Hexavalent Chromium Compliance Plan

Revision 12.2, 22-December-2025
INITIAL SUBMITTAL VERSION

San Andreas Mutual Water Company
Public Water System ID: 4400558

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Introduction

On Oct 1, 2024, the California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) issued a final Maximum Contaminant Level (MCL) for hexavalent chromium [Cr (VI)] of 10 µg/L. The Cr (VI) MCL triggered the implementation of quarterly compliance monitoring at entry points to the distribution system after treatment for individual water sources that are over the MCL. Compliance with the MCL is to be determined by a running annual average of quarterly samples. (CDPH, 2024). This new standard is substantially lower than the federal MCL of 100 µg/L for total chromium and California's prior total chromium standard of 50 µg/L.

San Andreas Mutual Water Company (SAMWAC) Site Background

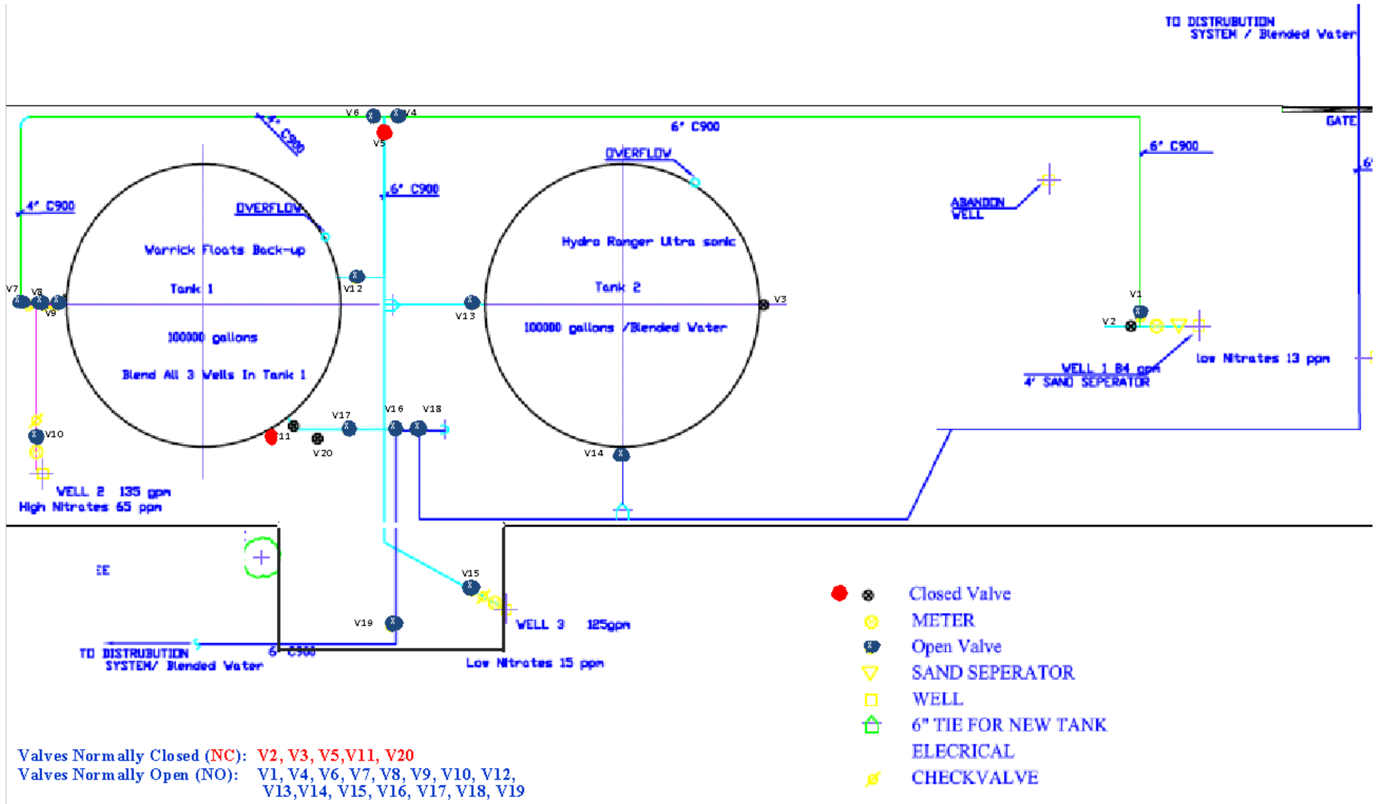
SAMWAC, located in Santa Cruz County, has two active wells (Well 1 and Well 3) serving a population of 350 through 140 service connections. Detailed water quality of each well is given in Table 1. In 2025, quarterly samples from both active wells contained Cr (VI) concentrations exceeding the California MCL of 10 µg/L. In addition to the presence of Cr (VI), all active wells contain elevated concentrations of nitrates but are currently below the MCL. Well 2 was taken offline due to Nitrate levels over the MCL.

