a waste management unit is not possible for the long periods of time (e.g., centuries) over which many wastes will remain hazardous. Pollution prevention for ensuring ground water protection means not exceeding the carrying capacity of the subsurface environment so as to result in concentrations of hazardous material in excess of protective levels.

CHAPTER IV. DETERMINING SIGNIFICANT ASPECTS

Due to the ramifications that regulatory violations could have for a site, DOE G 450.1-2, *Implementation Guide for Integrating Environmental Management Systems into Integrated Safety Management Systems,* dated 8-20-04, recommends that all environmental aspects with regulatory implications be managed through the ISMS/EMS. GWPP elements should support compliance with site-specific regulatory requirements, permit or compliance agreement conditions, DOE Order requirements, and any other applicable agreements governing ground water protection activities.

To support efforts to determine significant aspects, the following actions should be considered.

1. Identifying and Determining the Significance of All Environmental Aspects Related to Ground Water That Are Regulated or Have Regulatory or Policy Implications.

   In support of a site-wide ISMS/EMS approach, environmental aspects pertaining to ground water that are regulated or have regulatory implications should be identified. In addition, determinations of which ground water-related aspects have significance based on environmental or organizational considerations should be made.

2. Identifying Subsurface Investigation Data Needs.

   Subsurface investigations should support the ground water monitoring, resource evaluation, waste management, and environmental remediation objectives. Sites should conduct studies that lead to better understanding of contaminant fate and transport mechanisms and that support the site decision-making process. Sites also should address the role of numerical modeling of ground water flow and contaminant transport. This is particularly important in the context of long-term waste disposal unit design, construction, and monitoring. For example, DOE low-level radioactive waste disposal units are subject to a performance assessment that includes projections of potential future impacts on ground water that may occur over many centuries in the future. Thorough understanding of subsurface conditions obtained from well-planned and executed subsurface investigations enhances the value of such projections.

   The results of site investigations should be documented in accordance with the site's ISMS/EMS procedures and distributed to avoid duplication of effort and ensure integration with other information. Easy accessibility to studies and ground water data by all site-wide organizations will be a benefit of a well-organized and successful GWPP.

3. Developing a System for Ranking Potential Sources of Contamination by Degree of Risk.

   Each DOE site can develop a system for ranking identified potential sources of contamination by degree of risk to or impact on the ground water resource. This ranking system could be qualitative (e.g., high vs. medium vs. low, or short term vs. long term), could be based on current or potential use of the ground water resource (e.g., drinking water, irrigation, industrial process), or could be based on existing water quality (e.g.,

uncontaminated, naturally saline, contaminated due to past practices). The purpose of the ranking system is to assign priorities for remediation and prevention and to provide a risk-related basis for determining the level of resources that should be applied to remediation and prevention. Ranking systems can be used to prioritize resources and set schedules and should be described in the GWPP documentation. The GWPP elements of the site's ISMS/EMS should include appropriate contingencies based on priorities and risk associated with the consequences.

4. Setting Priorities for Designing and Implementing Predictive and Preventive Measures.

An important component of an ISMS/EMS aspect's significance is the consequence of the potential impact. In determining the priorities for predictive and preventive measures, consideration should be given to the potential future use of the land and the vulnerability of the ground water. It is possible that a potentially significant source of future contamination (e.g., a radioactive waste management unit) located in an area where the ground water is already contaminated and, therefore, is not likely to be used as a source of drinking water, or where the ground water is not vulnerable to contamination due to favorable structural features of the subsurface, may be designated a lower priority for preventive measures than another source (e.g., a leaky valve on a solvent storage tank or a shallow well that receives storm water runoff) located in an area where the ground water is a current source of drinking water or is particularly vulnerable to contamination. In such cases the site can designate a source as significant based on the consequences of the impact to the environment. Consequences of an environmental impact on the continued accomplishment of the site missions could also be considered at this stage.

CHAPTER V. ESTABLISHING SITE-WIDE GROUND WATER PROTECTION GOALS FOR PREVENTING FUTURE CONTAMINATION AND FOR CONTROLLING EXISTING CONTAMINATION

As part of its ISMS/EMS, each DOE site should establish and maintain documented ground water protection objectives and targets. These should include specific goals for protecting ground water that take into account site-specific subsurface conditions and the site mission and that address the appropriate combination of short-term and long-term issues, such as—

- remediation of existing contamination,
- prevention of future contamination,
- application of risk-based and resource-based objectives,
- compliance with applicable requirements, and
- management of monitoring data and performance indicators.

Ground water protection goals can be used as the basis for—

- seeking long-term resource commitments for ground water protection,
- implementing effective ground water remediation,
- evaluating performance of monitored natural attenuation remedies,
- setting standards for radioactive waste management,
- designing and implementing detection and surveillance monitoring systems,
- defining necessary institutional control requirements, and
- conserving resources, etc.

The site-wide ground water protection goals should ensure equivalent protection of the ground water resources from radiological and nonradiological contaminants associated with wastes that are disposed onsite. Using a GWPP to establish effective site-wide ground water protection goals that meet applicable requirements based on thorough knowledge and understanding of site-wide subsurface conditions will enhance ground water protection and remediation activities for as long as the site exists.

The following activities should be considered when establishing site-wide, site-specific ground water protection and remediation goals in the context of overall ISMS/EMS goals.

1. Defining Ground Water Protection and Remediation Goals.

The DOE site ground water program manager should define ground water protection and remediation goals and ensure that these goals—

- are consistent with the goals of other site-wide programs integrated in the site's ISMS/EMS;
- are appropriate to the nature, scale, and potential environmental impacts of site-wide activities and missions;
- include specific, site-wide goals for setting and reviewing environmental objectives and targets;
- account for present and future land use and potential future uses of the ground water resource;
- are measurable in terms of progress; and
- are documented, implemented, maintained, and communicated to appropriate DOE and contractor staff.

2. Relating Goals to Site-Specific Subsurface Conditions Established as Part of the Aspect Identification Phase of the ISMS/EMS Process.

