CITY OF
BROKEN ARROW
Where opportunity lives

Office of the City Manager

May 8, 2013

Ms. Erin Brockovich
Brockovich Research and Consulting (I/C/O EB, Inc.)
5737 Kanan Road, No. 592
Agoura Hills, CA 91301

RE: CITY OF BROKEN ARROW'S RESPONSE TO BROCKOVICH RESEARCH AND CONSULTING'S REQUEST FOR CITY TO REJECT CHLORAMINATION LETTER

Dear Ms. Brockovich:

Mayor Craig Thurmond forwarded your letter to me and requested I respond to your inquiry. We appreciate your concern about our water system and treatment process.

Broken Arrow is fortunate to have a highly skilled team of water professionals who ensure we provide our residents the safest water possible. The City has worked diligently in conjunction with other water and engineering professionals for nearly a decade to study and develop the City's long-term water supply plan. Without question, we agree with you that any change as significant as this one requires extensive research and planning. We can assure you that this decision has been made only after examining and evaluating a tremendous amount of scientific evidence regarding this matter.

In your letter, you identify several questions and made several comments. The City definitely wants to make sure we address those issues as completely and thoroughly as possible – with the additional hope that these responses might also answer similar questions our residents may have about the water treatment process. To that end, we will be posting your letter on our City's website along with specific responses provided from our water professional and engineering team.

The City of Broken Arrow takes pride in providing and maintaining a safe environment where our residents can work and raise their families. Providing them clean, quality water is a responsibility we take very seriously. As we move forward, the City will continue to work with state and federal regulatory agencies, as well as a wide range of water professionals, to monitor the latest industry news and provide the safest drinking water possible, both now and in the future.

Respectfully,

Thomas M. Moton, Jr.
City Manager

CC: Mayor and City Council

CT/klp

CITY OF
BROKEN ARROW
Where opportunity lives

INTEROFFICE MEMO

To: **Mr. Thomas M. Moton, Jr.**
City Manager

From: **Mr. Kenneth D. Schwab, P.E., CFM**
Engineering and Construction Department

KDS
05-07-13

Copied: **Mr. Roger Hughes, P.E., City of Broken Arrow, Acting Utilities Director**
Mr. Jimmy Helms, City of Broken Arrow, Water Plant Manager
Mr. Barney Campbell, City of Broken Arrow, Distribution System Manager
Ms. Stephanie Higgins, City of Broken Arrow, Director of Communications
Mr. Joel Cantwell, P.E., HDR Engineering, Inc., Project Manager
Mr. Mike Kyser, P.E., PEC, PC, Project Manager
Dr. Brian Wintel, Ph.D., P.E., PEC, PC, Environmental Engineer

Date: **May 7, 2013**

Re: **Water Supply System**
Letter to the Mayor from Erin Brockovich dated April 17, 2013

On April 22, 2013, Mayor Thurmond received a letter dated April 17, 2013, from Ms. Erin Brockovich concerning the City of Broken Arrow's conversion to chloramines. The letter is attached for your reference. Please note that it was copied to the Broken Arrow Citizen Against Chloramine organization as well as to the Tulsans Against Chloramine organization. A review of the corresponding social media sites indicates that this letter has been posted on at least one of the organization's sites.

Ms. Brockovich is the president of Brockovich Researching and Consulting, a consumer and environmental activist consulting firm located in Southern California. According to her website, Ms. Brockovich rose to national prominence while working as a file clerk at the Masey & Vititoe law firm. Her unwavering effort was instrumental in the firm's success in winning a $333 million toxic tort injury settlement against Pacific Gas & Electric, one of the largest energy suppliers in the nation. Currently, her organization is actively involved in environmental, pharmaceutical, medical, military, workers compensation, product liability and personal injury actions and pursuits. The vast majority of her organization's environmental effort is associated with groundwater contamination; however, the organization has more recently supported many communities' efforts to protest the use of chloramines. For more information concerning her organization and its corresponding work, please view her website at www.brockovich.com.

With respect to the issues voiced in her letter to the Mayor, city staff in concert with our professional environmental consulting experts, who include HDR Engineering, Inc., one of the leading contributors to American Water Works Association publications, as well as Professional Engineering Consultants, PC, one of the leading environmental consulting firms in this region of the United States with specialized experience in the use of chloramination, have provided a detailed response for your information. This documentation identifies the specific issues voiced

in Ms. Brockovich's letter immediately followed by the team's response and appropriate supporting reference to external documentation. Please note that team's approach with respect to external documentation is to solely refer to federal regulations and subsequent documentation as well as to reference scientifically, peer-reviewed documentation.

The following issues were directly raised by Ms. Brockovich and her staff concerning our scheduled conversion to chloramines as a secondary disinfectant technique:

1. **Please don't allow yourselves to be tricked into the use of chloramines as a secondary water treatment chemical, there is no reason for you to make this change.**

   The City is not being tricked into making a decision of this magnitude. In fact, the City can clearly and analytically demonstrate good reason to convert our secondary disinfection technique from chlorination to monochloramination.

   On April 2, 2007, the City of Broken Arrow entered into an agreement with HDR Engineering, Inc. to conduct a comprehensive investigation, examination, and evaluation with respect to the objectives previously recommended by the Long-Range Water Supply committee and subsequently adopted by the City Council on March 6, 2006. The final deliverable associated with this agreement was a Plan Development Report dated January 24, 2008, which essentially provides our community's master plan with respect to the water treatment improvements necessary to meet the adopted objectives.

   As a part of this effort, HDR conducted wide-spectrum, water quality testing on the oxbow of the Verdigris River where the City will actually draw our community's raw water. This effort included performing analytical laboratory testing of the source water in order to identify the constituents and the corresponding constituent concentrations in our new source water. In addition, this effort also included conducting extensive bench-scale, water treatability testing on various water treatment process alternatives and options including coagulant versus enhanced coagulation, as well as the various types of coagulants that were best suited for the removal of constituents discovered in our source water. This bench-scale testing also examined the settling and pre-treatment techniques that may be best-suited for the removal of potential precursors that may form disinfection byproducts.

   Moreover, this testing evaluated the expected efficiency and effectiveness of the most viable filtration techniques practical for our source water. The techniques evaluated included: conventional filtration technology, filtration technology using a Powdered Activated Carbon (PAC), as well as a state of art treatment technology such as membrane microfiltration technique. The filtration with PAC is a similar treatment technique in comparison to the Granular Activated Carbon (GAC) technique recommended by Ms. Brockovich. The PAC uses a powdered media in concert with conventional filtration technology as opposed to GAC which is used as a fixed-media.

