SITE CLOSURE CHECKLIST

A Technical Toolbox to Obtain NFA and Site Closure Letters

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Introduction

Most everyone who regularly uses the word “environmental” in their professional life is familiar with the terms No Further Remediation (NFR) Letter, No Further Action (NFA) Letter, Certificate of Completion, and Covenant Not to Sue, all of which describe a document issued by a regulatory agency that provides liability protection for a party who investigates and cleans up contaminated property. Unlike environmental projects conducted 15 to 20 years ago that involved significant cleanup actions (e.g., excavation of contaminated soil or groundwater pumping and treatment), today’s sites seeking a closure letter will almost certainly incorporate risk-based elements such as:

- Site-specific cleanup objectives;
- An evaluation of the potential for contamination to dissipate (“naturally attenuate”) over time without active cleanup;
- Statistics to describe the risk of exposure even when contamination exceeds a cleanup objective;
- Prevention of exposure to contaminants using a physical barrier (e.g., pavement or building);
- Prevention of exposure through institutional controls (e.g., local ordinance that prevents use of groundwater).

This article describes some technical tools in the environmental toolbox that are commonly accepted by many state and federal agencies to obtain risk-based site closure in different regulatory programs, such as leaking underground storage tank, voluntary remediation and brownfield. Outputs from these tools can sometimes lead to a conclusion that a site can be closed as is, but at a minimum, the outputs can be used to limit future investigation and cleanup costs.

Site Assessments: Clean or Dirty?

One of the first steps in pursuit of site closure is to test soil, groundwater, vapor and other media for various chemicals that may be present from historical site uses. These data are then compared to generic state and federal criteria ("screening levels") to determine if the site is "clean" or if additional investigation or cleanup may be required. Regulators develop screening levels for specific exposure situations (e.g., direct contact with contaminated soil or consumption of contaminated groundwater) using conservative assumptions (e.g., ingestion of a given amount of contaminated soil or groundwater every day over one's lifetime.

In addition, screening levels are typically based on physical site characteristics designed to evaluate a worst-case condition in the absence of site-specific data. Therefore, while meeting published screening levels typically means that no further investigation or cleanup is warranted, due to the use of conservative assumptions, exceeding a screening level should not lead one to conclude that extensive investigation or cleanup is required. Instead, consider developing site-specific cleanup objectives as described below.

Removal of contaminated material can be minimized by developing site-specific cleanup objectives.

Site-Specific Cleanup Objectives

For sites that have a few "hits" of samples that don't meet screening levels, collecting some basic site-specific data can usually lead to much less conservative site-specific cleanup criteria that are still considered safe. Some examples of such data and evaluation techniques are:

Tool	Discussion
Calculate a background soil concentration by analyzing samples in areas not affected by past operations.	Naturally occurring compounds such as arsenic and lead may be present at or above the levels at a given site. Regulators may also allow the use of background concentrations as cleanup criteria when caused by historical human activities (e.g., burning of fossil fuels in urban areas) that are unrelated to site operations.
Calculate a site-specific value that assesses the ability of contaminants to migrate in the environment.	Migration of contaminants from soil to groundwater through leaching is a pathway that may have relatively low (conservative) contaminant screening levels due to the worst-case conditions assumed by the screening level formulas. Samples of site soil for analysis of natural organic carbon content can be used to calculate a site-specific value that often leads to significantly higher (but still safe) cleanup objectives.
Determine if the default assumptions used to develop screening levels are appropriate for the site.	Regulators publish default screening levels that are based on standardized equations and assumptions. For a given exposure pathway, it may be possible to adjust the default values. Examples of default values that can be evaluated include soil type (clay vs. sand); the time and frequency of exposure to a contaminant; and the use of updated toxicity data for a given contaminant.

Real World Example: Benzo(a)pyrene in Urban Soil

In 2008, the Electric Power Research Institute[1] collected and analyzed soil samples from urban areas in the states of Illinois, Pennsylvania and New York. Benzo(a)pyrene, one of the chemicals studied, is a common environmental contaminant derived from fossil fuels, with a state or federal screening level that is typically in the range of 20 to 100 µg/kg. As shown below, soil in an urban area might contain 5 to 10 times more than this screening level.

Land Use	Number of Samples	Median Concentration, µg/kg	Concentration Range, µg/kg
Rights of Way	74	254	2.1 - 4,740
Recreational	96	98	2.6 - 7,920
Residential	9	108	30 - 2,150

[1]Examination of the Sources of Polycyclic Aromatic Hydrocarbon (PAH) in Urban Background Soil, December 2008.
Note: Only partial data set listed above.

Predicting the Future with Contaminant Transport Modeling

After the initial or final environmental site investigation phase is complete and data are compared to screening levels, predictive models can be used to demonstrate how contaminants will behave and migrate in the environment. Modeling techniques range from simple spreadsheets that automate multiple calculations to more detailed evaluations that incorporate site-specific data to describe contaminant transport. Some examples are listed below.

