

AENV TIER 2 GUIDELINES IN REMEDIATION PLANNING

Miles Tindal
Axiom Environmental Inc.

Introduction

Alberta Environment (AENV) has recently provided revised Tier 1 (generic) soil and groundwater guidelines for a wide range of common environmental contaminants (AENV, 2008a) and has also developed a framework for making site-specific (Tier 2) modifications to these generic guidelines (AENV, 2008b).

Developing Tier 2 guidelines can be a key element in remediation planning at many sites. Within Tier 2, there are three “Management Levels” available, as indicated in Figure 1. Two of these levels, “Pathway Exclusion” and “Guideline Modification” can often be factored into remediation planning at a relatively modest incremental effort level. Where straightforward Tier 2 options are available, this is referred to in this paper as a situation having “good Tier 2 potential”.

AENV Management Levels

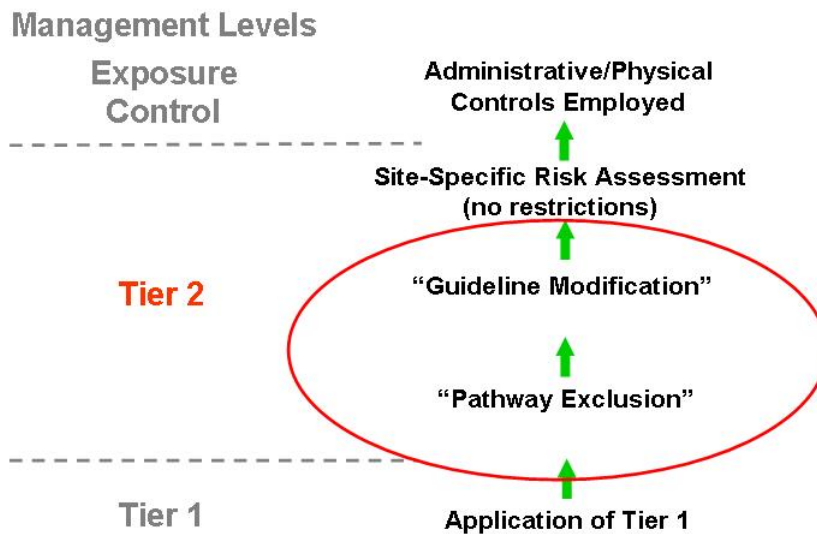


Figure 1. AENV Management Levels

This paper introduces some relevant concepts, provides some “rules of thumb” to help anticipate which limiting contaminants will be most likely to be amenable to straightforward Tier 2 approaches, and then goes on to discuss implications for common groups of contaminants.

Limiting Contaminant(s)

Contaminated sites often have multiple contaminants exceeding Tier 1 guideline values. However, limiting contaminants are defined as only those contaminants which are likely to actually drive remedial or risk management efforts at a site. Often a site can be managed based on a single limiting contaminant, and rarely are more than 2-4 limiting contaminants required. It is critical to identify limiting contaminants for a site, because it is these contaminants which will govern the Tier 2 potential for a site.

Limiting Exposure Pathway

The limiting exposure pathway for a particular contaminant is the exposure pathway that has the lowest value for the contaminant and land use in question. Soil guideline values for each exposure pathway can be found in AENV (2008a) Appendix A.

Direct and Indirect Pathways

Direct exposure pathways are those that involve direct contact between contaminated soil and receptor. These would include the human direct contact, the ecological direct soil contact and livestock and wildlife soil and food ingestion pathways, among others. Indirect exposure pathways are those in which the contaminant is transported via another medium from source to receptor. Indirect exposure pathways include the groundwater mediated pathways (e.g., protection of groundwater for aquatic life and protection of domestic use aquifer) and the indoor air exposure pathway.

Tier 2 “Rules of Thumb”

The following process should help identify contaminant situations where Tier 2 potential is good.

- Identify the limiting contaminant(s).
- Determine the limiting exposure pathway for the limiting contaminant(s) for the applicable land use.
- If the limiting exposure pathway for a limiting contaminant is an *indirect* pathway, then the Tier 2 potential is good.
- Conversely, if the limiting exposure pathway for a limiting contaminant is a *direct* pathway, then the Tier 2 potential is less good. Tier 2 options may still be available, but will likely be more resource intensive, for example involving eco-toxicity testing.

Contaminant Groups

Certain groups of contaminants are often encountered together at sites. Some of the more common groupings at Alberta contaminated sites are discussed below, with general comments as to the typical limiting contaminants and the potential for Tier 2.

- Volatile hydrocarbons (benzene, toluene, ethylbenzene, and xylenes (BTEX) and PHC F1. Most commonly benzene is the limiting contaminant, but other situations may occur. Typically an indirect exposure pathway is limiting, and the Tier 2 potential is good.
- Heavier hydrocarbons (PHC F2 and F3). Where the source of the hydrocarbon is diesel (e.g., invert drilling mud), and the release is fresh, F2 is often limiting. For heavier crude oils and diesel sources that have been thoroughly biotreated, F3 may be limiting. In either case the ecological direct soil contact pathway is always limiting, and the only Tier 2 options involve ecological toxicity testing, which is potentially more expensive and time consuming than other Tier 2 options.
- Metals. Guidelines for arsenic, lead, cadmium and mercury are limited by human direct contact and Tier 2 options are limited or non-existent. Chromium, copper, nickel and zinc are limited by ecological direct contact and toxicity testing may be worth considering. Barium is often found in the form of barite, in which case the AENV (2004) barite guidelines should be consulted.
- Chlorinated solvents. Depending on the compound released and the microbial environment for biodegradation, various contaminants can be limiting. Common examples of limiting contaminants are trichloroethylene (TCE), tetrachloroethylene (PCE) and vinyl chloride. Typically an indirect exposure pathway is limiting, and the Tier 2 potential is good.
- Salts. Salt contamination is typically assessed based on electrical conductivity and is limited by the ecological direct contact pathway, and accordingly the Tier 2 potential is poor.

Summary

“Tier 2 potential” describes the likelihood that straightforward options exist for a site at Tier 2. Tier 2 potential is good when the limiting pathway for limiting contaminant(s) is an indirect pathway. This is often the case for volatile hydrocarbons (BTEX and F1) and for chlorinated solvents. Where the limiting pathway is a direct pathway, the Tier 2 potential is less good, or, in some cases, non-existent. Examples of contaminants which are typically limited by a direct exposure pathway include metals, heavier hydrocarbons (F2 and F3) and salts.

References

- AENV (Alberta Environment), 2004, Soil Quality Guidelines for Barite: Environmental Health and Human Health. Science and Standards Branch, Pub. No: T/738.
- AENV (Alberta Environment), 2008a. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. August 2008.
- AENV (Alberta Environment), 2008b. Alberta Tier 2 Soil and Groundwater Remediation Guidelines. August 2008.