

**ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM**

Technical Memorandum

DATE: March 16, 2017

ESTABLISHING ARCTIC ZONE CLEANUP LEVELS

Purpose

This technical memorandum clarifies the implementation of the soil, groundwater, sediment, and surface water characterization and cleanup requirements in the Site Cleanup Rules under 18 AAC 75 for sites located in the Arctic zone.

Background

Under 18 AAC 75.350, the Alaska Department of Environmental Conservation, Contaminated Sites Program (department) has made a general determination that the presence of continuous permafrost acts as a barrier to the downward migration of contaminants to groundwater where the current use or the reasonably expected potential future use of the groundwater is a drinking water source. Seasonal groundwater above the permafrost is not normally considered a current or reasonably expected potential source of drinking water. Therefore, the migration to groundwater cleanup levels are not applicable in areas of the state where these conditions are found. These areas are referred to as the Arctic Zone, except as noted in the following sections.

The department recognizes that porewater present in manmade gravel pads or active layer groundwater (above the permafrost) can act as a transport medium to the surrounding soil; to sediment or surface water where it may pose a risk to ecological receptors; or to a subpermafrost aquifer or other zones of saturation that may have a current or reasonably expected potential future use as drinking water. These potential transport pathways and potential risks to ecological receptors in receiving waters must be taken into consideration when evaluating sites in the Arctic zone.

Soil Cleanup Levels for Sites in the Arctic Zone

Regulations under 18 AAC 75.340 establish the requirements for developing cleanup levels for hazardous substances in soil using one or more of the following methods: method one, method two, method three, and method four. Site specific or alternative cleanup levels may be proposed under methods three and four.

Commonly, the cleanup levels listed in method one and method two are selected to guide the characterization and cleanup of contaminated sites in the Arctic Zone. The cleanup levels outlined in 18 AAC 75.341(b) method one Table A2 are specific to gasoline range organics (GRO), diesel range organics (DRO), and residual range organics (RRO) and are only applicable to manmade roads and pads constructed over tundra. Whereas, the cleanup levels listed in 18 AAC 75.341(c) and (d), method two, Tables B1 and B2 can be applied to all sites located in the Arctic Zone, be it manmade roads and pads, or tundra. However, these human health-based cleanup levels may not be sufficient to evaluate migration of contaminants in more porous soils.

Regardless of the method(s) proposed by a responsible party, a demonstration must be made that the selected soil cleanup level(s) and cleanup remedy address the migration of contamination to surface water, sediment and any unimpacted areas.

The maximum allowable concentrations for petroleum that are listed in table B2 are known to have lethal effects on the tundra plant community and may continue to migrate through certain soil types that are used to construct pads. In addition, ingestion and inhalation levels in Table B2 that are not capped at the maximum allowable concentrations still may not be protective of ecological receptors, therefore evaluation of ecological receptors may be required on a site-specific basis.

In areas and at sites where there is an increased risk of contaminant migration to a surface water body or a groundwater aquifer that is or may be used as a drinking water source, more stringent cleanup levels than the human health values listed in Tables B1 and B2 may be appropriate. In these cases site characterization should evaluate whether suprapermafrost groundwater has the potential to carry contaminants to surface water. This evaluation may include sampling at the groundwater/surface water interface. A site-specific alternative cleanup level may then be proposed that addresses this migration pathway. See below for a more detailed discussion.

Groundwater Cleanup Levels for Sites in the Arctic Zone

18 AAC 75.345 states that “contaminated groundwater must meet the cleanup levels in Table C if the current use or the reasonably expected potential future use of the groundwater, determined under 18 AAC 75.350, is a drinking water source”.

The Table C groundwater cleanup levels are not typically applicable to suprapermafrost water (including pad pore water) at sites located in the Arctic Zone. However, they should be used for site characterization purposes to ensure the extent of groundwater contamination is delineated and to determine if contaminants are being transported across property boundaries or lease tracts, or to surface water bodies, or to groundwater outside of the continuous permafrost zone. Long-term groundwater monitoring may be required to establish a stable and/or decreasing trend, as determined on a site specific basis.