   In the bench-scale testing, PAC treatment was evaluated for reduction of organic precursors and the resulting disinfection byproduct (DBP) formation using free chlorine for primary and secondary disinfection. The bench-scale testing demonstrated that a large quantity of activated carbon would be required using either PAC or GAC in order to effectively remove enough organic precursors to safely meet with current disinfection byproducts (DBPs) regulatory limits using only free chlorine. More importantly, the

bench-scale testing also demonstrated that enhanced coagulation coupled with either convention filtration or microfiltration treatment technique utilizing chlorination for primary disinfection and chloramination for secondary disinfection produced more effective results in meeting DBP regulatory limits.

Based upon the results of this water quality testing and the corresponding bench-scale testing, HDR Engineering, Inc. along with City staff recommended the microfiltration membrane treatment process be employed as the treatment mechanism for the new water plant.

More importantly, the testing identified above investigated the anticipated disinfection byproduct (DBP) formation that may be expected from each treatment alternative. The extensive testing concluded that the "[t]reatment strategies which converted to chloramines produced significantly lower TTHM and HAA5 concentrations than the strategies using strictly free chlorine. In addition, DBP formation decreased with a decrease in free chlorine CT [chlorine concentration contact time]. This observation is consistent with previous research that demonstrates that the conversion of free chlorine to chloramines essentially "freezes" or greatly reduces the production of DBPs."[1]

It is also critical to note that in Table 3-10 the Plan Development Report records the historical average DBP concentrations in comparison to the regulatory requirements for the four (4) community water systems (CWSs) that currently use the Verdigris River as their water source. These CWSs include the City of Coweta, Wagoner County Rural Water District No. 4, Wagoner County Rural Water District No. 5, and Rogers County Rural Water District No. 5. Both the City of Coweta and Wagoner County Rural Water District No. 5 recorded historical averages which far exceeds the HAA5 Maximum Contaminant Level (MCL) of 60 micrograms per liter. Likewise, the City of Coweta, Wagoner County Rural Water District No. 4 and No. 5 recorded historical averages also exceeds the Total THMs MCL of 80 micrograms per liter.[2] The report discusses in detail the individual water treatment processes employed by each entity. The overreaching fact demonstrates the difficulty associated with providing the federal and state required disinfection levels on the Verdigris River water without forming excessive DBPs using chlorine.

2. **While I appreciate the desire to comply with USEPA Stage II Disinfection Byproducts Rule, as it has been represented to you;[,] the City of Broken Arrow has never violated the regulation.**

First, not only is compliancy with the United States Environmental Protection Agency (USEPA) Stage II Disinfection Rule a desire of the City, but it is also a requirement of federal law. Second, the statement that the City of Broken Arrow has never violated the Stage II regulation is incorrect.

---

[1] HDR Engineering, Inc. City of Broken Arrow, Water Supply Improvements, Final Plan Development Report. January 24, 2008, p. 3-40.

[2] HDR Engineering, Inc. City of Broken Arrow, Water Supply Improvements, Final Plan Development Report. January 24, 2008, p. 3-12.

The Stage II Disinfection Rule requirements became effective for the City of Broken Arrow in February 2012. Presently, the City is required to test for Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAA5s) in eight (8) separate and distinct locations throughout our community system. The federal rule requires that each site be independently tested four (4) times a year; however, the rule does allow for a locational running annual average (LRAA) concentration for both TTHMs and HAA5s be calculated for each specific site. Our testing, which was established by the USEPA, is conducted in February, May, August and November of each calendar year.

Since the requirements of the Stage II Disinfection Byproduct Rule were only recently enacted, the first scheduled reporting period for the City was this past November 2012. As of November 2012, the City exceeded the Maximum Contaminant Level (MCL) of 60 micrograms per liter for HAA5 at three (3) of the eight (8) locations. This equates to a 37.5% exceedence in the very first reporting period. As of February 2013, one (1) of the three (3) locations is still out of compliance with the Stage II Disinfection Byproduct Rule requirements. To the contrary, if left unaddressed the City of Broken Arrow anticipates being subjected to a potential consent order with either USEPA or the Oklahoma Department of Environmental Quality (DEQ).

3. **Further, if there is a concern you might, the City of Broken Arrow is eligible for a waiver for at least two years if you are engaged in a Capital Improvement Project, such as your new Surface Water Treatment Plant.**

The City of Broken Arrow is not eligible for a waiver due to the construction of our new surface water treatment plant. In fact, the current disinfection byproduct compliancy issue, which occurred this past November, involves our present-day purchased water treatment and distribution system. The United States Environmental Protection Agency (USEPA) is aware of the current construction of our new water plant, yet they still required the City of Broken Arrow to meet all the requirements of the Stage II Disinfection Byproduct Rule criteria. For instance, the USEPA required the City to notify all of our water customers this past December 2012[3] and again this past March 2013[4] concerning the violation and what steps the City is taking to correct the exceedence issues.

Furthermore, simply obtaining a waiver for a two (2) year period during the construction of the new plant would not resolve potential compliancy issues nor does it seem to be in the best interest of our customers. The City is committed to providing safe drinking water to our customers that meets or exceeds the federal and state regulatory requirements. The weight of the evidence suggests that THMs and HAA5s that exceed the limits as prescribed by the USEPA may be carcinogenic.

Moreover, on March 12, 2013, Mr. Robert Bowcock, an associate of Ms. Brockovich, spoke at a Tulsans Against Chloramines public meeting and presented the findings of a report published by the Environmental Workgroup, a non-profit environmental organization located in Washington, D.C. This report indicated that there may be a link between chlorinated DBPs in drinking water that exceed a Maximum Contaminant Level

[3] Refer to Broken Arrow Municipal Authority letter dated December 21, 2012 sent to all water customers.
[4] Refer to Broken Arrow Municipal Authority letter dated February 20, 2013 sent to all water customers.

(MCL) above 20 micrograms per liter to 35 micrograms per liter and gestational developmental concerns associated with an unborn child. This organization along with others is requesting that the USEPA lower the present-day MCLs from 80 micrograms per liter for Total Trihalomethanes (TTHMs) and 60 micrograms per liters for Haloacetic Acids (HAA5s) to limits well below those identified above. The USEPA has previously discussed lowering the current limits to 40 micrograms per liter.[5]

Based upon the above information presented by the Brockovich organization, it is in the City of Broken Arrow's best interest not to ignore the potential effects of chlorinated DBPs for an extended period of two years simply because our community is under construction of a new facility. This is especially true considering the fact that the construction of the new plant actually has no impact on our current present-day water supply system. Instead, this fact seems to support the conversion of one's secondary disinfection process from chlorination to monochloramination in order to reduce the production of chlorinated DBPs in the distribution system.

