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United States Government **Department of Energy**

memorandum

DATE: March 19, 2002

REPLY TO ATTN OF: EM-22 (Steve Golian 301-903-7791)

SUBJECT: Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Five-Year Review Guide

TO: John A. Gordon, Administrator National Nuclear Security Administration, NA-1
Dr. James F. Decker, Principal Deputy Director, Office of Science, SC-1

I have signed out guidance (see attached memorandum) to the Managers of the Field Offices for which I am the Lead Program Secretarial Officer, and I encourage you to provide similar guidance to your sites. The guidance clarifies the Office of Environmental Management's programmatic objectives and recommendations for the conduct of Comprehensive Environmental Response, Compensation and Liability Act five-year reviews. Specifically, the guide highlights the importance of utilizing these reviews to identify opportuaities to reduce life-cycle project costs, and the need to integrate these reviews into long-term stewardship planning activities.

If you have any further questions, please feel free to contact me at (202) 586-7710, or Ms. Patrice Bubar, Associate Deputy Assistant Secretary for Integration and Disposition, at (301) 903-7130.

Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Attachment

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COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) FIVE-YEAR REVIEW GUIDE

OFFICE OF ENVIRONMENTAL MANAGEMENT

DEPARTMENT OF ENERGY

March 2002

I. Introduction

This guide is intended for use by Department of Energy (DOE) personnel responsible for conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) five-year reviews. The purpose of this guide is to clarify the Office of Environmental Management's (EM) programmatic objectives for the conduct of these reviews. The guide is intended to serve as a companion document to the Environmental Protection Agency's (EPA) Comprehensive Five-Year Review Guidance; however, it is tailored to the unique challenges posed by many DOE sites and the long-term stewardship (LTS) activities being planned to meet those challenges.[1]

A five-year review of remedial actions is required if, upon completion of the remedial actions, hazardous substances, pollutants, or contaminants will remain above levels that allow for unlimited use and unrestricted exposure, and the Record of Decision (ROD) for the site was signed on or after October 17, 1986[2]. Whereas reviews at many DOE sites will be statutorily required, there are also sites where they are not. To address situations where a review is not statutorily required, but the EPA believes such a review would be desirable, the EPA has recommended reviews be conducted as a matter of policy[3]. Although DOE does not foresee the need to conduct policy reviews at its sites where ongoing LTS activities are meeting the intent and substantive requirements of five-year reviews, DOE project managers should work closely with the EPA to ensure *regulatory compliance is maintained*, i.e., remedies are operating as intended and adequately protecting human health and the environment.

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[1]*Comprehensive Five-Year Review Guidance*. Office of Emergency and Remedial Response. EPA 540-R-01-007. OSWER Directive 9355.7-03B-P, June 2001.

[2]Unlimited use and unrestricted exposure means that there are no restrictions on the potential use of land or other natural resources. If a site is restricted to industrial use because hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure, a five-year review is required.

[3]The EPA suggests that policy reviews should be conducted for sites where the remedy will take longer than five years to allow for unlimited use and unrestricted exposure; where a remedial action was selected prior to October 17, 1986, and residual hazardous substances, pollutants, or contaminants will not allow for unlimited use and unrestricted exposure; and a removal only site on the National Priorities List where hazardous substances, pollutants, or contaminants will not allow for unlimited use and unrestricted exposure and where no remedial action has or will take place.

DOE's Objectives

In addition to ensuring the long-term effectiveness of engineered or institutional measures put in place to protect human health and the environment, the DOE has three programmatic objectives with respect to five-year reviews:[4]

1) Optimizing the effectiveness and implementation of remedy requirements.

   Although the CERCLA five-year review provision was instituted as a validation of protectiveness, the DOE believes these reviews should also be used to evaluate opportunities to optimize the effectiveness of remedy controls or to reduce long-term maintenance and monitoring costs. This focus on optimization will be particularly important for long-term remedial actions (e.g., where groundwater restoration is anticipated to take one or more decades).

2) Reducing repetitive documentation and paperwork.

   As part of the CERCLA remedy selection and implementation process, a wealth of information on remedial action requirements is compiled and documented (e.g., RODs, Remedial Designs, Close-out Reports). The DOE's intent is to build upon this existing documentation to develop an "audible" baseline on remedy performance, while minimizing duplication of previous paperwork.

3) Integrating the five-year reviews with other LTS requirements.

   In recognition of the long-term management challenges that will be posed by much of the wastes and residual contamination remaining at its sites, the DOE is requiring that its facilities develop LTS plans to ensure protectiveness is continually maintained. The five-year review process will constitute an important component of LTS plans whenever such a review is required.

[4]Although remedy review reports are to be prepared every five years, monitoring and associated assessments of remedy performance will be performed on a continuing basis. Necessary actions to address identified deficiencies should be initiated as needed in the interim periods between reports.

II. DOE's Responsibilities & Expectations

As the lead agency, the DOE is responsible for conducting five-year reviews and documenting the findings in a report. Consequently, DOE personnel should identify, collect, and compile the necessary information and data to determine whether the engineered or institutional controls in place to prevent exposure continue to be fully protective of human health and the environment. The EPA's primary responsibility with respect to five-year reviews at DOE sites is to review the DOE's evaluation and findings and, following their review, issue a finding of concurrence or non-concurrence.[1] Should a five-year review identify protectiveness concerns, the EPA will assist in evaluating appropriate corrective measures.

One of the DOE's LTS goals is to continuously make findings available to the public as remedy performance data are collected and evaluated, including data collected to meet requirements under other regulatory programs such as the Nuclear Regulatory Commission. Ultimately, the DOE expects to have performance data easily accessible as it is collected, thus making documentation of remedy effectiveness more of a continuum rather than being limited to a periodic report every five years.