Effective goals reflect the specific site conditions, including the existing quality of the ground water, hydrogeology, contaminants, water use, operations, specific regulatory requirements, etc. Procedures should be established and maintained for achieving goals to allow specific decisions to be made for activities such as the following:

- existing or planned major ground water protection and pollution prevention activities and milestones with time frames,
- ongoing or planned major ground water remediation activities and milestones with time frames,
- ongoing or planned major ground water monitoring activities and milestones with time frames,
- assessing performance of a low-level radioactive waste disposal unit, and
- assessing the effectiveness of the GWPP in supporting watershed management goals.

3. Stating Ground Water Protection Goals in Terms of Risk- or Resource-Based Approaches.

Describe how ground water protection and remediation are implemented at the site relative to other site-wide programs. Approaches include risk-based (decisions based on risk to humans and the environment) and resource-based (decisions based on the value of ground water as a resource). In describing how the GWPP will be implemented, ground water program managers should consider each of the following:

- expected future land use and uses of ground water resources,
- technical and economic practicability of ground water protection and remediation,
- application of the best available technology for radioactive effluent control consistent with DOE guidance for treating contaminated ground water, and
- water conservation.

Ground water protection and remediation goals should be put into a site-wide perspective. For example, the decision to include monitored natural attenuation as a long-term remedy for contaminated ground water, after active remediation (e.g., pump, treat, and reinject) has achieved short-term removal goals, may be based on an assessment of risks associated with management of remediation wastes or it may be based on the costs of constructing and operating a treatment system and a disposal unit for the remediation waste. The goals for ground water protection adopted in the GWPP should be used as the basis for such decisions. Examples of ground water protection and monitoring goals and goals for ground water program implementation are provided in Appendix B to this Guide.

4. Setting Objectives and Targets for Ground Water Protection and Remediation.

It is through the achievement of objectives and targets that a DOE element can address its significant aspects, including its compliance, mission, and environmental risks. To increase confidence that objectives and targets will be effective, they should be established systematically and periodically reviewed and reconsidered within the management review process. "Objectives" describe the DOE site's goals for environmental performance. "Targets" are specific and measurable immediate steps that the DOE site can take in terms of obtaining objectives. Measurability and time frames should be considered when setting objectives and targets.

All of the GWPP objectives should be listed with detailed descriptions, including all of the targets that make up each objective and a detailed resource estimate and justification.

Examples of objectives for ground water protection include the following.

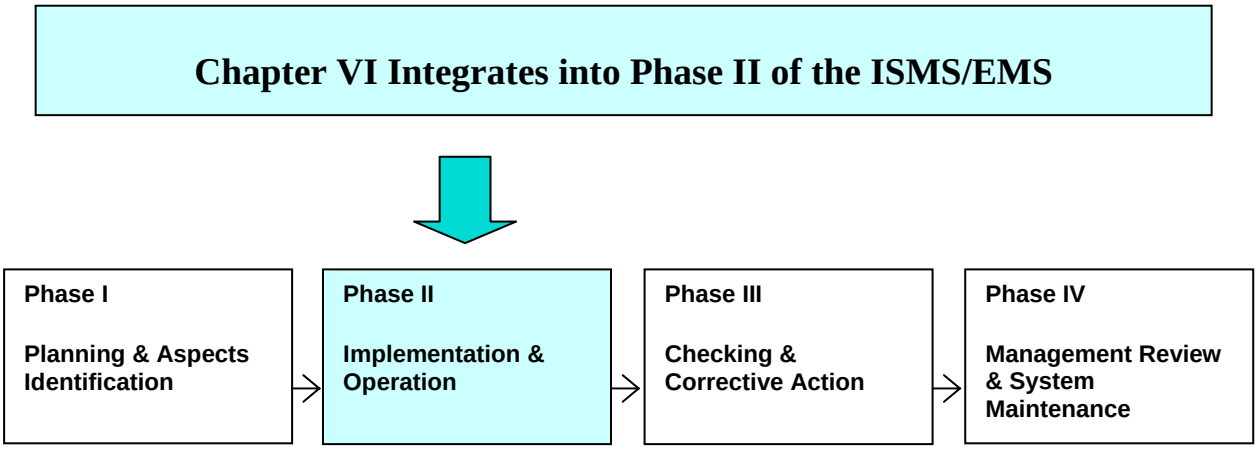
- Develop a strategy for controlling existing contamination and pursuing site-wide pollution prevention goals for preventing future contamination.

- Establish and maintain a process for identifying possible future sources of contamination.
- Ensure that all applicable regulatory requirements are met.
- Maintain documentation of all measures used for monitoring the ground water and vadose zone.
- Maintain a consolidated system for documenting the quality of ambient ground water and vadose zone conditions and reporting the results of ground water and vadose zone monitoring.
- Maintain a process of program review and evaluation that includes regular evaluation of technical improvements and cost-effective technologies.

Once ground water protection and remediation goals and objectives have been established, targets may be set to (1) ensure compliance with applicable regulatory requirements, (2) identify and document possible source of contamination, and (3) prevent contamination.

Examples of targets for ground water include the following.

- Promote awareness of ground water protection activities to regulators and stakeholders.
- Provide evidence that potential impacts to ground water have been evaluated through a systems approach considering all relevant site activities and associated environmental aspects and that any significant impacts to ground water are identified and are being addressed in the site ISMS/EMS.
- Review, refine, and revise ground water environmental monitoring and surveillance program elements to ensure information obtained from the monitoring program is optimized and supports achievement of GWPP goals.
- Implement checks and corrective actions and conduct management reviews and monitoring program maintenance annually.



CHAPTER VI. ESTABLISHING STRATEGIES TO PREVENT FUTURE CONTAMINATION AND CONTROL EXISTING CONTAMINATION

Successful implementation of a GWPP will depend on clear articulation of environmental roles and responsibilities across the various elements of the DOE site. The GWPP should document strategies for interacting with other site planning and operational activities that may relate to the goals of the GWPP. In Phase II (Implementation and Operation) of the ISMS/EMS, the site-wide GWPP can address a number of issues, and the following activities should be considered.

1. Establishing and Maintaining a Procedure for Integrating Ground Water Protection with All Site-Wide Operations and Documenting These Efforts.

   DOE site ground water program managers should establish and maintain a procedure for integrating ground water protection with all site-wide operations[2]. Standard operating procedures that are related to the ISMS/EMS need to be developed or existing procedures should be modified as needed to support the ISMS/EMS. Integration mechanisms could include a standing coordinating committee, a work group or Web site, and a GWPP plan or other documentation. Currently there is no specific DOE requirement for the development of a separate GWPP plan. The GWPP could be documented in the ISMS/EMS documentation or a separate site-wide GWPP plan could be prepared and referenced in the ISMS/EMS.

