

Site Exit Strategy Checklist

This checklist is meant to assist in evaluating site exit strategies. The following sections form part of this checklist:

- 1) Evaluation Team Composition
- 2) Typical Exit Strategy Components
- 3) Appropriateness of Cleanup Goals and Definition of Success
- 4) Adequacy of Site Decision Logic and Process for Making Decisions
- 5) Adequacy of Data Collection and Data Review for Determination of Site Progress
- 6) Alternative Exit Strategies

1) Evaluation Team Composition

The following contributors may be included in the evaluation team:

- Hydrogeologist
- Geochemist
- Environmental Engineer
- Regulatory Specialist
- Risk Assessor

2) Example Exit Strategy Components

The exit strategy represents a formalized long-range process for taking the site from its current state to closure or best long-term use. The strategy represents a plan to actively manage the site and make decisions at various points to best tailor the remediation and monitoring efforts. The strategy is best developed with regard to stakeholder and regulatory agency concerns, resource constraints, and technical realities, and includes well-defined means to measure progress and a desired timeline. A well-prepared exit strategy contains:

- Statement of the problem limiting beneficial use of the resources
- Statement listing remediation goals by matrix
- Summary of the conceptual site model (indicate update schedule)
- Description of past and future site land use
- Decision logic in the form of decision tree, flow chart, or defined sequence of remedial activities
- Justification for implementation of selected remedy and/or monitoring program
- Clearly established process to evaluate performance measures relative to decision parameters, including provisions for periodic re-evaluation of the project goals and technologies
- Clearly established process to demonstrate that clean up goals have been attained
- Clearly established milestone(s) that will prompt cessation of active remediation and/or monitoring

With this in mind, any optimization effort should include an evaluation of the exit strategy.

3) Appropriateness of Cleanup Goals and Definition of Cleanup

The optimization team's evaluation should begin with a review of the project goals defined in the decision documents for the site. The evaluation should verify that the goals are measurable and realistic and are consistent with ultimate land use. Measurable goals include specific cleanup concentrations, acceptable risk levels, or hydraulic conditions (for long-term containment). Realistic goals are those that are achievable with the current technology in a reasonable time frame.

- a) Describe the perceived and reported stakeholders concerns and requests.
- b) List the cleanup prioritization, and its justification.
- c) What is the specific cleanup objective(s) for ground water (and soil, if applicable)? If there are numerical standards, are they based on regulatory standards or are they risk-based standards developed based on the site-future land use conditions? Describe the basis for these criteria. If no numerical criteria exist, describe the nature of the operational or cleanup goals. Note that for some containment or interim actions, the goals may not be related to cleanup.
- d) Are the goals consistent with current and probable future land use? If not, explain the inconsistency.
- e) Can the currently implemented technology realistically achieve the cleanup goals in a reasonable time?

4) Adequacy of Site Decision Logic and Process for Making Decisions

The team's review should verify that the approach to achieving closure or suitability for ultimate land use is logical and realistic, both technically and from a regulatory perspective, and would result in (continuing) protection of current human and ecological receptors during remediation. The plan should also be compared to the requirements of the decision documents to assure consistency. Various remediation activities, such as extraction from specific wells, use of a particular above-ground treatment process, or in-situ treatment of a source area, may be reduced or eliminated at points in the process prior to site closure or attainment of long-term goals. The decisions as to when and where to implement these interim changes should be made in a technically sound manner based on reasonable metrics. The review should verify that specific metrics for evaluating cleanup progress are set. Target values and timeframes may be based on modeling.

- a) Does an exit strategy exist? If so, cite where it is documented. Attach a copy of any flow chart or decision tree.
- b) Does the strategy identify the bases for changing or ceasing the operation of extraction wells or specific steps/processes in the treatment plant, and monitoring program? If not, describe the missing aspects of the strategy.

c) Is the strategy consistent with the remediation objectives stated in the site decision documents? If not, what are the differences?

d) Is the logic for making interim decisions valid and appropriate? Is the decision logic based on definable metrics? If not, state what the problems may be and how the strategy could be improved.

5) Adequacy of Data Collection and Data Review for Determination of Site Progress

The monitoring program must provide adequate data for the purpose of making the decisions about the remediation, both interim decisions on the extraction and treatment and to determine when the entire system can be shut down. The exit strategy should include a specific approach to tailoring necessary monitoring frequency, location, and analyses. As progress is made toward goals, the scope of monitoring to make site decisions should drop. There may also be a need for provisions for increased monitoring in the event unexpected conditions are encountered. The exit strategy must include provisions for monitoring of response of the subsurface to the cessation of any remediation activity for some period of time. There should be some contingency provisions for restart of the remediation process if some undesirable response is observed. The review should verify that a staff member(s) has clear responsibility for assessing all new monitoring data and evaluate progress or problems. All pertinent project staff members must be aware of the exit strategy provision and remediation objectives.

a) Are the appropriate monitoring data collected to support the decisions in the flow chart/decision tree?

b) Does the strategy include provisions for modification to the long-term monitoring program (and treatment process monitoring) as the site progresses or if unexpected conditions arise? Are the bases for making the changes to the monitoring program (location, frequency, analytical) logical and technically sound?

c) Is the potential for concentration rebound considered in the exit strategy and does the monitoring program address this phenomenon?

d) Is there a person clearly tasked with the responsibility to evaluate the collected monitoring data in light of the exit strategy decision process? Who is that person? How often do they evaluate the data?

e) Are the project team members familiar with the remedial objectives and exit strategy? To what extent are they unfamiliar with them?

6) Alternative Exit Strategies

a) Could the current strategy benefit from aggressive source removal or treatment? This could include excavation and treatment, in-situ treatment using, for example, in-situ chemical oxidation, in-situ thermal treatment, enhanced bioremediation, etc. Describe possible measures appropriate for the site.

- b)** Could the exit strategy benefit from more effective containment of the contaminant source? This could involve engineered barriers such as slurry walls, sheet pile walls, engineered caps, or treatment walls. Such measures may reduce the amount of required ground water pumping and reduce the contaminant mass loading such that passive techniques (such as natural attenuation) may be effective. Describe possible measures appropriate for the site.
- c)** Could interim goals, above the ultimate treatment standard, be set at which active remediation may be terminated and natural attenuation adequately remediate the remaining contamination such that no unacceptable risks occur? What would such interim goals entail?
- d)** Should criteria for cessation (or initiation) of pumping from specific wells be developed? If so, what type of criteria (e.g., extracted concentrations, hydraulic gradients/capture) would be appropriate?
- e)** Would the site benefit from aggressive treatment of the entire ground water plume (as opposed to capture of the leading edge of the plume)? What would be appropriate and cost-effective measures to consider?
- f)** Can the migration of the contaminant plume be adequately controlled by engineered passive treatment technologies in lieu of active ground water extraction? This may entail passive barriers such as zero-valent iron, slow-release oxygen enrichment, emulsified oils, etc. What technologies would be appropriate?
- g)** Does the strategy need to identify contingent technologies to employ if the current approach fails or if unexpected conditions arise? Additional wells, supplemental in-situ treatment, etc. may be needed if concentration or physical goals are not met.

Adapted from www.environmental.usace.army.mil/docs/AFCEEversexitstratchecklist.doc