Technical Memorandum

SUBJECT
Hardness Reduction Evaluation

TO
Gregory Swart, PE

DATE
June 8, 2021

OUR REF
AES: Ticonderoga Hardness

DEPARTMENT
Water

PROJECT NUMBER
30067228

COPIES TO
J. Dechen (AES)
B. Powers (Arcadis)

NAME
Dana Bryant, PE
518.250.7347, dana.bryant@arcadis.com

AES Northeast retained Arcadis to assist with an evaluation related to hardness concerns with the Town of Ticonderoga (Town) water supply wells, PW-1 and PW-2. Installation of a standard ion exchange system to reduce hardness at the wellfield is reportedly complicated by hard clay soil that limits on-site subsurface disposal of the wastewater produced by an ion exchange softener. Consequently, the Town seeks to evaluate other options for hardness reduction, including alternative treatment methods and ion exchange at a treatment site near the Town's sanitary sewer system, remote from the wellfield.

System Background

Water Supply History

Prior to placing new wells online in recent years, the Town was served by the surface water sources of Lake George and Gooseneck Pond. In 2015, the Town requested Department of Health (DOH) approval for PW-1 to be used as a back-up water supply. Then, in 2018, the Town requested approval for PW-2 to be used as a back-up water supply. Beginning in 2019, these wells became the primary source of supply for part of the Town, with the remainder continuing to receive surface water. In the future, the intent is to serve the entire Town from the wellfield rather than constructing treatment improvements at the surface water supplies.

Wellfield Control Building

The Town owns and operates a wellfield control building on the east side of Route 9N/22 (**Figure 1**) that receives water from both PW-1 and PW-2, and at which treated water enters the distribution system. Currently, the average flow through the control building is one million gallons per day (mgd). The maximum capacity is 1.5 mgd. PW-1 is the primary water source with a 20-inch diameter steel casing extending to a screen that extends from 140 feet to 190 feet below grade. PW-2 is approximately 185 feet southwest of PW-1, is also 20-inch in diameter, but extends to 218 feet below grade. Each well is equipped with a submersible pump and they are each capable of producing 1,100 gallons per minute (gpm) at 190 psi discharge pressure. The wells individually pump to the Wellfield Control Building via 12-inch ductile iron pipes.

The Wellfield Control Building is 76 feet by 48 feet and has an electrical room, generator room, water processing room, mechanical room, chemical room, and laboratory. Flow from the active well is treated solely with sodium hypochlorite before entering the distribution system via 16-inch ductile iron water main.

Gregory Swart, PE
AES Northeast
June 8, 2021

Challenges Relating to Hardness

Due to elevated hardness in the well water, the Town has received complaints from customers of scaling and unpleasant taste and odor. Neither the United States Environmental Protection Agency (USEPA) nor DOH have set regulatory limits on hardness. Concerns relative to hardness are generally aesthetic in nature, not health based.

The United States Geological Survey (USGS) classifies water hardness as follows:

- Soft Water: 0 – 60 mg/L as calcium carbonate
- Moderately Hard Water: 61 – 120 mg/L as calcium carbonate
- Hard Water: 121 – 180 mg/L as calcium carbonate
- Very Hard Water: greater than 180 mg/L as calcium carbonate

The average hardness in the well water is approximately 190 mg/L as calcium carbonate, which is in the range of very hard water as described by USGS. At these concentrations, scaling in sinks, toilets, faucets, etc. is expected as the calcium carbonate precipitates at these locations.

It is not expected that any taste and odor complaints are directly related to hardness other than the fact that the well water contains more minerals than the soft surface water it replaces and to some customers may therefore taste different and could possibly have a somewhat metallic odor.

Ion exchange softening is the typical solution to hard water. However, it generates wastewater from backwashing and rinsing the resin beds that requires disposal. The Wellfield Control Building is reportedly not located near Town sanitary sewers and a significant infrastructure project would be required to extend sanitary sewers to its location. According to information provided to Arcadis, the soils at the wellfield are not conducive to infiltration, so a wastewater lagoon is not considered a feasible solution. While the Town could consider a soils investigation during detailed design to confirm whether a lagoon is feasible, Arcadis evaluated hauling ion exchange wastewater to the Town's wastewater treatment plant (WWTP) and deep well injection.