III. Scope of Five-Year Review

In general, a five-year review should be used to:

1. Evaluate whether the remedy is operational and functional;
2. Evaluate those assumptions critical to the effectiveness of remedial measures or the protection of human health and the environment (e.g., land use, site conditions, applicable standards) made at the time of the remedial decision to determine, given current information, whether these assumptions are still valid;
3. Determine what corrective measures are required to address any identified deficiencies; and
4. Evaluate whether there are opportunities to optimize the long-term performance of the remedy or reduce life-cycle costs.

Each of these primary focus areas is discussed in more detail below.

1. *Operational and Functional Remedy*

Project managers should document whether remedies are operational and functional by evaluating whether those measures that were identified as necessary in the decision document (e.g., ROD, action memorandum) to ensure protection of human health and the environment are working as intended. An evaluation of those parameters the DOE and the EPA established as appropriate indicators of performance during site closeout, or the operation and maintenance (O&M) period for long-term remedial actions, should serve as the basis for determinations of

[1]The EPA will have had significant input into which data are collected and evaluated through their previous involvement in the remedy selection, design/implementation, and closeout processes.

whether remedies are operating properly and successfully. The scope of this review will vary, however, depending on the status of the action, i.e., whether it is a completed action, a long-term (ongoing) action, or an interim action.

[**NOTE**: Implicit in any determination that a remedy is operating properly and successfully is the assumption that a performance assessment of the remedy has been conducted. It is the performance assessment that establishes how a remedy is working and provides predictions of how contaminant concentrations will respond to the remedy in the future, thus providing a measure against which subsequent monitoring data can be compared. If no set of performance expectations/measures have been established, it may be difficult to evaluate and interpret monitoring data. Hence, if no formal basis for assessing performance has been previously agreed to, one should be established and completed as a part of the first five-year review. In subsequent reviews, the predictions should be reviewed and modified to reflect the best interpretation of monitoring data and site knowledge.]

For **completed actions,** i.e., where construction is complete or response goals have been achieved, project mangers should determine whether monitoring data demonstrate that performance objectives continue to be met. In addition, project managers should assess whether any problems to date suggest a potential for remedy failure in the near future if not addressed (e.g., frequency of equipment breakdown or part replacement occurring more frequently than anticipated based on system design life). Project managers also should *confirm that all required institutional controls are in place and adequately addressing those exposures they were intended to prevent*[1].

For ongoing **long-term remedial actions** (i.e., remedial actions that require more than five years to attain response objectives), remedy performance should be reviewed to ensure systems are working as intended and contaminant reductions are consistent with predictions. If, based on the current performance assessment, it appears cleanup levels will be achieved in the time designated in the decision document, the ongoing action should be considered operational and functional. However, if there are differences between site data and the expected performance of the remedy, site project managers will need to evaluate whether the selected remedy actually will achieve the remedial objectives in the desired time frame.

In some cases, data may indicate that cleanup levels will not be achieved (the measures the DOE will take if it finds a remedy to be deficient are discussed later). At the same time, it is also possible to have differences between data and performance expectations that result more from mis-specifications in the conceptual site model (e.g., attenuation mechanisms, rate data, baseline geochemical characteristics) than a deficiency in the remedy. Consequently, when there are differences between site data and performance expectations, project mangers should determine if or what additional information is necessary to identify the cause of these differences and to establish if the remedy is functioning properly.

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[1]See *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups*, OSWER Directive 9355.0-74FS-P, US EPA, September 29, 2000.

For **interim remedial actions** the review should not only focus on the measures put in place to address a specific problem, but also discuss associated areas or pathways not yet being addressed. For example, if a source area is excavated as an interim action but hazardous contaminants above health-based levels that emanated from the source remain in the vadose zone and ground water, project managers should assess whether institutional controls are successfully preventing use of the ground water until such time a ground water cleanup decision is made and successfully implemented.

2. ***Validity of Assumptions***

An essential component to ensuring remedies remain protective is the confirmation of the continuing validity of the critical assumptions made at the time of the remedial decision. As used here, a critical assumption is one that, if invalid, puts the protectiveness of the remedy in question.

In general, there are three types of critical assumptions that should be reviewed for each remedy:

a) Assumptions regarding ***future land use and associated exposure pathways***.

Whenever future land use is assumed to be something other than unlimited use, the DOE must ensure that other uses of the land that would result in exposures that could present an unacceptable risk(s) do not occur. Therefore, project managers will need to periodically evaluate current land use activities to ensure they are consistent with earlier assumptions.

An assessment of the land use and the associated exposure pathways may vary greatly depending on the circumstances at the site. Such an assessment may range from a simple site visit (e.g., to ensure that no construction of residential buildings has begun on an area zoned for recreational use) to a more elaborate analysis of the specific activities occurring at the site. For example, if a site zoned for industrial use has a restriction on excavations deeper than two feet, an additional effort to determine whether current or planned activities are compatible with this restriction would be required.

