

23) Does monochloramine cause cancer?

EPA believes that water disinfected with monochloramine that meets regulatory standards poses no known or anticipated adverse health effects, including cancer.

Most of the research on the cancer risk of monochloramine comes from animal studies using mice and rats.¹ **SO DO THE STUDIES ON CHLORINE – THEY USED THE SAME PROTOCOL. In fact, the Drinking Water Criteria Document for Chloramine, published in 1994 which EPA authored and continues to cite for justification for using chloramines was based upon studies of rats and mice.**

EPA believes that available data support the use of monochloramine to protect public health. **Only in terms of reducing chlorine byproducts, where is the data on the safety of chloramine byproducts?**

EPA's regulatory standard for chloramines provides a wide margin of safety² to offset any uncertainties in risk assessments. **These are speaking of standards for the compound chloramines not the byproducts of NDMA, hydrazine, iodo acids or DXAA.**

Monochloramine use may reduce bladder cancer risk compared to chlorine use.

Several studies have shown lower rates of bladder cancer in communities served by systems that use monochloramine as a secondary disinfectant compared to systems that use chlorine.¹

Compared to chlorine, water treated with monochloramine may contain higher concentrations of *unregulated* disinfection byproducts but the cancer risk is unknown.³

EPA continues to support research³ on the safety of monochloramine use. **EPA sponsored studies have reported highly toxic byproducts associated with monochloramine that have been found to be genotoxic, cytotoxic and carcinogenic. EPA has classified two of these byproducts (NDMA and Hydrazine) to be ‘probable human carcinogens’.** EPA and WHO studies have determined that monochloramine is the least effective alternative for bacteria and virus deactivation.

Monochloramine use produces lower levels of regulated disinfection byproducts that are linked to cancer.

Regulated disinfection byproducts are produced in lower amounts when monochloramine is used.

Regulated disinfection byproducts serve as indicators⁴ of other types of byproducts that may also be reduced as a result of using monochloramine.

Compared to chlorine, water treated with monochloramine may contain higher concentrations of *unregulated* disinfection byproducts.³

Additional Supporting Information:

3. EPA is currently researching *unregulated* disinfectant byproducts that can form from monochloramine use. Compared to chlorine, water treated with monochloramine may contain different *unregulated* disinfection byproducts than chlorinated water. **There are few studies on health effects of unregulated disinfection byproducts. However, additional information on NDMA, an unregulated byproduct, can be found at: <http://www.epa.gov/tio/download/contaminantfocus/epa542f07006.pdf>.** Also see question 9 and 19. **This page does not load.**

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25) Do chloramines cause breathing problems?

EPA believes that water disinfected with monochloramine that meets regulatory standards has no known or anticipated adverse health effects, including breathing problems.

Monochloramine does not enter the air easily and therefore would be difficult to inhale. This statement completely ignores the fact that monochloramine speciates into di and tri chloramines with the slightest change in pH and temperature. PAWC chemist stated that all chloraminated water contains all three species of chloramines. It is widely known that tri-chloramine is the culprit for respiratory irritation. Tri chloramines is created when chloraminated water is heated and vaporized as in heated pools or showers.

CDC's investigation¹ of reports of monochloramine-related breathing problems associated with drinking water use was unable to draw any conclusions about monochloramine use and health effects. See above

Breathing problems associated with trichloramine and indoor swimming pools have been reported.² In a study by Dr. Richard Bull to determine dermal affects of chloramines on mice, Dr. Bull emerged mice in chloraminated water. One hundred percent of his test mice died from inhalation of chloramines before he could complete his testing. Special harnesses had to be made for the mice in order to conduct the dermal study. Dr. Bull indicated that no such problem occurred with chlorinated water.

Trichloramine³, a chemical related to monochloramine and often found in swimming pools, has been linked to breathing problems.

Trichloramine forms in swimming pools when chlorine reacts with ammonia from bodily fluids.

Breathing problems traceable to disinfected water are typically related to swimming pool use.⁴

EPA continues to review research related to the use of disinfectants used in swimming pools. The findings in this area are unanimous. Dr. David Reckhow indicates that the respiratory issues associated with swimming pool chloramines is analogous to chloraminated drinking water that is heated or where pH is similar to that of swimming pool conditions. Where are the studies in progress???

People who believe their breathing problems are related to monochloramine should consult with their doctors.

The causes of breathing problems are often difficult to determine.

People who have breathing problems should inform their doctors if they have spent time in or around a swimming pool recently.

CDC's investigation¹ of reports of monochloramine-related breathing problems associated with drinking water use was unable to draw any conclusions about monochloramine and health effects. This is how they keep changing the subject of the discussion. They acknowledge that tri-chloramine is caused by ammonia and chlorine and a respiratory problem in swimming pools. Connecting the dots – tri-chloramine is a respiratory irritant...tri-chloramine is created with temperature and pH change in monochloramine.... Trichloramine is created in showers, spas, dishwasher vapor, etc.Yet they say MONO chloramines does not pose

breathing related problems. this is not rocket science it is simple logic..it is not the mono chloramines – it is the TRI chloramines...but the trichloramine is an unintended and unavoidable result of monochloramine use in a treatment system...and, by their own admission, has not been studied by EPA.

