

Analytical Methods for Perchlorate: Current Technology and Possibilities for the Future

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The new Unregulated Contaminant Monitoring Regulation (UCMR) has been promulgated in accordance with the 1996 Amendments to the Safe Drinking Water Act (SDWA). The UCMR requires that all CWSs and NTNCWSs serving more than 10,000 persons, plus a randomly-selected statistical sample of PWSs serving 10,000 or fewer persons monitor for unregulated contaminants. This presentation provides an overview of the UCMR Program and explains the monitoring responsibilities for affected PWSs

Definitions

- | | |
|-------------------------|--|
| Unregulated contaminant | - does not have an MCL or treatment technology requirement |
| State | - includes territories |
| Small system | - serves 10,000 or fewer persons |
| Large System | - serves more than 10,000 persons |

Discussion Overview

- **History of early IC methodologies**
- **Development of EPA Method 314.0**
- **Unregulated Contaminant Monitoring Regulation (UCMR)**
- **Promising future analytical techniques**
- **EPA's methods development partnership program**

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Presentation Outlook

We will be covering the **purpose of the UCMR**

Where this regulation comes from....**Statutory Background**

Critical **differences from Previous Unregulated Contaminant Monitoring**

The “nuts and bolts” providing a **Program Overview**

Explain the simple details about: **Lab approval and certification**

Cover some of the **Roles and Responsibilities**

Finally discuss **Reporting Elements**

:

Initial IC Methods

- **Concern in the early 90's prompted development of early IC methods**
- **California Dept. of Health Services, June 1997**
 - **Ion Chromatography Method**
 - **Suppressed Conductivity Detection**
 - **AS5 analytical column, required eluent modifier (p-cyanophenol)**
 - **Method was approved for CA State monitoring**
 - **High Total Dissolved Solids (TDSs) can impact analysis**

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Initial IC Methods

- **New column technologies eliminated need for eluent modifier**
- **Dionex Corporation, 1998, Application Note 121**
 - **Ion Chromatography Method**
 - **Suppressed Conductivity Detection**
 - **AS11 analytical column, no eluent modifier needed**
 - **Adopted as approved alternate for CA State monitoring**
 - **High TDSs are less of an impact but still can effect analysis**

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Development of EPA Method 314.0

- **Further advances in analytical column technology**
- **Need to have a standardized method**
- **EPA Method 314.0, November 1999**
 - **Ion Chromatography Method**
 - **Suppressed Conductivity Detection**
 - **AS16 analytical column, no eluent modifier needed**
 - **AS16 further reduces TDS effect**
 - **Includes additional safeguard to monitor TDS**
 - **Optional sample TDS reduction techniques specified**
 - **Widely adopted as the standard perchlorate method**

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So what is the UCMR?

Candidate Contaminant List (CCL)

- **1996 Amendments, SDWA mandated CCL to be published every 5 years**
- **CCL1 published February 1998**
- **Four research priorities**
 - **Treatment**
 - **Health Effects**
 - **Analytical Methods**
 - **Occurrence (UCMR)**

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What is the UCMR?

- **Determine the occurrence of selected unregulated contaminants in drinking water**
- **Use occurrence information in future regulatory decision-making**
 - Monitoring results input into national database to determine significance and distribution of occurrence (NCOD)
 - Refine future CCLs
 - Support the Administrator’s regulatory decision
- **Assessment Monitoring (2001 -2003)**
 - ~ 3800 water systems throughout US are monitoring
 - perchlorate MRL = 4 ug/L

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Is there a better way?

- **Standard IC is widely used, moderately sensitive but is not selective**
- **New analytical tools may increase selectivity and sensitivity**
- **Preliminary health effects studies suggest effect at lower concentrations**

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Promising Analytical Techniques

LC/MS

- **Liquid chromatography/Mass Spectroscopy (LC/MS)**
(Some using suppressed IC rather than LC)
 - More selective and reported to be a more sensitive procedure
 - More labs obtaining equipment
 - Electrospray interface between LC or IC and MS
 - **Concern: Common anions in sample may impact electrospray**
 - Sample pretreatment may reduce this impact
 - Significant expense to equip laboratory
 - Limited labs to support analysis
 - Significant method development required

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Promising Analytical Techniques

Large Volume Concentration

- **Large Volume Concentration**
 - Sample passed through an ion exchange media
 - Perchlorate captured by this trap
 - Increase sensitivity above Method 314.0
 - Analysis by conductivity or MS
- **Potential problems**
 - Common anions in sample can impact efficiency of trap
 - Sample pretreatment can reduce this effect
 - Perhaps common anions can be washed off trap
 - Significant method development required

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Promising Analytical Techniques

PCR Detection

- **Post Column Reaction (PCR) Techniques**

- Following chromatographic separation, a reagent (often a chromophore) is introduced and reacts with the eluting target analyte
- EPA Methods 317.0 and 326.0 (draft) are PCR based for bromate
- As an oxidizer, perchlorate may be a good candidate for PCR
- The high activation potential presents some challenges
- PCR reagent has not been identified, but limited research conducted

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EPA's Method Development Partnership Program

- Collaborative development, review, and validation of new analytical methods
- Informal partnerships have been formed with private and public organizations, commercial labs and public water systems

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