The well and tank site layout is illustrated in Figure 1. All wells are blended in Tank 1 to ensure nitrate concentrations below the MCL. The water from these wells does not undergo disinfection prior to distribution to customers.

Table 1. Water quality for SAMWAC wells. Cr (VI) is represented as maximum Cr (VI) concentration for 2025, and all other constituent concentrations are from December 2025 sample analysis

Well	Design Flow (gpm)	Maximum Cr (VI) (µg/L)	Iron (µg/L)	Nitrate as N (mg/L)	Sulfate (mg/L)	Manganese (mg/L)	Alkalinity as $CaCO_3$ (mg/L)	pH (SU)
Well 1	84	18	ND	7.7	12	ND	85	7.3
Well 3	125	18	ND	7.2	23	ND	130	7.4

Figure 1. San Andreas Mutual Water Company site layout



Cr (VI) compliance strategies

In general, Cr (VI) compliance alternatives can be grouped in two primary categories: non-treatment and treatment. Non-treatment compliance strategies include source destruction, source status change, source modification, blending, and merger with another water system. Treatment strategies include strong base anion exchange (SBA-IX), centralized Reverse Osmosis (RO) treatment, RO filtration at Point of Use (POU), Reduction-Coagulation-Filtration (RCF) and conversion of Cr (VI) to trivalent chromium [Cr (III)] with stannous chloride. Any selected treatment strategies should be in compliance with the State of California Water Board approved technologies.

An overview of compliance alternatives is detailed below, and an initial compliance evaluation based on water quality and discharge information for each SAMWAC well was conducted.

Non-treatment compliance strategies

Source modification

Modification of impacted source wells by limiting screened intervals to regions of better water quality may allow for withdrawal of water with lower Cr (VI) levels. Well modification programs could include any of the following:

- Changing the pumping capacity
- Installing packers on pump columns to eliminate upper aquifers
- Placing casing patches over casing holes or sections of well screen

- Installing well liners in conjunction with placing cement seals against upper aquifers
- Well plug back (however not likely because Cr (VI) is thought to decrease with depth)

Source status change or source destruction

With adequate capacity from other sources, the simplest option for management of Cr (VI) sources is well destruction. However, the lack of sufficient alternative water supplies often rules out well destruction as an option.

Blending

The dilution of a Cr (VI) impacted source with an alternate low Cr (VI) concentration source – blending can, in certain cases, be a cost-effective option to produce compliant potable water. Blending can be applied without or with treatment. Blending relies on the availability of another low Cr (VI) concentration source and the consistency of Cr (VI) levels in both supplies to avoid MCL violations. The cost of a tie-in and blending control would have to be evaluated.

Merger with another water system

By merging with a water system that does not violate the Cr (VI) MCL or has a functioning treatment program, the task of meeting the MCL would move to the acquiring water system. This could be done by a total take over with the shutdown of all wells in violation. The cost of interconnection would need to be evaluated. SAMWAC has completed the first step of filing for an Extraterritorial Service Agreement (ESA) with the neighboring Soquel Creek Water District. The ESA is anticipated to be approved by the Santa Cruz LAFCO in February of 2025. The immediate goal of the ESA is to provide the potential for an emergency service connection between the two districts.