Additional Supporting Information:

1. CDC and EPA conducted a preliminary investigation of reports of monochloramine-related respiratory problems associated with drinking water. The investigation consisted of a questionnaire filled out by complainants. The information collected could be used to help design future epidemiologic studies.

CDC's trip report can be found at:

http://healthvermont.gov/enviro/water/documents/CDC_Chloramines_report_011608.pdf.

2. Reported breathing problems due to chloramines are primarily related to inhalation of household chemicals (mixing ammonia and bleach cleaning products), indoor swimming pool air, or industrial exposure. See question 1 for further information about different types of chloramines.

3. Trichloramine formation does not usually occur under normal drinking water treatment conditions. However, if the pH is lowered below 4.4 or the chlorine to ammonia-nitrogen ratio becomes greater than 7.6:1, then trichloramine can form. Trichloramine formation can occur at a pH between 7 and 8 if the chloramine to ammonia-nitrogen ratio is increased to 15:1. Source: *Optimizing Chloramine Treatment*, 2nd Edition, AwwaRF, 2004. **It may not occur in the treatment process but it does occur in the water use. They will only talk about the conditions of treatment and the water quality as it leaves the plant.....not the end point use.**

4. Improper pool maintenance can often lead to trichloramine formation: Some examples include: www.cdc.gov/niosh/hhe/reports/pdfs/2007-0163-3062.pdf and www.cdc.gov/mmwr/PDF/wk/mm5636.pdf.

27) Does monochloramine use change water chemistry? Does monochloramine use contribute to the release of lead or other contaminants into drinking water?

Water chemistry¹ can be changed by many factors, including the use of monochloramine.

Water chemistry can be changed by many factors including temperature, rainfall, the presence of natural organic matter², and monochloramine use.

Changes in water chemistry from monochloramine use may impact lead or other contaminant levels.³

Changes in water chemistry from monochloramine use can also impact biofilm activity as well as nitrite and nitrate formation.⁴

Water utilities typically monitor for problems caused by changes in water chemistry from monochloramine use.

Water utilities should monitor for changes in water chemistry at water treatment facilities.

Utilities should monitor for lead and other regulated contaminants from metal corrosion that may be caused by monochloramine use.³

Water utilities using monochloramine should monitor and control for biofilm activity as well as nitrite and nitrate formation.⁴

Water utilities may need to adjust their treatment processes for problems caused by changes in water chemistry from monochloramine use.

Water utilities may need to adjust their treatment processes to reduce levels of lead or other regulated contaminants to meet EPA regulations.

Water utilities may need to adjust their treatment processes to reduce biofilm activity, including nitrite and nitrate formation.⁴

EPA provides guidance for water utilities on problems that can arise from changes in water chemistry from monochloramine use.⁵

Additional Supporting Information:

1. Water chemistry describes the chemical properties of water such as pH, hardness, and alkalinity. Changes in water chemistry can cause subsequent changes to the physical (e.g., taste and odor) and biological (e.g., biofilm formation and nitrification) properties of water.
2. **Natural Organic Matter:** Complex organic compounds that are formed from decomposing plant, animal and microbial material in soil and water. They can react with disinfectants to form disinfection by products. Total organic carbon (TOC) is often measured as an indicator of natural organic matter.
3. Changes in water chemistry can make water more corrosive, which may lead to pipe corrosion (in the distribution system and home plumbing) and an increase in the release of lead or other contaminants into the water. However, utilities can test water for corrosiveness and make changes to the water treatment process to address this problem. See monitoring guidance at http://www.epa.gov/OGWDW/lcrr/pdfs/guidance_lcrr_pws_monitoring.pdf. (Also see question 18 and footnote 5 below).
4. The addition of ammonia that is added to the water to make monochloramine, or which naturally occurs in some waters, impacts water chemistry. Ammonia can be converted by naturally occurring bacteria through a process called nitrification to form nitrites and nitrates. **EPA regulates these contaminants at the treatment plant.** For more information about nitrification see: http://www.epa.gov/safewater/disinfection/tcr/pdfs/whitepaper_tcr_nitrification.pdf For more information about biofilms see question 2 or: www.epa.gov/safewater/disinfection/tcr/pdfs/whitepaper_tcr_biofilms.pdf. Nitrate/nitrite, biofilm and lead/ corrosion control are discussed in EPA's simultaneous compliance manual at: http://www.epa.gov/OGWDW/disinfection/stage2/pdfs/guide_st2_pws_simultaneous-compliance.pdf. **High levels of nitrates/nitrites can be especially harmful to infants; additional health effect information can be found at:** http://www.epa.gov/ogwdw/contaminants/dw_contamfs/nitrates.html.

