

CHAPTER

7

Inorganic Chemicals (IOCs)

Inorganic Chemicals (IOCs) consist of salts and metals, which may be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming. There are 17 regulated IOCs (14 IOCs are both state and federally regulated while 3 are only regulated by the state). This chapter will discuss these 17 IOCs and explain the monitoring requirements. In addition, this chapter will also discuss the special monitoring requirements for sodium.

Illinois EPA Assistance

In most cases, as a monitoring requirement approaches for a community water system (CWS), the Illinois EPA will send reminder notifications that detail the requirement and specific timeline for completion. Please remember that these are “reminder” notifications and does not relieve the CWS in meeting the monitoring schedule deadlines. If a CWS is unsure of its schedule or timeframe described in any Illinois EPA notification, it is very important that the CWS contact the Drinking Water Compliance Unit at 217/785-0561 for clarification. All IOC correspondence should be sent to:

IOC Coordinator
Illinois EPA /BOW/CAS #19
P.O. Box 19276
Springfield, IL 62794-9276
Telephone: 217-785-0561
Fax 217-557-1407

Sample Bottles

If your supply participates in the Community Water Supply Testing Fund (CWSTF), sample containers will be sent to your supply during the monitoring period. If your supply does not participate in the CWSTF, it is your responsibility to have all testing completed by an Illinois EPA certified laboratory and submitted on the correct reporting forms. The IOC certified laboratory reporting form is available on the Internet (see next page). This form must be submitted within 10 days after the end of a monitoring period. If the laboratory you choose submits data electronically, it is not necessary to submit a paper copy. However, it is the responsibility of the CWS to insure data reaches the Illinois EPA within 10 days of the end of the monitoring period.

Contents of Chapter 7

IOC Sample Locations.....	Page 3
Monitoring Requirements (excluding Asbestos, Nitrate and Nitrite).....	Page 3
Monitoring Requirements following a Detection.....	Page 3
Monitoring Requirements for Sodium	Page 4
Monitoring Requirements for Fluoride	Page 4
Monitoring Requirements for Nitrate and Nitrite	Page 4
Monitoring Requirements for Asbestos	Page 5
Monitoring Requirements for Emergency Wells.....	Page 5
IOC (cyanide only) Vulnerability Waiver Program.....	Page 6
Compliance with the Maximum Contaminant Level (MCLs).....	Page 6
Iron and Manganese Compliance.....	Page 8
Nitrate and Nitrite Compliance.....	Page 8
IOC Contaminant Listing.....	Page 9
IOC Sample Collection.....	Page 10

Certified Laboratory Result Reporting Forms can be downloaded at:

<http://www.epa.state.il.us/water/forms.html#compliance-and-enforcement-drinking-water>

If Internet access is unavailable, please contact the IOC Coordinator at 217-785-0561 for a copy of this form.

IOC Sample Locations

IOC samples must be collected at locations that represent each well or surface water source after all treatment but prior to entering the distribution system. If water from several sources is combined and treated at a common location, then one sample can be collected to represent all combined sources.

If a well pumps directly to the distribution system (no added treatment), then a representative sample must be collected prior to the first distribution location. This is not a common situation.

On occasion the Illinois EPA will require an IOC sample to be collected directly from a well prior to treatment. If the case, the sample collector will receive specific sample collection instructions.

Monitoring Requirements (excluding Asbestos, Nitrate and Nitrite)

Per sample location as specified above, IOC samples are collected triennially for ground water supplies and annually for surface water supplies.

Please remember that several factors influence monitoring requirements; such as, violation of regulations, new regulations, and/or contaminant detections. It is recommended that each CWS water operator and/or sample collector periodically (at least quarterly) download a new schedule since monitoring schedules change frequently. A CWS can download their most current monitoring schedule at:

<http://www.epa.state.il.us/water/compliance/drinking-water/sdwis/index.html>

Monitoring Requirements for Sample Locations with IOC Detections

Quarterly monitoring is initiated for any detected IOC that was above the MCL until results demonstrate “reliably and consistently” low results. Groundwater CWS must demonstrate results “reliably and consistently” below the Maximum Contaminant Level (MCL) for a minimum of two consecutive quarters. Surface water system must demonstrate results “reliably and consistently” below the MCL for a minimum of four consecutive quarters.

Reduced Monitoring following a Detection

The Illinois EPA will periodically review sample data to determine if a sample location qualifies for reduced monitoring. If a sample location qualifies, the Illinois EPA will send written notification to the CWS that sampling has been reduced.