4. The arguments in favor of the use of chloramine are extremely outdated and quite frankly dangerous.

The City's selection to use monochloramination as a secondary disinfection technique as opposed to using chlorination is based upon the evidence provided by HDR Engineering, Inc. in the Plan Development Report as well as the scientifically, peer-reviewed information provided by the United States Environmental Protection Agency (USEPA), American Water Works Association (AWWA), Water Research Foundation (WRF) formerly known as American Water Works Association Research Foundation (AwwaRF).

In addition, staff also reviewed significant, comprehensive material concerning the use of chloramination produced by other well-known environmental world leaders including the Austrian Water Association (AWA), the Canadian Water Resource Association (CWRA), World Health Organization (WHO), and the Centers for Disease Control (CDC).

Likewise, staff has engaged other local communities throughout the state of Oklahoma in conversations and discussions concerning their experience with chloramines, specifically communities with a long track record of chloramination use such as the City of Lawton and the City of Sand Springs. Each of these communities reported a positive, beneficial experience using monochloramines as a secondary disinfectant.

Furthermore, staff personnel examined several independent scholarly studies specifically evaluating potential concerns associated with the use of chloramination. The more prominent studies included: the National Center for Environmental Health study concerning increased blood lead levels due to lead service lines in Washington, D.C.[6]; the University of Pittsburgh Graduate School of Public Health study concerning possible respiratory issues associated with chloramination in showers and baths[7]; the Catholic

---

[5] Sharp, Renee & Pestano, J. Paul. "Water Treatment Contaminants: Forgotten Toxics in American Water," Environmental Working Group. February 2013, p. 3-6.

[6] Brown, Mary Jean, et. al. "Association between children's blood lead levels, lead service lines, and water disinfection, Washington, D.C., 1998-2006." Environment Research (2010), doi: 10.1016/j. envres.2010:10:003.

[7] Andelman, Julian. "Toxic showers and baths." Science News, Vol. 130 no. 12, p. 177-192.

University of Louvain in Brussels, Belgium and Heartlands Hospital in Birmingham, United Kingdom studies concerning possible respiratory issues associated with the formation of Trichloramines in chlorinated swimming pools[8]; and a collaborative effort between the University of Illinois and the USEPA study concerning the potentially dangerous disinfection byproducts formed from chloramines.[9]

Moreover, staff examined the in-depth information and subsequent documentation prepared by the San Francisco Public Utility Commission in association with the California Department of Health Services concerning the use of chloramines.[10]

The vast majority of the above information was prepared in the past 10 years with a significant portion of it being as recent as 2010 through 2013. The weight of the evidence associated with the above data suggests that the use of monochloramination as a secondary disinfectant technique, which meets federal regulations, is safe and can be extremely effective and efficient in a distribution system.

5. **There is overwhelming new evidence being published by a team of water treatment experts and medical doctors that is extremely important for you to consider before you begin the process of causing unnecessary harm to your constituents.**

First, Ms. Brockovich unfortunately does not provide any documentation to support her claim of new evidence. The City of Broken Arrow is more than willing to investigate, examine, and evaluate the new evidence, provided it has been "peer-reviewed." Ms. Brockovich may submit it to the Engineering and Construction Department.

Second, the City has conducted an extensive and exhaustive review and examination of much of the most recent and thorough scientific, toxicological and epidemiological evidence available. In 2012, the Austrian Water Association published a "peer-reviewed," comprehensive and up to date work that extends the full spectrum of the disinfection byproduct formation and mitigation. This thorough scientific collection of essays examines aquatic chemistry of primary and secondary disinfectants as well as toxicology and epidemiological evidence.[11] The weight of the evidence provided in this current and industry leading document suggests that chloramination when used in accordance with the limits established the United States Environmental Protection Agency (USEPA) is a safe and effective secondary disinfectant.

6. **The perception is that the use of chloramine is cheap and easy.**

The City of Broken Arrow is fully aware of the above alleged perception; however, our decision to convert our secondary disinfection system from chlorination to

---

[8] Thickett, K.M., et. al. "Occupational asthma caused by chloramines in indoor swimming-pool air," European Respiratory Journal, ERJ May 1, 2002 Vol. 19, No. 5, p. 827-832.
[9] Cooney, Catherine. "Drinking-water analysis turns up even more toxic compounds," Environmental Science & Technology, 2008, 42 (22), doi: 10.1021/es802584a, p. 8175.
[10] N.A., "Question and Answers Regarding Chloramines," San Francisco Public Utility Commission, April 9, 2007.
[11] Hrudey, Steve & Charrois, Jeffrey. Disinfection By-products and Human Health. IWA Publishing: London, 2012.

chloramination is not based upon an alleged perception. To the contrary, it is based upon scientific data collected during the water quality and bench-scale treatability testing conducted upon our source water and the proposed treatment technologies considered for the City. Refer to Question No. 1 for more details.

With regard to the alleged perception, the City realizes that there are in fact additional costs associated with ammonia injection, potential capital improvements necessary to improve mixing zones within the system's storage facility, as well as automatic flushing valves to reduce probable stagnation zones in the system that may not necessarily be associated with chlorination as the secondary disinfection process. In addition, the City recognizes that staff must increase efforts to provide additional monitoring and maintenance in order to ensure proper operation within the distribution system is achieved in accordance with regulations and best management practices.

7. **Deploying a new state of the art designed treatment plant in 2014 will exceed the standard of this regulation~~...~~[;]why would you consider anything else, especially chemicals that do harm?**

The wording of this question implies that since the City is constructing a state of the art water treatment facility, then disinfection byproducts due to chlorine will simply not be an issue. Although it is true that the new microfiltration system will prevent potential pathogenic outbreaks such as bacteria and oocysts greatly reducing the need for chemical (chlorine) disinfection, certain viruses may still pass through the microfiltration membrane openings. Therefore, free chlorine must be added in order to effectively inactivate these potential pathogens.

Although the state of the art new water treatment plant will, in fact, allow the City of Broken Arrow to meet or exceed the water treatment standards as established by the Oklahoma Department of Environmental Quality (DEQ) as detailed in the Oklahoma Administrative Code (OAC), Title 252:626, it does not directly imply that the Maximum Contaminant Levels (MCL) associated with chlorinated disinfection byproducts will automatically be met. Based upon the results of the extensive testing performed by HDR Engineering, Inc., this implication is simply not true.

The pre-treatment settling basin, enhanced coagulation coupled with microfiltration process will, without question, improve the City's ability to remove Total Organic Carbon (TOC) as well as specific precursors necessary for certain disinfection byproduct formation as proven through the water quality and bench-scale water treatability testing. However, further water quality and bench-scale testing conducted during the Plan Development Report phase of the design clearly indicates that disinfection byproduct formation at the plant remains a concern. This testing proved that once adequate free chlorine contact time is achieved for virus inactivation as well as the state requirement for 0.5 log Giardia inactivation that the addition of ammonia to form monochloramines for secondary disinfection greatly reduces the potential formation of chlorinated disinfection byproducts in the distribution system. For more in-depth discussion of this issue, please refer to Question No. 1 above.

