Strategic Plan and Strategy of the Oak Ridge National Laboratory Environmental Restoration Program
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Strategic Plan and Strategy
of the Oak Ridge National Laboratory
Environmental Restoration Program

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PREFACE

This report on the *Strategic Plan and Strategy of the Oak Ridge National Laboratory Environmental Restoration Program* was prepared for the U. S. Department of Energy Office of Environmental Restoration and Waste Management in accordance with requirements under budget and reporting code EW 20. This work was performed under Work Breakdown Structure 1.4.12.6.3.01 (Activity Data Sheet 3501). This document provides the U.S. Department of Energy Office of Environmental Management with information about the use of an integrated strategic plan, strategy, and life-cycle baseline in the long-range planning and risk-management process employed by the Environmental Restoration Program at the Oak Ridge National Laboratory.
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ABBRVIATIONS

DOE  U.S. Department of Energy
ER   Environmental Restoration (Program)
ORN  Oak Ridge National Laboratory
1. BACKGROUND

The Oak Ridge Reservation consists of approximately 58,000 acres of federally owned land in Oak Ridge, Tennessee. The Reservation comprises three major operating facilities—the Oak Ridge National Laboratory (ORNL), the Oak Ridge K-25 Site (formerly the Oak Ridge Gaseous Diffusion Plant), and the Oak Ridge Y-12 Plant—as well as land used by Oak Ridge Associated Universities.

ORNL covers approximately 2900 acres in Melton and Bethel valleys. The Laboratory was built in 1943 as part of the World War II Manhattan Project. Its original mission was to produce and chemically separate the first gram quantities of plutonium as part of the national effort to produce the atomic bomb. The current mission of the Laboratory is to conduct applied research and engineering development in support of U.S. Department of Energy (DOE) environmental and energy programs and to perform basic scientific research in selected areas of the physical life sciences.

During 50 years of operations, the research and production facilities on the Reservation have contaminated facilities, soil, groundwater, and surface water. The Laboratory itself has generated a large quantity of hazardous, low-level radioactive and mixed waste that was disposed of on site, primarily by shallow land burial. Contaminant releases from the disposal sites, as well as contaminant releases from leaks, spills, and operations, have resulted in widespread contamination of groundwater; surface water; soils and sediments; and facilities.

The Remedial Action Program, now the Environmental Restoration (ER) Program, was established to remediate these contaminated sites and facilities. The Oak Ridge Reservation was placed on the National Priority List in 1989, making it subject to requirements of the Comprehensive Environmental Response, Compensation, and Liability Act. The Oak Ridge Reservation Federal Facility Agreement provides the framework for implementing this Act on the Oak Ridge Reservation.

Success of the ER Program depends on effective and acceptable risk management. The way risk is defined, how strategy for risk reduction is developed, and how the strategy is integrated into all phases of the program are critical aspects of risk management. It is important that stakeholders such as the public and regulators agree with the program’s vision, mission, objectives, and strategy from the beginning and as each evolves.
2. INTRODUCTION

Long-range planning is essential because the ER Program encompasses hundreds of sites; will last several decades; and requires complex technology, management, and policy. Long-range planning allows a focused, cost-effective approach to identify and meet Program objectives. This is accomplished through a strategic plan, a strategy, and a life-cycle baseline. This long-range methodology is illustrated below.

First, a strategic plan is developed that defines the mission, vision, objectives, and challenges of the program. This strategic plan guides and focuses all activities being performed on a common mission and a set of objectives that ensures that all activities are consistent with the strategic plan. Second, a strategy is developed that describes the approach to be taken to accomplish the mission. The strategy addresses topics such as the specific clean-up objectives to be attained and the technologies to be employed in achieving these clean-up objectives. Finally, a life-cycle baseline is prepared that identifies all projects necessary to implement the strategy, along with accompanying assumptions about scope, schedule, and cost. Since these three steps are related, they will be developed and continually evolve in an interactive fashion.