As mentioned, this is a periodic review. It is strongly recommended that the CWS routinely evaluate their data. If it is felt that a sample location qualifies for reduced monitoring, a request in writing should be sent to the IOC Coordinator (address on page 1 of this Chapter).

Monitoring Requirements for Sodium

The routine IOC sample will also include analysis for sodium. Sodium does not have a MCL; however, monitoring and reporting is required.

Sodium occurs in drinking water due to erosion of naturally occurring deposits. Monitoring is required to provide information to consumers and health officials that are concerned about sodium intake due to dietary precautions. If a consumer is on a sodium-restricted diet, they should consult their personal physician if they have concerns about the concentrations found in the drinking water.

It is important to note that sodium is an essential nutrient. The Food and Nutrition Board of the National Research Council recommends that most healthy adults need to consume at least 500 milligrams (mg)/day, and that sodium intake be limited to no more than 2400 mg/day.

Monitoring Requirements for Fluoride

In addition to the routine IOC analysis, if the CWS adds fluoride as part of the treatment process, monthly fluoride monitoring is also required.

Illinois Department of Public Health (IDPH) rules require all water systems to maintain a fluoride level of 0.9 -1.2 mg/L at each active entry point (EP) where fluoride is added. Each active EP (where fluoride is added) must be monitored daily for fluoride by using an on-site test kit. The on-site test results must be recorded on the monthly "Facility Operating Report" that is sent to the Illinois EPA Regional Office. In addition to the daily on site monitoring, once each month, a split-sample analysis must be performed by collecting one sample and splitting it into two separate vials. One vial is analyzed on-site using the test kit. This on-site result must be recorded on the Illinois EPA laboratory report form. The other vial must be sent to a certified laboratory. The purpose of the split sample is to verify the accuracy of the on-site test kit.

For CWSs that participate in Community Water Supply Testing Fund (CWSTF), a twelve-month supply of fluoride bottles is normally sent in May/June of each year. If a fluoride sample result exceeds 4mg/L, a new sample should be collected for analysis. The Illinois EPA Laboratory will automatically mail a new sample bottle to your facility. If additional bottles are needed, please call the Illinois EPA laboratory at 217-782-9780.

Monitoring Requirements for Nitrate and Nitrite

Like the other inorganic chemicals, nitrate/nitrite samples must be collected at locations that represent each well or surface water source after all treatment but prior to entering the distribution system. If water from several sources is combined and treated at a common location, then one sample can be collected to represent all combined sources.

Nitrate

Nitrate monitoring for a ground water system is annual. If any results are equal to or greater than 5 mg/L, quarterly monitoring must be initiated and continued until 4 consecutive quarterly results demonstrate levels below 5 mg/L (return to annual).

Initial nitrate baseline monitoring for a surface water system is quarterly. If after the initial four quarters of monitoring and all results are below 5 mg/L, then monitoring is reduced to annual. The annual samples must always be collected during the April through June period. If at any time the results are 5mg/L or greater, quarterly monitoring must resume.

Nitrite

Nitrite monitoring for a ground water system is triennial (once every three years). Nitrite monitoring for a surface water system is annual or triennial. If any results are equal to or greater than 0.5 mg/L, quarterly monitoring must be initiated and continued until 4 consecutive quarterly results for ground water systems and 4 consecutive quarterly results for surface systems demonstrate levels below 0.5 mg/L (return to triennial or annual).

Monitoring Requirements for Asbestos

Only supplies that have asbestos-cement (A-C) pipe within the distribution system (vulnerable to asbestos contamination) and have an aggressive water quality index of less than 12 must monitor once every nine years.

Every nine years the Illinois EPA will send each CWS an asbestos related questioner. In order for the Illinois EPA to verify the current number of water supply systems that have A-C pipe in the distribution system, it is necessary to check the materials inventory for your water supply and advise the Illinois EPA as to the presence or absence of A-C pipe within the system. The presence of A-C pipe does not automatically mean that your water supply will be required to monitor for asbestos; however, it will trigger testing to determine whether or not the water is corrosive. If the water quality index indicates the water is corrosive (index of less than 12), monitoring for asbestos will be required from a location served by A-C pipe. Quarterly monitoring will be required if any sample result exceeds 7 million fibers per liter.

If actual asbestos monitoring is required for your CWS, specific sampling instructions/requirements will be sent from the Illinois EPA to the CWS.

Monitoring Requirements for Back-up and/or Emergency Wells

All wells that are active and are either on back-up or emergency status must be monitored every three years. If the CWS purchases its primary source of water from another CWS, annual nitrate/nitrite samples are required from the well(s). There are no exceptions to this requirement.

If there is detection above the MCL, the CWS will be required to locate the source of the contamination and remediate in an established amount of time or properly abandon the well.