Furthermore, the above-identified testing indicates that the new water treatment facility using chlorination process for primary disinfection and chloramination for secondary

disinfection process will, in fact, meet the recommended levels of current regulated chlorinated disinfection byproducts as well as comply with the levels prescribed by Mr. Bowcock in his March 12, 2013, presentation and endorsed by the Environmental Workgroup (refer to Question No. 3 above).

8. **While its use may allow Broken Arrow to more easily blend its water supplies with wholesale water from Tulsa, it will cause a myriad of other problems for your customers;[,] financial and property damage, as well as, medical and physical.**

Although it is a true statement that using monochloramination as a secondary disinfectant will more easily allow the City of Broken Arrow to blend treated water produced by our new plant with purchased water from the City of Tulsa, it is incorrect to assume that this is the reason for the City of Broken Arrow to convert our secondary disinfection process to monochloramination. The City of Broken Arrow made our decision to convert to monochloramines independent of the City of Tulsa. Furthermore, based upon the scientifically, "peer-reviewed" data and information investigated, examined, and evaluated, there is no significant evidence to suggest that monochloramination used as a secondary disinfectant within the City of Broken Arrow's distribution system will cause a myriad of problems for our customers.

9. **There <u>are alternatives</u>...why wouldn't the City of Broken Arrow attempt chlorine dose adjustments rather ~~then~~ {than} adding more toxic chemicals to its water?**

The State of Oklahoma, Department of Environmental Quality has primacy with respect to the enforcement of treatment and distribution standards for public water supply systems. However, the United States Environmental Protection Agency retains primacy with regards to secondary disinfection requirements. The City of Broken Arrow fully recognizes that there are only three (3) federal regulatory alternatives with respect to secondary disinfection. These alternatives include: free chlorine, total/combined chlorine which includes chloramines, and chlorine dioxide.[12]

Based upon the water quality and bench-scale water treatability testing identified in detail in Question No. 1 above as well as our historical experience with chlorination residual within the distribution system, simply modifying the chlorine dosage will not resolve the issues at hand. Both past experience on the Verdigris River and the recent testing conducted on our new water source prove that the water will be more difficult to treat. Although the new state of the art treatment process will provide our water customers with quality water that meets today's standards, certain dissolved organics will be a challenge to remove completely from the water. The water quality and bench-scale treatability testing indicates that the potential to form chlorinated DBPs will still be present.

In addition, the City of Broken Arrow not unlike many larger utility systems that are still experiencing growth has experienced difficulty maintaining minimum disinfectant residuals in certain extremities of our distribution system. Although routine maintenance, installation of strategically located automatic flushing valves and the implementation of a

[12] Code of Federal Regulation (CFR), Title 40 – Protection of the Environment, Part 141 – National Primary Drinking Water Regulations, Section 72 – Disinfection, Item b. CFR 40:141:72(b).

comprehensive flushing program has significantly mitigated some of these concerns, it has not resolved all of these potential and realistic issues. In order to increase the concentration of chlorine disinfectant residual at the extremities of our distribution system, the City would need to likewise increase the amount of chlorine dosage added to the system. This effectively creates a much greater potential for increase chlorinated DBPs, which is counterproductive with respect to the current regulatory MCLs as well as complicates the matter associated with our recent violations as noted in Question No. 2 above.

Moreover, it is simply not possible to reduce the chlorine dosage to a level that fully mitigates free chlorine disinfection byproduct formation while also maintaining adequate disinfectant residual in the extended distribution system.

10. A far better approach might be to work with Tulsa Municipal Utility Authority to help them seek an alternative to chloramine poisoning of its citizens; this can be done in Tulsa by enhancing coagulation, improving filtration or using granular activated charcoal.

First and foremost, the City of Broken Arrow greatly values our working relationship with the City of Tulsa (COT) and the Tulsa Municipal Utility Authority (TMUA). They have been an excellent resource in our conversion from chlorination to chloramination as a secondary disinfection technique as well as a partner in other endeavors.

It should be noted that the City of Tulsa has two (2) water sources and, therefore, must blend their water; whereas, the City of Broken Arrow only has one (1) water source to date. Likewise, the City of Tulsa employs a different water treatment technology than does the City of Broken Arrow. Each community is a separate and stand-alone public water system and supplier.

Based upon one of the more recent press releases from the City of Tulsa, their conversion from chlorination to chloramination as a secondary disinfection technique appears to be paying dividends and benefits beyond expectation. In their March 26, 2013, press release the City of Tulsa states "[t]he conversion to chloramine reduced the concentration of Trihalomethanes (THMs) in the water delivered to the City's customers from a high of 106 μg/l in May 2012 prior to the change to less than 37 μg/l after the change at all sampling locations."[13] It is important to note that the City of Tulsa's raw water sources historically have less Total Organic Carbon (TOC) concentrations that what is expected and anticipated in the Verdigris River.

11. You will be told that these options are more expensive, but in truth they are ultimately much less expensive and have additional benefits.

The City of Broken Arrow's new water treatment plant, which was selected based upon extensive testing, will utilize enhanced coagulation for effective organics removal and microfiltration for effective filtration. Despite the use of these state-of-the-art treatment processes, the bench-scale testing results along with information from surrounding systems that currently treat the same raw water supply demonstrated that disinfection

[13] N.A. "City of Tulsa Water Department, Change to Chloramine to Meet New EPA Standards," City of Tulsa, March 26, 2013, p. 1.

byproduct regulatory limits will still be exceeded if free chlorine is utilized for secondary disinfection in the distribution system. The testing demonstrated that additional treatment processes, such as activated carbon, would be required to allow the use of free chlorine in the distribution system. The addition of an activated carbon system would significantly increase the cost of water delivered to our customers. Implementing the proven, effective, and widely utilized method of chloramines as secondary disinfection is significantly less costly than the capital costs to add an activated carbon system along with a significant recurring operational and maintenance cost to purchase carbon for disinfection byproduct precursor removal.

12. Bottom line, enhancing coagulation, improving filtration or using activated charcoal all remove more chemicals and toxins from the water ~~then~~ {than} what you are doing now.

Currently, the City of Broken Arrow does not treat our own water; instead, we are a purchased water treatment system. The actual water treatment processes and operations are being performed by the Oklahoma Ordnance Works Authority (OOWA) at their enhanced coagulation, conventional water treatment facility near Pryor, Oklahoma. Recently, the City of Broken Arrow violated the Stage II, Disinfection Byproduct Rule utilizing treated water that was purchased through OOWA which uses enhanced coagulation.

