GUIDELINE	SECTION
Treatment and Public Reporting Expectations for Water Systems Containing Arsenic	Environmental Health Services

AUTHORIZATION	DATE APPROVED	DATE REVISED
Regional Director, Health Protection	April 24, 2007	June 5, 2011

INTENT

The following guideline will be used to assist the Drinking Water Officer Delegate/Environmental Health Officer (EHO) in establishing treatment and public reporting expectations for water systems containing arsenic.

The International Agency for Research on Cancer (IARC) has determined that arsenic causes cancer in humans and has classified arsenic as a Group 1 carcinogen. The Guideline for Canadian Drinking Water Quality (GCDWQ) has set the Maximum Acceptable Concentration (MAC) for arsenic in drinking water at 0.010 milligrams per litre (mg/L) or 10.0 micrograms per litre (µg/L)). The guideline states that "In the case of arsenic, the MAC is higher than the concentration that would present an "essentially negligible" risk of internal organ cancers, since it represents the lowest level of arsenic in drinking water that can be technically achieved at reasonable cost, especially for smaller public systems and private wells." Therefore, Health Canada recommends that every effort should be made to maintain arsenic levels in drinking water as low as reasonably achievable (ALARA).

> **Note:** The assigned risk is based on a lifetime consumption of 2 liters of water per day over a period of 70 years. Also, exposure through inhalation and skin contact with low levels of arsenic from drinking water is not considered to be a significant health hazard.

Water systems exceeding the MAC of 10 µg/L may present a potential long term health risk to some individuals. As such, water systems exceeding the MAC must treat the drinking water in compliance with GCDWQ and must inform their consumers as to the health related risks associated with arsenic in drinking water.

People drinking water with arsenic levels exceeding 200 ug/L can develop arsenic poisoning after a few days or weeks. Symptoms of exposure to high levels of arsenic include stomach pain, vomiting, diarrhea, and impaired nerve function, which may result in 'pins and needles' sensation in hands and feet. Arsenic can also cause skin changes, which include darkening, and wart-like or corn-like growths. These are mostly found on the palms of the hands or bottoms of the feet.

Further details are available in the *HealthLinkBC* File #49c *Arsenic in Drinking Water* (http://www.healthlinkbc.ca/healthfiles/hfile49c.stm) (See Appendix A) Fraser Health's – Health Information on Arsenic Fact Sheet http://www.fraserhealth.ca/media/ArsenicFactSheet.pdf (See Appendix B) and the Health Canada's Guideline Technical document on Arsenic. http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/arsenic-eng.php

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RELEVENT LEGISLATION AND REFERENCE MATERIAL

Drinking Water Protection Act

Water Supply Systems Must Provide Potable Water

6 *Subject to the regulations, a water supplier must provide, to the users served by its water supply system, drinking water from the water supply system that*

- *(a) is potable water, and*
- *(b) meets any additional requirements established by the regulations or by its operating permit.*

Operating Permits and Requirements for Water Supply Systems

8 *(2) An issuing official may include in an operating permit terms and conditions the official considers advisable respecting the water supply system.*

8 *(3) As examples, but without limiting the authority under this section, terms and conditions respecting the following may be included in an operating permit:*

- *(a) treatment requirements;*
- *(b) equipment, works, facilities and operating requirements;*
- *(c) qualifications and training of the persons operating, maintaining or repairing the water supply system;*
- *(d) monitoring of the drinking water source and the water in the water supply system;*
- *(e) standards applicable to the water in the water supply system;*
- *(f) reporting and publication of monitoring results or other information respecting the water supply system.*

Publication of Other Information

15 *A water supplier must ensure that the following information is made public in accordance with the regulations and any requirements of the drinking water officer:*

- *(b) the results of the monitoring required by the regulations, its operating permit or the drinking water officer, subject to any applicable time limits established by the regulations;*
- *(e) other information required to be made public by the regulations, its operating permit or the drinking water officer.*

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PROCEDURE

Treatment and Reporting Expectations

Arsenic Level	Treatment Required	Public Reporting Expectations	
		Post /Publish Test Results and Treatment Processes/Plans	**Post/Publish a copy HealthLinkBC Fact Sheet on Arsenic**
10.0 micrograms per litre (µg/L) and greater	Yes	Yes	Yes
Less than10.0 (µg/L) but greater than 0.3 micrograms per litre (µg/L)	Optional. FH will encourage water suppliers to achieve a level of arsenic that is **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA).	Yes	Yes
Less than 0.3 micrograms per litre (µg/L)	No action required. Health risk is considered essentially negligible	Yes	Optional