   The GWPP clearly should identify and document the ground water protection roles, responsibilities, and authorities of the appropriate organizations and individuals. Clear identification of organizational structures and relationships should be developed to provide a road map to the specific organizational responsibilities for each ground water

[2]DOE G 450.1-1, Section 7.4.1, *Organizational Scope*, discusses how different DOE organizations account for multiple facilities, activities, divisions and contractors when implementing ISMS/EMS.

activity or project and should be included to enhance effective communication and coordination.

Examples of these ground water activities or projects include—

- subsurface investigations,
- ground water environmental monitoring and surveillance,
- site-wide ground water monitoring protocols,
- ground water information and data management,
- spill prevention and response planning,
- site-wide coordinating activities, and
- preparation of site-wide reports and plans.

Prevention of ground water contamination encompasses a large number of site activities, including many that are not specifically related to ground water projects. Communication on ground water protection, a process for coordination of ground water protection with operational programs, and integration of concerns for ground water protection into site operations are important to the success of the GWPP.

To ensure that the GWPP is an effective integration mechanism, site-wide coordination efforts should exist within the overall ISMS/EMS. Portions of many programs that already exist at the site may be relevant to preventing future ground water contamination and may be adopted into the GWPP. These include—

- pollution prevention;
- environmental management processes, plans and actions;
- waste minimization;
- spill prevention, control, and countermeasures;
- well closure and abandonment;
- purge water management and management of other investigation derived wastes;
- D&D; and
- authorized limits and release of property.

Within the ISMS/EMS each site-wide GWPP should establish procedures to identify and resolve inconsistencies in approaches to ground water protection by various organizations

across the site and should explore ways to achieve greater efficiency and cost effectiveness in the overall program. Ground water protection standards and goals, site-wide monitoring, subsurface investigation, and data analysis and reporting should be established in the GWPP for use throughout the site for any site-wide activities that may affect ground water.

2. Communicating and Coordinating Site-Wide Programs on Ground Water Issues.

The GWPP should include a site-wide ground water protection communication and coordination function, which could be accomplished by either an individual or a committee as part of the DOE site's overall ISMS/EMS team. Communication among site-wide programs provides an effective means to share information on a variety of topics such as lessons learned, best practices, success stories, experiences with the use of innovative technologies and approaches to monitoring. Effective dissemination of information among site-wide programs could improve cost effectiveness of ground water activities. For example, in the area of ground water monitoring, sharing information on well installation, sampling operations, and laboratory analysis among different DOE organizations across the site could result in opportunities to reduce operating costs and to improve ground water monitoring efficiencies. As part of the ground water coordination and communication function, sites also should maintain awareness of DOE-wide ground water activities and, as appropriate, share pertinent site information with others in the DOE complex.

Regular communication with program managers of facilities or activities that may have potential impacts on ground water is essential to understanding, assessing, and preventing potential and ongoing impacts on the ground water resource. Such programs and activities may include, but are not limited to, the following:

- waste management (including low-level waste performance assessments and composite analyses),
- environmental monitoring,
- environmental remediation,
- facilities operations,
- underground storage,
- onsite drinking water systems operation,
- future-use (e.g., land-use) planning and stewardship, and
- water consumption and wastewater disposal.

Communication with program managers responsible for other site resource protection areas that have the potential to be impacted by ground water contamination or by activities related to ground water protection or remediation also is important for an integrated GWPP. This could include such program areas and activities as—

- surface water protection,

- watershed protection and restoration,
- protection of other natural resources including biota,
- protection of cultural resources, and
- protection of site resources from wildland and operational fires.

Successful communication and coordination among relevant DOE programs and activities can be institutionalized in a number of ways, such as the following.

a. Designating responsible organizations and individuals.

To coordinate site-wide programs affecting ground water, the DOE site ground water program manager should consider identifying site-wide DOE and contractor organizations and individuals with ground water protection and remediation roles, responsibilities, and authorities as part of the site's ISMS/EMS. Designating an individual or organization to be responsible for ensuring communication between organizations and programs can be an effective way to coordinate site-wide efforts.

b. Establishing site-wide work groups or committees.

An effective way to coordinate ground water protection activities is by participating in a site-wide EMS work group or committee. The EMS work group or committee could consist of members with different roles, responsibilities, and authorities (e.g., detailed knowledge of the site ground water programs, representation of specific positions of relevant organizations, authority to make cross-cutting site decisions). The EMS work group would meet regularly to discuss activities that may have potential impacts on ground water; avoid redundant work among the various organizations and programs; and ensure the efficient flow of information between groups, such as the monitoring group and the remediation and waste management groups. The EMS work group would also coordinate on well utility, maintenance and closure decisions. The EMS work group or committee should consist of appropriate DOE and contractor representatives, and a DOE chairperson should be appointed.

c. Developing communication tools.

Whether or not individuals are designated for specific roles or coordinating committees or environmental teams are established, regular communication among all DOE site-wide programs having ground water responsibilities is essential. Tools for internal DOE communication and reporting between the organizations, programs, and individuals with responsibilities related to ground water protection may include regularly scheduled meetings, universally accessible databases, newsletters, electronic mail, and the site's Web site.

3. Prioritizing New Studies and Coordinating Between Areas or Programs.

Successful programs will support not only regional or site-wide needs, but also the specific goals of individual investigation areas. For example, specific subsurface data needs, identified in the context of a low-level radioactive waste performance assessment or composite analysis, could form the basis for long-term, ongoing studies designed to be used to reduce the uncertainty in the assessment of potential dose to the general public from the ground water pathway. The priority placed on such studies by another site program (e.g., waste management) could assist in directing GWPP resources towards obtaining the most critical data.

4. Encouraging Public Participation and Outreach in the GWPP.

DOE P 141.2, *Public Participation and Community Relations*, dated 5-2-03, recognizes that public participation is a fundamental component in program operations, planning activities, and decision making within DOE. A DOE site's ISMS/EMS environmental policy statement should encourage programs and processes that facilitate public participation in planning activities and outreach to obtain external perspectives on ground water issues and to increase public awareness of the DOE site's efforts to protect ground water. Ground water program information should be shared as part of a site's general public participation program to enhance public understanding of DOE's ongoing ground water protection activities. DOE sites need to ensure that the public is notified in a timely manner of any environmental incident related to ground water.