This document contains a strategic plan and strategy that reflect an objectives-driven approach to defining the goals of the ORNL ER Program. The document:

- provides a focal point that facilitates project coordination;
- establishes effective communication of programmatic objectives to program staff, DOE management, and stakeholders;
- develops synergy between projects and project teams; and
- identifies logical outcomes of the program.
Perhaps the greatest challenge for the program is the need to plan effectively to manage uncertainty in an evolving process and a rapidly changing environmental setting. The goal of this document is to provide the basis for an integrated programmatic planning, budgeting, and evaluation process. The report is intended to be a "living" document, able to reflect policy re-direction, fiscal sensitivities, and evolving program direction based on continually developing information and stakeholder participation. This flexibility ensures that if the program mission or objectives change or the expected clean-up objectives change, then resultant changes elsewhere in the strategic plan, strategy, and life-cycle baseline can be consistent, logical, and traceable.
3. STRATEGIC PLAN

3.1 MISSION

The mission of ORNL ER Program is to reduce to acceptable levels the human health and environmental risks resulting from past DOE activities.

This mission will be achieved in a manner commensurate with the availability of resources and technology. At the same time, the program will remain responsive to stakeholder preferences and regulatory requirements. The approach for environmental restoration will be innovative and cost effective and will affirm ORNL’s position as a leader in environmental management. This mission is consistent with DOE’s overall mandate to achieve improved environmental quality, as well as with their mission for environmental restoration activities that involve the following:

- ensure that risks to the environment and human health and safety posed by inactive and surplus DOE facilities and contaminated areas are either eliminated or reduced to prescribed acceptable levels;
- comply with all applicable federal, state, and local regulations and agreements and DOE orders;
- establish cooperative clean-up approaches that involve the public, states, government agencies, industry, and other stakeholders;
- attain environmental clean-up goals using the most technically effective and cost-efficient means possible; and
- contribute to the development of national capabilities to address environmental problems.

Compliance with this mission requires development of a complex program with many parallel activities, including continual identification and development of information necessary to make efficient and effective decisions.
3.2 VISION

The vision of the ORNL ER Program is to restore all contaminated sites to a level acceptable to the stakeholders in a manner that establishes ORNL as a leader in environmental management. This vision will be achieved over time as follows:

3.2.1 Immediate Vision

- Inventory contaminated sites and current releases and rank them based on risk.
- Develop a strategy for addressing sites and releases.
- Assemble contaminated sites into logical projects based on the clean-up strategy.
- Optimize the projects to be implemented based on value per dollar spent.
- Complete an integrated strategic plan, strategy, and life-cycle baseline.

3.2.2 Intermediate Vision

- Complete all early actions to control off-site risks.
- Identify, develop, and utilize state-of-the-art assessment and remediation technologies.
- Initiate remediation activities addressing future risk.
- Comply with applicable federal, state, and local regulations and agreements and DOE orders.
- Attain national leadership through the effective management and integration of site remedial actions, facility decontamination and decommissioning, and facility transition.
- Achieve world leadership in environmental management, taking advantage of ORNL’s ability to coordinate environmental restoration and waste management activities with environmental research and development and the use of effective environmental technologies.
3.2.3 Long-term Vision

- Complete restoration of all sites that were identified before the ER Program was established in 1989.
- Maintain all sites that were identified after 1989 in safe condition and integrate them into the ER Program.
- Transfer technical and management skills for application throughout the world.

This vision is consistent with that of DOE’s Office of Environmental Management.

3.3 OBJECTIVES

The program is guided by the following four objectives that reflect the mission to reduce the human health and environmental risk resulting from past DOE activities to acceptable levels:

- Objective 1—Reduce risk to the environment and human health.
- Objective 2—Encompass perspectives of stakeholders.
- Objective 3—Maintain an effective program decision and management structure.
- Objective 4—Comply with regulations, guidance, and DOE orders.

