



BUREAU OF CLEAN WATER

SITE SPECIFIC CRITERIA FOR NATURAL SOURCES

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Category 5 of the Integrated List includes waters with pollutants from natural sources when the pollutant does not meet water quality standards. Waters appearing in Category 5 require a TMDL even though the pollutants originate from natural sources.

There is a provision in Pennsylvania's water quality standards that allows the natural site specific background water quality to replace statewide water quality criteria when the "pollutants" arise from natural sources. When site specific criteria are established, pollutant concentrations are not compared to the water quality standards allowing waterbodies listed for natural sources to be exempted from Category 5 and the resulting TMDL. Note below that 93.7(d) pertains only to aquatic life uses.

93.7 (d) of Title 25 Chapter 93 Water Quality Standards "If the Department determines that natural quality of a surface water segment is of lower quality than the applicable aquatic life criteria in Table 3, the natural quality shall constitute the aquatic life criteria for that segment. All draft natural quality determinations shall be published in the *Pennsylvania Bulletin* and be subject to a minimum 30-day comment period. The Department will maintain a publicly available list of surface waters and parameters where this subsection applies, and shall, from time to time, submit appropriate amendments to § § 93.9a—93.9z."

To use 93.7 (d) the natural source of the pollutant(s) must be identified and mapped. Examples include pollutants such as low pH and organic loads originating from natural bogs, marshes, springs and unusual geology or soils. There must be a logical causal mechanism between the natural source and the pollutant such as plant decomposition leading to low pH and organic loads in bogs.

Once the pollutant is identified and the sources mapped, the next step is to eliminate the possibility that anthropogenic sources might contribute to the pollutant loadings. Aerial photography now covers the entire state but ground truthing by reconnaissance is still recommended since some anthropogenic sources such as old mining seeps may not be apparent in the photography. DEP has a number of searchable databases for soils, geology, and discharge locations to mention a few other data sources that should be checked. Chemical sampling of seeps and springs may be required in areas previously mined to determine if the discharges are contaminated from past mining disturbance.

Once it is established the source is natural, collect chemistry samples to determine background water quality. This requires a minimum of ten grab chemistry samples collected over a one year period. Samples should be collected at least three weeks apart and reflect the usual range of conditions (e.g., flows, temperatures) at that site. If there are unusual conditions such as

drought or flooding, the sampling should be suspended until more normal flows return.

Compile the sample results and compute summary statistics including the median and 95% confidence limits of the median. The median concentration will be considered the long term natural concentration of the constituent in that waterbody. For parameters with a maximum threshold, the upper 95% confidence limit of the median will be the background level used to develop permit limit concentrations if a discharge is proposed in this site specific waterbody – background levels for parameters with a minimum threshold will be set by the lower 95% confidence limit of the median.

All findings including identification of the source and cause, elimination of possible anthropogenic sources, raw chemistry data, and summary statistics should be included in a final report. The report must include a map indicating the effected waters and sources of the natural pollutant. This report should be submitted to the Division of Water Quality Standards for review. Upon acceptance the findings will be made available for public comment in the Pennsylvania Bulletin. The Division will maintain a list of these waters and their site specific criteria that will be available to the public.

pH

Special mention needs to be made of low pH since unambiguously identifying the source can be difficult because of possible contributions from atmospheric deposition. Compounding the problem is that the stream's natural history prior to widespread atmospheric deposition is usually not known. First, determine if the local geology makes the stream susceptible to acid precipitation problems and if other streams in the area are impacted. If it can be documented that the watershed geology is not susceptible and other streams in the area are not impacted then the provisions in 93.7 (d) can apply.

If the watershed geology is susceptible to acid precipitation effects and/or other streams in the area are impacted, the next step is to devise a study that defines the problem source as natural or atmospheric deposition. The study will, at a minimum, involve chemical sampling during specific times of the year and flow events. The study plan should be peer reviewed by persons knowledgeable in the field of acid precipitation before field work begins.

LAKES

Identification of naturally low pH ponds or lakes in PA will follow the same general guidelines as above but should also consider the following additional data. Since naturally low pH lakes in PA are characterized by phenomenons that

are due to very long-term natural processes, these characteristics can be used to identify them. Boggy, low pH lakes/ponds can be identified by their colored (tannic) waters, presence of long-term low pH tolerant plants in the lake proper and in undisturbed lake inlet areas (i.e. aquatic macrophyte populations dominated (>50% occurrence) by bladderwort (*Utricularia* spp.); presence of sundew and/or pitcher plants in boggy areas), plankton populations dominated by acid-tolerant types (Desmids and Chlorophytes), and chemical identifiers such as color, lack of acid-neutralizing capacity (ANC), low alkalinity, and high total dissolved solids (TDS). Water chemistry grabs should be analyzed for the above parameters along with the standard chemistry array plus in-situ profile measurements (specifically including pH), using standard DEP lake collecting methods (Methods Document 391-2000-013).

If additional information is needed, the presence of mercury (Hg) in the environment above a baseline standard could be used to indicate anthropogenic influences on a lake. The degree to which Hg varies in lakes in response to trophic gradients can be useful in determining where the presence of Hg may be enhanced. Lakes of increased trophic status usually have significant watershed disturbance, and those watersheds deliver larger Hg loadings than undisturbed watersheds, resulting in increased in-lake and sediment Hg burdens (Kamman 2003). Data will be collected on in-lake or lake sediment Hg levels by either of the two following methods: a mid-lake sediment core should be collected and analyzed for mercury from the top 2 cm of an undisturbed sample, or an extra water grab sample should be taken from the epilimnion at the established (minimum of two) lake stations. Undisturbed cores can be collected by a KB Corer, which was used nationwide during the 2007 National Lake Survey coordinated by EPA. Water grab samples should be taken by a Beta-type water sampler, free of metallic contamination. Background Hg levels in northeastern lakes are from 0.01- 0.24 ppm (or mg/kg dry weight, Perry et al. 2004), or <.05ug/g dry wt in low organic sediments, and up to 0.2 ug/g dw in higher organic sediments (Kamman, personal communication). Anthropogenic levels are considered to be from 10.4 to 66.3g/m² yr (Perry et al 2004). The benchmark will be the same as was used in the 2007 EPA National Lakes Survey, and future results may be compared to these 2007 levels. In water, total mercury benchmarks in epilimnetic waters vary quite a bit. Various sources cite levels of 0.02ng/L to 0.14ng/L in Lake Michigan, 0.55 to 2.1ng/L in Ontario Lakes, and 0.09 to 7.4ng/L in Nova Scotia lakes. After a few years of data, PA will be able to establish its own benchmarks. Time series data and an enhanced monitoring network for PA will help identify/document areas of high Hg deposition, and hopefully the response to future emissions reductions.

LAKE REFERENCES

Kamman, N.C. 2003. Assessment of Mercury in Waters, Sediments, and Biota of New Hampshire and Vermont Lakes, USA, Sampled Using a Geographically Randomized Design. Pg. 1172-1186 in: Environmental Toxicology and Chemistry, Vo. 23 No. 5.

Perry, E, S.A. Norton, N.C. Kamman, P.M. Lorey, and C.T. Driscoll. 2005. Deconstruction of Historic Mercury Accumulation in Lake Sediments, Northeastern United States. Pg. 85-99 IN: Ecotoxicology, 14, 85-99, 2005.

Kamman, Neil, personal communication, email dated 11/26/2008.