5. Interacting with Other Federal and State Entities.

Under the Safe Drinking Water Act (SDWA) each State is required to develop and implement State-wide source water assessment programs to identify potential sources of contamination of source water for existing public water systems. Cooperation of DOE ground water program staff in Environmental Protection Agency (EPA) and State activities in the area of source water protection (providing reports, data, and technical assistance) can enhance public acceptance of GWPP activities and can gain acceptance of the site-wide ground water protection goals. DOE is one of nine Federal land management agencies that signed a Memorandum of Agreement for providing technical assistance to States in conducting State-wide source water assessments.

6. Interacting with Tribal Governments.

The SDWA authorizes EPA to treat Native American tribal governments in a manner similar to that in which it treats States. Implementing regulations outline requirements that must be met for tribes to obtain EPA approval to assume the roles of and be treated as States. This means that authorized tribes have jurisdiction over ground water programs on their lands.

DOE sites should encourage input from Native American tribes on program management activities that could affect them.[3] Communication and requests for tribal input should occur early in any DOE process that may affect tribes and consideration should be given to the policies, priorities, and concerns of the affected tribes and/or, where appropriate, affected tribal members. Existing methods of communication with tribes can be used to convey information on ground water protection and remediation.

7. Integrating Waste Management Planning into GWPP Activities.

Waste management encompasses both prevention and remediation of ground water contamination. For radioactive waste, DOE requirements (e.g., DOE O 435.1) are applicable. Programs designed to meet RCRA requirements must include responsibilities for waste management and for corrective actions when necessary. DOE, in conjunction with EPA's Office of Solid Waste and Emergency Response, has enhanced the integration of RCRA and CERCLA cleanup actions. The goal is to produce more logical and consistent consolidation of RCRA and CERCLA requirements when they overlap at a site. The GWPP is an appropriate venue for developing the strategy for RCRA/CERCLA integration with DOE requirements and other issues regarding the impacts of waste management activities on ground water resources. For example, DOE requirements for radioactive waste management (DOE O 435.1) and requirements for existing RCRA units need to be implemented so that they do not impact ground water and so that existing impacts are addressed.

Preventing ground water contamination in the context of waste management involves integrating specific internal and external waste management requirements to achieve each of the following objectives.

a. Waste management units should be designed to prevent releases to the subsurface in the short term and should minimize releases beyond the short term.

b. Waste management units should be located to minimize potential future exposures through the ground water pathway. This can be accomplished, for example, by—

- locating units where natural geologic and hydrologic features provide favorable conditions for containing wastes, minimizing long-term migration potential, and allowing for natural attenuation and/or
- locating units where the ground water is not usable (e.g., water is already contaminated and the contamination is being addressed, either actively or passively; the salinity of the water makes it unusable as a source of drinking water).

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[3] A number of Executive orders and policies provide guidance on how Federal agencies should consult with and consider tribal interest when taking actions. These include: Executive Order 14084, *Consultation and Coordination with Indian Tribal Governments*, May 14, 1998; *Presidential Memorandum on Government-to-Government Relations With Native American Tribal Governments*, April 19, 1994, and the *Department of Energy American Indian & Alaska Native Tribal Government Policy*, October 2000.

c. Subsurface conditions in the ground water, the soil column, and the vadose zone, as appropriate, should be monitored for two purposes:

- to detect releases from the unit as early as possible, but at least as early as is necessary to allow appropriate corrective measures (the use of indicators and any other innovative mechanisms for detecting a release should be explored) and

- to provide flow system and environmental process data for prospective and conceptual model calibration and postaudits.

d. Inspection and maintenance of all engineered barriers; leak detection devices; leachate collection; containment; and cover systems should be conducted throughout their design lives. At the end of their expected useful lives, they need to be upgraded or replaced, as appropriate.

e. Institutional controls should be put in place to prevent releases at any site or area of a site where hazardous or radioactive material remains at levels of concern for human exposure, where long-term management is needed, or where the likelihood of potential long-term future exposure (hundreds of years hence) is unknown. It is desirable to limit the areal extent of long-term institutional controls and land-use restrictions. Where institutional controls or ground water use restrictions are needed, it may be appropriate to set a goal based on ensuring that the applicable drinking water standards (40 CFR Part 141) are not exceeded at any public water system whose source water may be affected by the DOE site.

8. Integrating Remediation of Ground Water with Other Ground Water Protection Activities and Long-Term Stewardship Efforts.

Remediation of contaminated ground water at DOE sites should effectively protect human health and the environment and should be designed to achieve environmental benefits equivalent to the cost of the remedy. Selection of remedies for contaminated ground water should be done in the context of future land-use plans adopted at the site. (As previously discussed, DOE P 455.1 commits DOE sites to establish cleanup goals consistent with anticipated future land use.) Such considerations should be brought together in the context of the site-wide GWPP.

As part of the site's ISMS/EMS, the GWPP should integrate the ground water remediation program with all other relevant ground water protection activities. Ground water remediation should seek to achieve the same goals as other ground water protection activities, including waste management. Under the AEA, DOA, and other related laws, DOE must maintain control of its sites and restrict public access to them until the hazards associated with past DOE operations no longer require control. At many DOE sites, waste disposal units (including radioactive waste, hazardous chemical wastes, mixed wastes, and other wastes) will be a potential source of future ground water contamination for centuries. Therefore, DOE will need to control such facilities indefinitely. Although much of the remedial action currently underway at DOE is projected to be completed in

the near term and a number of DOE sites are scheduled to be closed by 2006, ground water remediation activities at certain DOE sites will continue beyond that date. Even when ground water remediation is completed at a site, the long-term maintenance of the site's disposal units will continue. To the extent that ground water remediation includes passive measures (e.g., monitored natural attenuation), monitoring of existing contaminant plumes will continue for many years following completion of all other active remediation. Therefore, it is essential to integrate ground water remediation—from initial subsurface investigation and technology evaluation to cleanup standard-setting to selection of remedial approach to evaluation of performance to completion of remedy—with DOE long-term stewardship responsibilities under the AEA, DOA, etc., and with all other aspects of ground water protection, particularly waste management. The integration of approaches for remediation, waste management, monitoring, and all other preventive measures should be accomplished in the GWPP. Guidance material prepared by DOE's Office of Environmental Management (DOE, May 2002, and DOE, October 1999) addresses the long-term considerations for ground water remediation and monitoring.