These objectives are consistent with the DOE Office of Environmental Management’s following seven major goals:

- Design and deploy sufficient infrastructure to fulfill the environmental restoration mission.
- Minimize health risks to the general population.
- Integrate activities with waste management and decontamination and decommissioning to address clean-up problems.
- Implement a uniform, comprehensive management system for ensuring a cost-effective program.
- Minimize the magnitude of waste generated during the restoration process.
- Reduce the inventory of surplus facilities.
- Ensure DOE compliance with all applicable regulations.

These program objectives are organized into an intent structure (Fig. 2), which is an hierarchical organization relating the higher order, or more general objectives, with the lower-level, or more specific objectives. In an intent structure, every objective must have a superior objective that justifies the existence of the objectives. Similarly, for any superior objective, there must be a subordinate objective (or objectives) that describe(s) how the objective will be achieved. For example, to achieve Objective 1, subobjectives 1.1 through 1.4 must be achieved because they define how Objective 1 is achieved. All tasks, activities, and projects must assist in satisfying one of these objectives, or the objective adds no value to the program.
3.4 CHALLENGES

The following are some significant challenges that need to be met to manage the program:

- Address hundreds of contaminated sites, facilities, and contaminant releases within a complex environmental and industrial setting.
- Determine which sites require action and which can be removed from consideration.
- Balance rapid actions for near-term risks with comprehensive actions for future risks.
- Simultaneously minimize life-cycle decontamination and decommissioning costs, manage risks, and balance resources with remedial actions.
- Show real progress with less study and more cleanup.
- Develop a strategy for achieving regulatory compliance within a risk/benefit approach.
- Ensure early stakeholder participation in prioritizing actions, identifying acceptable endpoints, and making decisions that will accelerate the cleanup process.
- Prioritize, optimize, and schedule projects within a resource limited environment and with a long-term view.
- Minimize exposure of remediation workers to contamination and balance this risk against potential future risk to the public.
- Overcome technology and waste management limitations.
- Streamline the investigation and decision-making processes.
To comply with ARAR's, TBC guidance and DOE orders.

To define and integrate land use objectives for ORNL.

To work with regulators to define ARARs.

To strive toward the ALARA concept.

To identify clean-up levels.

To maintain planning and control systems for life cycle planning and project control.

To maintain an effective program decision and management structure.

To develop and maintain an information base.

To develop and maintain documentation of effectiveness of remedial actions.

To assess cumulative impacts and evaluate potential actions.

To support site identification and prioritization.

Figure 2. Strategic Objectives of the Oak Ridge National Laboratory Environmental Restoration Program.
To reduce Risk to the Environment and Human Health

1.1 To Reduce Current Risk Through Early Actions

1.2 To use Innovative and Cost-effective Technologies and Approaches

1.3 To Prioritize Actions Based on Optimal Cost and Risk

1.3.1 To provide Prioritization Criteria for Remedial Action

1.4 To Reduce Future Potential Risks through Comprehensive Actions

1.4.1 To Identify and Minimize Worker Risk in the ER Process

1.4.2 To Characterize and Prioritize sites requiring Remedial Action

1.4.3 To Define a Remediation Schedule

2.0 To Encompass Perspectives of Stakeholders

2.1 To Develop and Maintain Effective Systems for Information and Communication

2.2 To include stakeholders in all aspects of the Program
INTENT STRUCTURES

Figure 2, Strategic Objectives of the Oak Ridge National Laboratory Environmental Restoration Program, represents an effective form of organizing and communicating the intents (objectives) of an organization or program. This brief write-up provides information on the approach and organization of intents using a tool of systems planning.