IOC (Cyanide Only) Vulnerability Waiver Program

This is only applicable to cyanide. The Illinois EPA has a “vulnerability waiver” program that many systems already utilize which allows cyanide monitoring to be reduced to one sample per sample location every nine years.

The objective of the cyanide vulnerability monitoring waiver program is to reduce monitoring, while assuring the safety of the drinking water currently provided by the public water supplies. The intent of this program is to recognize where natural protection exists by differentiating between confined and unconfined aquifer systems. A confined aquifer more readily qualifies for a waiver. For aquifers determined to be unconfined this program includes: mapping the 5-year recharge area; identifying potential sources and routes of contamination located within the recharge area; contingency planning; and managing potential sources and potential routes of contamination, thereby reducing vulnerability to contamination. The program requires the identification and sealing of potential routes of contamination located within 1,000 feet of wells.

To obtain a waiver, the PWS must evaluate the vulnerability of their wells to potential contamination sources. Systems vulnerable to contamination must develop a management program for controlling potential contamination sources and routes. If a CWS is interested and would like more information, please call the IOC Coordinator at 217-785-0561. The application is on line at:

<http://www.epa.state.il.us/water/compliance/drinking-water/forms/phase-2-and-5-monitoring-waiver-application-and-instructions.pdf>

Compliance with the IOC Maximum Contaminant Levels (MCL)

The following excludes nitrate and nitrite (see Chapter 7-8).

Compliance is based on the running annual average of quarterly samples. This is calculated for each entry point to the distribution system. If one sample location is out of compliance, the entire system is out of compliance.

If any single sampling result is high enough to cause the annual average to be exceeded, the supply is out of compliance immediately (for example, the analytical result is greater than four times the MCL or two analytical results are greater than twice the MCL, etc.).

Systems monitoring annually or triennially whose sample result exceeds the MCL, must revert to quarterly sampling for that contaminant the next quarter. Systems are only required to conduct quarterly monitoring at the sampling point at which the sample was collected and for the specific contaminant that triggered the system into the increased monitoring frequency. An exceedance is not necessarily a violation. Systems triggered into increased monitoring will not be considered in

violation of the MCL until they have completed one year of quarterly sampling unless any sample collected during quarterly monitoring would result in the annual average exceeding the MCL.

Systems may monitor more frequently than quarterly. Samples must be clearly marked as “compliance/routine samples” prior to being submitted to the laboratory (and not after the results are known). All samples must be used when determining compliance (the system cannot pick and choose results) unless the samples are clearly marked as “special”. Samples marked as “special” samples will not be used for compliance and cannot later be changed to routine samples so that they will be counted for compliance. There are no exceptions to this rule.

If a system does not collect all required of quarterly samples, compliance will be based on the running annual average of the samples that were collected. If a sample result is less than the reporting limit, zero will be used to calculate the annual average.

The Illinois EPA has the flexibility to require confirmation samples for positive or negative results. The Illinois EPA may require more than one confirmation sample to determine the average exposure. If confirmation samples are required by the Illinois EPA, the average of the initial sample and the confirmation sample will be used for compliance determinations.

Examples of Determining Compliance

Example 1: A ground water supply was on triennial monitoring at TP01 Well 1. Cadmium was detected at 5.6ug/L in the sample collected on 10/18/2007. The detection triggered quarterly monitoring. The MCL for cadmium is 5ug/L.

Sample Location	Date Collected	Single Result (ug/L)	*Quarterly Average	Running Annual Average
TP01 Well 1	10/18/07	5.6	5.6	$5.6 / 4 = 1.4$ (no MCL)
TP01 Well 1	01/05/08	5.9	5.9	$5.6 + 5.9 / 4 = 2.8$ (no MCL)
TP01 Well 1	04/20/08	6.3	6.3	$5.6 + 5.9 + 6.3 / 4 = 4.4$ (no MCL)
TP01 Well 1	07/08/08	6.2	6.2	$5.6 + 5.9 + 6.3 + 6.2 / 4 = 6$ (MCL Violation)
TP01 Well 1	10/02/08	5.4	5.4	$5.9 + 6.3 + 6.2 + 5.4 / 4 = 5.9$ (MCL Violation)
TP01 Well 1	01/05/09	2.4	2.4	$6.3 + 6.2 + 5.4 + 2.4 / 4 = 5.0$ (no MCL)

* Only one sample collected per quarter

The water supply had 2 quarters in which the running annual average exceeded the MCL; therefore, the water supply was in violation. Public notice is required for these two quarters (see Chapter 1 Public Notification for requirements).

