

Q&A

from the 2005 Arsenic Treatment Technology Training

Regulatory

Q. How do I apply for an exemption?

A. You will need to contact your primacy agency (usually your state) to discuss the issuance of an exemption.

Q. Who has the enforcement authority over the arsenic regulation? What role does my county have?

A. U.S. EPA has enforcement authority over the Arsenic Rule. However, EPA can approve a State or tribe to be the primary enforcement authority (primacy agency). Some States or Tribes may also delegate some of their authorities to other government entities (e.g., a county). You will have to contact your county or state to see whether they have enforcement authority for the Arsenic Rule.

Q. What happens if I am not in compliance on January 23, 2006?

A. Your primacy agency (typically your state) is responsible for enforcing the rule. After January 23, 2006, when your system is shown to exceed the running annual average for the arsenic MCL, you may be subject to enforcement action, including fines. You should contact your primacy agency, preferably before January 23, 2006, to discuss your options.

Q. Does the Filter Backwash Recycling Rule apply to ground water systems treating for arsenic?

A. The Filter Backwash Recycling Rule does not apply to ground water system. The Filter Backwash Recycling Rule applies to all public water systems that: use surface water or ground water under the direct influence of surface water; practice conventional or direct filtration; and recycle spent filter backwash, thickener supernatant, or liquids from dewatering processes. If the public water supply fits this description, then the Filter Backwash Recycling Rule applies.

Q. What are the regulatory requirements for a non-transient non-community water system with outdoor drinking water fountains?

A. Non-transient non-community public water systems are required to comply with the arsenic rule. All taps designated for consumptive use will have to provide water that meets the MCL.

Q. Does the Arsenic Rule apply to water used for an emergency shower at a work site? Does the Arsenic Rule apply to all other showers, lavatories, and toilets at a work site?

A. If the site is a public water supply, the Arsenic Rule applies. For detailed information on how it might apply to specific non-consumptive points of use (e.g. toilets), you should contact your primacy agency.

Q. What is grandfathering and where can I find more information about it?

A. Grandfathering means using previously collected samples to meet the monitoring requirements of the Arsenic Rule that come into effect on January 23, 2006. Ground water systems may grandfather any arsenic sampling results for samples collected between January 1, 2005 and January 23, 2006. Surface water systems may grandfather samples collected between January 1, 2006 and January 23, 2006. All the data should be consistent with the analytical methodology approved for use by the January 22, 2001 Final Rule. For more information, refer to 40 CFR 141.23c(1) and 141.23k(1) and EPA's Arsenic Rule Web site (<http://www.epa.gov/safewater/arsenic.html>).

Treatment Selection

Q. If you are very close to the 20:1 Fe:As ratio, which way would you go?

A. When you have iron in the source water at levels at or above the secondary standard of 0.3 mg/L, in almost every case the iron will have to be removed to prevent staining and other problems. The iron removal process (oxidation/filtration) is also effective for arsenic removal. Therefore, iron removal by oxidation and filtration is likely to be the technology of choice.

Q. In the West, water quantity is as big an issue as water quality. Can you discuss some of the water loss considerations for systems in an arid climate in terms of the treatment options available?

A. Most arsenic removal technologies are relatively efficient in terms of water loss. In many cases, they can be designed to waste even less water by providing for recycle of wastewater streams. Reverse osmosis is the exception to the rule and typically has high water losses but these water losses can be minimized with additional stages. Additionally, the waste water produced has high total dissolved solids with can make it difficult to dispose of in arid areas.

Q. I'm getting conflicting information on the effectiveness of treatment technologies in removing arsenic (III). Can you comment on your experiences?

A. No common technology will remove arsenic (III) as effectively as arsenic (V). Arsenic(III) has to be oxidized to arsenic(V) for efficient arsenic removal.

Q. Most examples shown in the presentation show low flow rates. How would a 1,200 gpm well with arsenic levels in the 10-20 ppb range be handled differently?

A. This well can be effectively treated by any of the arsenic removal treatment technologies. Obviously, the size of the treatment plant has to be larger. The considerations for technology selection are very similar, including water quality and residuals management/disposal.

Q. A system has 14 ppb arsenic and 350 ppb iron. The system has a 5 mile transmission line. Would it be possible to chlorinate at the well, i.e. change arsenic(III) to (V) and tie up arsenic with the iron?