However, once our new treatment facility is operational in July 2014, then the City of Broken Arrow will oversee the process and operations of our surface water treatment facility. As stated in several locations above, our new facility will be a state of the art microfiltration membrane treatment facility with enhanced coagulation and advanced pre-treatment in order to optimize the total organic carbon removal efficiency associated with the challenges expected with respect to the treatability of the Verdigris River.

13. Your future Water Treatment Plant will work better at removing these precursor chemicals than all of these technologies.

The City agrees that our new state of the art microfiltration membrane treatment plant coupled with enhanced coagulation and advanced physical pre-treatment will be more efficient and effective at removing total organic carbon (TOCs) as well as other precursors that directly contribute to the formation of DBPs in drinking water than conventional treatment. However, this fact does not directly preclude the possible formation of chlorinated DBPs that may exceed the legal, regulatory limit as defined by the USEPA. To the contrary, the water quality and bench-scale testing performed by HDR Engineering, Inc. indicated concern with the expected DBP formation potential for THMs and HAA5s. If the USEPA lowers the current limits as detailed in Question No. 3 above, then the City would expect significant difficulty in reaching the proposed MCL if free chlorine is used for secondary disinfection.

14. The March 2010 edition of the AWWA Journal (American Water Works Association) – the industry's premier publication – which has an extensive article on

alternative disinfectants. Under chloramine, the ONLY benefit listed is reduction of haloacetic acids (HAAs) and trihalomethanes (THMs).

The City of Broken Arrow completely agrees with the above statement concerning the American Water Works Association. This organization is the premier scientific and educational organization in the world which is dedicated to the improvement of drinking water quality. Historically, no other country in the world has spent as much money either through government funded or privately funded research on drinking water quality as has the United States of America. This is the very reason why the City of Broken Arrow focused the extent of our research on scientifically, peer-reviewed articles, documents, books, and other literary sources such as those published by the American Water Works Association (AWWA), the Water Research Foundation (WRF) formerly known as the American Water Works Research Foundation (AwwaRF), and the United States Environmental Protection Agency (USEPA), as well as the Austrian Water Association (AWA), the Canadian Water Resource Association (CWRA). However, not to be one-sided in our focus, the City also investigated and examined other critical documents published by industry leading environmental focus groups such as the Environmental Work Group and other individual scientific studies conducted by leading scientific universities.[14]

The article that Ms. Brockovich references is an excellent introductory synopsis of different regulatory alternatives permitted by the USEPA in contrast to using chlorination for disinfection purposes either alone or altogether. The article is not intended to be an in-depth, extensive analytical evaluation of each regulatory method permitted for either primary or secondary disinfection. It is simply intended to serve as a basic and brief overview of the different possible regulatory processes.

Ms. Brockovich's comment "[u]nder chloramine, the **ONLY** benefit listed is reduction of haloacetic acids (HAAs) and trihalomethanes (THMs)" is not accurate. In addition to the benefit identified by Ms. Brockovich, the article also clearly states under the same advantages heading that chloramines, more specifically monochloramines, "maintains a residual in the distribution system."[15] This is considered a significant benefit for a large distribution system that has experienced low residual disinfectant concentrations throughout the system as our community has historically encountered.

Just as important and significant is the substantial reduction of disinfection byproducts as identified by Ms. Brockovich. As identified in Question No. 3 above, minimizing chlorinated disinfection byproducts below current regulatory levels is a crucial and critical decision facing utilities. Chloramination, specifically monochloramination, provides a municipal utility with a proven and realistic opportunity to accomplish this essential goal. Please refer to footnote 13 above for further information on this matter.

15. Under disadvantages column the {AWWA March 2010 Journal Article} list includes, *"N-Nitrosodimethylamine (NDMA) formation, Iodoacids, potential to form cyanogen chloride (cyanide), not as strong {of} a disinfectant, more complicated to*

[14] Refer to footnotes numbers 5 through 9 above.

[15] Roy, Alan J. "Treatment alternatives for compliance with Stage 2 D/DBPR: An economic update," American Water Works Association, Journal: March 2010, Volume 102, Number 3, p. 45.

produce (avoiding di and tri chloramine), less effective against viruses, nitrification problems and toxic to fish."

Ms. Brockovich continues in her letter and identifies eight (8) disadvantages that were depicted in the March 2010 AWWA Journal article. Each one of the eight disadvantages will be addressed in detail below.

(1) *N-Nitrosodimethylamine (NDMA) formation.* Although it is more significant with chloramination than with chlorination, NDMA is a disinfection byproduct (DBPs) of both disinfection processes.[16] The formation of DBPs in general is influenced as much by the disinfectant used as it is by the source water quality and reaction environment.[17] NDMA specifically requires nitrogen as a precursor in order to form with a chemical disinfectant. Source waters that are influenced or impaired by agricultural runoff and/or wastewater effluents may exhibit a greater potential to form NDMA due to the higher dissolved organic nitrogen content that may be present in the water.[18]

Furthermore, NDMA precursor analysis of drinking water natural organic matter (NOM) has demonstrated that Dimethylamine (DMA), a secondary amine which historically has been considered the model NDMA precursor, is not the major NDMA precursor. Instead, analyses suggest that NOM is the major contributor to NDMA formation due to humic substances or N-containing biopolymers.[19] In fact, organic nitrogen-containing polymers have been found to be a significant contributor in NDMA formation.[20]

Recently, studies have shown that "dichloramine concentration is the ***key factor*** [emphasis added by City] in NDMA formation."[21] In order to minimize the dichloramine formation, studies conclude that increasing the pH of the water to around 8.5 and reducing the molar chlorine to nitrogen ratio to below 1 has a significant impact upon limiting or reducing the formation of NDMA.[22]

With respect to our new water treatment plant, the City of Broken Arrow has taken several steps in order to mitigate the potential formation of NDMA in our effluent. The more significant measures employed include no use of organic nitrogen-containing polymers to aide in the treatment process, increase alkalinity of the process water near a pH of 8.5, reduction of the molar chlorine to nitrogen ratio by installing three (3) ammonia injection ports in the chlorine contact basin in order to allow the City the opportunity to add ammonia after the injection of free chlorine in such a manner that allows appropriate contact time required to achieve chemical disinfection of Giardia and viruses. "The application of chlorine as little as one minute prior to ammonia has been shown to reduce subsequent NDMA formation,

---

[16] Hrudey, Steve & Charrois, Jeffrey. Disinfection By-products and Human Health. IWA Publishing: London, 2012, p. 86, Table 6.2 and p. 138.
[17] Ibid., p. 83.
[18] Ibid., p. 83.
[19] Ibid., p. 88, Table 6.3.
[20] Ibid., p. 90.
[21] Ibid., p. 86.
[22] Ibid., p. 137-138 and p. 92, Table 6.5.

