Water Resources
Environmental Quality

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
S. JAY ZIMMERMAN
Director

October 31, 2017

MEMORANDUM

To: Water Quality Regional Operations Section (WQROS) Supervisors

From: Jon Risgaard, Chief WQROS JR

Subject: Internal Technical Guidance: Evaluating Impacts to Surface Water from Discharging Groundwater Plumes

Purpose:

This guidance document is intended to aid WQROS staff in developing a strategy to collect data for the evaluation of contaminated groundwater discharges to surface water. Characterization of the groundwater to surface water pathway at a site is necessary to:

- Determine if corrective action alternatives under 15A NCAC 02L .0106 (k), (l), and (m) may be pursued by evaluating if 15A NCAC 02B .0200 (02B) regulatory standards are exceeded in surface water as the result of groundwater discharge, and

- Locate strategic groundwater and surface water sampling locations to support site assessment and remedial action performance monitoring networks.

To pursue any of the three referenced corrective action alternatives, the Responsible Party applying for Corrective Action must demonstrate the following per 15A NCAC 02L .0106 (k)(5), (l)(6), and (m)(2)(c):

> *"...if the contaminant plume is expected to intercept surface waters, groundwater discharge will not possess contaminant concentrations that would result in violations of standards for surface waters contained in 15A NCAC 02B .0200"*

This guidance is specific to evaluating site conditions to determine the appropriateness of groundwater corrective action alternatives and does not supersede any surface water sampling guidance or procedures developed for water quality assessment or NPDES program purposes.

Strategies and Expectations: Surface Water Sampling to Assess Impacts from Contaminated Groundwater

To meet requirements for a Comprehensive Site Assessment (CSA) in 15A NCAC 02L .0106(g), samples must be collected in a manner that demonstrates *groundwater discharges intercepting surface waters* do not adversely affect identified receptors. The CSA must identify the area(s) of groundwater contamination that currently, or are predicted to, intercept surface water. The following three key components should be used to identify potential surface water impacts. Additional guidance for determining sampling areas related to risk based remediation can also be found in "Assessment of Groundwater Discharge to Surface Water" Section 3.5.2.3 of the Risk-based Remediation requirements.

1) Data collection: Site sampling data including surface water, ground waters and soils from areas where a plume is known or predicted to intercept a surface water body. Seasonal variability in base flow, discharge conditions and potential tidal influences must be considered when developing a sampling plan.
2) Conceptual site model: A conceptual site model must convey an understanding of the contaminants of concern and their source (e.g. the chemical, geological, and hydraulic characteristics of the aquifer; and the extent, transport behavior, and stability of the contaminant plume); If current monitoring does not allow for a complete understanding of the site, additional wells and/or surface water sites should be added.
3) Fate and Transport: An understanding of the fate and transport of contamination including any points or zones of contaminant discharge to surface water is required;

Surface waters identified to have a potential to be impacted by the contaminated groundwater should be evaluated as follows:

1) Conduct near bank surface water sampling in a location(s) that is (are) at the greatest risk to be impacted by the groundwater plume. This collection is intended to capture groundwater/surface water interception in the surficial aquifer. Near bank sampling aids to avoid lateral mixing that can dilute the sample and is consistent with other North Carolina Department of Environmental Quality (NC DEQ) groundwater remediation programs (reference: Appendix A) When practical, sampling should be conducted at low or base flow conditions.
2) If evidence exists that near bank sampling may not adequately capture or characterize the potential for a groundwater contaminant plume entering a surface water by aquifers other than the surficial aquifer, sampling location other than near bank should be considered. Best professional judgement would have to be used in this case.
3) Distances between upstream and downstream surface water sample locations for a given plume will vary depending on site conditions. For example, a plume bisecting across 600 feet of a shallow stream may warrant more than one surface water sample location to better define plume characteristics. If the plume and its movement is well defined and the location of maximum concentrations is understood, only one or two sample locations may be warranted.
4) Samples should not be co-located with NPDES permit effluent sample locations. Consider moving upstream or as far as practical downstream of the NPDES effluent location to avoid an overlap.
5) Additional sampling may be warranted when site conditions change, anomalous results are obtained, or plume refinement indicates other areas of concern. Consultation is recommended.