In this example, the water supply would remain on quarterly monitoring until it could demonstrate reliably and consistently results below 5 ug/L for a minimum of two consecutive quarters.

If more than one sample is collected during the quarter from the same sample location, the samples are averaged to calculate a quarterly average. See example below.

Example 2: A water supply was on triennial monitoring at TP02 Well 2. Cadmium was detected at 23.3ug/L in the sample collected on 10/18/2007. A confirmation sample was collected on 11/12/07 and was 27.2ug/L. The detections triggered quarterly monitoring. The MCL for cadmium is 5ug/L.

Sample Location	Date Collected	Single Result (ug/L)	Quarterly Average	Running Annual Average
TP02 Well 2	10/18/07	23.3	$23.3 + 27.2 / 2 = 25.2$	$25.2 / 4 = 6.3$ (MCL violation)
TP02 Well 2	11/12/07	27.2		
TP02 Well 2	2/12/08	6	6	$25.2 + 6 / 4 = 7.8$ (MCL Violation)
TP02 Well 2	04/20/08	4	4	$25.2 + 6 + 4 / 4 = 8.8$ (MCL Violation)
TP02 Well 2	07/08/08	18	$18 + 2 / 2 = 10$	$25.2 + 6 + 4 + 10 / 4 = 11.3$ (MCL Violation)
TP02 Well 2	8/2/08	2		
TP02 Well 2	10/02/08	No detect	0	$6 + 4 + 10 + 0 / 4 = 5$ (no MCL)
TP02 Well 2	01/05/09	No detect	1	$4 + 10 + 0 + 1 / 4 = 3.7$ (no MCL)

The water supply had 4 quarters in which the running annual average exceeded the MCL; therefore, the water supply was in violation. Public notice is required for these four quarters (see Chapter 1 Public Notification for requirements).

Compliance with the Iron and Manganese MCL

Iron and manganese are state only regulated contaminants (no federal MCL exist). If levels are detected above the MCL, quarterly monitoring is initiated. Like other IOCs, quarterly monitoring must continue until results are below the MCL (two consecutive for ground water supplies and four consecutive quarters for surface water supplies).

The MCL for iron and manganese is only applicable to CWS suppliers that serve a population of more than 1000 persons OR have more than 300 service connections. The Illinois EPA may allow iron and manganese in excess of the MCL if sequestration is tried on an experimental basis and proves to be effective.

Compliance with the Nitrate and Nitrite MCL

Nitrate and nitrite MCLs are considered acute contaminants. This essentially means that infants less than six months of age drinking the water could have immediate health effects if levels are above the MCL. If a CWS has levels above the MCL, immediate (Tier 1) notification must be initiated. Please refer to *Chapter 1 Public Notification* for Tier 1 public notice requirements.

Compliance with the nitrate and nitrite MCL is determined immediately after the routine sample is collected and the laboratory has determined the result. If the routine sample is above the MCL, the water supply MUST collect a confirmation sample within 24 hours of being notified of the result. This notification most likely will be verbal (telephone) by the laboratory or the Illinois EPA.

The routine and confirmation samples will be averaged and if the average exceeds the MCL, Tier 1 requirements must be initiated. If the CWS is unable to collect the confirmation sample within 24 hours, public notice requirements must immediately be distributed.

It is recommended that routine nitrate and/or nitrite samples be collected on a Monday or a Tuesday. This will ensure a laboratory is available to analyze a confirmation sample if needed. There is no waiver from the 24-hour confirmation sample requirement. In many cases, the CWS official will drive the confirmation sample to the laboratory so that time constraints are met.

IOC Contaminants

Below are the 17 regulated IOCs.