Determination of Arsenic Concentration in Drinking Water Supply

1. The water system operator (WSO), in consultation with the EHO, is to determine the baseline concentration of arsenic in the drinking water supplied to the consumers.
2. Repeat testing should be conducted when samples have arsenic level greater than 5.0 µg/L but less than 10 µg/L. The reason for this is because in cases where the levels from the occasional single samples are above the 50% of the Health Canada guideline or close to the guideline, there is an increasing probability in the long run that the actual levels may exceed the guideline. The recommended approach of more comprehensive multiple and higher frequency sampling in these situations is expected to increase the level of reliability of the test results and to reduce the probability of exceeding the GCDWQ in periods between the scheduled sampling rounds.
3. Source samples reflecting seasonal variation are required. *A minimum of one sample from the water supply source is required.
4. Water systems with multiple sources require samples be collected from each source.
5. Where multiple sources are blended a representative sample, as determined by the water supplier in consultation with the EHO, are to be collected from the distribution system prior to the first user.

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*__Note:__ Seasonal variations in arsenic concentrations are to be considered where the arsenic is from agricultural or commercial sources. In deep aquifers, with naturally occurring arsenic, seasonal variations are unlikely. Testing Laboratories must be appropriately certified (i.e. CAEAL) and have analytical capabilities of detecting arsenic at or below a concentration 1.0 µg/L. Some laboratories report results in parts per billion (ppb) rather than micrograms/L (µg/L). 1ppb is equivalent to 1 µg/L.

Treatment Requirements

1. For water systems containing arsenic concentrations of 10.0 µg/L or greater a treatment system capable of removing the arsenic to a level below 10.0 µg/L will be required.
2. The design and installation of treatment system must be approved by the Regional Public Health Engineer.
3. For water systems with arsenic concentrations less than 10.0 µg/L installation of a treatment system will be optional. In following Health Canada ALARA recommendation, Fraser Health will encourage operators to consider treatment.

Treatment Monitoring

1. Water Quality Monitoring and Reporting requirement will be added as a Term and Condition on the operating permit.
2. Repeat testing is to be conducted by the WSO for post treatment samples with arsenic level exceeding 5.0 ug/L
3. The WSO will be required to collect a minimum of one water sample (post treatment) every six months, for arsenic monitoring.
4. Testing Laboratories must be appropriately certified (i.e. CAEAL) and have analytical capabilities of detecting arsenic at or below a concentration of 1.0 µg/L.
5. The results of the testing are to be reported to the EHO, by the WSO, by means of a copy of the laboratory report.
6. The WSO will also be required to provide documentation indicating the treatment device is being maintained and serviced according to manufacturers' specifications.

Public Reporting Expectations

As part of the water supplier's annual report the following information is to be made available to the users:

1. A list of physical and chemical parameters tested along with the test results for arsenic (raw & treated).
2. For water systems that have arsenic at levels at 0.3 µg/L or greater in the delivered water a copy of *HealthLinkBC* File #49 titled *Arsenic in Drinking Water.*

3. Water systems with arsenic concentrations of 10.0 µg/L or greater in the delivered water, are also required to include in their annual report to their users a plan (with timeline) for instituting water treatment that will reduce the level of arsenic delivered to the consumer to a level that meets the Canadian Drinking Water Quality Guideline. As long as the level of arsenic in the delivered water is above that level, the water supplier will be required to issue a Water Quality Advisory (WQA). The WQA is to be issued as an interim measure pending the installation of an approved treatment system. (See Appendix C)
4. For water systems with arsenic concentrations of 200 µg/L or greater in the delivered water the water supplier will be required to issue a "Do Not Consume" Advisory (See Appendix D). This Advisory is to be an interim measure pending the installation of an approved treatment system.
5. Provided that the arsenic level in the delivered water is less than 200 µg/L, the water supplier serving a transient population will only be required to provide customers with arsenic test results and a copy of the *HealthLinkBC* File #49 upon request (as opposed to proactively providing this information in a published annual report). Water systems fitting into this category include: campgrounds, hotel/motels, restaurants, gas stations, rest stops, recreation facilities & community halls.