What are nitrate's health effects?

Infants below six months who drink water containing nitrate in excess of the maximum contaminant level (MCL) could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.

18) What does EPA see as the disadvantages of using monochloramine?

Water utilities work with local and state regulatory agencies to determine if monochloramine is appropriate for their utility.

The appropriateness of monochloramine use varies with water types and among water utilities.¹ **Water utilities are using chloramines across the board with no concern for need or appropriateness to the system.**

The appropriateness of monochloramine use varies with the amount of organic matter in the source water, temperature, rainfall, distance from the treatment plant, and other factors. **Yet companies like PAWC intend use of chloramines across their systems regardless of water types, source water, temperature, etc.**

EPA guidance is available to help states and water utilities make informed decisions as to whether monochloramine use is appropriate.²

Gaps in research on how monochloramine affects water should be filled.

There are few studies on how monochloramine affects human health.

There are few studies on the disinfection byproducts that form when monochloramine reacts with natural organic matter in water.

Compared to chlorine, water treated with monochloramine may contain higher concentrations of some unregulated disinfection byproducts.¹

Utilities using monochloramine should monitor water quality for problems that may arise related to monochloramine use.

Utilities using monochloramine should monitor for lead and other regulated contaminants from metal corrosion that may be caused by monochloramine use.² **Yet EPA only requires lead testing every 3-4 years. Testing is only required in hand picked homes, not randomly selected, worst case or in school.**

Water utilities that add substances to control for metal corrosion must comply with all relevant regulations related to these substances.

Water utilities using monochloramine should monitor and control for biofilm activity as well as nitrite and nitrate formation.³

Additional Supporting Information:

1. Use of monochloramine with source waters with high bromide, high iodide or high total organic matter may lead to bromo-, iodo-, and nitrosamine disinfection byproduct formation, which are unregulated disinfection byproducts. EPA scientists are currently studying the unregulated disinfection byproducts that form in water treated with monochloramine. **If it is still being studied why are they allowing its widespread use? Are we the canaries in the mine? The preliminary studies are showing highly toxic byproducts.** See Question 7 for additional information about disinfection byproducts.

2. The addition of monochloramine can make water more corrosive, which may lead to pipe corrosion and increased levels of lead or other contaminants in the water. However, utilities can test water for corrosiveness and make changes to the water treatment process to address this problem. EPA requires that systems monitor lead and copper levels in the distribution system under the Lead and Copper Rule. **Monitoring is only required every 3 years! That is 3 years of a child's development. Doctors agree that there is NO safe level of lead for children. Schools are not required to be tested.** Monitoring for other water quality issues are discussed in guidance manuals. Guidance manuals are available at: <http://www.epa.gov/safewater/disinfection/stage2/compliance.html>. Hard copies are available by ordering publications through EPA's Water Resource Center (phone: 202-566-1729). EPA's

simultaneous compliance manual can be found at:

http://www.epa.gov/OGWDW/disinfection/stage2/pdfs/guide_st2_pws_simultaneous-compliance.pdf.

3. See questions 2 and 27 for more information on contaminant release, biofilms, and nitrification. High levels of nitrates/nitrites can be especially harmful to infants; additional health effect information can be found at:

http://www.epa.gov/ogwdw/contaminants/dw_contamfs/nitrates.html.

19) What is EPA's current focus regarding chloramines research¹? What other ongoing research is EPA aware of?

The current focus of EPA chloramines research is on determining disinfectant effectiveness, the effects of disinfection, and disinfection byproduct formation.¹

Evaluating the effectiveness of disinfectants, including monochloramine, is a focus for EPA's chloramines research.² **The verdict is already in...there are NO studies that indicate that chloramines is an effective biocide..every study and the WHO Guidelines indicate that chloramines is the LEAST effect biocide of the options available. What studies are in progress? Why aren't the studies that have been completed persuasive to EPA???**

Research is targeted at understanding the various effects that may be caused by disinfectant use, such as byproduct formation.³ WHY are we using it if we don't yet understand it???

EPA supports research on evaluating potential treatment technologies that can reduce effects sometimes caused by disinfectant use.

Results from past and ongoing research indicate monochloramine use at regulated levels can be a safe means for disinfecting drinking water.

Several large cities such as Denver and Philadelphia have used monochloramine successfully as part of their water treatment process for decades. **What does that mean "successfully"...that it functions? That it reduces chlorine byproducts? That does not mean it is safe or that the byproducts are safe or that people aren't suffering illness connected with it but are unaware of the connection to the water. This statement means nothing but that these two places have chloramines systems in use. As for Denver, they use much less chloramines than PAWC plans to use in PA and their system is probably 4 times as large.**

Research shows that monochloramine produces fewer potentially harmful **regulated** disinfection byproducts than chlorine.⁴

EPA reviews and considers new research results as they become available.⁵ **then why isn't EPA acting on the studies they have been reviewing? Can EPA point to even one study that disputes the findings of the studies we have supplied?**

Many organizations support research on the safety of monochloramine use.