Antimony	MCL = 6 ug/L (or 6 parts per billion)
Antimony is a metal found in natural deposits as ores containing other elements. The most widely used antimony compound is antimony trioxide, used as a flame retardant. It is also found in batteries, pigments, and ceramics/glass.	
Arsenic	MCL = 10 ug/L (or 10 parts per billion)
Arsenic's common sources of contamination in drinking water include erosion of natural deposits; runoff from orchards, runoff from glass and electronics production wastes.	
Asbestos (Fiber > 10 micrometers)	MCL = 7 MFL
Asbestos is a fibrous mineral occurring in natural deposits. Because asbestos fibers are resistant to heat and most chemicals, they have been mined for use in over 3,000 different products, including roofing materials, brake pads, and cement pipe often used in distributing water to communities.	
Barium	MCL = 2,000 ug/L (or 2,000 parts per billion)
Barium is a lustrous, machinable metal which exists in nature only in ores containing mixtures of elements. It is used in making a wide variety of electronic components, in metal alloys, bleaches, dyes, fireworks, ceramics and glass. In particular, it is used in well drilling operations where it is directly released into the ground.	
Beryllium	MCL = 4 ug/L (or 4 parts per billion)
Beryllium is a metal found in natural deposits as ores containing other elements, and in some precious stones such as emeralds and aquamarine. The greatest use of beryllium is in making metal alloys for reactors and the aerospace industry.	
Cadmium	MCL = 5 ug/L (or 5 parts per billion)
Cadmium is a metal found in natural deposits as ores containing other elements. The greatest use of cadmium is primarily for metal plating and coating operations, including transportation equipment, machinery and baking enamels, photography, television phosphors. It is also used in nickel-cadmium and solar batteries and in pigments.	
Chromium	MCL = 100 ug/L (or 100 parts per billion)
Chromium is a metal found in natural deposits as ores containing other elements. The greatest use of chromium is in metal alloys such as stainless steel; protective coatings on metal; magnetic tapes; and pigments for paints, cement, paper, rubber, composition floor covering and other materials. Its soluble forms are used in wood preservatives.	
Cyanide (As Free Cyanide)	MCL = 200 ug/L (or 200 parts per billion)
Cyanide is a carbon-nitrogen chemical unit which combines with many organic and inorganic compounds. The most commonly used form, hydrogen cyanide, is mainly used to make the compounds needed to make nylon and other synthetic fibers and resins. Other cyanides are used as herbicides.	

Fluoride	MCL = 4 mg/L (or 4 parts per million)
Fluoride is a water additive which promotes strong teeth. Common sources of contamination in drinking water include erosion of natural deposits, discharge from fertilizer and aluminum factories.	
Iron (State Only)	MCL = 1,000 ug/L (or 1,000 parts per billion) (State Only)
Iron's common source of contamination in drinking water includes erosion of natural occurring deposits.	
Manganese (State Only)	MCL = 150 ug/L (or 150 parts per billion) (State Only)
Manganese's common source of contamination in drinking water includes erosion of natural occurring deposits.	
Mercury (Inorganic)	MCL = 2 ug/L (or 2 parts per billion)
Mercury is a liquid metal found in natural deposits as ores containing other elements. Electrical products such as dry-cell batteries, fluorescent light bulbs, switches, and other control equipment account for 50% of mercury used.	
Nitrate	MCL = 10,000 ug/L (or 10,000 parts per billion)
Nitrate is a nitrogen-oxygen chemical unit which combines with various organic and inorganic compounds. Once taken into the body, nitrates are converted into nitrites. The greatest use of nitrates is as a fertilizer.	
Nitrite	MCL = 1,000 ug/L (or 1,000 parts per billion)
Nitrite is a nitrogen-oxygen chemical unit which combines with various organic and inorganic compounds. Once taken into the body, nitrates are converted into nitrites. The greatest use of nitrates is as a fertilizer.	
Selenium	MCL = 50 ug/L (or 50 parts per billion)
Selenium is a metal found in natural deposits as ores containing other elements. The greatest use of selenium compounds is in electronic and photocopier components, but they are also widely used in glass, pigments, rubber, metal alloys, textiles, petroleum, medical therapeutic agents, and photographic emulsions.	
Thallium	MCL = 2 ug/L (or 2 parts per billion)
Thallium is a metal found in natural deposits as ores containing other elements. The greatest use of thallium is in specialized electronic research equipment.	
Zinc (State Only)	MCL = 5,000 ug/L (or 5,000 parts per billion) (State Only)
Zinc's common sources of contamination in drinking water include erosion of natural occurring deposits and discharge from metal factories.	

IOC Sample Collection – Things to Remember

Sample instructions should be supplied with the sample containers from the laboratory. If the laboratory fails to include sample instructions, contact the laboratory and request sample instructions. Some general practices to remember:

- Samples should be collected at the entry point to the distribution system after all treatment (finished water)

- Select a sampling faucet that does NOT have an aerator (sampling must be done with minimum aeration)
- Run the water until the temperature is as cold as it gets
- Just before sample collection, adjust to a very low flow. Do not change the flow while collecting the sample
- Routine nitrate and nitrite samples should be collected on a Monday or a Tuesday
- When filling sample bottle, tip bottle slightly so that water flows down the side wall of the container. Bring bottle to an upright position as it fills
- Call the laboratory if bottles are received broken (or break while collecting samples)
- If a sample location is out of service (for an extended period of time), notify the IOC Coordinator in writing or by phone at 217-785-0561
- The owner or operator of a water supply must maintain chemical analysis reports (results) or a summary of those reports for at least 10 years