Consistent with the DOE site's overall ISMS/EMS goals, consideration of the implications for ground water remedy selection of long-term stewardship, institutional control of waste sites, surveillance monitoring, and future land use should be a major component of the site-wide GWPP. Where DOE will maintain control of its sites and will restrict general public access, including use of ground water for drinking or for other purposes, the remedy selected for ground water remediation should reflect the actual or potential risk to the general public from the contaminants in the subsurface. Where such risks are minimal or nonexistent in the short term (e.g., 100 years following closure of a waste site or some equivalent period of time after completion of active remediation of the RCRA or CERCLA unit), the selected cleanup goal should include consideration of the institutional controls and stewardship responsibilities that DOE assumes at the site. Cleanup goals selected for ground water remediation may not need to be based on the most conservative scenario (e.g., the inadvertent use of the ground water as an untreated source of drinking water by some future resident who is not aware of the presence of radiological or other contaminants resulting from the past operations of a DOE site) where long-term stewardship will be conducted.

9. Evaluating the Need for Employee Training Related to Ground Water Protection and Remediation.

DOE sites should identify training needs related to ground water protection and remediation. Personnel whose work may create a significant impact on the GWPP should be considered for general awareness training on issues of concern related to water so that they have the necessary knowledge to carry out the responsibilities of their positions. For example, fuel pump operators would learn the effect that spilling gasoline could have on water resources. Training could address issues of concern in the areas of ground water, surface water, and watershed management, as appropriate.

10. Documenting the History of Ground Water Protection Activities and Establishing an Information Repository.

Ground water protection activities are major components of the ISMS/EMS at every DOE site that has an ongoing mission and at every DOE site where wastes or subsurface contamination will remain following site closure. Ground water protection activities at these sites will continually evolve over time as active site operations change or cease and as active ground water remediation is completed and is phased out in favor of passive remediation, institutional controls, and long-term site maintenance. Maintenance of accurate and complete records of historical GWPP activities is essential for the successful long-term management and protection of ground water resources.

The GWPP documentation should be a primary source of information on past work on site hydrogeologic conditions. Historical data on site activities (such as production well installation, facility construction, waste management) that may have affected ground water also are relevant. The GWPP should address how the results of ground water investigations will be communicated and maintained for future use and how permanent archiving of geologic samples will be implemented.

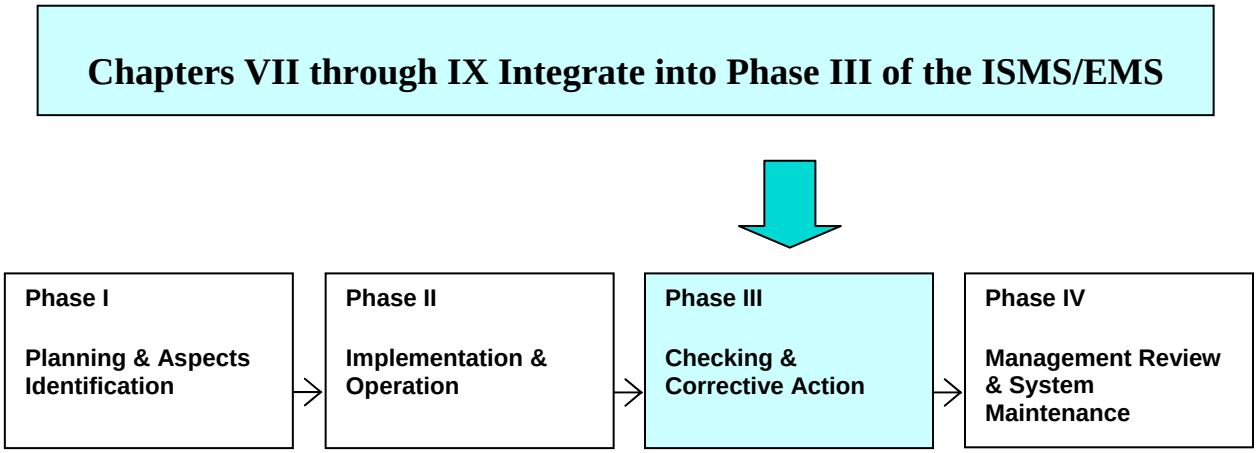
The site-wide GWPP should contain provisions for establishing and maintaining a repository for information developed throughout the site's history. Such information should include—

- documents describing subsurface hydrogeologic characterization;
- descriptions of the monitoring networks established across the site and the chronological history of revisions to these networks;
- technical descriptions of all observation points (wells, seeps, springs, etc.), including precise locations, type of equipment, maintenance records, etc.;
- historic monitoring network data, including sampling history, quality assurance and quality control (QA/QC) data, analytical methods, detection limits, and quantitative results;
- documentation of active remediation activities, including feasibility studies, performance data, technologies employed, and quantities of ground water extracted or treated;
- documents describing ground water environmental monitoring and surveillance networks, their objectives, technical designs, and performance histories;
- descriptions of site-wide organizations with responsibility for the GWPP and how these organizations have changed throughout the site's history;
- locations throughout the site where waste disposal has occurred or where known contaminated areas exist;
- locations of abandoned wells, piezometers, temporary wells, injection wells, drinking water or other production wells, or any other known excavation that could present a potential future conduit of contaminants to the subsurface; and

- documents describing occurrence reports and oversight review reports involving ground water protection and the response that DOE made to recommendations included in these reports.

Most sites possess historical records which, although not maintained for the purpose of protecting ground water, can be used in conjunction with monitoring data to determine where future ground water vulnerabilities may exist and allow a reasonable evaluation of the need for expanded surveillance or detection monitoring.

DOE sites can also identify or establish a subsurface studies information repository. This repository could store the results of ground water investigations in library and bibliography form for site-wide program use and for future generations. Selected sample materials, such as representative sediment and soil cores, should be maintained for future use. The nature of this information repository should be described in the GWPP and its priority established. In addition, the maintenance of well logs, geophysical logs, well as-built diagrams, etc., in a retrievable form is vital to the success of ongoing and future programs and is more cost effective than regenerating data to meet new specific program needs and objectives.



