ALTERNATIVE LANDFILL REMEDIATION – *Ready for Air Force Use*

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Introduction

The technology available for landfill remediation is changing. New remediation methods are becoming available and some are now being accepted by regulators. The old notion of entombment and preservation of waste is giving way to new concepts for managing wastes.

The regulatory community still prefers the "prescriptive remedies" and "preservation of waste" approach to landfill remediation. However, there are new technologies that are equally or more protective of human health and the environment than the old technologies. These new technologies can be used within the context of the old "prescriptive remedies" approach.

The conventional remediation methods seek to prevent the infiltration of precipitation into landfills to limit the leaching of wastes from the landfills. The conventional methods typically employ barrier-type landfill covers coupled with groundwater remediation, if needed, to control the wastes in landfills. This discussion centers on effective alternative remediation strategies.

The critical goal of landfill remediation is to protect human health and the environment. New technologies, including alternative covers, must satisfy that requirement.

Alternatives

Figure 1 presents cross-sections to compare a conventional barrier-type landfill cover with the alternative evapotranspiration (ET) cover. Both are designed to prevent precipitation from entering the waste. The ET landfill cover concept is discussed in detail in Hauser et al. (2001). Other alternative landfill remediation options available to the Air Force include "no further action" and "limited action". The no further action alternative is an option when it is demonstrated that no remediation is needed to protect human health or the environment from contaminant releases from the landfill. There may be cases where only limited action will be appropriate. For example, if small ponds exist on top of the landfill, but the landfill otherwise qualifies for no further action, a limited action to fill the ponds, establish surface drainage, and replant vegetation on the surface may adequately protect public health and the environment. Landfill remediation options include:

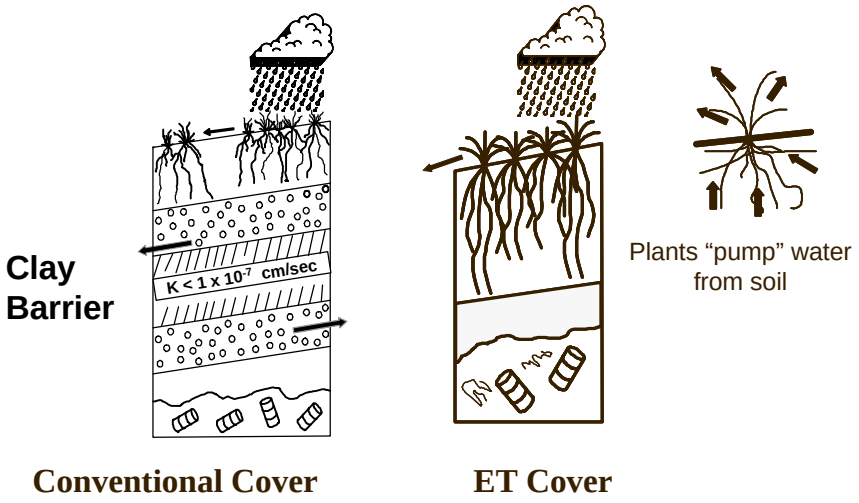

Figure 1 Comparison of the conventional, barrier-type landfill cover to the ET landfill cover.

- Conventional methods
  - Barrier-type covers
  - Groundwater remediation, <u>if needed</u>
- Alternatives
  - No further action
  - Limited action (enhanced current cover)
  - Evapotranspiration (ET) cover

The alternatives have significant advantages over conventional technology. They are typically substantially less costly options for meeting requirements for landfill remediation at Air Force sites. In addition, the ET landfill covers, in particular, are natural, self-renewing plant-based systems with the potential for both long life and low maintenance requirements.

How to Choose and Implement Alternatives

The Air Force Center for Environmental Excellence (AFCEE) commissioned the development of a “Decision Tool” to assist in navigating rules and regulations, evaluating the properties of a site, and determining the appropriate kind of remedial activity for a landfill (Boyer et al., 1999). The rules and regulations governing landfill remediation are numerous and complex. The “Decision Tool” greatly simplifies the process in support of developing remedial decisions for landfills based on the available data. Most users will need to use only one or two of the decision charts in the document. Each chart is linked to specific notes and help topics discussed in the document to provide more detailed information, as needed, to facilitate the process. For example, Figure 2 shows the path to a no further action decision, demonstrating that only a small part of one chart of the “Decision Tool” is needed to illustrate the path. The reference to a note in Figure 2 identifies the location of supporting material in the document.