The formulation of integrated plans for executing ER operations is a complex problem because it involves many diverse groups with their own objectives, different agencies with different requirements, many technologies to serve various needs, various concepts of what remediation ought to be, and uncertainty in long term budget availability and policy. This complexity makes effective and efficient planning and policy formulation very difficult. Most of the complexity comes about because of the large number of elements to be considered and the myriad of interactions and interconnections between elements. Systems engineering methodology is used to evolve a structure which allows interactions and interconnections between elements to be more visible to those involved with the planning and policy formulation than conventional approaches.

With a group of planners, there may be several different concepts of how the elements involved in the planning relate to each other. Each of these concepts constitutes a mental model. The systems approach identifies the relationships of the mental model and structures them to create a more well defined model in which relationships are clearly visible. If the group has differing conceptions of a particular relationship, these can be pinpointed and discussed so as, hopefully, to lead to concepts acceptable to all involved. If this can be accomplished, opportunities for misunderstanding are minimized. The net results of all this is that the graphical displays which result from the application of these systems engineering methodologies to urban and societal situations are in fact a transformation of an essay or mental model of the situation to a graphical model of the same situation. It is this graphical model which aids greatly in dealing with complex issues.

The intent structure, as illustrated by Figure 2, can help overcome four issues that normally inhibit the formulation of objectives. These are: invisible intent, a frequent desire to focus on alternative concepts, questions of ownership of goals and objectives, and the inadequacy of language in communication interactive and implicitly dependent meanings.

It is sometimes difficult to recognize that objectives can be activities as well as or even independent of results (events). Ordered in a hierarchy one would generally see axiological objectives (policy and goals) at the top of the hierarchy, regulations (or activities) at the bottom and various realities in between. The intent structure enables one to perform two of the primary functions of effective strategic planning and management: organizing and communicating.

There are several methods of developing and organizing intent structures, the most common is the "why" and "how" technique as illustrated in this example. In developing intent structures one must remember not to interpret activities or procedures as intents (objectives). Using the how and why technique, intents are organized in order of subordinate relationship; "Why" is an objective being considered should be answered by the objective above, and "How" is an objective being accomplished should be answered by a more specific objective below. The general rules for placing objectives in an intent structure include: (1) If objective B necessarily must be attained in order to attain objective A, then objective B is place below objective A in the structure. (2) If objective C, either separately or in combination with other objectives, represents one alternative way of accomplishing objective A, C lies below A in the structure. When an intent structure is complete, it is most useful as an aid in communication.
STRATEGY

CONSIDERATIONS IN STRATEGY DEVELOPMENT

As stated previously, the Oak Ridge National Laboratory Environmental Restoration Program is a risk management program with a mission to remediate contaminated sites to reduce risk to human health and the environment. The Strategy is the means by which the mission will be achieved. The basis from which a risk management approach (a Strategy) was developed is presented in the following text.

The major contaminant sources and releases at the Laboratory are known, and their impact on potential current and future risk have been assessed. This information is sufficient to develop an approach, or Strategy, and perform long-range planning. Factors that were considered when developing the Program Strategy are:

- The remediation of the Oak Ridge National Laboratory sites will require more than 30 years, and institutional control should be present for 100 years;
- The future use of the site is not known and is likely to be based on technology, cost, social values, and other factors;
- The safety, effectiveness, cost, and environmental impacts of current technologies for characterization, remediation (removal, isolation, and in situ treatment) and waste treatment and disposal limit the ability to conduct rapid and effective remediation;
- Conditions (regulations, technology, risk concern levels, and funding) will change before completion of the mission;
- The Program is subject to public scrutiny and is influenced by politics and multiple stakeholders. Therefore, to be successful, stakeholder acceptance of the mission, vision, objectives, and Strategy is needed. Stakeholders must participate in the process and have trust in the process.

STRATEGY SELECTION

Numerous approaches can be employed to meet the objectives of the Program that were identified in the Strategic Plan. Possible approaches range from complete restoration of the site for unrestricted use to permanent use of the site for waste disposal with perpetual federal control and monitoring. These approaches are described in the following text as Alternatives 1 and 2, respectively. A third alternative, industrial use, is also described.