A. In the process described above, the iron would be oxidized and the arsenic would be tied up with the iron. However, the resulting precipitate containing the arsenic should be filtered from the system prior to pumping it through the transmission main in order to keep sludge from settling out in the main.

Q. Is there a set of laboratory tests that should be used to characterize source water for the purposes of evaluating the most suitable treatment?

A. U.S. EPA's Arsenic Treatment Technology Evaluation Handbook for Small Systems has a list of suggested water quality parameters on pages 40-41. See http://www.epa.gov/safewater/smallsys/arsenic_treatment_handbook_lo.pdf.

Q. How effective are the portable test kits as a screening method for arsenic, i.e., process control monitoring?

A. Some portable test kits are effective in measuring the arsenic level in drinking water. Some systems are using test kits for process control monitoring in ~~some~~ of their arsenic treatment facilities. However, these test kits are not approved for compliance monitoring.

Q. For those of us who are already approaching the preliminary design stage, is there any opportunity to get "peer review" of the "reasonableness" of the proposed approach, from those who have so much experience and knowledge from across the nation?

A. There is no nationally-sponsored peer review process. Contact your primacy agency for assistance in evaluating your treatment process.

Q. How does the influent concentration variability affect design and sizing of a system?

A. Variability of the arsenic concentration in the raw water will normally have very little impact upon the design of the treatment facilities. When using adsorptive media, it will have an impact on the length of time between media change-outs and/or replacements. Most system designs will be flexible enough to handle some variability.

Q. Because of the waste disposal limitations in California, what are the most feasible treatment options?

A. All treatment technologies are feasible in California, even with the more stringent waste disposal limitations. The suitability of the option depends on your water system's specific water quality characteristics.

Working with Vendors & Engineers

Q. I've been hearing some things about leasing options. Why might this be a good option for my system?

A. Leasing may be a good alternative for some water systems for several reasons: the water system will not have initial high capital costs; leasing allows the community to try

out a technology without making a long-term commitment; and, leasing puts the burden of system design on the supplier.

Q. What type of contract stipulations or guarantees should I make sure are included in a contract with a vendor?

A. There are many stipulations that should be included in a contract, including, but not limited to: cost schedules; performance guarantees; maintenance agreements; waste disposal requirements; and provision of technical assistance.

Q. What can a potential client do to be best prepared for meeting with an engineer?

A. Understand your water system (existing treatment, flow requirements, future flow requirements, etc.) and be familiar with your system's raw water characteristics.

Non-treatment Strategies

Q. What do you know about systems using aquifer storage and recovery techniques?

A. Truckee Meadows Water Authority (Nevada) is putting treated surface water down their well with chlorine and are able to extract four times as much water (with less arsenic) due to the oxidation in-situ. This set-up requires sufficient iron within the aquifer to facilitate the arsenic removal.

Treatment, General

Q. When you look at the project timeline for communities who are just now selecting an engineer and a technology, is it realistic to think that the system will be in compliance by January 23, 2006?

A. No. Unless you are a very small system that can install a package system, the compliance date will be difficult to meet. If you cannot comply by January 23, 2006, you should contact your primacy agency as soon as possible to discuss compliance options, such as an exemption or enforcement agreement.

Q. What are the possible interferences with arsenic treatment? How do we know if we will face these interferences and how can that affect which technology we select?

A. There are numerous water quality parameters that effect arsenic treatment. Some of the major ones include sulfate, silica, pH, and organic matter. Each affects treatment technologies differently. Visit the Arsenic Virtual Trade show at arsenictradeshow.com to learn more.

Q. How does this regulation affect the level of certification that a system operator requires?

A. If you plan to install arsenic treatment, contact your state for operator certification requirements.

Q. Once I have a system in place, what should I be looking for to maintain proper function? How do I know when breakthrough might occur if I haven't pilot-tested the system?

A. There is no substitute for pilot testing and process monitoring. Typically, systems that are vulnerable to breakthrough need to monitor between the treatment and guard columns if possible.

Q. If I have pressure tanks installed, how difficult would it be to switch from one adsorptive media to another, or even to coagulation/filtration?

A. Typically, adsorption systems provide 5 to 10 minutes of empty bed contact time. The media can be easily changed out for a new media, though you will need to make provisions to easily drain the media from the vessels. You would need to design in backwashing capability if you wanted the ability to switch from adsorption to coagulation/filtration.