Removal treatment compliance strategies

Currently, there are three possible Cr (VI) treatment technologies that can be considered for full-scale implementation given the size and constraints of SAMWAC.

- Strong base anion exchange (SBA-IX)
- Reduction Coagulation Filtration (RCF)
- Reverse Osmosis (RO)
  - Centralized
  - Point of Use (POU)

A brief description of each of these technologies is provided below.

Strong Base Anion Exchange (SBA-IX)

A strong base anion (SBA) resin for the removal of chromium-6 using specialized resins designed to be chromium-selective. The IX resins used for treatment can either be single-use resins which will need to be disposed of and replaced when they reach the end of their lifespan, or resins that can be regenerated with a brine solution. The brine waste can potentially be treated through the IX system and/or recycled into the brine tank to minimize the volume to be disposed of at the landfill or disposed to a lined impoundment.

An SBA can operate over a wider pH range and would not require adjustment prior to treatment minimizing the level of pretreatment required. SBA can work well as a single-use resin with low sulfate concentrations in the source water; if the source water has high concentrations of sulfate, it would cause interference with the removal of chromium-6. This is due to the sulfate ions having a higher affinitive to the SBA resins.

It is recommended that the appropriate resin type is selected based on the source water quality per the engineering design requirements and the manufacturer specifications.

Reduction Coagulation Filtration (RCF)

Reduction Coagulation Filtration (RCF) is a water treatment process used to remove hexavalent chromium (Cr (VI)) from drinking water by first reducing it to the less soluble trivalent chromium (Cr (III)) using a reducing agent such as ferrous iron (Fe (II)) or ferrous chloride. The reduced Cr (III) then forms a precipitate through coagulation, which is subsequently removed by filtration. This process can be effective for systems with moderate Cr (VI) levels and can be integrated with existing water treatment infrastructure.

Reverse Osmosis

Centralized Treatment

Reverse osmosis uses a membrane filtration technique to remove most analytes from within a water source. RO forces water under pressure through semi-permeable membranes, this allows for the water molecules to pass through while retaining the contaminant molecules on the other side of the membrane. The two flows are then separated, and the treated water is sent through to distribution, and the contaminant flow is sent to waste.

RO has high removal efficiency, and one treatment system would be able to treat both chromium-6 and nitrates. On average RO systems can have approximately 98 percent removal efficiency while maintaining 75 percent of the flow. RO systems create a highly concentrated waste which can be sent back through the treatment system to recover a portion of the lost flow and minimize the volume that will need to be disposed of. Disposal of the waste stream must meet the requirements in Title 27, CCR, section 20005. There is the potential that exemptions for waste disposal exist per Title 27 section 20090, but this would be determined during engineering design. If the waste were determined to not be exempt, it would either need to be conveyed to a lined impoundment, allowing the water to evaporate, or stored in a tank and disposed of in a landfill. The waste stream from an RO system is projected to not be hazardous waste, but this will need to be confirmed during the engineering design by a licensed professional engineer in the state of California.

Point of Use (POU) filtration

The attraction to POU filtration is the efficiency of the process, in that it is only necessary to treat actual drinking water versus all delivered water. With an exaggerated estimate of a drinking water consumption rate of one gallon per person per day, a full supply treatment system would have less than 1% of all delivered water consumed as drinking water. The maintenance of 140 Reverse Osmosis POU systems would be easier and less costly than maintaining a single treatment facility handling 200x the water flow.

Point of use reverse osmosis systems have a long history of exceptional performance and durability and are very cost effective because of mass production. They require no user training or maintenance during the life of the membrane element.

Preliminary compliance options evaluation

A preliminary compliance evaluation was conducted by SAMWAC using water quality data and site limitations. This analysis forms the basis for two compliance plans, a short-term Plan A and a longer-term Plan B, both of which are detailed later in this report.

Non-treatment compliance strategies

The non-treatment options are not expected to be feasible for SAMWAC. All wells have Cr (VI) over the MCL, so neither local blending nor well destruction is an option. Due to the prevalence of chromium in the area and the proximity of the well site to the ocean, well modification is also not expected to be a viable option. The layer of fresh water sitting above normal saltwater intrusion is too shallow to allow for tapping into other aquifers. All wells sit on a single aquifer.