Alternative 1: Unrestricted Site Use. Removal of all contaminant sources and removal and treatment of contaminated media to allow unrestricted use of the site with little or no federal control. Components of this alternative are summarized in the following text:

- Rapid actions taken to capture or control current contaminant releases to reduce off-site contaminant flux;
- Long-term, final remedial actions taken that require major excavation, treatment, and disposal of contaminant sources and contaminated media; and
- Some in situ immobilization of contaminants included where it is effective, where radioactive decay helps, and where there is no other choice.
This is a long and costly effort, but it results in a low-maintenance cost once complete, and the land is returned to some public utility.

**Alternative 2: Long-Term Institutional Control.** Containment of contaminant sources and releases to protect off-site receptors, along with perpetual federal control of the site. Components of this alternative are summarized in the following text:

- Rapid actions taken to capture or control contaminant releases to reduce off-site contaminant flux;
- Long-term collection and treatment of contaminant releases or contaminant source control required to meet off-site risk concerns; and
- Long-term perimeter monitoring and institutional control required.

This alternative is responsive to changes in technology/regulations/concern levels over time. In addition, it is a less costly effort but has high maintenance costs.

The remediation Strategy for the Oak Ridge National Laboratory is captured in the following intermediate approach.

**Alternative 3: Industrial Use.** Stabilization of contaminant sources and releases, focused remediation, and monitoring and assessment, assuming the site will be industrial for the next 30 to 100 years. Components of this alternative are summarized in the following text:

- Rapid actions taken to capture or control contaminant releases to reduce off-site contaminant flux;
- Areas that are either currently releasing or have the potential to release contaminants to the environment stabilized;
- Actions for high activity, long half-life (or high hazard) areas located, characterized, and implemented; and
- Long-term limited institutional control and perimeter monitoring will be required.

Since the future is uncertain, actions will be taken that provide acceptable risk reduction for the next 30 to 100 years. These actions should be compatible with possible future actions and may be suitable final actions given future restrictions on land use. This Strategy strikes a balance between monitoring and removal (using available, less-than-optimal technologies); allows meaningful near-term progress to address current problems; takes reasonable steps toward final actions; and maintains flexibility to respond to changes in factors such as land use, public concern, and technology.

The selection of this Strategy for planning purposes influences the assumptions made for:

- Technologies needed (removal, isolation, monitoring, etc.);
- The type of characterization information needed;
- Waste treatment, storage, and disposal capacity;
- The composition of the environmental restoration team;
- Priorities for remediation;
- The rate of progress; and
- Worker exposure.
If the Strategy changes, then assumptions for the previous items may change as well. For example, the Strategy selected influences the technologies that are appropriate, which, in turn, influence the cost and schedule. If technological breakthroughs occur, then the Strategy may adopt a more aggressive remediation objective and a higher land use, which, again, will affect the cost and schedule. Conversely, waste management restrictions can alter the technologies that can be implemented and again affect the Strategy.

PROGRAM PLANNING PROCESS

A life-cycle approach is used to plan how to implement the Strategic Plan and Strategy. The Program planning process being implemented (Fig. 3) views environmental restoration as a business, maximizing value where value is measured in terms of protecting public health and the environment and making efficient use of limited resources. This life-cycle approach supports cost-effective risk management for individual remediation projects as part of an integrated Program. An upper-level view of the Program planning process follows.

**Problem Identification.** Through ongoing environmental monitoring programs, routine surveillance activities, and historical knowledge, the following problem areas have been identified at the Laboratory:

- Groundwater;
- Surface water;
- Soil and sediment;
- Buried waste;
- Inactive low level liquid waste tanks;
- Pipelines;
- Hydrofracture wells and grout sheets; and
- Facilities.
Fig. 3 Barney
These eight problem areas embrace all of the types of environmental problems encountered at the Oak Ridge National Laboratory, and they physically exist at multiple sites throughout the Laboratory’s boundaries.