with longer free-chlorine contact time and doses generally yielding greater reductions in NDMA formation upon chloramination."[23]

Moreover, it is important to realize that humans encounter N-Nitrosamines in our everyday life. N-Nitrosamines have been found in leather and rubber products that we come into contact with on a daily basis.[24] Likewise, N-Nitrosamines have been known to be contained in many food and commercial-use products, such as smoked meats, cured ham, cheeses, beer, dairy products, cosmetics, shampoo, and tobacco smoke.[25] In addition, humans form N-Nitrosamines in our stomachs during the normal digestion process where amines react with certain foods that contain nitrates and nitrites.[26] Studies concerning our exposure to N-Nitrosamines have concluded that "NDMA exposure from drinking water is not significant" when it is compared to other forms of exposures.[27]

(2) *Iodoacids*. Without question, iodinated DBPs are becoming an emerging area of concern and subsequent study. Studies have demonstrated that iodine-containing DBPs are more toxic than bromine-containing DBPs or chlorine-containing DBPs.[28] First, iodinated DBPs can form with any of three (3) regulatory disinfectants, which include chlorine, chlorine dioxide or chloramine.[29] Second, iodine is a relatively rare naturally occurring element. It is extremely rare to find it occurring in nature. Therefore, when it is found in source waters, it generally occurs in an anionic disassociated state as iodide. Iodide may be found in certain salt brines, but most often is found in association with the medical and pharmaceutical industries.

(3) *Cyanogen chloride (cyanide)*. This family of disinfection byproducts is commonly referred to as a Cyanogen Halide, which forms when a negatively charged cyanide molecular ion (a carbon atom bonds to a nitrogen atom, CN^{-1}) reacts with halogen family ion such as fluoride, chloride, bromide or iodide. With respect to Cyanogen chloride (CNCl), this compound forms when a cyanide molecule reacts with a disassociated chloride ion. A couple of different synthesis reactions have been observed and proposed by scientists.

Cyanogen chloride forms with both chlorinated and chloraminated drinking waters; however, chlorinated cyanogen chloride disinfection byproducts tend to be extremely volatile, whereas chloraminated cyanogen chloride disinfection byproducts tend to be more stable.[30] This fact suggests that chloraminated CNCl disinfection byproducts remain in the distribution system slightly longer than compared to chlorinated CNCl disinfection byproducts.

There are two (2) critical points to recognize with respect to chloraminated CNCl disinfection byproducts. First, specific studies have demonstrated that by increasing

---

[23] Ibid., p. 137.
[24] Ibid., p. 129.
[25] Ibid., p. 129-130.
[26] Ibid., p. 129.
[27] Ibid., p. 131.
[28] Ibid., p. 20 and p. 60.
[29] Ibid., p. 60.
[30] Hrudey, Steve & Charrois, Jeffrey. Disinfection By-products and Human Health. IWA Publishing: London, 2012, p. 101.

the pH of the water prior to the moment of ammonia injection significantly reduces the amount of all cyanogen halides, including cyanogen chloride, which forms as a byproduct of the disinfection process.[31] With respect to our new water treatment process, the pH of the water will be increased to around 8.5 which will, therefore, significantly reduce the cyanogen chloride formation potential.

Second, scientific research with respect to actual cyanogen chloride formation concentrations that have occurred in drinking water utilities located across the United States demonstrates that the disinfection byproduct concentrations are well below those considered potentially harmful.[32] In fact, as recent as 2011, the World Health Organization (WHO) has removed its previous guideline of 70 microgram per liters of Total Cyanogenic compound concentration citing that "cyanide occurs in drinking waters at concentrations well below those of health concerns."[33]

(4) *Not as strong {of} a disinfectant.* The City of Broken Arrow fully recognizes that chloramine is not as a strong of a disinfectant as chlorine. Therefore, in order to provide the protection level mandated by the USEPA in the National Primary Drinking Water Standards, the City of Broken Arrow shall continue to use chlorination as the primary disinfection process immediately followed by the injection of ammonia in order to convert the free chlorines to chloramines prior to transmission to the distribution system.[34] The combination of the two disinfection techniques is commonly used through the United States as well as in other urbanized and developed countries in the world. The method of primary chlorination for pathogen inactivation and secondary chloramination for longer-lasting residual disinfectant has proven to be a viable alternative to meet primary and secondary disinfection requirements.

(5) *More complicated to produce.* The City of Broken Arrow does not consider the automated injection of liquid ammonia through strategically located portals along the chlorine contact basin a difficult and complicated task or effort to produce the desired formation of monochloramines. The technology of producing monochloramination is constantly improving in direct connection with an increasing knowledge of the disinfection byproduct precursor formation. The designed process that will be incorporated within the City of Broken Arrow's new treatment facility complies with the current standards and methodologies associated with proper monochloramination production techniques employed to minimize adverse issues, such as dechloramination and trichloramination formation as well as N-nitrosamine formation using precursor control measures coupled with treatment optimization techniques.[35]

Furthermore, the United States Environmental Protection Agency (USEPA) states as an advantage for using chloramines as an alternate disinfection technique that

---

[31] Ibid., p. 102, Table 6.14.
[32] Hrudey, Steve & Charrois, Jeffrey. Disinfection By-products and Human Health. IWA Publishing: London, 2012, p. 100.
[33] Ibid., p. 99.
[34] Code of Federal Regulations, Title 40 – Protection of the Environment, Part 141 – National Primary Drinking Water Regulations, Section 72 – Disinfection.
[35] Hrudey, Steve & Charrois, Jeffrey. Disinfection By-products and Human Health. IWA Publishing: London, 2012, p. 91-92, Table 6.5.

"[c]hloramine technology is relatively easy to install and operate."[36] The plant control system will be automated with advanced analytical instruments, including an ammonia and monochloramine analyzer, in order to instanteously and continuously monitor and control the monochloramination process.

(6) *Less effective against viruses.* In essence, this statement is essentially answered in item (4) above. Chloramination as the sole primary disinfection technique is much less effective than chlorination and, therefore, would require a considerable amount of contact time in order to achieve the same inactivation requirements. However, the City of Broken Arrow in compliance with state of Oklahoma statutes will use chloramines as a secondary disinfectant in the distribution system only.[37] The City of Broken Arrow shall continue to use chlorination for primary inactivation of waterborne microbial pathogens and, therefore, shall comply with state of Oklahoma statues as well.[38]

(7) *Nitrification problems.* The City of Broken Arrow recognizes the potential concerns and possible problems associated with nitrification. More importantly, the American Water Works Association – which is the premier scientific and educational organization in the world that is dedicated to the improvement of drinking water quality – recognizes this potential problem and has provided community water systems with excellent resources such as two (2) separate Manuals of Water Supply Practices. The first manual is titled Water Chlorination/Chloramination Practices and Principles, M20.[39] The Second manual is titled Fundamentals and Control of Nitrification in Chloraminated Drinking Water Distribution Systems, M56.[40] A third essential publication concerning nitrification was prepared by the Awwa Research Foundation and is titled Ammonia from Chloramine Decay: Effects on Distribution System Nitrification.[41]

Nitrification is a microbial process in which ammonia (NH_3) is converted through oxidation-reduction chemical reactions to first the chemical compound nitrite (NO_3^{-1}) and then second to compound nitrate (NO_2^{-2}). This microbial process may lead to a reduction in chloramine disinfectant residual and sequentially allow for a potential increased growth of heterotrophic bacteria (HTP).