[**NOTE**: In limited situations, changes in land use off-site may also need to be carefully monitored. For example, changes in site conditions resulting from off-site changes in land use (agricultural practices, ground water withdrawal rates) could impact the effectiveness of any natural attenuation processes being relied on to remediate a contaminant plume.]

b) Assumptions regarding ***site conditions.***

Conceptual Site Models (CSM) developed during the remedial investigation/feasibility (RI/FS) process to identify site problems and guide selection of response actions contain a number of assumptions about site conditions (e.g., subsurface geochemistry, presence of aquitards). Whether an assumption in the CSM about site conditions is critical will depend on the degree to which remedy performance is based on that assumption. For

example, some remedies (e.g., capped disposal cell with a leachate collection system) are sufficiently robust and will function under various site conditions. In such cases, actual site conditions may vary from the assumed site conditions without presenting a risk to human health or the environment; as long as the actual site conditions lie within the range of conditions that can be adequately addressed by the remedy. In contrast, a remedy such as monitored natural attenuation (MNA) may only function as intended if site conditions are as assumed. Because an MNA remedy depends only on natural processes to reach performance objectives, the actual site conditions, if different from assumed conditions, may cause the remedy to be ineffective.

c) Assumptions regarding ***contaminant toxicity.***

Remedial action objectives (RAO) and associated remediation levels are established on the current understanding of contaminant toxicity, regulatory standards and guidelines, and the accepted methods for assessing risk at the time that the decision document is signed. However, as a better understanding of contaminant toxicity evolves over time, regulatory standards or guidelines may be lowered (e.g., arsenic) and, therefore, the protectiveness of previous cleanup decisions may be called into question. However, a change in a regulatory standard or contaminant's toxicity value does not necessarily require a change in the selected remedy. For example, if the contaminant resides in an engineered containment structure that prevents exposure to the contaminant, a change in the contaminant's guideline value has no effect on the remedy's protectiveness.

Given risk evaluations to support remedial decisions typically are based on fairly conservative exposure assumptions and remedies are often selected to provide the greatest level of protection practicable, only in limited situations should a modified toxicity value or risk assessment methodology render a previously protective remedy unprotective, i.e., where there is uncontrolled access to a contaminant(s) and the post-remediation risk was near the limit of acceptability. Nevertheless, if there has been a modification to a toxicity value or methodology, at a minimum project managers should revisit previous risk calculations to ensure no unacceptable risks are posed to human health and the environment. For carcinogens, the latter will require confirmation that risk remains within the EPA's protectiveness range of 10^{-4} to 10^{-6}.

3. ***Corrective Measures to Address Identified Deficiencies***

Should any deficiency in a remedy be discovered, regardless of whether these deficiencies are identified during routine LTS activities or reviewing data while preparing a five-year review report, it is the DOE's responsibility to identify appropriate corrective measures.

The level of effort required for determining the appropriate corrective measure for an identified deficiency will depend on the significance of the deficiency (See Highlight 1). For example, if the remedy is failing, the DOE will need to work with representatives from the overseeing regulatory agencies to decide what is the most appropriate corrective measure. For deficiencies which do not directly impact the protectiveness of the remedy, project managers may identify and implement the appropriate action (without formal consultation with overseeing agencies),

and simply report on the action taken.

4. Remedy Optimization

Project managers should continually look for opportunities to optimize remedies. Optimization may include both measures to improve the performance of the remedy or to reduce associated monitoring, sampling, or maintenance costs as discussed below.

a) Expediting attainment of remedial objectives. For long-term remedial actions, project managers should evaluate whether enhancements to the remedy can be implemented that would expedite the attainment of remedial objectives. If enhancements to the remedy will likely expedite the attainment of remedial objectives, project managers should evaluate the impact to life cycle costs, and determine if it is cost effective to move forward with implementation.

In some situations, new technologies may become available that allow environmental contamination to be remediated in a manner not possible at the time the remedy was selected. Should the application of this technology offer potentially significant reductions in life-cycle costs, project managers may elect to "revisit" the original remedy. [**NOTE:** It is solely the DOE's choice, as lead agency, on whether to re-open the original remedy based on the potential savings or improved performance another technology may offer, unless the protectiveness of the original remedy is called into question.]

b) Transitioning Response Phases. For those response actions involving a transition from one phase of response to another, project managers need to evaluate whether data indicate the criteria established to trigger a shift in response phases has been met. For example, the ROD may specify that at a given point (only *x* lbs contaminant extracted for *y* gallons water pumped) the pump and treat system may be shut down and residual contamination managed through MNA. In such cases, project managers will need to assess performance data to determine whether the decision criteria to transition between phases or terminate an action has been met[1].

c) Scaling back monitoring. As confidence grows that a remedy is performing as expected, project managers should evaluate the appropriateness of scaling back the frequency, location, or scope of monitoring that may no longer be necessary as uncertainties are reduced. For example, if a "pump and treat" remedy has been implemented to control a ground water plume, some monitoring wells may become unnecessary, as they no longer register contamination levels above cleanup levels after the plume has contracted. Under these circumstances, the sampling plan should be revised to eliminate these wells from the sampling routine or reduce the frequency of their sampling. It also may be possible to remove specific ground water extraction wells from service and increase the pumping rate on others to optimize ground water remediation. If apparent inconsistencies in remedy performance arise, project mangers may need to increase monitoring to better assess the situation and, consequently, better

[1]See DOE fact sheet *Developing Exit Strategies for Environmental Restoration Projects*, March 2000.

address any deficiency/problem that might be found.

IV. Documentation of Findings

Because the complete history of the site and associated data will be contained in the Administrative Record, in post-decision document files, or LTS files that can easily be referenced and accessed, this information need **not** be duplicated in five-year review reports. Instead, only a brief chronological history (problems discovered, RAOs, remedies implemented) should be prepared. Primarily, five-year review reports should serve to summarize any substantive findings and conclusions reached from monitoring and maintenance activities compiled over the previous five years, and any corrective measures taken or being recommended to address identified deficiencies.

