

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

Technical Memorandum – 08-002

Date September 30, 2008

**GUIDELINES FOR TOTAL ORGANIC CARBON (TOC) SAMPLE COLLECTION
AND DATA REDUCTION FOR METHOD THREE AND METHOD FOUR**

PURPOSE:

The Alaska Department of Environmental Conservation (DEC) allows for a site specific alternative cleanup level under the Oil and Other Hazardous Substances Pollution Control site cleanup rules, 18 Alaska Administrative Code (AAC) 75.340(e) and (f). 18 AAC 75.340(e), referred to as Method Three, specifies that the soil migration to groundwater or inhalation levels listed in 18 AAC 75.341 Tables B1 and B2 may be modified based on the use of approved site-specific data and the equations set out in the department's *Cleanup Levels Guidance*. 18 AAC 75.340(f), referred to as Method Four, specifies that an alternative cleanup level may be approved by the department based upon a site specific risk assessment following the department's *Risk Assessment Procedure Manual*. The collection and use of site specific Total Organic Carbon (TOC) data is common for Method Three or Method Four determinations. This memo provides clarification on the department's requirements for TOC sample collection and data reduction for proposed site specific Method Three or Method Four evaluations.

BACKGROUND:

Since the site cleanup rules were adopted in 1999 there has been a general rule of thumb to collect enough soil samples adjacent to the area of contamination to derive a TOC average. This number is then used to override the default fraction organic carbon input parameter in the soil-water partitioning equation when determining a site-specific migration to groundwater cleanup level. Sample collection methods have varied, however, and project manager judgment has been paramount when determining data defensibility.

As a result of these inadequacies, the following methodology has been developed to ensure greater consistency when collecting, analyzing and evaluating TOC data for the purpose of making a Method Three or Method Four determination and subsequent site management decision.

Total Organic Carbon

- 1) An alternative migration to groundwater (MGW) cleanup level based on site specific soil TOC concentrations is only applicable to vadose zone contamination.

Sites where contamination has already migrated to the smear zone, saturated zone, and/or to groundwater above Table C cleanup levels should be evaluated separately, as the TOC calculation may not apply to these zones. A MGW determination may be made at these sites for vadose zone contamination; however, since contamination remains in direct contact with groundwater or seasonal groundwater, long term monitoring should be required until Table C cleanup levels are achieved and/or appropriate institutional controls (ICs) are in place.

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- 2) Thorough site characterization to determine the lateral and vertical extent of contamination must be completed prior to collecting soil samples for total organic carbon analysis.
- 3) After submittal of the site characterization report that adequately defines the lateral and vertical extent of soil contamination, a proposal to collect TOC samples and determine a site-specific cleanup level must be submitted in a work plan. The work plan must be approved by the department prior to collection of the TOC samples identified in the work plan. Site characterization work plan requirements can be found at <http://www.dec.state.ak.us/regulations/pdfs/75mas.pdf>.
- 4) TOC samples must be collected from a minimum of four (4) borings or test pits adjacent to but outside of the zone of contamination. Soil type(s) analyzed for TOC must be representative of the impacted soil type(s). It is recommended that the sampling locations be selected at points surrounding (on each side of) the contaminated zone to ensure adequate characterization of the soil TOC variability. If the zone of contamination extends over a significant area, additional samples may need to be collected from the soil horizon below the impacted soils.
- 5) If the depth to seasonal high groundwater is more than 5 feet below the deepest contaminated vadose soil stratum, one sample must be collected from the deepest contaminated vadose soil stratum and a second sample collected from 5 feet below the contaminated soil stratum. This will result in a total of eight (8) TOC samples.

If the contamination extends to within 5 feet, but not to the seasonal high groundwater level, one sample must be collected from the deepest contaminated soil stratum and one sample immediately adjacent to the groundwater interface. This will result in a total of eight (8) TOC samples.

If the contamination extends to or below the seasonal high groundwater level, the TOC samples must be collected immediately adjacent to the groundwater interface. This will result in a total of four (4) TOC samples.

- 6) At sites where numerous source areas are present, specific cleanup level determinations may be required by the ADEC project manager for each individual area. Therefore, separate TOC samples may need to be collected for some or all of the source areas within a site unless the responsible party demonstrates that similar soil types exist at some or all of the contaminated areas.
- 7) Each sample will be analyzed in triplicate using SW-846 Method 9060. All analytical results must be reported to the department.
- 8) TOC data sets must be evaluated for variability. If any result(s) differ by one order of magnitude or more, the mean of the more conservative (lower) TOC results of the same

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magnitude shall be used for the site and Method Three/Four determinations. This may result in a mean TOC value from only 1 or 2 samples. The TOC results and calculation(s) used to determine the mean value must be reported to the department. The TOC value for the applicable soil horizon is the mean of the results of the same magnitude and may be proposed for site specific Method Three/Four evaluations.

- 9) TOC sample locations must also be analyzed for the site specific fuel contaminant of concern; GRO and/or DRO/RRO, as applicable. If results indicate the presence of DRO or RRO hydrocarbons, the sample extract may be passed through a silica gel column and re-analyzed to remove polar compounds attributed to a biogenic source, per DEC Technical Memorandum 06-001. If re-analysis determines the hydrocarbons to be biogenic interference, the TOC data can be used to determine a site-specific cleanup level. If the hydrocarbons are determined to be from a petroleum source, the TOC data will be rejected and additional TOC samples representative of non-impacted soils will need to be collected.

- 10) Supporting documentation must be provided to DEC for the proposed site specific TOC value. Supporting documentation includes, at a minimum, a narrative of site characterization activities, a diagram depicting boring locations and sample collection depths in relation to the contaminated soil mass, boring logs and soil description for TOC and contaminated zone sampling points; tabulated sample results, laboratory reports including results of all TOC analyses; and the proposed mean TOC value.