Academic institutions and water industry groups conduct research on monochloramine use.⁶

CDC has investigated community concerns related to monochloramine use.⁷**Their investigation was limited to monochloramine considerations, not byproducts or speciation. CDC and EPA both 'investigated' the DC lead issues and declared that there was no health risk. A conclusion that resulted in exposing thousands of children to high levels of lead and permanent brain damage.**

EPA continues to work with other organizations on research related to the safe use of monochloramine. **What is missing here is the results of those studies. We have over 50 peer reviewed studies, some authored by EPA's own scientists, others funded by EPA and/or AWWA, published in AWWA and American Chemistry Society Journals, ALL concluding that chloramines is a mistake. Where are their studies? What are the titles? Where are the conclusions that chloramines**

byproducts and unintended consequences are safe? In two years of asking we have yet to see one.

Additional Supporting Information:

1. More information on the EPA Drinking Water Research Program can be found at <http://www.epa.gov/ord/npd/dwresearch-intro.htm>.
2. Research includes studying the effectiveness of chloramines at controlling potentially harmful organisms under different source water and treatment options. **The WHO has concluded as has most of the scientific community that chloramines is LESS effective in killing ecoli , rotoviruses and polio 1 . They state that there are studies but fail to state the conclusions.** See question 3 for more information on potentially harmful organisms.
3. Efforts include improving the understanding of the various effects that may be caused by the use of disinfectant(s) or mixed disinfectants on water properties, such as the formation of disinfection byproducts, the release of contaminants, including lead into water, and biofilm activity, including nitrification. See question 27 for additional information on contaminant release, biofilms, and nitrification.
4. Compared to chlorine, water treated with monochloramine may contain different *unregulated* disinfection byproducts than chlorinated water. There are few studies on health effects of unregulated disinfection byproducts. For example, TTHMs and HAAs (see question 6 for more information) typically occur at higher levels than other known and known but unidentified disinfection byproducts. The presence of TTHMs and HAA5 is representative of the occurrence of many other chlorinated disinfection byproducts; thus, a reduction in TTHMs and HAA5 generally indicates a reduction of other types of disinfectant byproducts. Information on one unregulated byproduct associated with chloramination, NDMA, can be found at <http://www.epa.gov/tio/download/contaminantfocus/epa542f07006.pdf>. Also, see question 9 and 23.
5. See the Contaminant Candidate List online at <http://www.epa.gov/OGWDW/ccl/ccl3.html> for contaminants EPA proposes to review. **EPA scientists review regulations of disinfection byproducts every six years.** (<http://epa.gov/safewater/review.html>). EPA is currently monitoring for several unregulated disinfectant byproducts (NDEA, NDMA, NDPA, NPYR). More information can be found at <http://www.epa.gov/safewater/ucmr/index.html>.
6. The Water Research Foundation (WRF) is an example of a group that conducts water industry research. **And is the source for many of the studies that warn against chloramines use**
7. A federal partner of EPA is the Center for Disease Control and Prevention (CDC). The CDC Chloramines Vermont Trip Report can be found at http://healthvermont.gov/enviro/water/documents/CDC_Chloramines_report_011608.pdf.

2) How long has monochloramine been used as a drinking water disinfectant? How is monochloramine typically used? How many people/water utilities use monochloramine?

Monochloramine has been used as a drinking water disinfectant for more than 90 years.¹ Not completely true...history of chloramines use shows 16% use nationally in 1938. During WWII the use of ammonia was prohibited as it was needed for the war effort and chloramine use declined dramatically. After the war only 6% of water companies were using chloramines through to 1959. In the 1960's the number dropped to a mere 3%. In 1978 EPA imposed a ban on the use of chloramines due to chloramine's lack of biocidal efficiency. The ban was lifted in 1979. The spike in usage has come since the 1980's after EPA passed Stage 1 and 2 regulations which water companies are interpreting as a requirement to use chloramines.

Monochloramine has been shown to be an effective disinfectant based on decades of use in the U.S., Canada, and Great Britain. **The EPA fails to acknowledge that Germany has banned the use of chloramines in drinking water for the past 30 years, France refuses to use it, the majority of Europe does NOT use chloramines. Canada EPA has declared it a hazardous substance following massive fish kills resulting from main breaks in chloraminated areas, citizen opposition in England is mounting as well.**

Monochloramine is typically used along with chlorine as part of the drinking water treatment process.

Monochloramine helps protect people from waterborne diseases.² **Not true...the scientific community is unanimous in their determination that chloramines is the LEAST effective biocide available. Pennelias County in Florida ceased using chloramines after e-coli cultures increased after their change to chloramines. Ineffectiveness as a biocide was the reason Germany banned it and France does not use it. The WHO warns against the use of an ineffective biocide in an attempt to reduce questionable byproduct toxicity.**

Monochloramine is most often used to maintain water quality in the pipes.³

Monochloramine provides long-lasting protection of water quality.