Substantive observations or findings from the technical assessment, i.e., whether the remedy is operating properly and successfully; whether critical assumptions are still valid, and whether an opportunity exists to optimize the remedy should be concisely summarized. Examples of substantive findings include:

- Information that a deficiency exists (e.g., unexpected contaminant leaching from a containment cell; failure of an institutional control).
- Information that indicates that a remedy failure may occur in the near-term (e.g., detention times within a permeable treatment wall appear insufficient to achieve necessary reductions in contaminant concentrations).
- Unexpected deviations between performance monitoring data and expectations from the performance assessment model that require additional data be collected to determine whether a remedy's protectiveness is being maintained.
- Determination that remedy optimization is feasible and prudent.

Where a deficiency or a substantive finding has been identified, project managers should describe the recommended corrective or investigative measures, or identify those measures the DOE has already taken to address the concern or deficiency. Project managers should also note when a preferred corrective measure action has been identified but not yet implemented. Should a remedy begin to fail, and an alternative remedy be proposed, the DOE may elect to re-open the CERCLA Administrative Record and document remedy modifications there.

If project managers believe remedy optimization is possible, a brief description of the optimization approach should be included. If performance monitoring data are found to differ from expectations because of inaccuracies in the performance assessment model, any necessary modification to the model and new expectations against which future monitoring results will be compared should be outlined. All reports should include an appropriate protectiveness statement (see Highlight 2) and be provided to the EPA for concurrence.

The EPA is seeking to standardize the format for five-year reports. A hypothetical example report, prepared using the EPA's recommended format is provided in Appendix A.[1] In general,

[1]The example in Appendix A reflects an approach where the associated data and analyses compiled over the five-

the DOE expects five-year review reports will vary in length from 4-5 pages to 10-15 pages, depending on the complexity of the remedy, the history of findings from previous reports, whether deficiencies are found, and whether any recommendations (or actions taken) are discussed.

V. Timing of Reviews

In accordance with the EPA's guidance, the date a remedial action is initiated (which triggers the five-year review clock) is the date of "actual remedial action start."[2] Subsequent five-year reviews for that action should be conducted no later than five years after the signature date of the previous five-year review. Coordinating the timing of reviews for the DOE will be challenging as many of the DOE's response actions are being implemented at large, complex sites which have been organized into Waste Area Groups (WAG) or operable units (OU) and treated as separate cleanup projects. As a means to deal with this complexity, sites should conduct five-year reviews accordingly, i.e., to treat these WAGs/OUs as distinct "response actions" and not have a review of a remedy (ies) at one WAG/OU address all the other WAGs or OUs within the entire site/facility. Therefore, each five-year review should focus only on the problems associated with the particular WAG or OU to which the remedy being reviewed applies. If more than one media is impacted within a given WAG or OU, project managers should discuss the scope of the action to any other ongoing/planned actions to address these other media.

The EM program's preference when multiple WAGs or OUs require a review at a site is to combine these reviews into a single "site-wide" five-year report. Initially, doing so may mean that for some WAGs/OUs the first review occurs sooner than five years from start of actual remedial action. However, once the last remedial action for the site has been initiated, all WAG/OU-specific remedies within that site would be reported on at the same time in the site-wide report, thus eliminating the need to track an excessive number of reporting dates.

VI. Relationship to Other Reporting Requirements/Reviews

The DOE's long-term goal is to provide an opportunity for all data and related environmental reports being prepared for a site to be housed under one central program at the site. This includes data collected in support of five-year reviews, as well as those data collected for other reporting requirements (e.g., meeting Resource Conservation and Recovery Act post-closure permit requirements, annual environmental monitoring reports, etc.). This approach will facilitate the coordination of reviews and reporting requirements to promote: 1) consistency in the data and reports being released to the public and regulators; and 2) optimization of monitoring and data collection across programs to minimize duplicative sampling and analysis.

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year period are simply referenced rather than included in the report itself. Although DOE believes such an approach is preferred as it eliminates repetitive documentation, project managers will need to work with their EPA regulators to determine how supporting data and information should be handled.

[2]As noted in the "*Superfund/Oil Program Implementation Manual, Fiscal Year 99/00*," OSWER Publication 9200.3-141E.

VII. Public Involvement

One of the DOE's central goals is to ensure the public remains fully informed of all activities on-going at the site, including, but not limited to, the schedule and scope of five-year reviews. A public notice of the DOE's intent to initiate a five-year review should be prepared so interested parties may participate as appropriate (e.g., request an interview, voice their concerns). Once reviews are complete, sites will need to place copies of the reports in appropriate information repositories (e.g., post-decision document files, LTS information centers).

In general, it is anticipated that most corrective measures will be addressing insignificant deficiencies and, therefore, will only require documentation to the file as to what specific action was taken (e.g., cap repair, monitoring well maintenance), i.e., no formal public notification would be necessary prior to taking such measures. Should a five-year review identify the potential need to implement a previously identified contingency to correct a remedy failure, and that contingency was discussed in the original decision, it may be adequate to simply notify the public through an Explanation of Significant Difference (ESD) that the contingency plan is being implemented. However, if a review finds the original remedy is failing, and a new, not previously identified remedy is necessary, then those community participation requirements under which the original remedy was selected would be applicable to the selection of the new remedy.

Highlight 1: Significance of Deficiencies

In general, a deficiency is insignificant if it does not raise substantive protectiveness concerns and the required fix does not entail changing the nature of the remedy. Examples of insignificant deficiencies include:

- Signs that have been posted as part of the land restriction component of a remedy are missing. (Replacement of "No Trespassing" signs is required.)
- Piling wall requires additional iron. (Replenishing iron is required.)
- Cap erosion noted. (Shoring up erosion is required.)
- Plant growth is noted on a surface barrier. (Removal of plants is required.)