The AWWA clearly states that most community water systems can control the potential for nitrification through implementing several operational and maintenance measures. These measures include the following:

1. Controlling the chlorine to ammonia-nitrogen ratio which should be maintained between 4.5:1 and 5:1 to reduce the free ammonia concentration.

---

[36] N.A. "Information about Chloramines in Drinking Water," retrieved from www.epa.gov on May 1, 2013.
[37] State of Oklahoma, Oklahoma Administrative Code, Title 252 - Department of Environmental Quality, Chapter 631 - Public Water Supply Operations, Subchapter 3 – Operations, Section 3 – Disinfection requirements, effective date July 1, 2011, Subsection
[38] Ibid., Subsection 3(a), p. 5.
[39] N.A. Manual of Water Supply Practices: Water Chlorination/Chloramination Practices and Principles, M20. American Water Works Association (AWWA): Denver, CO., 2006.
[40] N.A. Manual of Water Supply Practices: Fundamentals and Control of Nitrification Principles, M20. American Water Works Association (AWWA): Denver, CO., 2006
[41] Harrington, Gregory, et. al. Ammonia From Chloramine Decay: Effects on Distribution System Nitrification. Awwa Research Foundation: Denver, CO., 2003.

2. Limiting the excess free ammonia below 0.10 mg/L N.
3. Maintaining a set chloramine residual throughout the system, specifically a residual of 2.0 mg/L or greater at storage facilities.[42]
4. Maintaining a pH between 7.5 and 9.0 as well as maintaining a water temperature on the order of 25^0 C or less.
5. Switching periodically to free chlorine as a secondary disinfectant for short periods of time.
6. Optimizing chemical addition and mixing where applicable.
7. Actively monitor the overall distribution system for ammonia, nitrite and nitrate concentrations.
8. Implement storage facility operational efficiency improvements including proper mixing of influent flow to reduce stratification and water age issues within the facility.
9. Incorporate system-wide flushing program to reduce water age and minimize dead end line scenarios by looping the system or installing automatic flushing systems where applicable.[43]

Likewise, the Awwa Research Foundation lists five (5) varieties of nitrification control and prevention strategies that have been used with varying degrees of success. These strategies include: (1) decrease initial ammonia concentration entering the distribution system by increasing the chlorine to ammonia application ratio; (2) increase the chloramine residual within the distribution system; (3) decrease distribution system detention time; (4) remove sediment from the distribution system; and (5) practice intermittent breakpoint chlorination.[44]

(8) *Toxic to fish.* Chloramines are harmful to aquatic life just like chlorine. The United States Environmental Protection Agency (USEPA) clearly identifies this adverse condition. The USEPA states that "[c]hloramines (and chlorine) is toxic to fish and amphibians at levels used for drinking water. Unlike chlorine, chloramine does not rapidly dissipate on standing or by boiling. Therefore, fish [and amphibian] owners must neutralize or remove chloramine from water used in aquariums or ponds. Treatment products are readily available at aquarium supply stores."[45]

16. Why haven't you as a City Council been told of these alternatives?

This question stands in direct connection with the items detailed in Question No. 14 above where Ms. Brockovich refers to the March 2010 AWWA Journal article. As stated in the response to Question No. 14, the article provides an excellent introduction into federally regulated disinfection techniques. The article presupposes that a community water system (CWS), such as Broken Arrow Municipal Authority (BAMA), currently uses chlorination as its sole primary and secondary disinfection technique. After a brief narrative concerning chlorination and the disinfection byproducts formed from

---

[42] N.A. Manual of Water Supply Practices: Fundamentals and Control of Nitrification Principles, M20. American Water Works Association (AWWA): Denver, CO., 2006, p. 166.
[43] N.A. Manual of Water Supply Practices: Water Chlorination/Chloramination Practices and Principles, M20. American Water Works Association (AWWA): Denver, CO., 2006, p. 111-112.
[44] Harrington, Gregory, et. al. Ammonia From Chloramine Decay: Effects on Distribution System Nitrification. Awwa Research Foundation: Denver, CO., 2003, p. 12.
[45] N.A. "Information about Chloramines in Drinking Water," retrieved from www.epa.gov on May 1, 2013.

chlorination, the article proposes that several critical questions concerning water quality parameters must be considered before a technology assessment is conducted.[46] In addition, the article provides an extremely brief synopsis of several different alternative disinfection techniques employed. These techniques include monochloramination, chlorine dioxide, ultraviolet light and ozone. Furthermore, the article indicates that disinfection evaluation should be paired with an evaluation of improved organic removal technologies. These removal technologies include microfiltration and ultrafiltration, nanofiltration and reverse osmosis, enhanced oxidation and enhanced coagulation. Ultimately, the author of this article concludes that in order to meet Stage 2 Disinfection and Disinfection Byproduct regulation, "precursor control – versus switching to alternate disinfectant- is the preferred primary approach to compliance."[47]

It is important to note that the conclusions of this author are intended to be a general statement since water source quality and water treatment varies significantly from one community to another community. Without performing raw water quality testing and bench-scale treatability testing, it is impossible for this author or any other author to draw specific conclusion concerning the treatment of raw water from Verdigris River.

In fact, the critical questions as well as the other critical questions proposed by the author in the article is exactly what the City of Broken Arrow set out to answer when in April 2007, we entered into an agreement with HDR Engineering, Inc. to conduct a comprehensive investigation, examination, and evaluation with respect to the objectives previously recommended by the Long-Range Water Supply committee and subsequently adopted by the City Council on March 6, 2006. The results of this extensive water quality and bench-scale treatability testing revealed significant and crucial concerns about chlorinated disinfection byproduct formation (refer to Question No. 1 above for more details).

In addition, the results of the previously identified testing lead to an extensive assessment of modern-day water treatment processes. Many of the technologies assessed are exactly in accordance with the technologies referenced in the AWWA Journal article cited by Ms. Brockovich. Essentially, the City of Broken Arrow followed the overall process of evaluation and assessment described in the AWWA article and concluded that for our water source and for our new treatment process that monochloramination produces better results for our water customers that did the other alternatives identified in the referenced article.