Considerations for evaluating metals:

15A NCAC 02B (11)(e) states that "Compliance with acute instream metals standards shall only be evaluated using an average of two or more samples collected within one hour. Compliance with chronic instream metals standards shall only be evaluated using an average of a minimum of four samples taken on consecutive days, or as a 96-hour average". At each sample location, two samples should be collected within one hour (acute evaluation) and two samples should be collected any time within the following 95 hours. The average of the four sampling events are used for the chronic evaluation. All four samples should be collected from the same physical location using the same sampling techniques. The location should be securely flagged for potential future use and its latitude and longitude measured and recorded.

Collect total metals (unfiltered sample) and dissolved phase metals samples (filtered). Request hardness to be reported from the total metals samples. Check with the laboratory to assure proper amounts and number of samples are collected.

Documentation of Result

After surface water sampling, has been completed, the following documentation is recommended:

1. A surface water monitoring summary table (hard copy and digital excel format) showing:
   a) Sample location name and dates
   b) List of parameters with known or potential groundwater standard violations for which site assessment is occurring, and correction action is pending. For each parameter, the following should be shown:
      a. Ground water standard or IMAC (15A NCAC 02L)
      b. Surface Water standards (15A NCAC 02B Freshwater/Water Supply, Human Health, and US EPA Nationally Recommended Water Quality Criteria (NRWQC));
      c. Results of sampling with proper units of measure
   c) List of other parameters sampled for including temperature (T) and electrical conductivity (Ec) values in both surface water and groundwater. Differences between groundwater and surface water T and Ec should be recorded.
   d) Latitude/longitude (decimal degrees with 8 significant digits) for each sample location. (Placing a permanent marker on the shoreline of the surface water body is good practice to assist the samplers)
   e) All historic CSA surface water sample events, including locations and dates;
   f) A footnote stating the antecedent rainfall (5-day and 48-hour) for the sampling.

2. A single high resolution, large scale map showing:
   a) All surface water sample locations along with any 02B surface water standards exceedances found at each location;
   b) All permitted discharge locations
   c) All shallow monitor well locations and the most recent leading-edge constituent value for each location;
   d) All identified jurisdictional waters;

References to Other DEQ Groundwater Remediation Programs

Division of Waste Management, Inactive Hazardous Sites Branch (DWM IHSB) – *A.4 Surface Water and Sediment Sample Collection A.4.1 Phase I sampling the purpose of the Phase I surface water/sediment investigation is to identify all releases of hazardous substances to surface water or sediments, to characterize the chemical nature of such releases, and to collect sufficient sampling data to establish remediation goals.* ***Surface water assessment will be necessary if there is a potential for contaminants to migrate to surface water via surface runoff or through a discharge of contaminated groundwater to a surface water body. If a surface water assessment is necessary, water and sediment samples should be collected at the probable point of entry****. In addition, at least one water and one sediment sample must be collected immediately upstream of the site and one water and one sediment sample collected immediately downstream of the site. These samples need only be analyzed for contaminants previously*

detected in other media at the site unless a non-permitted direct discharge of a hazardous substance from the site to surface water has occurred. If such a discharge has occurred, samples should be analyzed for the Phase I analyses described in Section A.7.1. A.4.2 Subsequent sampling If contamination is detected in any downstream sample, additional surface water/sediment assessment will be needed. The purpose of the next phase(s) of surface water/sediment investigation is to define the downstream extent of contamination to concentrations less than or equal to the remediation goals established by the Branch.

Ref: https://ncdenr.s3.amazonaws.com/s3fs-public/Waste%20Management/DWM/SF/IHS/guidance/IHSB%20GUIDANCE%20Assessment%20and%20Remediation%20saved%202-9-2016.pdf

Division of Waste Management, Underground Storage Tank Section (DWM UST Section) – *Sampling a surface water body, instead of performing predictive modeling to demonstrate that surface water standards are not violated, is not acceptable unless the responsible party can also demonstrate that the maximum groundwater contamination concentrations at the site are discharging to surface water at the time of sampling.* ***If this demonstration can be made, surface water samples should be obtained from the discharge area, as well as upstream and downstream of the discharge area.***

Ref: https://ncdenr.s3.amazonaws.com/s3fs-public/Waste%20Management/DWM/UST/NonUST/Non-USTGuide070112.pdf