In contrast, a significant deficiency exists when there is a substantive concern about whether a remedy continues to be protective. In these cases, project managers likely will need to consult with overseeing agencies to determine the appropriate path forward. [NOTE: In some cases, the possibility of encountering the deficiency, and the corrective measure to be taken, may have already been identified in an uncertainty management plan.* In these circumstances, the extent of consultation with regulatory or overseeing agencies should be based on the previous agreement on such consultation made at the time the uncertainty management plan was developed.]

Examples of significant deficiencies include:

- A containment cell is leaking and monitoring shows that contaminants are leaching to the ground water.
- Actual site conditions, discovered through monitoring for natural attenuation remedy, are different than originally assumed and ground water plume is migrating.
- Residential homes are under construction on lands designated for recreational use only.

* See DOE/EPA fact sheet, *Uncertainty Management: Expediting Cleanup through Contingency Planning,* February 1997

Highlight 2: Protectiveness Statements[3]	
Protectiveness Statements for Remedial Actions at an OU	
If remedial action(s) at OU is/are under construction and...	*Use this statement...*
Protective or will be protective	"The remedy for OU X is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."
Not protective	"The remedy for OU X is not protective because of the following issues (describe the issue). The following actions need to be taken (describe the actions) to ensure protectiveness."
Protectiveness Deferred	"A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions (describe). It is expected that these actions will take approximately (insert time frame) to complete, at which time a protectiveness determination will be made."
If remedial action(s) at the OU is/are operating or complete and...	*Use this statement...*
Protective	"The remedy for OU X is expected to be protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risk are being controlled."
Protective, in the short term, i.e., immediate threats have been addressed and there is no uncontrolled migration of contaminants	"The remedy for OU X currently protects human health and the environment because (describe the elements of the remedy that protect human health and the environment in the short term). However, in order for the remedy to be protective in the long-term, the following actions need to be taken (describe the actions needed) to ensure long-term protectiveness."
Not protective	"The remedy for OU X is not protective because of the following issues (describe). The following actions need to be taken (describe) to ensure protectiveness."
Protectiveness Deferred	"A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions (describe). It is expected that these actions will take approximately (insert time frame) to complete, at which time a protectiveness determination will be made."
Protectiveness Statements for Sites That Have Reached Construction Completion	
If the remedy(ies) is/are...	*Use this statement...*
Protective	"Because the remedial actions at OU X and Y are protective/are expected to be protective, the remedy for the site is/is expected to be protective of human health and the environment."
Not protective	"The remedial actions at OU X and Y are protective. However, because the remedial action at OU Z is not protective, the remedy for the site is not protective of human health and the environment at this time. The remedial action at OU Z is not protective because of the following issues (describe). The following actions need to be taken (describe) to ensure protectiveness."

[3]*Comprehensive Five-Year Review Guidance*. Office of Emergency and Remedial Response. EPA 540R-01-007. OSWER Directive 9355.7-03B-P, PB99-963214. June 2001.

APPENDIX A

"EXAMPLE" [1]

Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA) Five-Year Review Report
For
Gilman Site
George County, [Name State]

January 2002

Prepared by the United States Department of Energy

Approved by: **Date:**

Arthur Kleinrath January 15, 2002

Arthur Kleinrath
Long-term Monitoring Program Manager
Office of Environmental Management
US DOE

[1]This is a fictitious site used to illustrate the desired content and format of five-year reports

FIRST CERCLA FIVE YEAR REVIEW REPORT FOR GILMAN SITE
Prepared by the US Department of Energy
January 15, 2002

I. Introduction

The purpose of this five year review is to ensure that the engineered or institutional measures being relied upon to protect human health and the environment at the Gilman site continue to function and operate as intended in the Records of Decision (ROD) such that no unacceptable exposures to residual contamination remaining at the site occur. This review was conducted pursuant to CERCLA section 121(c), National Contingency Plan (NCP) section 300.430(f)(4)(ii), and OSWER Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance.* The U.S. Department of Energy (DOE) conducted the review for the entire site in accordance with the signed Federal Facility Agreement with the State and the U.S. Environmental Protection Agency (EPA). The review was conducted between October and December of 2001 by the DOE long-term monitoring project manager, with contract support from Dawson Analytical Services, Inc., under contract to DOE.

This is a statutory review, and the first review conducted for this site. This review is for the entire site, i.e., all remedial actions taken at the site are addressed in this review. The triggering action for this review is the initiation of construction of the landfill cap in December 1996. The review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. All supporting documentation relied on in selecting the remedies for this site is contained in the Administrative Record. The Administrative Record and other relevant post-ROD data reports for the Gilman site are maintained at the George County Public Library [*Provide address*], and on the web at *www.gilmanadmin@ltm.doe.gov.* Relevant documents and analyses are referenced throughout this document.

II. Site Chronology

1985	Site listed on the National Priorities List (NPL)
1987	DOE entered into and signed a Federal Facilities agreement with the State and EPA.
October 10, 1994.	OU1 (Landfill) Record of Decision was signed
1996	OU1 drum removal and cap construction activities were initiated and completed. [See OU1 Closeout Report, February 1997]
January 1997	The OU1 monitoring system was installed
January 1997	Quarterly monitoring for OU1 was initiated
January 15, 1997	No Further Action memorandum for approximately 90 acres of the Old Industrial Area received from state to DOE
January 31, 1998	Record of Decision for OU2 (Groundwater) signed
July 1998	The OU2 permeable treatment wall was installed
August 1998	Quarterly monitoring, both upgradient of the wall and in the off-site plume, began [See OU 2 Groundwater Monitoring Reports]

III. Background

The Gilman site is comprised of 850 acres, located in George County, [*state name*]. From the mid-1950's until 1984, approximately 100 of the 850 acres were used by the DOE to support a variety of

manufacturing and transportation operations associated with weapons parts production. The approximately 100 acres at which site operations occurred are located in the eastern most portion of the site. The remainder of the site, approximately 750 acres, was never developed and remains as timberland. As shown on the site map (Appendix A), the site is bounded by state park lands to the west and agricultural lands to the north, south, and east.