Conversion Blending

Blending with water from either Soquel Creek Water District or the City of Watsonville water systems has also been considered. Using either as a blending source is not feasible due to cost.

Soquel Creek: Assuming that Soquel Creek completes a planned main line extension to Renaissance High School in the next year, SAMWAC would need approximately 700 feet of 6" pipe to connect to Soquel Creek for blending purposes. At approximately $400 installed cost per linear foot this intertie would cost about $300,000 for pipe installation alone. In addition, SAMWAC would need to pay for additional valves and metering, plus pay Soquel Creek a monthly service fee. SAMWAC would also need to pay for water at Soquel Creek's current commercial water rates which are significantly higher than SAMWAC's water rates. SAMWAC and Soquel Creek are working together to have an ESA approved by the Santa Cruz LAFCO department with plans of SAMWAC connecting to Soquel Creek for an emergency water supply.

City of Watsonville: With a distance of 17,300 feet from the closest connection points of SAMWAC's and City of Watsonville's water systems, it would cost about $7 million for pipe and pipe installation alone. In addition, there would be costs associated with blending control, licensed supervision, and testing.

Consolidation

Consolidation with either Soquel Creek Water System or City of Watsonville water system has also been considered. In addition to the piping costs, each system would want SAMWAC to be upgraded to conform to their standards before being absorbed. Such a consolidation was previously explored with Soquel Creek in 2020 with an estimate of $4.0 million in upgrades needed. Soquel Creek also charges a Water Demand Offset Requirement charge of $55k per acre-foot/year of water used for a new connection. Current usage by SAMWAC would put this connection fee at $3.85 million. With a full consolidation, the piping cost could be reduced to $0.5 million since blending would not be required. Therefore, if a consolidation with Soquel Creek were allowed to take place, the cost would be approximately $8 million.

Upgrades to system needed for consolidation: $4.0 million

Water Demand Offset Charge:	\$3.85 million
Piping for interconnect:	\$0.5 million
Total:	\$8.0 million

This estimated cost does not include permitting fees, the fact that LAFCO does not have SAMWAC in the Soquel sphere of influence, or set-up costs. The cost of consolidation with the City of Watsonville would be much higher because of the long distance to any city pipeline. Given the high costs of obtaining blending water or consolidating our system with another, treatment options for Cr (VI) within our district will be needed.

Treatment compliance strategies

Centralized Reduction Coagulation Filtration (RCF), Reverse Osmosis (RO) Treatment and Strong Ion Based Exchange (SBA-IX) Treatment

An RCF treatment system based on SAMWAC's water volumes would have an estimated capital cost of approximately \$3M. Since SAMWAC Well-1 and Well-3 are not free of nitrates, the RCF exchange beds would need to be changed after less than 20,000 "bed volumes", which for planning will be estimated at about once a month. The cost of changing out the material at that frequency would be on the order of \$200k/year. Having the ability to change out exchange cartridges that would be recharged off-site could be explored, but there is no such local facility. Additionally, RCF systems can require a larger footprint which may be difficult to place at the well site.

A centralized Reverse Osmosis or Strong Ion Based Exchange (SBA-IX) treatment system at the well site is estimated to have similar Capital, operating and maintenance cost challenges.

The closest Median Household Income (MHI) data for San Andreas Mutual water company is based on La Selva Beach, CA and is \$159,094 as of 2023. The actual MHI for the subset of SAMWAC households is likely significantly less than this number. Based on this MHI data and 140 households served by SAMWAC, a system with an annualized cost greater than \$1,591x140= \$222,740 would exceed the 1% feasibility rule. In 2023, SAMWAC total operating expenses were \$161,374. Subtracting these annual expenses from 2% of MHI over 140 households (\$445,480-\$161,374= \$284,106) says that if the annualized cost of centralized treatment is more than \$284,106, then centralized treatment would be deemed not economically feasible for SAMWAC.