CHAPTER VII. ESTABLISHING AN ASSESSMENT PROGRAM

The assessment step is the third part of the **plan-do-check-act** ISMS/EMS cycle. Performance assessment provides the necessary feedback to determine the effectiveness of the **plan** and **do** phases and to **act** on any necessary changes. Regular assessments should be made to ensure compliance with, and implementation of, environmental requirements and DOE Orders. DOE sites should establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of their operations and activities that can have a significant impact on ground water.

A GWPP self-assessment is necessary to measure progress in achieving ground water protection goals and in implementing process improvements when necessary. Self-assessment is an ongoing effort; however, regularly scheduled external reviews of the overall program are also important. Voluntarily hosting a GWPP technical peer review sponsored by the DOE Ground Water Protection Work Group is one means by which a program-wide assessment can be performed by colleagues from other DOE sites who have professional background and experience.

In conducting a comprehensive GWPP that is appropriate to the site's unique mission, location, and environmental and social conditions, and that also achieves compliance with applicable Federal, State, tribal and local requirements, the DOE site ground water program manager may discover that certain requirements are duplicative, overlapping, or inconsistent. Thus, under certain circumstances, continuing to maintain an effective, efficient, logical program that also complies with all applicable requirements can present a challenge.

For example, it is possible that a monitoring system for a RCRA waste disposal unit, designed on the basis of identified up-gradient and down-gradient wells, could be disrupted by the pumping of a series of extraction wells for a nearby CERCLA unit where a pump/treat/reinject remedy is being conducted if the flow system is altered in the near-surface aquifer. The orientation of the wells to the RCRA unit may no longer be in the up and down gradient positions that they were originally. Another example is the appropriate level and type of QA/QC that is used for ground

water monitoring for various program needs. Samples taken for RCRA detection monitoring may require a different level of QA/QC than samples taken for compliance with CERCLA. Monitoring for compliance with drinking water requirements, some of which may be imposed by State or local agencies, may require a third level of QA/QC. Where multiple sets of requirements apply, simply attempting to meet all such requirements, or at least all of the most stringent requirements, could lead to excessive and unnecessary costs. A systematic process should be used to optimize the elements of the GWPP. To ensure that all applicable requirements are met but excessive and unnecessary costs are avoided, the DOE site GWPP manager should consider developing a "basis" for demonstrating that the site-wide GWPP is effectively meeting the goals of the various requirements and to identify where waivers or variances are needed. It may be necessary to explore the need for formally applying for waivers or variances from regulatory agencies from specific requirements that the DOE site GWPP manager determines to be unnecessary or conflicting with ground water protection goals. Such waivers or variances are available under RCRA, CERCLA, SDWA, and certain State and local laws.

CHAPTER VIII. DOCUMENTING THE QUALITY OF AMBIENT GROUND WATER AND VADOSE ZONE CONDITIONS AT THE SITE

Site characterization and monitoring activities should provide the basic information needed to describe the ground water regime with respect to quantity and quality, characterize the subsurface hydrogeological conditions, and identify trends in hydrogeological parameters critical to ongoing or long-term site operations. A resource assessment program could be developed, based on site-specific subsurface data, to classify ground water resources according to use, value, and vulnerability to contamination. Data also should be obtained to determine basic structural conditions of the vadose zone and to allow evaluation of long-term potential threats to ground water from waste disposal units and near-surface soil contaminants.

Ground water protection and remediation activities should be based on a thorough understanding of the hydrogeological conditions of the site and on the results of subsurface characterization and surveillance monitoring developed and collected in accordance with a rigorous QA/QC program. The GWPP should establish standard protocols and best management practices for sampling, analysis, and site investigation techniques. QA/QC requirements should be structured to meet programmatic data needs but also should be as consistent as possible across all site-wide monitoring and data gathering programs.

The following steps related to documenting the quality of a site's ambient ground water and vadose zone conditions should be considered.

1. Identifying Standard Subsurface Investigation Methods Used Site-Wide to Ensure Comparability with Acceptable Quality Assurance/Quality Control Procedures and Minimum Data Quality Requirements.

   Ground water programs collect information for a variety of purposes and under different drivers. A comprehensive GWPP should ensure that data collection serves as wide a variety of needs as is practicable. Information often is used over the long term, both for trend analysis and for future projects.

   Data comparability is problematic in that the specific protocols needed for some purposes—for example, the methods and validation procedures included in EPA's Contract Laboratory Program (CLP) may be excessive and overly costly for other purposes. Clearly it may not be realistic to require that standardized protocols be used in all investigations, or even in all stages of one investigation, but one possible alternative approach is to identify minimum standards for data and acceptable practices.

   DOE sites should calibrate monitoring equipment and maintain and record this calibration process according to the organization's procedures. A validated and consistent system for collecting, assessing, and documenting environmental data to ensure laboratory data meet program-specific needs and requirements within the framework of a performance-based approach for analytical laboratory work is essential. This quality system delineates the QA policies and QC practices of the laboratory to ensure obtaining data that are defensible and of known quality. A consistent quality

system would create a baseline to compare data across Federal agencies, avoid duplicative data collection, and, hence, save resources.

As part of an overall ISMS/EMS, maximizing the use of existing data and sharing data between programs may best serve DOE's interests. The GWPP should address the need to document the acceptability of existing information and efforts to obtain Departmental or other regulatory agency approval on the use of historical data and data collected under other regulatory or policy drivers to avoid collection of redundant data.

2. Establishing a Process for Adopting Standard Test Methods Site-Wide.

This process would include an evaluation of standard test methods such as those from the American Society for Testing and Materials (http://www.astm.org). The comparability and suitability of various analytical methods such as solid waste test methods developed by EPA for the RCRA program, Superfund CLP methods, and other procedures should be established for project specific needs. Acceptable assessment and documentation needs for innovative techniques should be established.

3. Integrating Descriptions of Analytical Procedures and Information on Methodologies Used in Their Development with Database Design.

Such integration ensures that metadata on analytical procedures are well documented to ensure that future uses of the data are defensible. In addition, data management should meet present needs for information storage and retrieval in a way that maintains data quality.

