

generation ICP-MS, addition of NaBH_4 reduces As to gaseous arsine hydride, which is subsequently introduced into ICP-MS (or atomic fluorescence spectroscopy), leaving the liquid matrix and associated Cl behind. Chromatographic techniques such as liquid chromatography or ion chromatography followed by ICP-MS analysis also separate As species from Cl and other matrix constituents before introduction of the sample into the mass spectrometer. Both hydride generation and chromatographic separation can be used to determine As speciation, which may be useful in some water quality applications.

Each of the ICP-MS techniques discussed here can be hybridized with other methods. For example, As has been analyzed by combinations of liquid chromatography and collision cell ICP-MS as well as liquid chromatography and hydride generation ICP-MS, yielding MDLs of 22 ng L^{-1} and 4.2 ng L^{-1} in 2% Cl solution (Nakazato et al., 2002). Moreover, the same ICP-MS instrument can be used with different accompanying methods to optimize performance for the analytes of interest. The variety of options for detection of As at trace levels suggests that the capability for such measurements could become widespread in response to future demand.

By definition, a PQL can be based only on routine analytical methods. In addition, methods that quantify multiple drinking water contaminants concurrently are clearly advantageous. Although hydride generation ICP-MS has an MDL lower than California's PHG for As, the method is element specific. Thus this method is not likely to be the basis for a lower PQL for As. For the same reason, chromatographic techniques probably will not be widely used by water quality laboratories. However, the other modified ICP-MS technologies are readily applicable to a large suite of analytes. High resolution ICP-MS and collision cell ICP-MS show particular promise for widespread

adoption. Although prices for high resolution ICP-MS instruments are still prohibitive, they have been declining with the advent of second generation instruments (Vanhaecke and Moens 1999). Thus, it is likely that such instruments will become more widely used. Collision cell ICP-MS is less expensive than high resolution ICP-MS and can be operated such that the elements whose analysis benefit from the collision cell are analyzed first, while other elements are quantified after flushing the reaction gas from the collision cell.

5.6 Conclusions

With a variety of techniques that are readily applicable to drinking water, it is likely (if not inevitable) that the PQL for As will be lowered in the future, requiring drinking water providers to report lower As values. Although As is discussed as the principal example in this study, the same trend is likely to occur with other regulated drinking water contaminants. If the feasibility of the MCL is based on analytical consideration, then a lower PQL leaves the MCL open for revision, which may eventually require utilities to modify their treatment methods. These eventualities should be considered when planning for future treatment plant upgrades, expansion, or design, even for contaminants whose concentrations fall below current PQL values.

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