APPENDICES

Appendix A HealthLinkBC File #49c, June 2007 Arsenic in Drinking Water
Appendix B Fraser Health – Health Information on Arsenic Fact Sheet
Appendix C Sample: Water Quality Advisory
Appendix D Sample Do Not Consume Advisory

REFERENCES

Health Canada, "Guidelines for Canadian Drinking Water Quality: Guideline Technical Document Arsenic, May 2006" www.hc-sc.gc.ca/iyh-vsv/environ/arsenic_e.html

HealthLinkBC File #49c *Arsenic in Drinking Water*
(http://www.healthlinkbc.ca/healthfiles/hfile49c.stm

BRITISH COLUMBIA
The Best Place on Earth

HealthLinkBC

Number 49c
June 2007

Arsenic in Drinking Water

Arsenic is found naturally in the rocks in the Earth's crust. Drinking water containing arsenic can have serious short-term and long-term health effects.

How does arsenic get in drinking water?

Arsenic can get in drinking water from natural deposits or runoff from agriculture, mining and industrial processes.

In BC, natural minerals are the most common sources of arsenic in drinking water.

The amount of arsenic in ground water supplies like wells is usually higher than in surface water supplies such as lakes, streams and rivers.

What are the health effects of arsenic exposure?

Short to medium term (days to weeks) exposure to very high levels of arsenic in drinking water can lead to arsenic poisoning.

Symptoms of exposure to high levels of arsenic include stomach pain, vomiting, diarrhea, and impaired nerve function, which may result in 'pins and needles' sensation in hands and feet.

Arsenic can also cause skin changes, which include darkening, and wart-like or corn-like growths. These are mostly found on the palms of the hands or bottoms of the feet.

As children tend to drink more water per unit of body weight than adults, they may have more exposure to arsenic in drinking water.
As a result children may be at greater risk of illness when higher levels of arsenic are present.

Long-term (years to decades) exposure to even relatively low amounts of arsenic in drinking water can increase your risk of developing certain cancers, including:

- skin,
- lung,
- kidney, and
- bladder cancer.

The risk of cancer is the reason for developing the Canadian guideline for arsenic in drinking water.

What amount of arsenic causes health effects?

Health Canada set a Maximum Acceptable Concentration (MAC) of 10 micrograms per litre for arsenic in drinking water.

This level was set based on the ability to treat water practicably to this level. This amount is still linked with a health risk higher than the level considered to be a very minor risk. For this reason people should consider taking precautions with their drinking water even if the arsenic levels are slightly below the guideline.

For more information on *The Guidelines for Canadian Drinking Water Quality* see, http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php
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How do I know if there is arsenic in my drinking water?

Public drinking water systems are monitored regularly. In drinking water, arsenic has no odor or taste. It is detected by a chemical test. However, most private wells are not tested routinely for water quality or contaminants.

It is the well owner's responsibility to test the water for arsenic. Any well may contain arsenic or other contaminants. Private wells should be tested regularly for water quality. For more information, see HealthLink BC File #45 Should I Get My Well Water Tested?

Contact your local public health unit or public health inspector for information on the testing process in British Columbia.

What can I do if there is arsenic in my drinking water?

Water with arsenic is only a concern if it is being used for drinking or preparing food.

Exposure through breathing and skin contact is not harmful. For example, there are no known health effects from hand washing, bathing or washing clothing in water with arsenic.

If an initial test detects arsenic, even at levels below the guideline, it is important to have a second test done to confirm the results. If arsenic is present, then you can use another source for drinking water or treat the current source.

There are several treatment devices and options including reverse osmosis filters and distillation. Chlorination and mechanical filters do not remove arsenic from water. Boiling water may increase the concentration of arsenic.

There is no regulatory control over treatment devices for private homes, therefore the well owner must be careful and select the appropriate treatment device.

When purchasing a treatment device, you should consider one that has been certified by an organization accredited by the Standards Council of Canada (SCC). The treatment device should meet the following standards:

- NSF/ANSI Standard 62 on drinking water distillation systems; or
- Standard 58 on reverse osmosis drinking water treatment systems; or
- Standards 53 on drinking water treatment units – with specific designation for the water quality parameters you are trying to remove (arsenic).

Certification assures that a device works as the manufacturer or distributor claims. Find an up-to-date list of accredited organizations by visiting the Standards Council of Canada website at www.scc.ca.

For more information on drinking water and treatment options, contact your local environmental health officer.