Q. When you are doing pH adjustment, how are the costs affected?

A. Installing pH adjustment chemical feed equipment will increase the initial capital costs. The additional chemical costs will increase the O&M costs. These increased costs may be offset by longer run times or increased treatment efficiencies.

Q. Explain NSF/ANSI Standards and what it means to be certified.

A. NSF/ANSI Standards are third party certifications for drinking water chemicals, components, and treatment units, indicating that these products meet specific quality or performance standards. This certification gives the consumer a significant degree of surety that the certified products are safe to use or meet specific performance standards.

Q. What processes would you recommend for the removal of both arsenic and uranium?

A. This would depend on system size. However, adsorption technologies would be good for most small systems.

Q. Are you seeing a change in the run length based on how the system is operated?

A. Systems are seeing longer run lengths for adsorption media when the pH is adjusted down. Also adsorption systems seem to have increased adsorptive when operated in the run-rest (on-off) mode.

Oxidation

Q. What is the consumption of chlorine during the oxidation process?

A. It takes about 1 mg/L of chlorine to oxidize 1 mg/L of arsenic. Because arsenic concentrations are so low, this demand is not very high.

Q. In an iron removal system, how far upstream should you be chlorinating before the water gets to the aerator?

A. You would probably want to have 1 to 2 minutes of contact time before the water is aerated.

Q. Do you lose some chlorine from the exhaust of the aeration process?

A. Yes. Also, keep in mind that the dissolved iron in the water will exert a chlorine demand. If you wish to have a chlorine residual in the distribution system, you will probably have to add more chlorine after filtration.

Q. What are some of the issues we should be concerned about in terms of meeting other drinking water regulations such as the Ground Water Rule?

A. Meeting multiple requirements can be challenging. However, the installation of chlorination facilities for arsenic oxidation may also be helpful for meeting the potential requirements of disinfection for the Ground Water rule. However, it is important to ensure adequate contact time and that the appropriate chlorine residual enters the distribution system. Additionally, chlorination may produce disinfection by-products and corrosion could increase with pH adjustment. These can be mitigated with proper application of the treatment processes.

Point of Use/Point of Entry (POU/POE)

Q. When will there be a final POU/POE guidance? Is there a requirement for 100% system-wide participation for approval?

A. The POE/POU guidance is expected to be available by the end of 2005. Contact your state for more information on their POU/POE requirements.

Q. What is the highest level of arsenic that POU can handle?

A. Each POU device will remove arsenic at different concentrations. There are NSF/ANSI challenge tests for arsenic treatment units at concentrations of 50 and 300 micrograms per liter. Ask your vendor for a copy of their unit's certification.

Q. What can a system manager do to help gain community buy-in to a POU project?

A. The primary factor that a system manager can use to encourage buy-in to a POU project is the cost effectiveness of this technology over centralized treatment. Public education on the health effects of elevated arsenic levels and an understanding of the other options for treatment of arsenic are also necessary.

Q. Are NSF Standards 42, 53, and 58 only for POU/POE or are they also for central treatment?

A. NSF Standards 42 and 53 are developed for POU and POE systems. NSF Standard 58 is for POU reverse osmosis units.

Iron Removal

Q. Why is arsenic removal enhanced when iron particles nucleate with chlorine instead of aeration?

A. The iron oxides produced when dissolved iron is oxidized by chlorine appear to be structurally different than those created by aeration. They seem to have a greater amount of surface area for adsorbing arsenic and, therefore, enhance removal. Chlorine oxidizes the iron to iron oxides. Arsenic attaches to the iron oxides. Aeration is efficient in oxidizing iron but is inefficient in oxidizing arsenic(III) to arsenic(V). Therefore, the arsenic(III) is not effectively removed with aeration only.

Coagulation/Filtration

Q. What type of material are the microfilters made from?

A. The most common types of reverse osmosis membranes are cellulose acetate, thin-film polyamine composites, and sulfonated polysulfone. Most hollow-fiber tube membranes are made from similar materials; cellulose acetate, polysulfone, polypropylene, or polyacrylonitrile.