The exact methods employed, the data gathered and the results obtained from the water quality and bench-scale treatability testing were compiled in the Plan Development Report and presented to the City Council and Broken Arrow Municipal Authority in a public meeting dated March 18, 2008.[48] The presentation discussed alternatives in accordance with those identified in the AWWA article that Ms. Brockovich references.

In addition, city staff conducted a special work session with the City Council and Broken Arrow Municipal Authority in an open public meeting forum on January 22, 2013. One

---

[46] Roy, Alan J. "Treatment alternatives for compliance with Stage 2 D/DBPR: An economic update," American Water Works Association, Journal: March 2010, Volume 102, Number 3, p. 45.
[47] Ibid., p. 51.
[48] Cantwell, Joel. PowerPoint Presentation prepared by HDR Engineering, Inc. titled "Water Supply Improvements, Plan Development Phase Update," dated March 18, 2008.

of the items presented during the work session was a detailed discussion with question and answers concerning the City's Water Supply System Improvements. The discussion re-iterated much of the information and material investigated, examined and evaluated in direct connection with the new microfiltration water treatment facility and the conversion of our secondary disinfection technique to chloramination.

The City Council and Broken Arrow Municipal Authority members have been informed throughout the study and design processes with the issues concerning chlorination and chloramination.

Ultimately, City staff, in conjunction with the assistance of our environment and water professionals, has presented the advantages and disadvantages of the different disinfection techniques and organic removal methods identified in the AWWA Journal article referenced by Ms. Brockovich. Based upon the best available data gathered with respect to our source water and scientifically evaluated with respect to aquatic chemistry, toxicology and epidemiology, monochloramination is the best choice for the City of Broken Arrow and our water supply system.

17. What they haven't told you is… the USEPA and water industry leaders are predicting the end of chloramination within the next three years.

This is an unsubstantiated claim that stands in direct opposition to the information that can be easily found on the United States of Environmental Protection Agency (USEPA) website www.epa.gov. A review of the numerous documents on the USEPA website clearly suggests that the use of chloramines in accordance with federal and state regulations as a disinfectant, specifically a secondary disinfectant, is a common and safe practice among large community water systems across the United States. In fact, the USEPA references a 1998 survey that identifies nearly 68 million people across the United States who use chloraminated drinking water.[49] Without question, this number has greatly increased over the past 15 years. The industry norm presently suggests that Ms. Brockovich's above-identified statement is inaccurate.

Interesting, the City of Broken Arrow has found no such support of this claim in any of the USEPA, American Water Works Association (AWWA), and Water Research Foundation (WRF) formerly known as American Water Works Association Research Foundation (AwwaRF) documents or other creditable professional organizations. If Ms. Brockovich has other scientific, "peer-reviewed" professional literature that states otherwise, then her organization may submit it to the City of Broken Arrow Engineering and Construction Department for review.

[49] N.A. "Information about Chloramines in Drinking Water," retrieved from www.epa.gov on May 1, 2013.

EB Inc.

ERIN@BROCKOVICH.COM

April 17, 2013

Honorable Craig Thurmond
Mayor, City of Broken Arrow
City Council Chambers, City Hall
220 South First Street
Broken Arrow, Oklahoma 74012

Honorable Mayor Thurmond,

RE: REJECT Chloramine Disinfection

Please don't allow yourselves to be tricked into the use of chloramine as a secondary water treatment chemical, there is no reason for you to make this change. While I appreciate City Council's desire to comply with USEPA Stage II Disinfection Byproducts Rule, as it has been represented to you; the City of Broken Arrow has never violated the regulation. Further, if there is concern you might, the City of Broken Arrow is eligible for a waiver for at least two years if you are engaged in a Capital Improvement Project, such as your new Surface Water Treatment Plant.

The arguments in favor of the use of chloramine are extremely outdated and quite frankly dangerous. There is overwhelming new evidence being published by a team of water treatment experts and medical doctors that is extremely important for you to consider before you begin the process of causing unnecessary harm to your constituents. The perception is that the use of chloramine is cheap and easy. Deploying the state of the art designed treatment plant in 2014 will exceed the standard of this regulation... why would you consider anything else, especially chemicals that do harm? I am indeed perplexed. While its use may allow Broken Arrow to more easily blend its water supplies with wholesale water from Tulsa, it will cause a myriad of other problems for your consumers; financial and property damage, as well as, medical and physical. There **are alternatives**... why wouldn't the City of Broken Arrow attempt chlorine dose adjustments rather then adding more toxic chemicals to its drinking water?

A far better approach might be to work with Tulsa Municipal Utility Authority to help them seek an alternative to chloramine poisoning of its citizens; this can be done in Tulsa by enhancing coagulation, improving filtration or using granular activated charcoal. You will be told these options are more expensive, but in truth they are ultimately much less expensive and have additional benefits. Bottomline, enhancing coagulation, improving filtration or using activated charcoal all remove more chemicals and toxins from the water then what you are doing now. If these chemicals are not there, then the chlorine doesn't have anything to react with and can attack bacteria like it is supposed to. Your future Water Treatment Plant will work better at removing these precursor chemicals than all of these technologies.

I want to call your attention to the March 2010 edition of the AWWA Journal (American Water Works Association) – the water industry's premier publication – which has an extensive article on alternative disinfectants. Under chloramine, the **ONLY** benefit listed is reduction of haloacetic acids (HAAs) and trihalomethanes (THMs). Under the disadvantages column the list includes, *"N-Nitrosodimethylamine (NDMA) formation, Iodoacids, potential to form cyanogen chloride (cyanide), not as strong a disinfectant, more complicated to produce (avoiding di and tri chloramine), less effective against viruses, nitrification problems and toxic to fish."* The author concludes, *"precursor control - versus switching to an alternate disinfectant - is the preferred primary approach to compliance."* Why haven't you as a City Council been told of these alternatives?

What you have been told is, "everyone else is doing it... and, USEPA says it is safe", both partial truths. What they haven't told you is... the USEPA and water industry leaders are predicting the end of chloramination within the next three years. Why? Because it costs more, is toxic and provides your citizens with less protection then they are receiving today. I encourage your reexamination of these facts and direct your professional staff back to open discussion of these issues; not simply brushing them aside. These concerns are real. If you have any questions, please contact me as soon as possible. Perhaps the most efficient way for us to communicate is to email me at: erin@brockovich.com. My associate, Bob Bowcock, will be reaching out to your staff. Thank you and I look forward to a chloramine free Broken Arrow.

Sincerely,

Erin Brockovich

CC: Broken Arrow Citizen Against Chloramine
Tulsans Against Chloramine