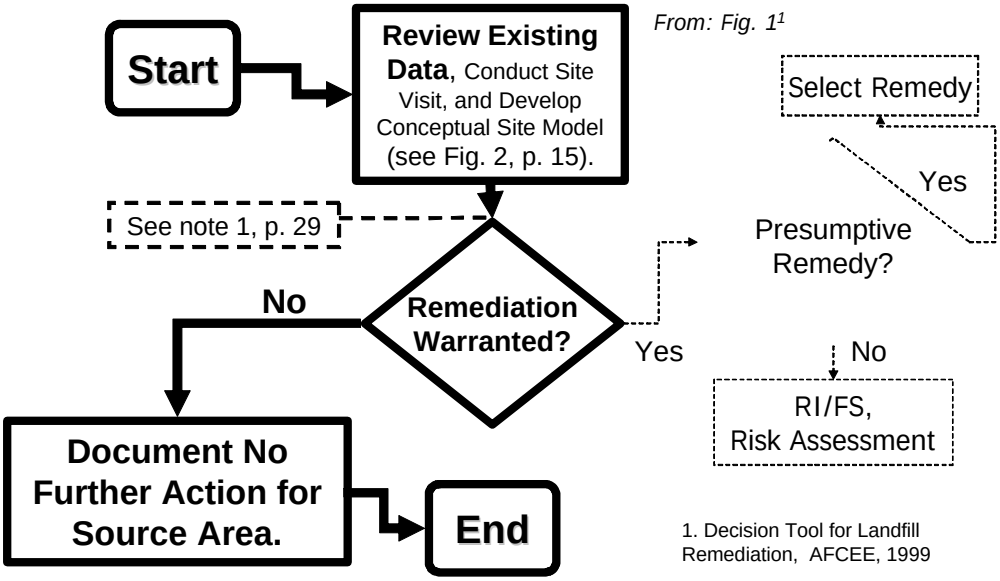

Figure 2 Pathway to a "no further action decision" with the decision tool.

The First Decision

The AFCEE also has a quick, inexpensive means to make a first assessment regarding the applicability of alternative remediation methods. This preliminary assessment is based on potential evapotranspiration (PET), which is the maximum amount of evaporation plus plant transpiration that is possible at a site. PET is controlled primarily by solar radiation, wind, and air temperature. The actual ET is less than the PET, and may be equal to annual precipitation. Where annual PET is larger than annual precipitation, the ET cover is a viable option for controlling water movement into the waste in a landfill. The AFCEE supported the development of estimates of the PET/precipitation ratio for Air Force bases within the United States (Hauser & Gimon, 2001); Figure 3 illustrates the result. The ratio is favorable for using the ET landfill cover if it is equal to or greater than 1.2. By this criterion, it is favorable for 93 percent of Air Force bases within the continental United States.

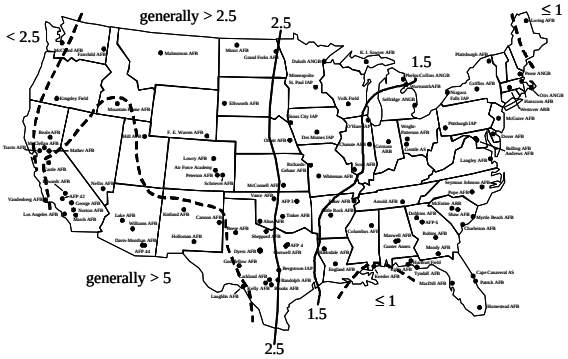

Figure 3 The PET/Precipitation Ratio

Resources

The AFCEE has provided for Air Force managers and technical personnel, the most complete library of technical information on Alternative Landfill Remediation that is available. Resources available from AFCEE include the following:

1. 1999. Landfill Covers for Use At Air Force Installations
2. 1999. Survey of Air Force Landfills, Their Characteristics, and Remediation Strategies (includes database)
3. 1999. Decision Tool for Landfill Remediation
4. 1999. Landfill Remediation Project Managers Handbook
5. 2000. Golf Courses on Air Force Landfills
6. 2001. Vegetated Landfill Covers and Phytostabilization– The Potential for Evapotranspiration-Based Remediation at Air Force Bases
7. 2001. Alternative Landfill Covers (developed for the Interstate Technology Regulatory Council use at their landfill summit, 11 September 2001)

These documents are available at: [http://www.afcee.brooks.af.mil/er/ert/landfill.htm].

Other resources include the paper by Hauser et al. (2001) and soon to be released technical regulatory guidance by the Interstate Technology Regulatory Council (ITRC).

Summary

More than 80 percent of Air Force landfills have been unused for almost a quarter century, they have no bottom liners, and they have produced limited groundwater contamination. In addition, 12 percent of Air Force landfills were closed with no further action decisions. The wastes in these landfills have substantially decayed. Many Air Force landfills pose less threat to public health and the environment than landfills described in the pertinent rules and regulations.

Alternative, less costly and more reliable landfill remediation options should be used extensively by the Air Force. ET covers have been used in California, Arizona, and Colorado, and have been recognized by the ITRC. Many state regulators (ITRC) have embraced the concept of alternative landfill covers and the potential of these alternatives as landfill remediation options. Alternative landfill remediation is ready for increased use by the Air Force.

References

Boyer, I., V. Hauser, D. Gimon, and M. Gill. 1999. *Decision Tool for Landfill Remediation*. AFCEE, available at: [http://www.afcee.brooks.af.mil/er/ert/landfill.htm]

Hauser, V. L. and D. M. Gimon. 2001. *Vegetated landfill covers and phytostabilization-the potential for evapotranspiration-based remediation at Air Force bases.* AFCEE, available at: [http://www.afcee.brooks.af.mil/er/ert/landfill.htm]

Hauser, V. L., B. L. Weand, and M. D. Gill. 2001. *Natural covers for landfills and buried waste.* Am. Soc. of Civil Engineers, J. Environmental Engineering, vol. 127, no. 9: 768-775.