As part of site closure, the DOE removed large quantities of scrap metals and equipment from the old industrial area at the site and dismantled all support facilities. The remaining area of potential concern not addressed during these activities was a 10 acre "landfill" near the southwest corner of the industrial area where, according to site historical records, solid and industrial waste and scrap metals from the support facilities were disposed. This area was closed to disposal in the early 1960's. No nuclear materials were used in site operations.

Ground water flows in a northwest direction across the site. A contaminant plume, extending from the landfill area (southeast quadrant of the site) to the north-west boundary of the site and approximately 1/4 mile beyond, was discovered. Contaminants detected in the plume include trichloroethylene (TCE) (ranging from 150 ppb in the center of the plume to 20 ppb in the off-site leading edge of the plume) and benzene (ranging in concentrations of 200 ppb to 50 ppb). Both TCE and benzene have been detected in the off-site wells at levels above Maximum Contaminants Levels (MCLs). Carbon tetrachloride (ranging in concentrations of 100 ppb to500 ppb) is also present. However, there has been no detection of carbon tetrachloride beyond the site boundary.

Future Land Use

Current plans are to transfer the property in its entirety (850 acres) to the state for incorporation into the adjacent state park and wildlife preserve. Future use of the site will be recreational. As part of the property transfer agreement, the State will be required to maintain use restrictions for the groundwater under the site until such time as remedial objectives are reached, and land use/access restrictions for the old industrial area, including the 10-acre landfill area.

IV. Remedial Actions

Two RODs were signed at the site. The first ROD (OU1) addressed the 10-acre landfill area and the second ROD (OU2) addressed contaminated ground water. The remedies selected to address the problems in these operable units are described below. Throughout the 100-acre old industrial area, investigations identified limited contamination above residential standards for lead. Lead in soil samples across the area ranged from 450 ppm to 700 ppm. However, based on the assumed future use of the site for recreational purposes, and because the site is intended to be transferred to the state and will be designated as part of the state recreational area, no further action was warranted beyond the scrap removal already conducted when the site closed [see 1985 and 1987 Sampling Reports and 1992 Site-Wide Remedial Investigation Report]. This decision is documented in a January 15, 1997, No Further Action (NFA) memorandum from the State to the DOE.

OU 1 - Landfill

The OU 1 ROD for the 10-acre landfill was signed on October 10, 1994. The ROD requires DOE to 1) remove all visible drums and conduct geophysical surveys to determine whether other non-visible drums were present and remove if found; 2) construct an impermeable cap to prevent further leaching of the contaminants to the ground water; 3) conduct annual inspections to check for erosion or other physical changes that could threaten the integrity of the cap; 4) conduct quarterly vadoze zone and ground water monitoring until a downward trend in contaminant levels is demonstrated for eight consecutive quarters,

then annually thereafter; and 5) enact institutional controls to restrict access and use of the landfill area and ground water. [See OU 1 Feasibility Study, August 1994, and ROD, October 1994].

Beginning in August 1999, data show a steady, downward trend in contaminant concentrations has occurred [See OU 1 Groundwater Monitoring Reports]. Currently, monitoring consists of one upgradient well on the southeastern most corner of the landfill and four well locations in the northwestern most portion of the site along the downgradient perimeter. At the time of this review, quarterly monitoring is still on-going. Once the last quarter of data are validated and if the downward trend continues to show the cap is achieving the performance objective to eliminate contaminant leaching to ground water, the site will switch to annual ground water monitoring for the landfill, as specified in the ROD.

OU 2 - Groundwater Plume

The ROD for OU 2 was signed on January 31, 1998. The remedy includes two components: 1) installation of a permeable treatment wall to capture and treat the leading edge of the carbon tetrachloride plume and prevent off-site migration; and 2) implementation of monitored natural attenuation (MNA) for the lower concentration areas of TCE and benzene downgradient of the treatment wall, and ground water use restrictions until such time drinking water standards are attained (see table below). The projected rate of degradation for both TCE and benzene is expected to prevent further migration of these contaminants. Remedial action objectives for the ground water plume are as follows: TCE - 5 ppb; benzene - 5 ppb; and carbon tetrachloride -5 ppb.

Required monitoring includes 1) sampling within and around the treatment wall to validate performance until such time that the carbon tetrachloride and TCE concentrations upgradient of the wall fall below MCLs (i.e., 5 ppb); 2) sampling within the off-site plume to ensure that TCE and benzene concentrations are naturally attenuating at the projected rate; and 3) monitoring of sentinel wells to confirm no further migration is occurring.

V. Five Year Review Process

Community Involvement

The DOE sent notification to the local residents, two local newspapers, and the State Department of Natural Resources (DNR) announcing that a five-year review would be conducted. All recipients were invited to attend a public meeting and to provide comments to the DOE on the review process. No concerns were raised regarding the protectiveness of site. On January 15, 2002, a second notice was sent to the same recipients announcing that the five-year review was complete and summarizing the protectiveness statements and subsequent actions being planned.

Document Review

The review team reviewed all relevant documents including operation and maintenance records and monitoring data, as well as a review of cleanup standards identified in the ROD. Relevant documents are referenced throughout this report and listed in Appendix B. A list of the applicable or relevant and appropriate requirements (ARARs) reviewed is provided in Appendix C.