If we make some reasonable assumptions that a centralized RCF, RO or IX system would have a capital cost of \$2M, a 10-year life and annual operating and maintenance costs at 10% of original system cost, the annualized cost of such a system would be \$400,000, well over the threshold for economic feasibility. Even a \$1.5M system would not be economically feasible using these assumptions. We would need to do a significant amount of preliminary cost estimating to determine if a centralized system could be built for an annualized cost of less than \$284,106. This work will take a significant amount of time.

The capital, operating and maintenance cost profiles of centralized treatment at the well site are likely not economically feasible for a small system like SAMWAC unless SAMWAC is able to secure grant funding from the State of California. Any grant funding application would likely require well over a year.

In addition, any centralized treatment system would require a Preliminary Engineering Report (PER) and then a final engineering design process. This engineering process would require both significant time and financial investment.

Given the uncertainty of grant funding, along with the significant time required to apply for grants, and do the engineering design work, SAMWAC will need to consider alternative treatment methods in the short term while further investigating the cost and operational viability of centralized treatment.

Reverse Osmosis (RO) Point of Use Filtration

Preliminary testing of commercially available RO "under sink units" have shown them to be very effective at removing all chromium from water along with all other minerals, required for health or not. The cost of the hardware and installation of POU RO systems can be reduced with volume purchase and is not out of the scope of an expense that a small water system can absorb. The monitoring that would be required can be conducted with staff that is already required to monitor the whole system, so incremental costs are minimized. The duration of service for the RO membrane is not well documented by the manufacturers because of the variability of the incoming water. Given that some sources give membrane lives of 2 – 5 years, testing required by the State of every quarter can easily monitor any degradation of the membrane and other associated filters.

SAMWAC has done preliminary testing of a POU RO system that shows it removes chromium down to a level less than 2 parts per billion, well below the State MCL. The system that SAMWAC is testing today had an "ND" level in Q4-2025. Our testing will continue every quarter with a recording of water volume and Cr-6 concentration.

Overall Chromium 6 Compliance Strategy:

SAMWAC will engage a professional engineer registered in the state of California to complete an alternatives analysis and preliminary engineering report (PER) to determine and confirm the best available treatment solution for the long term. The PER will be used to apply for funding for full engineering design and construction. SAMWAC has applied for additional technical assistance with the EPA Water TA Engineering support as of November of 2025. It typically takes 3-4 months to kick-off the engineering technical assistance and a PER has a typical timeline of 6-9 months. That said, SAMWAC anticipates applying for funding for treatment in the Fall of 2026.

To achieve overall compliance for Chromium 6, SAMWAC is proposed both a Plan A - short term compliance plan, and a Plan B long term compliance plan as follow:

Plan A – short term compliance plan

Reverse Osmosis "Point of Use" Filtration

This compliance plan outlines the intended action and associate timeline to meet Cr (VI) compliance by January 1, 2028. Plan A is based on the use of reverse osmosis point of use filters in every house. This type of treatment is the most cost effective for our small system and is the preferred treatment method of SAMWAC due to lower capital costs and operation requirements. The feasibility of using POU treatment systems will be confirmed in the alternatives analysis. The POU system will be designed in a manner in accordance with state and federal regulations.

Small scale testing

Three units of the Icepure UTR400 under sink Reverse Osmosis system were installed in SAMWAC shareholder properties in Q1-2024 to allow sampling of distributed water run through these devices. After almost 24 months of production, the Total Chrome readings at the output of these systems have all been "ND" (non-detect). Continued test results will be shared with the LPA quarterly.

Small scale test results should be submitted to DDW for approval considering State Water Board Resolution 2016-0015. Full system installation can be completed if this option is found to be workable by the Local Primary Agency (LPA).

Risk of State Approval of This Treatment Method

Currently, the State does not recognize RO-POU systems as enabling compliance with the MCL regulation. They also do not certify the Icepure UTR400 or **any** unit as being capable of extracting Cr-6. While there is minimal risk in running a small test unit to establish knowledge of its operation with our water, our options must be reviewed before a system-wide installation is done.