Q. What type of chemicals do you use to clean the filters? How do you dispose of them?

A. Cleaning agents for membranes vary dependent on feed water characteristics. RO membranes are cleaned with a variety of oxidizing agents and bases. Hollow-fiber membranes may be cleaned with water, air scour, acids, caustic soda, and detergent formulations. These cleaning waste streams are disposed in numerous manners dependent on available infrastructure. Existing installations use direct discharge, sewer discharge, land application, deep well injection, and evaporation ponds.

Q. Will coagulation/microfiltration work when you have a lot of particulate matter?

A. No. Microfiltration units will foul with high levels of particulate matter.

Iron-based Adsorptive Media

Q. Why does silica affect adsorption processes below a pH of 9?

A. Silica is similar to arsenic in that at different pHs, the silica species changes. At lower pHs the silica competes less for the adsorption sites and allows arsenic to be adsorbed more. Also recent research is showing that the percentage of silica that is in a polymeric form increases as the pH decreases. There is some evidence that this form of silica tends to bind off the adsorption sites on media.

Q. Is the effectiveness of the removal efficiency affected by water temperature, e.g., ground water having a temperature of 114 degrees F?

A. Generally, higher temperatures will speed up chemical reactions and increase the performance of reverse osmosis systems. However, 114 degrees F is probably too high for most membrane technologies. Otherwise, the effect of temperature on arsenic removal has not been examined in any published research.

Ion Exchange

Q. Is ion exchange practical for surface water when sulfate restrictions are so low?

A. Typically, ion exchange would not be the treatment of choice for surface water. A coagulation/filtration plant would be a better choice than you would get both turbidity removal and arsenic removal.

Q. How much salt is used for arsenic removal compared with water softening in ion exchange?

A. For small systems the salt requirements for arsenic removal and water softening would be similar. The amount of salt used would be directly related to the raw water quality, but would likely be approximately 3 to 5 pounds per cubic foot of media.

Q. Why do you use brine rather than caustic for regeneration? Is it a function of the size of the treatment plant?

A. Brine is cheaper, less hazardous, and more effective. Even larger systems would likely use brine.

Residuals & Waste Disposal

Q. What is U.S. EPA's response to the disposal of arsenic from water treatment processes when part of a mixed waste stream that includes uranium?

A. When a waste is classified as a mixed waste (both hazardous and containing small quantities of uranium) the waste disposal is regulated by both the Atomic Energy Act and RCRA.

Q. Are there any wastewater treatment plants that will allow liquid waste from arsenic removal plants to be sent to their facilities?

A. There are numerous Publicly Owned Treatment Works (POTWs) that will accept the waste from arsenic treatment facilities as long as the waste complies with technically based local limits. Each POTW will have specific limitations on the discharges that they will accept. Some wastes being discharged to a POTW may need to meet pretreatment requirements specified by the POTW before discharge is allowed. Liquid waste discharged to a POTW through a piped sewer connection would be excluded from regulation under RCRA under the domestic sewage regulatory exclusion (see 40 CFR 261.4(a)(1)). Liquid waste trucked to the POTW would not be excluded and would require RCRA manifesting and transport to the POTW. The POTW receiving trucked liquid waste would also need to meet the "Permit by Rule" requirements of 40 CFR 270.60(c).

Q. Will U.S. EPA change the toxicity characteristic (TC) limit of 5 mg/L?

A. There is no present activity within U.S. EPA to change the arsenic TC limit.

Q. What are intermediate wastes and what licensing and disposal issues accompany these?

A. Intermediate wastes include brines, rinse water, backwash waters, and sludge. Some intermediate wastes (ion exchange brines) may be classified as RCRA hazardous. You will need to work with your state to determine the licensing and disposal requirements for your waste streams.

Q. It has been my experience that landfills will not accept arsenic over 1 mg/L. Are there any disposal alternatives?

A. There are alternatives to disposing of the waste in a landfill. You may be able to dispose of the waste thru such alternatives as underground injection or discharge to a POTW, though these methods will have their own set of requirements to meet.