Site Inspection and Interviews

A site inspection was conducted on November 17 and 18, 2001, to visually check the landfill cap for signs of erosion, to ensure that monitoring wells were intact, and to verify that the land use restrictions are in effect throughout the site, including the entire Old Industrial Area. In addition to the site inspection,

the review team interviewed [*name contact, position*] at the State Department of Natural Resources (DNR). No issues were identified as a result of the visual inspection or the interviews. At that time the State confirmed that the land use restrictions were in place, and that there are no plans in the future to change the land use from recreational.

Data Review

The data review encompasses all remedial measures taken at the site:1) OU 1 landfill cap, 2) OU 2 permeable treatment wall, and 3) OU 2 monitored natural attenuation. The specific scope of the data review included:

OU 1 - Landfill

- Evaluation of annual visual inspection reports of the cap.
- Evaluation of annual ground water monitoring data beneath the landfill.
- Verification with State that use/access restrictions remain in place.
- Evaluation of exposure assumptions, toxicity data, cleanup levels, and remedial action objectives.
- Evaluation of availability of new information that could call into question the protectiveness of the remedy.

OU 2 - Permeable Treatment Wall

- Analysis of quarterly monitoring data for hydraulic head above and below the treatment wall.
- Analysis of TCE, benzene and carbon tetrachloride concentrations within and around the permeable treatment wall.
- Comparison of observations to performance from the performance model/conceptual site model.
- Evaluation of exposure assumptions, toxicity data, cleanup levels, and remedial action objectives.
- Evaluation of availability of new information that could call into question the protectiveness of the remedy.

OU 2 - MNA

- Analysis of quarterly monitoring data.
- Verification that use restrictions on ground water beyond the site boundary are continuing effectively.
- Comparison of performance monitoring to the performance assessment model.
- Confirmation that sentinel wells contain no contamination.
- Evaluation of exposure assumptions, toxicity data, cleanup levels, and remedial action objectives.
- Evaluation of availability of new information that could call into question the protectiveness of the remedy.

VI. Technical Assessment

OU 1 - Landfill

- The remediation system in OU-1 is functioning as intended by the ROD and as designed. This is evidenced by no indication of erosion or other intrusion into the cap, and by eight quarters of ground water monitoring data indicating a continuous downward trend in contaminant concentrations. Therefore, the cap has successfully stopped further contaminants from leaching into the ground water. The cleanup criteria set forth in the ROD are still appropriate at the site, and no new information has come to light which would call into question the protectiveness of the implemented remedy.

OU 2 - Permeable Treatment Wall

- The permeable treatment wall in OU-2 is not functioning as intended by the ROD. Data indicate that pressure drops are occurring across the wall, and downgradient TCE concentrations are remaining steady indicating that flow through the treatment barrier is not providing the level of degradation anticipated. These findings suggest design assumptions regarding the length of time the wall would effectively treat contaminants were in error, and the wall (or portions of the wall) are plugging and allowing contaminants to pass through. [See Gilman Site Permeable Treatment Wall Remedial Design Specification Report, March 1998.] The cleanup criteria set forth in the ROD are still appropriate at the site. However, at the time of this review, the EPA is in the process of evaluating the drinking water criteria for TCE. The outcome of this evaluation will be considered to determine if the criteria selected for TCE continue to remain protective.

OU 2 - MNA

- Ground water monitoring data indicate that natural attenuation processes are not functioning as intended by the ROD. Data indicate that the TCE levels in the off-site plume are fluctuating rather than showing a continuous downward trend as predicted in the performance model. Data also indicate that the plume has not expanded, and there has been no detection of contaminants in the sentinel wells. The cleanup criteria set forth in the ROD are still appropriate at the site. However, at the time of this review the EPA is in the process of evaluating the drinking water criteria for TCE. The outcome of this evaluation will be considered to determine if the criteria selected for TCE continue to remain protective.

VII. Issues

- No issues or deficiencies were identified for the OU 1 landfill or for the Old Industrial area.
- OU 2 permeable treatment wall: Data indicate that pressure drops are occurring across the wall, and downgradient TCE concentrations are remaining steady indicating that flow through the treatment barrier is not providing the level of degradation anticipated.
- OU2 MNA: Data show that TCE levels are fluctuating indicating that natural process are not fully understood.

VIII. Recommendations and Follow-Up Actions

OU1 - Landfill

- Should continued monitoring over the next two quarters demonstrate no leaching is occurring, the DOE will provide results to the EPA and the State and reduce monitoring frequency to an annual basis, as specified in the ROD.

OU 2 - Permeable Treatment Wall

- The DOE will conduct an evaluation of the practicability of rejuvenating or replacing the media and achieving necessary degradation rates. If impracticable, the DOE will evaluate whether alternative technologies are available to effectively address the problem. If the DOE, the EPA and the State conclude an alternate remedy is necessary, then appropriate documentation and pre-implementation public notification activities will be initiated. The DOE is responsible for conducting this evaluation and will provide results to the EPA and the State on March 15, 2002.

OU 2 - MNA

- DOE will collect necessary data to better understand the subsurface conditions and to evaluate effects of treatment wall deficiency. Should the collected data indicate the performance assessment model requires revision, the DOE will propose such revisions to the EPA and the State on or before May 15, 2002.

- The DOE will continue MNA as the remedy of choice and revisit the need to implement the contingent remedy (pump and treat) if data indicate that the plume will migrate to sentinel wells. If there is a need to implement the contingency, the DOE will notify the EPA and the State as soon as such a need is identified.

Protectiveness Statement

Old Industrial Area. Based on information available at the time of this review, land use restrictions are being maintained, and based on current and planned future use, this site remains protective.

OU 1 - Landfill. Based on information available at the time of this review, the remedy for OU 1 remains protective of human health and the environment.