Short Term Plan A Compliance Plan timeline

Compliance Plan Development: April/Nov-2025
Test unit installation and testing: Dec-2024 and ongoing
Compliance Plan Revision: Dec-2025
Compliance Report to DDW: Early Jan-2026
Explore possible Grant Funding for POU system: Q1 2026 to Q3 2027
Develop Cost Estimate for Centralized Treatment: Q1 2026 to Q4 2026
Determine Economic Feasibility for Centralized Treatment (**22 CCR § 64418.1**): Q4 2026
Verify POU system with State or find and test alternatives (**22 CCR § 64418.2**): Q1 to Q4 2026
Develop and Submit POU Treatment Strategy (**22 CCR § 64418.3**) Q3 to Q4 2026
Finalize selection and approval of POU unit: Q4 2026
Develop Detailed Purchasing and Installation Plan: Q1 to Q2 2027
Develop and Submit Operations & Maintenance Plan (**22 CCR § 64418.4**): Q2 to Q3 2027
Develop and Submit POU Monitoring Plan (**22 CCR § 64418.5**): Q2 to Q3 2027
Board approves funding assessment and shareholder vote (**22 CCR § 64418.6**): Q3 2027
Apply for Permit Amendment for POU Treatment (with above docs): Q3 2027
Purchase Hardware, Select and Contract with Installation Vendor: Q4 2027
Begin Installation of POU Systems: Q1 2028 (installation rate of ~15-20 units per month)
Complete system wide installation: Sep/Oct-2028
System monitoring: Quarterly after 1st installation
Permit Amendment Renewal if required: Q4 2030

Funding Requirements

It is estimated that the total hardware and initial installation cost for SAMWAC to install these systems in all its 140 households would be approximately $200k. This estimate is based on a purchase price including tax of ~$300 per system, and an installation cost under sink by a professional plumber of

$1,100 per unit. This cost includes some buffer for more difficult installations, etc. This capital outlay would require a shareholder assessment of about $1,400 per connection to be approved by the shareholders. The large installation cost is the result of the State requirement that liability for the system maintenance/ownership be with the water provider. If funding from shareholders cannot be secured, State sponsored loans and grants would need to be pursued.

Once installed, quarterly testing of 5% select field units would be less than $3000/year, and full system scheduled maintenance of the membrane units would be less than $30k/year. These estimates are based on approximate costs of $50 for the PPC Filter with a 12-month life and $100 for the RO filter with a 24-month life. Estimates also include an annual professional service call to replace filters at a cost of about $100 per service call. Maintenance and testing costs would have to be passed onto water users at an approximate cost of $20 per month. SAMWAC monthly water fees would therefore rise from a minimum of $75 per month to approximately $95 per month. If capital funding via assessment should fail, then amortized equipment and installation costs would have to be added to this rate hike. If these POU RO systems have a 5-year useful life, the incremental cost per household of Plan A would be about $43 per month or $520 per year.

Plan B - Long term Compliance Plan

Centralized IX Treatment for Cr (VI) and Nitrates at Well Site

Ion-Exchange (IX)

Ion exchange can be used to treat both chromium-6 and nitrates in a centralized process at the SAMWAC well site. The process would require separate specialized resins (nitrate-selective and chromium-selective) housed in independent vessels arranged in series, with nitrate removal occurring first followed by chromium-6 treatment. The treatment of Nitrates first will make the treatment of chromium-6 more efficient and effective. This system will require a layout of two treatment trains aligned in a series configuration. This configuration prevents competitive ion interference and enables independent regeneration or replacement schedules tailored to each resin's unique exhaustion rate.

The IX resins used for treatment can either be single-use resins which will need to be disposed of and replaced when they reach the end of their lifespan, or resins that can be regenerated with a brine solution. The brine waste can potentially be treated through the IX system and/or recycled into a brine tank to minimize the volume to be disposed of at the landfill or disposed to a lined impoundment.

The main benefit of a single-use resin is that it will allow for a much smaller footprint required for treatment than that of a regenerative resin. However, single-use resin will have a higher operating cost as the resin will need to be replaced more frequently than a regenerative resin. The exact lifespan of the resin is dependent on the source water quality and manufacturer requirements. It can be expected that a single-use resin will have a lifespan of approximately 1-3 years and a regenerative resin to have a life span of 8-10 years. The exact lifespan of a resin is dependent on the manufacturer’s requirements and influent water quality.