Q. Does the spent media have to undergo Toxicity Characteristic Leaching Procedure (TCLP) testing every time?

A. Under RCRA, waste generators are required to determine whether their waste is regulated as hazardous, using the provisions of 40 CFR 262.11. Generators may rely on either testing of the waste, or their knowledge of the waste and regulations to make this determination (i.e., no testing is specifically required by the regulations). If generator knowledge is the basis for a RCRA determination, the generator will need to present the basis for the determination when visited by an inspector. Typically, significant past testing of water treatment residuals showing consistent compliance with the TC value would be adequate, depending on the variability in the results, how close to the TC value the results come, and whether there have been any recent treatment system changes or disruptions. Totals testing showing that the spent treatment media could not exceed the TC value if the TCLP were used could also constitute adequate generator knowledge. However, in any situation where the inspector believes the basis for a non-hazardous determination to be inadequate, the results of a TCLP test would be relied on to resolve the disagreement. Note also that for multi-phase wastes, the solid and liquid portions of the waste are evaluated separately in the TCLP, with the solid portion being diluted by 20:1 with the TCLP extractant fluid, and the liquid portion tested for totals content without dilution. For low solids wastes (less than 0.5% dry weight solids), the TCLP result is the total concentration of the constituent(s) of concern in the liquid portion, after filtration (see SW 846 Method 1311 for details, at: <http://www.epa.gov/epaoswer/hazwaste/test/pdfs/1311.pdf>)

Q. Could an evaporation pond concentrate arsenic and cause the waste to become hazardous? If so, would the system then be classified as a RCRA hazardous waste generator?

A. The longstanding policy of the RCRA program is that hazardous waste generated in a surface impoundment is regulated at the time it is generated (i.e, becomes hazardous), and must be managed as hazardous until it no longer exhibits a hazardous characteristic. The point of generation is not when waste is removed from the impoundment, but rather when the waste exhibits any RCRA hazardous characteristic. Therefore, evaporation pond liquid or settled solids that fail any of the TC regulatory values are RCRA hazardous at the time they first exceed the TC values, regardless of whether wastes deposited in the impoundment failed to exceed a TC value. These wastes would also be required to meet the LDR treatment requirements of 40 CFR 268, which requires, among

other things, treatment to remove the hazardous characteristic. Note that dilution of the waste to meet LDR standards is prohibited by 40 CFR 268.3. This also makes the evaporation pond itself a RCRA hazardous waste management unit requiring an operating permit and must be designed to meet the requirements of 40 CFR 264 and 265. See 40 CFR 261.3(a)(2)(i) and 261.3(c)(1) [Note: for a detailed discussion of this issue see: 45 FR 72025, October 30, 1980; 55 FR 39410, September 27, 1990; 55 FR 46380, November 2, 1990; and 65 FR 67095, November 8, 2000.]

Q. What is the possibility of arsenic being resolubilized from the sludge?

A. Arsenic (as well as other metals) can be resolubilized from sludge to a certain degree under any management conditions that include exposure to rainfall. Other conditions that would enhance release include reducing environment.

Arsenic Treatment Technology Demonstration Program

Q. Once the demonstration project sites were selected and the vendor proposals narrowed, what criteria did systems use to select a final treatment process?

A. For Round 1 the treatment process was determined by a U.S. EPA peer review committee. For Round 2 the U.S. EPA peer review committee narrowed the treatment processes to about three and allowed the water system to select the technology.

Q. What are the top three things you've learned from the demonstration program so far?

A. Information on both Round 1 and Round 2 can be found on the EPA Office of Research and Development web site. Each demonstration site from Round 1 will eventually have a report on their project.

<http://www.epa.gov/ORD/NRMRL/arsenic/research.htm>

Distribution Systems

Q. We are seeing arsenic at the wellhead, but none at the tap? What is going on? Do we need to treat?

A. It may be that the arsenic is being removed in the distribution system either by adsorption or precipitation. The point of compliance for the arsenic rule is the entry point to the distribution system. If your waste has arsenic above the MCL at that point, then you must treat or take other action to achieve compliance with the MCL, even if the arsenic in the water is not, at least for now, reaching the taps.

Q. What type of monitoring should I be doing in my distribution system if I install arsenic treatment?

A. Distribution systems that have had elevated arsenic waters in them may have concentrations of arsenic in biofilms and corrosion deposits. Changing the water quality in the distribution system (e.g., though chlorination) could cause a release of significant

quantities of arsenic. You might want to consider sampling for arsenic and other metals in the distribution system.

Q. Does the type of piping material affect accumulation of arsenic in the distribution system?

A. Any pipe that will support a biofilm or corrosion can concentrate arsenic in the distribution system.