

# Establishing Environmental Context for Water Quality Monitoring Data (Newsletter)\*

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Water quality permit compliance monitoring data with concentration values exceeding statutory thresholds are assumed to result from permitted operations. Fines or penalties might be levied; remedial actions might be imposed. That permitted activities were responsible has not been demonstrated by the submitted data. This is particularly true when permitted activities are dispersed as mining, logging, and ranching are. Missing in permit compliance monitoring report evaluations is the context for those constituent values that exceeded thresholds.

"Context" means the environmental conditions prior to and at the time the water sample was collected. Soils and bedrock can leach metals, plant nutrients, and other constituents such as magnesium, sulfate, TDS, and turbidity. Soils might be saturated and stream flow increased by antecedent rain, sudden storms, and snowmelt runoff prior to water collection. Vegetation cover density of the upland and riparian areas affect measures of total dissolved solids (TDS), total suspended solids (TSS), and turbidity in the water column so wildland fires can affect measured values of water quality constituents. Current velocity and discharge affect chemical concentrations in the water, water temperature affects solubility, and pH affect binding and release of chemicals on streambed substrates.

This lack of context for measured water chemistry concentrations has several causes. A principal reason is the desire to simplify regulation and its enforcement by setting a single numeric standard for all water bodies in all geographic areas. The assumption that such a single value is scientifically valid is wrong. One well-examined constituent is arsenic. As reported by Alan Welch and colleagues in the US Geological Survey in their report issued in 2000, "Concentrations of naturally occurring arsenic in ground water vary regionally due to a combination of climate and geology. Although slightly less than half of 30,000 arsenic analyses of ground water in the United States were  $\leq 1 \mu\text{g/L}$ , about 10% exceeded  $10 \mu\text{g/L}$ . At a broad regional scale, arsenic concentrations exceeding  $10 \mu\text{g/L}$  appear to be more frequently observed in the western United States than in the eastern half. ... Investigations of ground

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water in New England, Michigan, Minnesota, South Dakota, Oklahoma, and Wisconsin within the last decade suggest that arsenic concentrations exceeding 10 µg/L are more widespread and common than previously recognized." Arsenic is not alone in having a single concentration threshold for regulatory enforcement that does not reflect the local environmental context.

Both regulators and the regulated public are better served when the context for chemical constituent threshold exceedances are scientifically established. Determining whether the measured value is natural or anthropogenic in origin are more successful when local weather data are maintained along with descriptions of soils, vegetation, and other factors. In many cases appropriate statistical analyses of a permittee's water permit compliance data history allow context to be determined without additional explanatory variables or research.

Another aspect of context is the designated beneficial use (or uses) of the water. What effect the chemical constituent has on that use at various concentrations should be quantified rather than assuming harm has occurred.

Underlying much of the basis for one-size-fits-all water chemistry concentration thresholds is the general belief that "normal" variation in natural ecosystems is narrow. The reality is that it is very broad. For example, while 100-year storm events are comparatively rare, they are accepted as within the normal range of storms, even when two such storms occur within a few years.

Regulators, regulated industries, and the public are better served when water quality decisions are based on local conditions and documented relationships to specific designated beneficial uses.

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