IX for Nitrates

Ion-exchange for nitrate removal uses an anion exchange system with resin beads containing positively charged ions. These positively charged ions attract and change places with the negatively charged nitrate ions as the water moves through the resin. Once all the positively charged ions have been released from the resin, the resin will have reached the end of its lifespan and be spent. At this point, the resin will need to be replaced or regenerated as it will no longer be able to effectively remove nitrates.

IX for Hexavalent Chromium

Either a weak base anion (WBA) or a strong base anion (SBA) resin for the removal of chromium-6. A WBA would require a pH adjustment to ensure a pH of 5.0-6.0 prior to treatment (verify per resin manufacturer requirements), additionally acid dosing of the ion exchange vessel is required to assist in the absorption of chromium-6 to the resin. WBA can be of benefit when there are competing anions in the source water, such as sulfate, as the WBA does not have an affinity for sulfate.

Alternatively, SBA resins can operate over a wider pH range and would not require adjustment prior to treatment. SBA can work well as a single-use resin with low sulfate concentrations in the source water, if the source water has high concentrations of sulfate, it would cause interference with the removal of chromium-6. This is due to the sulfate ions having a higher affinitive to the SBA resins. It is recommended that the appropriate resin type is selected based on the source water quality per the engineering design requirements and the manufacturer specifications.

Plan for design and construction of an Ion-Exchange Treatment System for SAMWAC

As previously discussed, the implementation of an Ion-Exchange treatment system for SAMWAC would require engineering design followed by construction. The cost of the project would likely be in the range of $1M or more and, as a result, would require SAMWAC to pursue grant funding from the State.

The implementation process would likely include the following steps:

1. Step 0: SAMWAC procures an engineering firm to complete a Preliminary Engineering Report.
    - PER's are required for some funding options such as the state SRF and USDA
    - A PER will recommend which technology is the best option for treatment and provide a construction cost estimate
2. Step 1: Complete funding application for planning and design and procure engineering services
    - After the PER design documents need to be completed this should include an engineering report, final cost estimate, design documents, specifications, and any required permits
    - An RFQ would be sent to qualified engineering firms
    - It could also be included in the scope for the engineering firm to complete the grant application for construction and bid documents
3. Step 2: Complete funding application for construction
    - Using the design documents apply for funding for construction
    - Use a competitive bid process to select contractor (potentially could work with the engineering team to do a design build)

Because of the time and uncertainty involved in Plan B, SAMWAC strongly recommends moving forward with Plan A - Reverse Osmosis (RO) Point-of-Use (POU) filtration in parallel with Plan B to meet the State Cr (VI) compliance timeline. Since the State currently only allows POU systems as a short-term solution while a longer-term centralized solution is developed, SAMWAC must also pursue the engineering and grant funding for Plan B.

Communicating and reporting

Quarterly status reports

Quarterly status reports will be prepared and submitted to the Local Primacy Agency (LPA) no later than the 10th day of the first month of each calendar quarter. These quarterly status reports will include a summary of work completed, progress completion with respect to the compliance plan timeline, and revision requests. These reports will begin when the Compliance Plan is accepted by DDW.

Source monitoring

Although public water systems with approved compliance plans will not be found out of compliance for Cr (VI) until 2028, all sources that contain Cr (VI) about the MCL will be monitored on a quarterly basis. Running annual averages will be reported quarterly to DDW or LPA by the 10th day of the first month of the calendar quarter for the previous quarter.

Public notifications

Public Notices are required a minimum of twice per year and must include a summary of the compliance plan and timeline, report of work completed, information regarding alternative drinking water access, and Cr (VI) sampling results and possible effects on human health. A public notice, based on the template developed by DDW, will be released to customers in conjunction with SAMWAC's bi-monthly newsletter, which is called ***In The Flow***. The newsletter was reviewed by our LPA, and we will edit the notice as needed. Total notices per year will be six.

Contact Information

For more information or questions regarding the compliance plan, please contact the following:

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