Monochloramine is effective as a disinfectant because it does not dissipate quickly. **Not true, while it may last longer in the system, it is not effectively killing bacteria and viruses.**

Monochloramine helps lower levels of **potentially** harmful **regulated** disinfection byproducts compared to chlorine. **While this is a true statement it is only half of the story...while monochloramine does reduce the byproducts formed by chlorine, it CREATES a new family of byproducts that are far more toxic than those of chlorine. Recent studies have called into question the findings that lead EPA to regulate the byproducts of chlorine and state that the new DBPs may be as much as 100-10,000 times more toxic than THHMs and considerably more toxic than the HAAs.**

More than one in five Americans use drinking water treated with monochloramine.

1 in 5 is only 20%...that means that 80% of the population is using something else. In a field that values statistics so highly, certainly 20% is not a statistically

substantial number. What are the 80% using that appears to be successfully cleaning the water without adding more toxic, little studied chemicals?

Monochloramine use has increased in recent years due in part to new drinking water regulations developed to limit certain disinfection byproducts.

New drinking water regulations limit the concentration of potentially harmful disinfection byproducts that may occur in drinking water. [See response above](#)

Several large cities such as Denver and Philadelphia have been using monochloramine as part of their treatment process for decades. **Denver uses far less monochloramine (.13 to 1.90ppb) than most facilities are implementing in the past several years and is a larger system (1.3 million people 300 square miles). No surveys or testing has been done in Denver or Philadelphia re: acute or long term health effects. In fact, Philadelphia's website includes questions from consumers that believe their water is making them sick. The water company's response is that the water is not causing their illness. Others write in and comment on black and grey particles in their water, again, the water company claims it is not the water. Of course there will not be recorded complaints of health or infrastructure problems if the people taking the reports unilaterally and finally conclude that the water is not the problem without any benefit of testing or analysis.**

3. Drinking water is typically treated before it is passed through the pipes, however, water is not sterile and can contain low levels of microorganisms that survive through treatment and distribution. Microbes can grow on pipe surfaces forming a thin biofilm layer. These microbes, while typically not harmful, can contribute to various problems, including (1) the release of coliform bacteria into the water, (2) increased disinfectant demand, (3) aesthetic water quality problems (e.g., unpleasant taste or odor), and (4) pipe corrosion or nitrification reactions and the resulting release of contaminants such as nitrite, nitrate, and lead into the water. See question 27 for more information on contaminant release, biofilms, and nitrification. In some cases, biofilms have been known to harbor pathogens that cause disease, especially in severely immunocompromised persons. See *Drinking Water Distribution Systems – Assessing and Reducing Risks*—chapters 6 and 7, http://www.nap.edu/catalog.php?record_id=11728#toc. Also see EPA's Biofilm White Paper: http://epa.gov/SAFEWATER/disinfection/tcr/pdfs/whitepaper_tcr_biofilms.pdf.

4) What disinfectants are available for drinking water?

Most water utilities use chlorine as a primary disinfectant because of its effectiveness in killing potentially harmful organisms.²

Chlorine is effective in killing bacteria, viruses, and other potentially harmful organisms in water.

One disadvantage of chlorine is it can react with natural organic matter³ present in water to form potentially harmful disinfection byproducts.

Water utilities sometimes use chlorine several times during treatment because the initial dose loses its effectiveness over time.

Monochloramine is commonly used as a secondary disinfectant to protect the water as it travels from the treatment plant to consumers. It is not commonly used at all...most of Europe does NOT use it, only 20% of the US uses it and many of them use it seasonally or in small amounts compared to what some water companies are using and planning to use, in particular, American Water.

Monochloramine is effective in killing bacteria, viruses, and other potentially harmful organisms but takes much longer to act than chlorine. **It is NOT effective according to WHO and a multitude of studies not only because of the extensive contact time required but also because e-coli is resistant to it and it cannot penetrate lipids.**

One disadvantage of monochloramine is it can react with natural organic matter present in water to form potentially harmful disinfection byproducts. This is precisely the wording EPA uses to explain why the byproducts of chlorine are regulated and the need for alternative disinfection. The disinfection byproducts of chloramines are not 'potentially' harmful, they are classified by the EPA as PROBABLE human carcinogens. Scientists sponsored by the EPA have declared them to be genotoxic, cytotoxic and carcinogenic.

Monochloramine is more chemically stable than chlorine, which makes it longer lasting and an effective secondary disinfectant. **It may make it longer lasting but it is not an effective disinfectant.**

3) Why is drinking water disinfected? What is the difference between primary and secondary disinfection? How is monochloramine used in a treatment plant?

Drinking water is disinfected to protect public health.¹

Prior to the widespread use of disinfectants, many people became ill or died because of contaminated water.²

Disinfection reduces or eliminates illnesses acquired through drinking water.