At each location where a problem occurs, a preliminary assessment based on historic information, environmental monitoring data, and limited field investigations establishes the type and magnitude of the hazard and whether or not action is required. Preliminary assessments provide the foundation from which stakeholders can participate in programmatic planning.

**Project Definition.** The Oak Ridge National Laboratory Environmental Restoration Program is responsible for more than 400 individual contaminated sites containing one or more of the problem areas listed previously. These sites have been assembled into projects for assessment and remediation based on such factors as type of contaminant, location, and risk. Identification and definition of these projects are consistent with the mission, vision, and objectives of the Strategic Plan and the approach contained in the Strategy. A conceptual life-cycle scope, cost, and schedule are developed for each project based on assumptions made concerning exposure scenarios, regulations, technology, waste management options, remediation objectives, and policy. These assumptions are based on the technical approach presented in the Strategy to ensure that there is consistency among projects and that all projects contribute to the Program’s mission.

To be effective, project assumptions must be realistic. For example, if remediation of a site to allow unrestricted use is not likely to be feasible, unrestricted use should not be used as a planning assumption. Planning assumptions concerning likely remedial actions do not bias the ultimate selection of remedial actions as part of the Comprehensive Environmental Response, Compensation, and Liability Act process. Feasibility studies evaluate a full range of remedial actions, although, for efficiency, remedial investigations focus on likely actions. Stakeholders are encouraged to participate in the development of these planning assumptions to increase their awareness of the assumptions being made and their implications.

**Prioritization of Activities.** It is not feasible to initiate all activities simultaneously; therefore, prioritization is required. All Program activities, including remedial actions, information systems, technology development, and surveillance and maintenance, are prioritized based on public health, environmental protection, personnel safety, stakeholder preferences, and mission. This approach focuses investigations and cleanups on the worst sites first; thus, meaningful and cost-effective progress can be made. Stakeholder participation in setting priorities enhances credibility and stakeholder satisfaction.

**Optimized Schedule.** Following prioritization, activities are scheduled for implementation using an optimization scheme. This scheme initiates activities that contribute most to the environmental restoration mission, given existing and projected funding constraints. Initially, assumed funding levels are used for optimization; however, when the actual funding levels are known, a detailed project cost estimate is prepared and the optimization is redone with more accurate cost estimates and resource availability. Life-cycle cost and schedule information is used to ensure that a project is not initiated unless funding will be available for continuous progress to completion. Scheduling a mixture of activities such as characterization; removal and remedial actions; decontamination and decommissioning; and surveillance and maintenance allows simultaneous progress toward near- and longer-term goals. The Program is optimized by selecting those projects for implementation that maximize accomplishment of the Program’s mission for the resources expended. Stakeholders are involved in selecting those activities.
on the prioritization list that reasonably can be accomplished within resource constraints. Unexpected projects, such as removal actions, are incorporated into the prioritization and optimization activities and implemented based on their ranking and available funding. This system provides flexibility without compromising credibility or the long-term programmatic objectives.

Summary. In summary, the planning process (Fig. 3):

- Identifies problems;
- Defines projects in terms of scope, schedule, and cost to solve these problems;
- Prioritizes the projects; and
- develops a schedule to implement the projects in a manner that optimizes risk reduction for the available funds.

This optimized schedule becomes the Program's Life-cycle Baseline for planning purposes. This approach takes a business-oriented view of environmental restoration. A life-cycle perspective makes optimal use of resources to support cost-effective risk reduction for numerous projects within a programmatic context. Emphasis on implementing remediation projects as a business promotes development of effective long-term schedules that optimize the use of limited resources to meet programmatic objectives, anticipate needs, and provide meaningful performance measures.

Following the planning phase, the projects are implemented based on annual funding. If the funding differs from that assumed in the baseline, then optimization must be redone to ensure the correct projects are implemented.
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