OU 2 - Permeable Treatment Wall. Based on information available at the time of this review, the remedy does not appear to be protective of human health and the environment without corrective actions. Although the remedy at OU 2 is not operating properly and performing successfully, because ground water access restrictions remain in place, there is no immediate threat to human health.

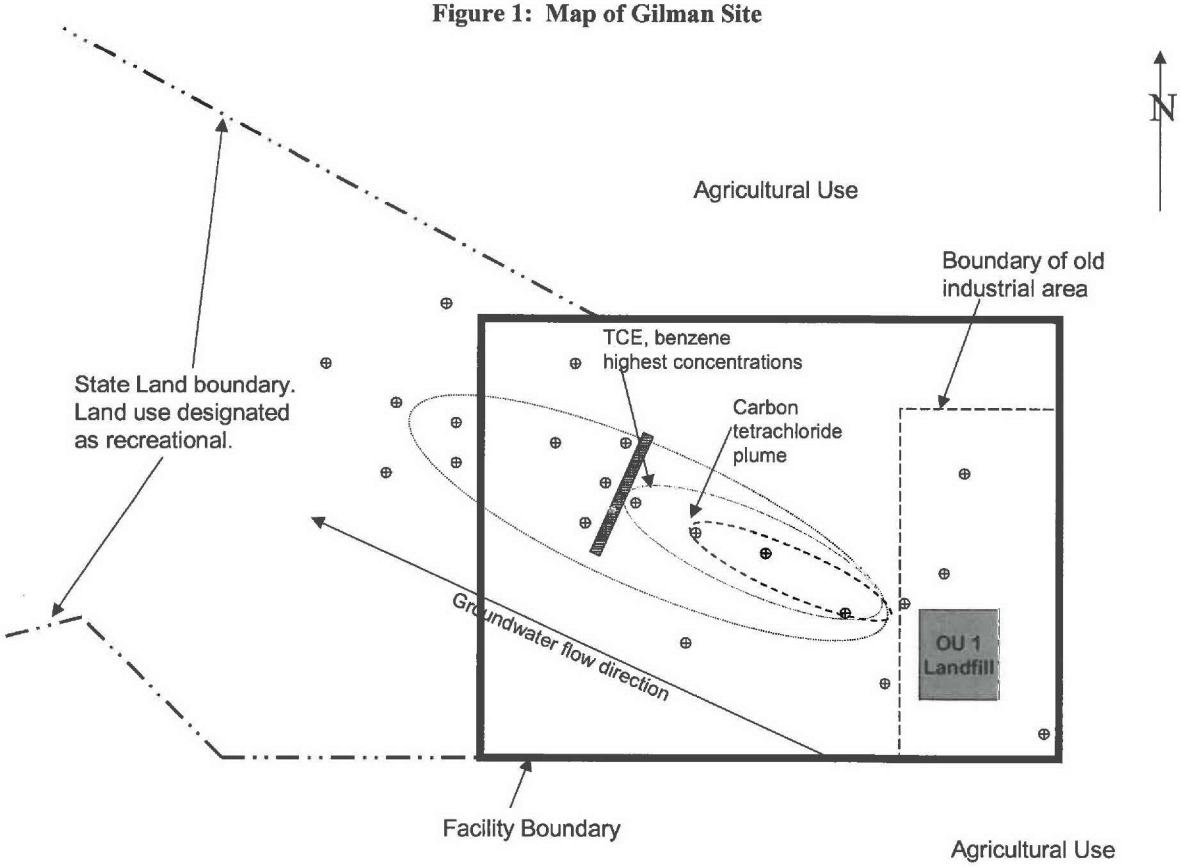
OU 2 - Monitored Natural Attenuation of Off-site Plume. Based on available information at the time of this review, the remedy is not performing as originally anticipated but may still meet remedial objectives. Because currently there are no viable receptors and the plume does not appear to be migrating, the remedy remains protective.

Next Review

The next review is expected to occur in Fall 2007.

Appendix A: Site Map

Figure 1: Map of Gilman Site



Appendix B: Documents Reviewed or Referenced for this Report

1. Gilman Site Administrative Record.
2. Federal Facilities Agreement, 1987.
3. 1985 and 1987 Gilman Site Sampling Reports.
4. 1992 Site-wide Remedial Investigation Report for the Gilman Site.
5. Gilman Site Conceptual Site Model.
6. OU 1 Feasibility Study, August 1994.
7. Operable Unit 1 Record of Decision, October 10, 1994.
8. OU 1 Closeout Report, February 1997.
9. OU 1 Monitoring System Design Report
10. OU 1 Quarterly Ground Water Monitoring Data Reports, January 1997 - August 2001
11. OU 1 Ground water Trend Analysis Report, August 2001.
12. No Further Action Memorandum for Old Industrial Area, January 15, 1997.
13. Operable Unit 2 Feasibility Study, August 1997.
14. Operable Unit 2 Record of Decision, January 31, 1998.
15. OU2 Quarterly ground water monitoring reports (November 1998 - November 2001) and OU2 ground water trend analyses.
16. Monitored Natural Attenuation performance assessment model, Gilman Site, 1998.

Appendix C: Table of ARARs Reviewed

Contaminant	Standard/ARAR	Finding/Comments
Lead	1,000 ppm industrial/recreational	Standard is considered protective; no recommended changes
Benzene	5 ppb	Standard is considered protective; no recommended changes
Carbon Tetrachloride	5 ppb	Standard is considered protective; no recommended changes
TCE	5 ppb	Standard is considered protective; no recommended changes. However, at the time of this review the EPA is evaluating the drinking water criteria for TCE. During the next five-year review, the outcome of the analysis will need to be considered to determine if the criteria selected for TCE remain protective.