CHAPTER IX. ENVIRONMENTAL MONITORING AND SURVEILLANCE OF GROUND WATER

Environmental monitoring and surveillance data contribute to the historical record of existing ground water contamination that may be useful for future evaluations of contaminant fate and transport and also provide a baseline for remediation programs. Additionally, monitoring data are needed to evaluate and predict present and future human health and ecological risks. The nature of the monitoring program will depend on a number of site-specific factors such as the site mission, waste disposal units, proximity to receptors, and status of environmental remediation programs.

Each DOE site's GWPP should provide a network for monitoring ground water quality. This network should be designed to address monitoring requirements contained in CERCLA compliance agreements and RCRA permits and corrective action orders as well as a DOE site-wide surveillance monitoring network, as described in DOE G 450.1-6, *Ground Water Surveillance Monitoring Guide for Use with DOE O 450.1, Environmental Protection Program,* dated 6-24-04. DOE G 450.1-6 describes the concept of an integrated site-wide program designed to meet the requirements of regulations in the relative short term and to form the basic framework for a long-term surveillance monitoring network to address stewardship responsibilities. DOE G 450.1-6 also suggests criteria for evaluating the effectiveness of an integrated site-wide monitoring network. Where ground water monitoring will be performed to meet long-term stewardship responsibilities there will be an ongoing need for continual review and improvement to the site-wide network. The DOE G 450.1-6 criteria can be used to evaluate the adequacy of the network as the needs of site-wide programs change and to evaluate proposed revisions to the network.

Ground water surveillance and detection monitoring provides an ongoing assessment of contaminant distributions. Site-wide surveillance monitoring should provide general information on the nature and extent of contamination and on emerging ground water quality concerns. Specific detection monitoring requirements also may need to be met under RCRA or CERCLA. DOE directives (e.g., DOE G 450.1-6) do not provide specific requirements for monitoring frequency, analytic methods, etc., but provide the Department's sites and operating programs with the flexibility to meet the overall goals in the most cost-effective fashion. If ground water characterization and monitoring activities are carried out for specific operable units or RCRA waste management units, then the information generated should be integrated into the site-wide monitoring network to avoid redundancy and to reduce costs, provided the methods used and the QA levels are acceptable.

The following recommendations may be considered in the site-wide GWPP.

1. Design Criteria Used in Developing the Network Should Be Clearly Identified.

   Regulatory compliance drivers should be identified where relevant. There may be a need for various unique monitoring networks at any one site, each designed to meet specific program data needs.

2. Data Management and Reporting Systems Are Needed for Sharing Data with All Audiences and for Maintaining the Historical Record of Contaminant Distributions.

   The data should be maintained in a coherent site-wide manner. Data users should be identified, and the monitoring program should address how information needs will be met.

3. Ongoing Management (Assessment and Modification) of the Monitoring Network Is Needed to Address Changing Contaminant Distributions, Site Conditions, and Budgets.

   Criteria for adding or subtracting wells may be identified in the monitoring plan. The timetable for reevaluating the site-wide network should be defined.

4. Innovative Monitoring Techniques Have the Potential to Provide Better Quality And Less Expensive Data.

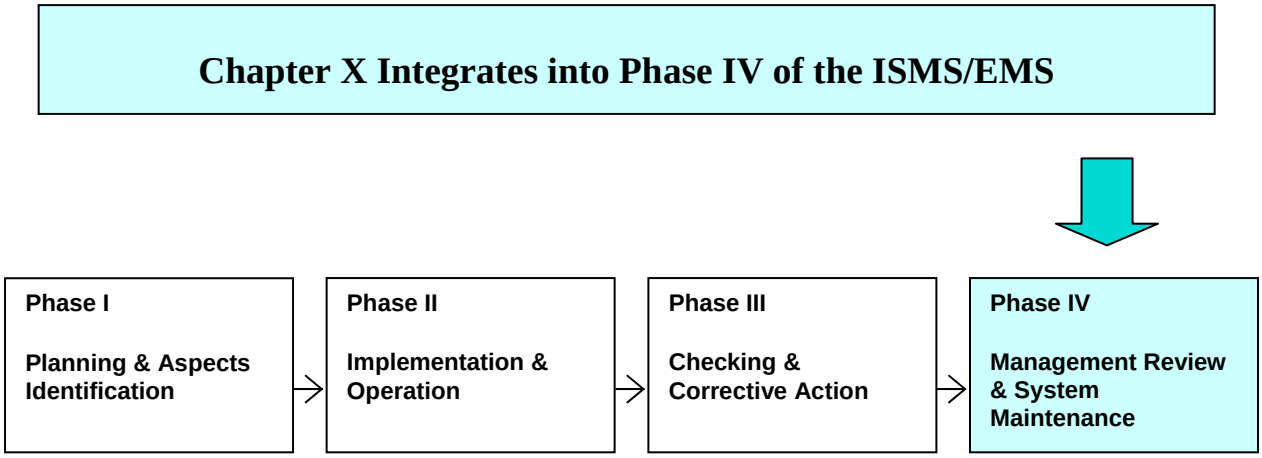
   The need for, and use of, innovative techniques should be discussed in the monitoring plan. In particular, the site-wide program should address the use of techniques to minimize investigation derived waste (e.g., micropurge sampling methods, in situ measurements) and methods for network optimization.

5. Use of an External Technical Review Process Should Be Considered When Reevaluating the Monitoring Network Design.

   Expertise in design and operation of ground water monitoring systems exists throughout the Department and can be obtained for performing a technical peer review through the DOE Ground Water Protection Work Group.

6. Nonconformances Should Be Investigated and Corrective/Preventive Actions Taken.

   DOE sites should establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformances, taking action to mitigate any impacts that were caused, and initiating and completing corrective and preventive actions.