For more information

- BC Ministry of Environment website at: www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/ground_fact_sheets/index.html
- Health Canada, It's Your Health website at: www.hc-sc.gc.ca/iyh-vsv/environ/arsenic_e.html

For more HealthLink BC File topics, visit www.HealthLinkBC.ca/healthfiles/index.stm or your local public health unit.

Click on www.HealthLinkBC.ca or call **8-1-1** for non-emergency health information and services in B.C.

For deaf and hearing-impaired assistance, call 7-1-1 in B.C.

Translation services are available in more than 130 languages on request.

BC Centre for Disease Control
AN AGENCY OF THE PROVINCIAL HEALTH SERVICES AUTHORITY

FACT SHEET

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Health Information on Arsenic

Arsenic in drinking water can have serious short and long-term health effects.

Acute Health Effects

The symptoms of acute arsenic poisoning are stomach pain, vomiting, diarrhea, muscle pain and weakness, and flushing of the skin. These effects are typically seen at arsenic concentrations above 1200-micrograms/L. However in children with high fluid intake acute poisoning has been seen with concentrations in the range of 200-micrograms/L.

Chronic Health Effects

Long-term exposure to lower concentrations of arsenic can produce a number of chronic adverse health effects. The skin can become thickened, heavily pigmented, or develop multiple wart-like lesions. Blood vessels in the extremities can be damaged, affecting the blood supply to the feet and hands. Chronic exposure to arsenic can also be a cause of high blood pressure.

However of most concern is the fact that arsenic is a known cause of cancer. Chronic exposure to arsenic in the drinking water (over the course of a lifetime) can lead to several types of skin cancer, and cancers of the lung, liver and bladder.

It is the ability to cause cancer that is the critical health effect used in deciding the standards for arsenic in drinking water.

What are the Current Drinking Water Standards?

The Guidelines for Canadian Drinking Water Quality published by Health Canada set a Maximum Acceptable Concentration (MAC) of 0.010 mg/L (10 micrograms/L).

This MAC is based on the ability of municipal treatment facilities and residential water treatment devices to reduce arsenic concentrations to 0.010 mg/L or less. It is set at a level that is higher than would be associated with an "essentially negligible" risk of lung, bladder and liver cancers (1 new case per 100,000 people).

At 0.005 mg/L the estimated lifetime additional risk of these cancers is 2 – 20 cases per 100,000 people exposed. These are cancer cases over and above the cases due to other causes that would occur in the population anyway.

At 0.010 mg/L the additional risk of these internal organ cancers is 3 – 39 cases per 100,000 people exposed.

It is only at concentrations of arsenic of 0.0003 mg/L or less that the risk could be considered "essentially negligible".

The risks associated with consumption of water containing arsenic are the same for everyone. Groups such as children and pregnant women are not at any greater risk of developing health problems from exposure to arsenic than the general population.

Conclusions

1. Arsenic is a human carcinogen, which means that exposure to any level in drinking water may increase the risk of cancer.
2. At low concentrations of arsenic the increased risk of lung, bladder, liver and skin cancer is small when compared to the number of cases that occur in populations that are not exposed to arsenic.
3. Lowering the concentration of arsenic in your drinking water will lower your lifetime risk of developing lung, bladder, liver and skin cancer.
4. However at low arsenic concentrations the treatment costs may be large for a small reduction in risk.

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June 2006; Reformatted October 2009

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Sample Notice

WATER QUALITY ADVISORY NOTICE

Issued *(Insert Date)*

Arsenic Contamination

WATER SUPPLY SYSTEM COVERED BY THIS ADVISORY

This Water Quality Advisory applies to the following water supply system: ***[DESCRIPTION OF SYSTEM]***

REASON FOR THIS ADVISORY

This Advisory is being issued because:

Include: A description of the drinking water threat that occurred, including the potential health effects

The *(insert name of water system)* contains elevated levels of arsenic according to a sample results dated *(insert date)*. The level of arsenic detected in the delivered water supply was *(insert level in µg/L)* The Guidelines for Canadian Drinking Water Quality recommends that there should be no more than 10 micrograms per litre (µg/L) or 10 parts per billion (ppb) of arsenic in drinking water.

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust and is present in trace amounts in all living matter.

Short to medium term (days to weeks) exposure to high levels of arsenic (100 µg/L or greater) in drinking water can lead to arsenic poisoning.

Symptoms of arsenic poisoning include stomach pain, vomiting, diarrhea, and impaired nerve function, which may result in 'pins and needles' sensation in hands and feet. Arsenic can also cause skin changes, which include darkening, and wart-like or corn-like growths. These are mostly found on the palms of the hands or bottoms of the feet.