EPA and CDC believe the benefits of drinking water disinfection outweigh the potential risks from disinfection byproducts. Then why would EPA allow the use of a disinfectant that is LESS effective in killing water borne bacteria and viruses to counter a 'potential' for toxic byproducts of chlorine? Chloramine represents a LESS effective biocide with higher toxicity of byproducts giving us the worst of both worlds.

9) How do the kinds and concentrations of disinfection byproducts formed by monochloramine compare to those formed by chlorine?

Water treated with chlorine and monochloramine contains different types and concentrations of disinfection byproducts.

Compared to chlorine, water treated with monochloramine contains fewer regulated disinfection byproducts that have been linked to human health problems. **But it creates as many unregulated disinfection byproducts that are more toxic.**

The formation of disinfection byproducts is influenced by source water type and the type of disinfectant used. **NDMA is formed from exposure of the chloramines to nitrogenous material which exists in every pipeline regardless of water source or type.**

Formation can vary daily with the amount of natural organic matter in the water, temperature, rainfall, and distance from the treatment plant or other factors influencing water chemistry. ¹

Compared to chlorine, water treated with monochloramine contains lower concentrations of regulated disinfection byproducts.²

Compared to water treated with chlorine, water treated with monochloramine contains lower concentrations of the two major types of regulated disinfection byproducts.²

Compared to water treated with chlorine, water treated with monochloramine contains lower concentrations of regulated disinfection byproducts linked to bladder cancer.

Regardless of the disinfectant used, the types and concentrations of disinfection byproducts vary from each utility and also from day to day.

Compared to water treated with chlorine, water treated with monochloramine may contain higher concentrations of unregulated disinfection byproducts. ³

EPA scientists are currently studying the unregulated disinfection byproducts³ that form in water treated with monochloramine.

Compared to water treated with chlorine, water treated with monochloramine may contain different unregulated disinfection byproducts than chlorinated water.

EPA and other organizations continue to conduct research on unregulated disinfection byproducts.³ **Then why is EPA permitting the use of this chemical in water systems across the country?**

Additional Supporting Information:

1. Water chemistry describes the chemical properties of water such as pH, hardness, and alkalinity. Changes in water chemistry can cause subsequent changes to the physical (e.g., taste and odor) and biological (e.g., biofilm formation and nitrification) properties of water.

2. TTHM and HAA5 are the regulated disinfection byproduct groups that form at lower concentrations with monochloramine. See question 7 for more information about TTHM and HAA5.

3. Examples of these unregulated disinfection byproducts include nitrosamines (including nitrosodimethylamine, NDMA), iodo-trihalomethanes, and iodo-acids. See question 7 for additional detail on disinfection byproducts. Specific information on NDMA can be found at <http://www.epa.gov/tio/download/contaminantfocus/epa542f07006.pdf>. See question 19 for additional information on disinfection byproduct research.

11) Other than chlorine and monochloramine, what options could water utilities consider to control the levels of disinfection byproducts?

Water utilities have several options for reducing disinfection byproducts other than chlorine and monochloramine.¹

One option for reducing disinfection byproducts is to reduce the amount of time water spends in pipes.²

Another option for reducing disinfection byproducts is to use ozone or ultraviolet (UV) light.³

A third option for reducing disinfection byproducts is improving filtration to reduce natural organic matter in water that react with disinfectants to form byproducts.⁴

14) How did EPA evaluate the safety of monochloramine for use as a drinking water disinfectant?

EPA evaluated monochloramine primarily through an analysis of human health and animal data.

Research reviewed in EPA's safety analysis is contained in EPA's *Drinking Water Criteria Document for Chloramines*.¹ This paper, published in 1994, includes rat and mice studies discounted by EPA with regard to the studies indicating Chloramine is highly toxic. The study indicated lower body weights and smaller organ weights in the kidneys, liver, brain but discounted the finding because the mice and rats stopped drinking the water because it was not palatable. The last line in the paper states, "This value should be viewed cautiously since the data in this study were not verified."

The criteria document for monochloramine provides a complete summary of health and other data considered in establishing a monochloramine standard. **The paper was written in 1994, 15 years ago and before most of the studies we have provided indicating the dangers of chloramines.**

EPA **periodically** updates the monochloramine "criteria document." **15 years and counting!**

15) Why does EPA believe that sufficient research has been conducted to approve the use of monochloramine as a drinking water disinfectant?

EPA uses risk assessment methods to evaluate the safety of drinking water disinfectants.

EPA's *Drinking Water Criteria Document for Chloramines*¹ provides the detailed risk assessment process followed in setting the standard for monochloramine.²

EPA's risk assessment process included a review of available research and historical data.

EPA's risk assessment process focused on health outcomes that scientists considered most critical. **When the document cited above was written (1994) most of the current knowledge of chloramines was unknown.**

EPA's regulations account for uncertainties in the risk assessment by applying uncertainty factors.³

Risk assessments of monochloramine contain substantial uncertainties regarding potentially harmful disinfection byproducts. **They are not as uncertain now as they may have been in 1994. There are NO studies indicating that chloramines and its byproducts are safe.**

Federal laws require EPA to act to protect human health even when there is incomplete information⁴. **THEN ACT!**

Regulators must weigh the public health benefits of disinfection against the risks of the harmful disinfection byproducts⁵.