Groundwater Hydrologically Connected to Surface Water and Sediment

Regulations under 18 AAC 75.345(f) state that groundwater that is closely connected hydrologically to nearby surface water may not cause a violation of water quality standards in 18 AAC 70.020 for the receiving surface water or sediment. The department may establish points of compliance for situations where groundwater is closely connected hydrologically to a surface waterbody. Where groundwater at a site is determined to be hydrologically connected to surface water, it must meet the more stringent or more protective of either the Table C criteria or the Alaska Water Quality Standards (AWQS) under 18 AAC 70 in order to be protective for use as a drinking water source and to protect potential ecological receptors.

If monitoring is determined to be necessary, the department will require a responsible person to establish sentinel wells and monitor for any hazardous substances that have the potential to migrate to the applicable point of compliance; i.e. a surface waterbody or a groundwater zone of saturation where the current use or the reasonably expected potential future use of the groundwater is a drinking water source.

Typically, at sites with petroleum releases, water samples collected from a surface waterbody will be analyzed for the AWQS total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH). Sediment samples may also be required. Because sediment cleanup levels are not promulgated in 18 AAC 75, analytical results from sediment samples are typically compared to National Oceanic and Atmospheric Administration (NOAA) Sediment Quick Reference Tables:

<http://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf>]. If the SQGs are exceeded and it is determined, based on site-specific information, that additional sediment evaluation is warranted, a second tier investigation may include: sediment toxicity testing, benthic community surveys, bioaccumulation evaluations and/or tissue sampling, and fate and transport modeling to further delineate site specific conditions. Site specific sediment determinations may then be developed based upon all available data (see also DEC's Sediment Quality Guidelines (2013)).

Groundwater Hydrologically Connected to Groundwater in a Zone of Saturation where the Current Use or the Reasonably Expected Potential Future Use of the Groundwater is a Drinking Water Source

If pad porewater or active layer water in the Arctic Zone is hydrologically connected to groundwater that is a current or a reasonably expected potential future source of drinking water, as determined under 18 AAC 350, then DEC may set a groundwater point of compliance in the same manner as described above. An example of the need for such a point of compliance would be a site where a subpermafrost aquifer drinking water well is located in the vicinity of contaminated groundwater.

Additional Site Specific Evaluation

Because cleanup levels established in Table B1 or B2 are designed for protection for human health exposure pathways in soil, site conditions may warrant additional evaluation for vapor intrusion, impacts to ecological receptors or to protect for other site uses such as subsistence. See 18 AAC 75.340(i).

Cleanup of undisturbed tundra can be challenging, and the human health based cleanup levels in Tables B1 and B2 may not be protective. Spills to undisturbed tundra should be evaluated on a site specific basis using the *Tundra Treatment Guidelines, Third Edition*, which provides information and strategies for responding to spills of oil and other contaminants on undisturbed tundra.

Climate change is introducing additional complexity for contaminated sites cleanup in the Arctic. Average annual surface temperatures in the Arctic have warmed at more than twice the global rate of temperature increase (NOAA, 2016 *Arctic Report Card*). As the Arctic continues to warm, permafrost may become less stable and continuous over time. Therefore, remedy design for cleanup in pads and roads may require additional evaluation and modification to account for this change during the life of these improvements.

Management of Residual Contamination through Institutional Controls

Land owners, managers and responsible parties are required to comply with requirements concerning the off-site movement of soil or water from sites addressed under the “site cleanup rules” (18 AAC 75.325(i)). Sites where residual contaminants are allowed to remain in place at concentrations that are safe for current land use, but that could pose an unacceptable risk if contaminated soil or water were moved off-site or the site use changed in the future, will warrant establishment of institutional controls.

Applicability

This guidance is applicable to all sites located in the Arctic Zone. This guidance is not all-inclusive, and other regulatory requirements under 18 AAC 75 are applicable. Also recommended for review is the technical memorandum: “Contamination in Hydrologically Connected Groundwater and Surface Water (2011).” Each site is unique, and will be evaluated individually. Terms used in this document have the meaning given in 18 AAC 75.990.