CHAPTER X. CONDUCTING PERIODIC MANAGEMENT REVIEWS AND SYSTEM MAINTENANCE

Management review is the periodic review of the GWPP in the context of an ISMS/EMS by senior management (i.e., managers who have the authority to make decisions for the site or facility.) The DOE site's top management should, at intervals determined appropriate, review the GWPP to ensure its continued suitability, adequacy, and effectiveness. The GWPP should be reevaluated and modified as necessary to reflect changes in site operations or missions as new requirements arise from laws, Executive orders, DOE directives, or contracts and as needed to achieve the goals, objectives, and targets established for the GWPP. The management review should address the possible need for changes to policy, objectives, targets, and other elements of the GWPP and the commitment to continual improvement. This review should be documented. DOE site ground water program managers should develop programs that efficiently meet the goals and objectives and should strive to continuously improve the programs at their respective sites as time passes and conditions change.

Guidance pertaining to management review can be found in DOE G 450.1-1. A GWPP is part of an EMS and, as with the EMS, a clear declaration of management commitment to ground water protection is key to an effective and functional program.

APPENDIX A. REFERENCES

1. 40 CFR Part 141, *National Primary Drinking Water Regulations* (http://www.access.gpo.gov/nara/cfr/waisidx_03/40cfr141_03.html).

2. DOE, October 1999, *Technical Guidance for the Long-Term Monitoring of Natural Attenuation Remedies at Department of Energy Sites.* Office of Environmental Restoration (http://web.em.doe.gov/techguide).

3. DOE, May 2002, *Guidance for Optimizing Ground Water Response Actions at Department of Energy Sites.* Office of Environmental Management (http://web.em.doe.gov/er/May2002gwguide1_508.pdf).

4. DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* dated 2-8-90 (http://www.directives.doe.gov/pdfs/doe/doetext/oldord/5400/o54005c2.pdf).

5. DOE O 414.1B, *Quality Assurance*, dated 04-29-04 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/414/o4141b.pdf).

6. DOE O 435.1, *Radioactive Waste Management*, dated 7-9-99 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/435/o4351c1.pdf).

7. DOE O 450.1, *Environmental Protection Program*, dated 1-15-03 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/450/o4501.pdf).

8. DOE G 450.1-1, *Implementation Guide for Use with DOE O 450.1, Environmental Protection Program,* dated 2-18-04 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/450/g4501-1.pdf).

9. DOE G 450.1-2, *Implementation Guide for Integrating Environmental Management Systems into Integrated Safety Management Systems*, dated 8-20-04 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/450/g4501-2.pdf).

10. DOE G 450.1-6, *Ground Water Surveillance Monitoring Implementation Guide for Use with DOE O 450.1, Environmental Protection Program,* dated 6-24-04 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/450/g4501-6.pdf).

11. DOE P 141.2, *Public Participation and Community Relations*, dated 5-2-03 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/141/p1412.pdf).

12. DOE P 454.1, *Use of Institutional Controls*, dated 4-9-03 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/454/p4541.pdf).

13. DOE P 455.1, *Use of Risk-Based End States*, dated 7-15-03 (http://www.directives.doe.gov/pdfs/doe/doetext/neword/455/p4551.pdf).

14. DOE Standard ENVR0004 (draft for use and comment), *Application of Best Available Technology for Radioactive Effluent Control*, dated March 1997 (http://tis.eh.doe.gov/oepa/guidance/aea/batw.pdf).

15. Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual, July 2004 (http://www.eml.doe.gov/marlap).

16. Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), June 2004 (http: www.epa.gov/swerffrr/documents/intergov_qual_task_force.htm).

APPENDIX B. EXAMPLES OF GROUND WATER GOALS

The following are examples of goals for ground water protection, monitoring, and program implementation that could be incorporated, either singly or in combination, in a site-wide ground water protection program to comply with DOE 5400.5, *Radiation Protection of the Public and the Environment*, and DOE O 450.1, *Environmental Protection Program*.

1. Examples of Ground Water Protection Goals.

- Protect potential future sources of drinking water from contamination that would cause any public water system to exceed the National Primary Drinking Water Regulations without installing new or additional treatment technology.

- Establish site-wide, *numerical* ground water protection targets based on current use and site-wide *qualitative* ground water protection targets based on potential future use of the ground water.

- Establish site-wide ground water protection goals based on current resource use and on future site land-use plans.

- Establish site-wide ground water protection goals or targets that ensure compliance with the all sources–all pathways radiation protection standard of DOE 5400.5.

- Remediate existing contaminated ground water by a combination of natural attenuation, monitoring, and physical removal of a substantial portion (at least 50 percent) of the mass or the activity of the contaminants.

- Remediate existing ground water to meet applicable Federal or State ground water protection standards, except for areas that are permanently dedicated to waste management, where remediation will be designed to prevent the further spreading of contaminants into uncontaminated areas.

- Protect ground water from future contamination based on the quality of the ground water that must be maintained for expected future resource use.

- Protect uncontaminated ground water from future contamination and prevent spreading of existing contaminants into uncontaminated areas of the subsurface.

- Conduct waste management practices in a manner that protects the ground water resource and minimizes further ground water contamination.

- Conduct all remediation activities in a manner that ensures protection of the ground water resource for reasonably expected future uses.

2. Examples of Ground Water Monitoring Goals.

- Conduct site-wide ground water monitoring according to a well-developed strategy to assess ground water quality, determine impacts as a result of operations, and establish baseline conditions for remediation and future activities.
- Develop a ground water resource management strategy that protects and provides optimum use of ground water resources
- Conduct effluent monitoring at all pertinent facilities to provide timely information regarding operations that may adversely affect ground water resources.
- Conduct well construction, maintenance, and abandonment practices in a technically sound, cost-effective manner that complies with applicable regulations
- Conduct site-wide ground water monitoring to provide an indication of trends in ground water quality.
- Conduct site-wide ground water monitoring to provide consistent water quality data for resource management and early warning of potential contamination.
- Assess vadose zone contaminants for their potential impact on ground water.

3. Examples of Ground Water Program Implementation Goals.

- Conduct hydrogeologic regime analysis to understand the hydrogeologic conditions that maximize use of existing facilities and provide for efficient coordinated collection of additional data.
- Demonstrate compliance with requirements applicable to ground water protection to DOE, regulators, and stakeholders.
- Identify the organizational responsibilities of DOE, prime contractors, and other organizations engaged in ground water protection activities.
- Perform technically sound verification of ground water modeling results used to support site-wide ground water protection decisions by comparison to actual monitoring data.
- Make complete, current, and accurate information on the operations and results of the ground water protection program available to local citizens; Federal, State, tribal, and local agencies; and other interested parties.