Introduction
Chromium in the +6 charge state is found in the environment as an oxygen ion and is commonly referred to as hexavalent chromium. All hexavalent chromium (Cr(VI)) compounds are strong oxidizing agents and considered toxic and potentially carcinogenic. Hence, they are regulated in the environment as a primary drinking water contaminant.

Chromate in the news:
- Original case filed in 1993 (Hinkley, CA, 0.58 ppm)
- Chemical compound in Erin Brockovich case (2000)
- Environmental Working Group Report, December 2010

Drinking water standards are regularly re-evaluated by the U.S. EPA. In September 2010, the EPA released the Toxicological Review of Hexavalent Chromium. Based on that report, the state of California’s Office of Environmental Health Hazard Assessment issued a new public health goal (PHG) of 0.02 μg/L for chromium in drinking water. In addition, the State of New Jersey has been studying the concentration of Cr(VI) in contaminated soils.

Currently, hexavalent chromium in drinking water is measured according to EPA Method 218.6. This method is based on an isocratic chromatography on a Thermo Scientific Dionex IonPac AS7 column (4 mm format) and detection after postcolumn reaction with diphenylcarbazide to yield a compound with strong absorbance at 530 nm. This permits a method detection limit (MDL) for chromium in drinking water of 0.3 μg/L. Modifications including lower eluent and postcolumn reagent flow rates, larger reaction coil, and larger injection volume significantly increased the sensitivity over Method 218.6, resulting in an MDL of 0.02 μg/L.

However, the modified method does not allow sufficient sensitivity for routine analysis at the proposed California PHG level of 0.02 μg/L. Described here are additional modifications to 218.6, including the use of the column in a 2 mm format and a smaller reaction coil to permit an MDL of 0.001 μg/L, which is more than sufficient for analysis at the proposed California PHG level. In addition, results from National Institute of Standards and Technology (NIST) standards and various soil extracts from Cr(VI) contaminated soils will be explored.

Materials
- Thermo Scientific Dionex ICS-2100, ICS-1600, ICS-3000, or ICS-5000 system including:
  - SP Single Pump or DP Dual Pump
  - DC Detector/Chromatography Component
  - VWD Variable Wavelength Detector

Methods
Sample Preparation
An aqueous solution is filtered through a 0.45 μm filter and the filtrate is adjusted to a pH of 9.5-9.9 with a buffer solution.

Liquid Chromatography
Thermo Scientific Dionex ICS-2100, ICS-1600, ICS-3000, or ICS-5000 system including:
- SP Single Pump or DP Dual Pump
- DC Detector/Chromatography Component
- VWD Variable Wavelength Detector

Results

Conclusion
- Modifications proposed: 2 mm format column and proportional reduction of the flow rates and reaction coil volume.
- MDL chromium at 1 ppt will allow a minimum quantitation limit of 3 ppt.
- Modifications allow sufficient sensitivity for determining hexavalent chromium at the proposed California PHG level of 20 ppt.

References