

## THE GREENNESS OF MONITORING METHODS

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### ABSTRACT

Greenness profiles for many of the monitoring methods in the National Environmental Methods Index (NEMI, [www.nemi.gov](http://www.nemi.gov)) are now available in NEMI. The greenness profiles, based on four criteria, give guidance for selecting a method that has a less negative impact on the environment.

The four criteria used for defining the greenness profiles are Persistent/Bioaccumulative/Toxic (PBT), Hazardous, Corrosive, and Waste. A method is defined as less green if:

1. PBT – A chemical used in the method is listed as persistent, bioaccumulative, and toxic (PBT), as defined by the EPA's Toxic Release Inventory (TRI).
2. Hazardous – A chemical used in the method is listed on the TRI or on one of the RCRA's D, F, P or U hazardous waste lists.
3. Corrosive – pH during the analysis is less than 2 or greater than 12.
4. Waste – Waste amount generated is greater than 50 g.

This talk will focus on examples of how the greenness profiles can be compared and used for selecting a method.

For example, a search in NEMI for methods that measure total residual chlorine in water will show these three methods among the search results. One titration method (EPA Method 330.4) generates more than 50 g of waste, uses mercuric chloride (a PBT) for preservation, and passes only one of the four greenness criteria. Another titration method (EPA Method 330.3) generates more than 50 g of waste but does not use mercury and passes three greenness criteria. A spectrophotometric method (EPA Method 330.5) generates less than 50 g of waste, but uses mercuric chloride (a PBT) for preservation, and passes two greenness criteria. The greenness profiles illustrate the differences between these three methods.

Another example is comparing two methods for lead analysis in water. In Standard Methods 3500-Pb-B, hazardous chemicals are used, pH is less than 2, and greater than 50 g of waste is generated. This method passes only one of four greenness criteria. On the other hand, USGS Method I-1401-85 uses 20  $\mu$ L of water sample with 5  $\mu$ L matrix modifier solution, injected into a GFAA spectrometer. This method passes all four greenness criteria.

### KEYWORDS

green, green chemistry, green methods, monitoring, database