Research and experience indicate that monochloramine is safe at levels that are typically used to treat drinking water.

Research indicates that monochloramine produces lower levels of regulated disinfection byproducts that may be harmful.

Monochloramine use may reduce the potential cancer risk from chlorinated byproducts.

EPA continues to encourage research⁶ on the safety of monochloramine as a drinking water disinfectant.

17) What does EPA see as the advantages of using monochloramine?

Switching to monochloramine is one approach that utilities can use to meet new EPA drinking water regulations. ¹

Water utilities are required to comply with EPA's new drinking water regulations to control disinfection byproducts.

Water utilities are assessing whether to switch to monochloramine use as a way to meet new EPA drinking water regulations.

To meet the new EPA regulations, a subset of utilities has decided to use monochloramine as a secondary disinfectant.² Perhaps these utilities are not properly trained in the area of assessing whether they need to change their process to meet EPA 2012 regs, because it appears that they are adding it in areas where it is not needed.

Water treated with monochloramine contains reduced levels of regulated disinfection byproducts compared to water treated with chlorine. ³

Monochloramine produces lower concentrations of *regulated* disinfection byproducts because it is less reactive than chlorine with natural organic matter.⁴

The formation of disinfection byproducts is influenced by source water type and the type of disinfection used.

The formation of disinfection byproducts can vary daily with the amount of natural organic matter in the water, temperature, rainfall, distance from the treatment plant, and other factors.

Monochloramine is a practical and effective secondary disinfectant.

The use of monochloramine is often more affordable and requires less new equipment than other alternatives², especially if a water utility is already using chlorine.

Monochloramine helps protect drinking water quality as it moves through pipes.

Several large cities such as Denver and Philadelphia have used monochloram

20) Is it safe to drink and cook with chloraminated water? Chloraminated water that meets EPA regulatory standards is safe to use for drinking and cooking.

□ The proposed Stage 1 Disinfectant and Disinfection Byproduct Rule (DBPR) provides the detailed risk assessment process followed in setting the standard for monochloramine.¹ **The information is now outdated and replaced by unanimous scientific studies indicating that it creates a significant risk of acute and long term health problems.**

□ Health authorities recognize that some people may have chemical sensitivities and some people may have a chemical sensitivity to monochloramine.² **Water is life sustaining and delivered by monopolies across the US. One who is allergic to cosmetics can simply not wear them. One who is allergic to food can simply eat something else. When one is allergic or sensitive to their water they cannot bathe, shower, wash their clothes, cook, eat or drink with it. One cannot function with normal minimal daily activity. The FDA has now permitted levels of residual chlorine and chloramines in bottled water. How is a person to live without water? Where is a person to move to get away from this toxin?**

□ People who have health concerns about monochloramine use should consult their physicians. **The doctors, for the most part, are unaware that chloramines is in the water and certainly not aware of the potential acute and long term health effects, largely because the health departments and EPA refuse to acknowledge them.**

EPA regulations limit chloramines³ to levels where no adverse health effects are anticipated.¹

□ The proposed Stage 1 Disinfectant and Disinfection Byproduct Rule (DBPR) provides the detailed risk assessment process followed in setting the standard for monochloramine.¹ **But not the byproducts or di or tri chloramines.**

□ EPA's risk assessment process included a review of available research and historical data.

□ EPA's risk assessment process focused on health outcomes that scientists considered to be most critical.

Special populations, such as people with weak immune systems, should check with their physicians before consuming any type of drinking water.

Special populations with potentially weak immune systems include transplant patients and people with AIDS.

People with weak immune systems can be more susceptible than others to harmful organisms in water.⁴

People who have weakened immune systems should consult with their physicians regarding any type of drinking water they consume, including bottled water.⁵ **Once again, Water is life sustaining and delivered by monopolies across the US. One who is allergic to cosmetics can simply not wear them. One who is allergic to food can simply eat something else. When one is allergic or sensitive to their water they cannot bathe, shower, wash their clothes, cook, eat or drink with it. One cannot function with normal minimal daily activity. The FDA has now permitted levels of residual chlorine and chloramines in bottled water. How is a person to live without water? Where is a person to move to get away from this toxin?**

21) Can I shower in or use a humidifier with chloraminated water?

Chloraminated water that meets EPA standards is safe to use for showering.

Showering with chloraminated water poses little risk because monochloramine does not easily enter the air. **Monochloramine does not, but monochloramine speciates into di and tri chloramines with temperature and pH changes such as a hot shower, a spa, a dishwasher, steam iron, running hot water in the sink, etc.**

Trichloramine¹, a chemical related to monochloramine and often found in swimming pools, enters the air more easily and **has been linked to breathing problems.**

Trichloramine may form more easily in swimming pools because of higher levels of chlorine as well as ammonia from bodily fluids that are often found in swimming pools.²

Chloraminated water that meets EPA standards is safe for use in humidifiers.