As children tend to drink more water per unit of body weight than adults, they may have more exposure to arsenic in drinking water. As a result children may be at greater risk of illness from elevated levels of arsenic in drinking water.

Considering that arsenic is a carcinogen, drinking water that contains arsenic over a lifetime (approximately 70 years) may increases the risk of developing certain cancers, including:

- skin,
- lung,
- kidney, and
- bladder cancer.

The risk of cancer is the reason for developing the Canadian guideline for arsenic in drinking water.

Exposure through inhalation and skin contact with low levels of arsenic from drinking water is not considered to be a significant health hazard. For example, there are no known health effects from hand washing, bathing or washing clothing in water with arsenic.

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- **What the water system is doing to correct the problem**

Insert information as to the corrective action that the water supplier is taking.

RECOMMENDATIONS

If arsenic levels are at 100 µg/L or greater:

- **Do not consume this water. Short term use for weeks or even days can cause arsenic poisoning.**
- Boiling, freezing, or letting water stand does not reduce the arsenic level.
- Most household filtration units will not remove arsenic. Check with the manufacturer.
- If you develop any symptoms of arsenic poisoning, contact your physician.

If arsenic levels are above 10 µg/L but less than 100 µg/L:

- **Please note that the current level of arsenic in your water supply is not expected to pose a significant risk to health provided that you do not consume it for an extended period of time, such as longer than a year.**

US Department of Health, Agency for Toxic Substances and Disease Registry (ATSDR) defines acute-short-term, intermediate, and chronic exposure durations as 1-14 days, 15-364 days, and >364 days, respectively.

- Users may choose to use an alternate source of drinking water (i.e. commercially bottled water).
- Boiling, freezing, or letting water stand does not reduce the arsenic level.
- Most household filtration units will not remove arsenic. Check with the manufacturer.

DURATION OF THIS ADVISORY

This Advisory remains in effect unless and until another public notice is issued advising you that the Advisory has been amended or rescinded.

QUESTIONS

If you have any questions concerning this advisory, please contact:

_____, Owner or Operator of the water supply system at ***[TELEPHONE]***

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Sample Notice

DO NOT CONSUME ADVISORY

Issued *(Insert Date)*

Drinking Water Contaminated with high levels of Arsenic

WATER SUPPLY SYSTEM COVERED BY THIS ADVISORY

This Do Not Consume Advisory applies to the following water supply system: ***[DESCRIPTION OF SYSTEM]***

REASON FOR THIS ADVISORY

This Advisory is being issued because:

Include: A description of the drinking water threat that occurred, including the potential health effects

The *(insert name of water system)* contains levels of arsenic that are above 200 ug/L according to a sample results dated *(insert date)*. Consuming water containing these levels of arsenic for as little as days to weeks, can cause health problems. The level of arsenic detected in the delivered water supply was *(insert level in µg/L)* The Guidelines for Canadian Drinking Water Quality recommends that there should be no more than 10 micrograms per litre (µg/L) or 10 parts per billion (ppb) of arsenic in drinking water.

Short to medium term (days to weeks) exposure to high levels of arsenic in drinking water can lead to arsenic poisoning.

Symptoms of arsenic poisoning include stomach pain, vomiting, diarrhea, and impaired nerve function, which may result in 'pins and needles' sensation in hands and feet. Arsenic can also cause skin changes, which include darkening, and wart-like or corn-like growths. These are mostly found on the palms of the hands or bottoms of the feet.

As children tend to drink more water per unit of body weight than adults, they may have more exposure to arsenic in drinking water. As a result children may be at greater risk of illness from elevated levels of arsenic in drinking water.

Exposure through inhalation and skin contact with low levels of arsenic from drinking water is not considered to be a significant health hazard. For example, there are no known health effects from hand washing, bathing or washing clothing in water with arsenic.

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust and is present in trace amounts in all living matter.

- **What the water system is doing to correct the problem**

Insert information as to the corrective action that the water supplier is taking.

RECOMMENDATIONS

- **Do not consume this water. Short term use for weeks or even days can cause arsenic poisoning.**
- Boiling, freezing, or letting water stand does not reduce the arsenic level.
- Most household filtration units will not remove arsenic. Check with the manufacturer.
- If you develop any symptoms of arsenic poisoning, contact your physician.

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