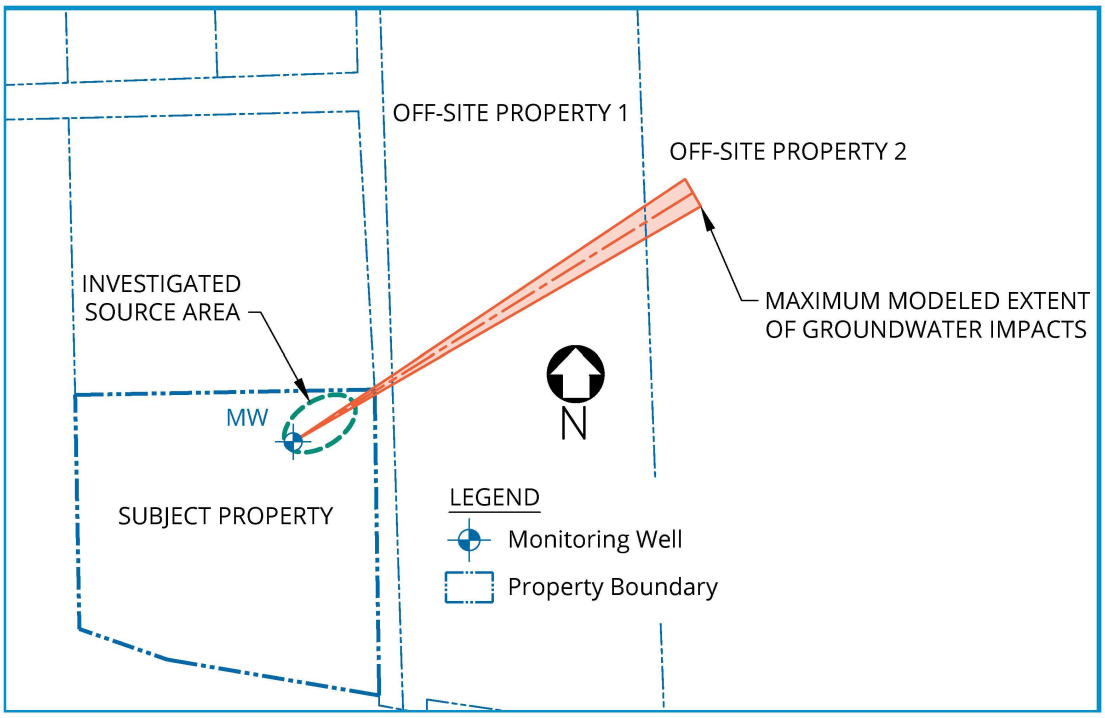
Tools	Discussion
Assess historical data using statistical calculations.	For sites with a relatively long history of groundwater monitoring (two years or more), a statistical evaluation may be useful to show concentration trends over time. One common approach is the Mann-Kendall test, which is well-suited for many groundwater monitoring data sets.
Determine if contaminants will naturally attenuate.	Certain chemicals such as petroleum products and organic chemicals are transformed after being released into the environment. The potential for and rate of such transformation can be qualified.
Model the movement of the contaminants.	If contaminants are present in soil or groundwater in concentrations above screening levels, simple modeling can be conducted to demonstrate how far the contaminants may move. Model results can be combined with the natural attenuation tool mentioned above to more accurately describe the ultimate fate and transport of contaminants (i.e., distance traveled and concentrations at that distance). This information can be used for multiple purposes, including limiting the scope of subsequent investigation and required cleanup.

Real World Example: Former Asphalt Plant Cleanup

Cleanup of free product at this former asphalt plant was required, but residual impacts were addressed through a risk-based approach that limited the cost of excavation and off-site disposal at a landfill.

Real World Example: Groundwater Modeling

Groundwater impacts were found on-site (the green ellipse) above relevant screening levels. Through modeling, it was determined that the impacts could extend to off-site properties, but due to the existence of a local ordinance prohibiting the use of groundwater, no active remediation was required.



Site Closure Checklist

This article briefly discusses common approaches to successfully obtaining site closure. A few takeaways are:

- Remember that screening levels published by regulatory agencies are conservative starting points in the evaluation of sample data, and not final cleanup objectives or standards.
- Development of site-specific cleanup objectives often leads to less conservative values, but these values are still considered safe when accepted by a regulatory agency.
- It is often cost-effective to collect some extra physical site data at the same time as samples for chemical analysis, since the cost of the physical data is relatively low.
- Although there are always tradeoffs between collecting and evaluating more site data and cost, spending a little more on the tools described herein to limit the scope of, or perhaps eliminate the need for, site cleanup is money well spent.