The use of chloraminated water in humidifiers poses little risk because **monochloramine** does not easily enter the air. **Yes, but a humidifier heats the water to create steam which turns monochloramine into trichloramine which does cause breathing problems.**

EPA is not aware of any studies that investigate the use of disinfected water in humidifiers. Shouldn't EPA be DOING the studies?

It is important to follow the manufacturer's instructions regarding proper maintenance and operation of your humidifier.

EPA considered a wide range of household uses in establishing regulatory limits for chloramines in water.

EPA considered all available research in establishing regulatory limits for chloramines in water.³ **in 1994**

EPA considered historical data in establishing regulatory limits for chloramines in water. ³

EPA's regulatory standard for chloramines provides a wide margin of safety⁴ to offset any uncertainties in risk assessments.

28) Can my doctor tell if my health problems are caused by monochloramine or any other disinfectant in drinking water?

A doctor would have difficulty making a direct link between a health problem and monochloramine or any other disinfectant in drinking water. Yet EPA, DEP and the water company claim that there exists no health concern regarding chloramines because no one has reported any health problems. A doctor would be unable to diagnose chloramines-related ailments because the Health dept and EPA has not acknowledged the connection. EPA has created a catch 22.

People are exposed to many chemicals and other irritants in their daily lives and their sensitivity to these agents varies.

EPA's drinking water regulations limit the use of chloramines to levels where no adverse health effects are anticipated.

EPA's regulatory standard for chloramines in drinking water provides a wide margin of safety ¹ to offset any uncertainties in risk assessments.

EPA believes that drinking water disinfected with monochloramine that meets regulatory standards poses no known or anticipated adverse health problems.

Isolated cases of health problems thought to be related to drinking water have been reported and were investigated by CDC. ² **Isolated – a minimum of 20 states with actual reports of acute symptoms, reports from other countries, hundreds in California and Vermont...**

Trichloramine, a chemical that may be formed in swimming pools³, has been linked to skin irritation and breathing problems.

CDC's investigation² of reports of monochloramine-related breathing problems related to drinking water was unable to draw any conclusions about monochloramine and health effects.

Contact your doctor if you think you have a health problem related to drinking water use.

It is important for your doctor to know where and how you believe you were exposed to chloramines (e.g., via drinking water or a swimming pool).⁴

Health problems are typically highly diverse in origin, making it difficult for doctors to specify exact causes.

Your doctor should discuss health problems that he/she believes may be related to chloramines in drinking water with the local health department.

Additional Supporting Information:

1. For additional information regarding how uncertainty factors (also known as safety factors) are applied to risk assessments to provide a wide margin of safety see: <http://epa.gov/risk/dose-response.htm>.

2. CDC and EPA conducted a preliminary investigation of reports of monochloramine-related health problems associated with drinking water. The investigation consisted of a questionnaire filled out by complainants. The information collected can be used to help design future epidemiologic studies.

CDC's trip report can be found at:

http://healthvermont.gov/enviro/water/documents/CDC_Chloramines_report_011608.pdf.

3. Improper pool maintenance can often lead to trichloramine formation: Some examples include: www.cdc.gov/niosh/hhe/reports/pdfs/2007-0163-3062.pdf and www.cdc.gov/mmwr/PDF/wk/mm5636.pdf.

4.. See question 1 for a discussion of the different types of chloramines.

29) How can I remove monochloramine from my drinking water?

EPA believes that drinking water disinfected with monochloramine that meets regulatory standards is safe to use and it does not need to be removed.¹

EPA drinking water regulations limit monochloramine use to levels where no adverse health effects are anticipated.

Water utilities must test drinking water regularly to make sure it is within EPA regulatory limits.

EPA's regulatory standard for monochloramine in drinking water provides a wide margin of safety² to offset any uncertainties in risk assessments.

Monochloramine can be more difficult to remove from drinking water than chlorine.

Boiling water does not remove monochloramine from drinking water.

Allowing water to sit at room temperature does not remove monochloramine from drinking water.

Reverse osmosis filters³ do not remove monochloramine from drinking water.

So now we have chloramines in the water with people who cannot tolerate it AND they can't remove it.

Commercial products are available that indicate that they remove monochloramine from drinking water.

Commercial products that remove monochloramine from drinking water often contain certifications describing their effectiveness.³

Some home treatment systems and water filters³ may remove monochloramine. ⁴

EPA does not test or certify home treatment systems or filters³ that may remove monochloramine from drinking water. **The cost??? Over \$6,000 for a whole house filter which doesn't protect a person beyond the four walls of their home or if they move plus yearly maintainance. In addition, NSF cannot certify that they can remove the NDMA, Iodo Acids, Hydrazine or DXAA created by chloramines. Cost of pou filter is \$90 per faucet.**