Individual users could install residential water softeners as their backwash quantities are much smaller and subsurface disposal or discharge to the Town's sanitary sewer system may be feasible. There is ongoing maintenance associated with residential softeners, including routine salt addition, and point-of-use devices are generally discouraged when possible to increase customer confidence in the municipal supply and limit potential points of contamination that the utility does not control.

Technology Review

Chemical Sequestration

Chemical sequestration is a way to prevent calcium scaling without removing calcium (hardness) from the water. It involves adding a chelating agent that combines with the calcium and prevents it from precipitating (forming scale).

Gregory Swart, PE
AES Northeast
June 8, 2021

Evaluation

Several chemical manufacturers were contacted for a chemical sequestrant that will treat hardness in the drinking water supply. Coyne Environmental and Carus Group, leaders in the water treatment and chemical supply industry, provided recommendations for likely chemical sequestrants the Town could consider. Carus recommended their product Carus 8500 and Coyne recommended their product CP-27. Refer to the information attached. The Coyne product is a polyphosphate while the Carus product is an orthophosphate and polyphosphate blend that will sequester calcium as described above. Polyphosphate is the chemical that actively sequesters while the orthophosphate helps to protect the distribution system from corrosion. Sequestering agents can cause existing scale formation on pipe walls to dissolve, which could increase the corrosion rate in those pipes. The addition of orthophosphate helps develop or preserve a protective coating on the distribution piping.

Implementation

The manufacturers recommend that the product be introduced to the well water via a flow-paced chemical metering pump. To provide redundancy, *Recommended Standards for Water Works* (10 States Standards) published by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, recommends two chemical metering pumps, one duty and one standby. Assuming that adequate spare input/output capacity was included in the existing PLC, it could be reprogrammed to control the chemical feed in addition to existing duties.

Carus recommends feeding the phosphate product at approximately 4.1 gallons per million gallons of flow. Given the makeup of the product and relative percentages of ortho- and polyphosphate, the manufacturer indicated that measuring orthophosphate residual is the easiest way to monitor for the correct product dosage. At the recommended feed rate, the orthophosphate residual would be approximately 1.0 mg/L. This would indicate that the orthophosphate dose was at the manufacturer-recommended concentration for corrosion inhibition and the polyphosphate dose was as recommended for sequestering the calcium and the small amount of iron and manganese in the well water.

The chemical injection needs to overcome the wells' discharge pressure of 190 psi. Arcadis recommends a direct feed of the blended phosphate product from totes, eliminating the need for a day tank. Each tote usually holds 275 gallons of chemical, which represents approximately a two-month supply for the Town.

Unless the chemical totes are installed in the existing Chemical Room, the Town will have to acquire secondary containment for chemical totes. A common choice is a spill containment pallet. This option allows the Town to place the tote wherever it is needed inside the plant, as well as allow the operators to reposition the chemical feed system. When an empty chemical tote is replaced, the operator will be able to remove and replace the tote using a forklift or pallet jack or it could possibly be refilled from a delivery truck. This option is favorable because it allows the most versatility and is typically more economical than constructing additional permanent secondary containment in the Plant, especially if the Town may not feed a sequestering agent permanently. If the totes are placed in the Chemical Room, and there appears to be adequate space in the Chemical Room to do this, there would be no need to install a new emergency eyewash/shower, since there is already a combination emergency eyewash/shower present in that room. Otherwise, a new eyewash/shower or portable station should be installed near the totes and chemical feeders. Refer to **Figure 2**. Arcadis assumed the Chemical Room would be used.

Addition of this ortho/polyphosphate blended chemical is recommended with a slow ramp up in the dosing rate lasting approximately 10 weeks. The blended phosphate product is recommended for corrosion control and the

slow ramp up allows the corrosion protective layer to build up on the distribution system pipes and prevents a sudden increase in polyphosphate that could remove existing protective scale.

This option is the most economical of those evaluated with the only equipment cost being two chemical feed pumps with associated installation. Also, there is a low operation and maintenance cost with the chemicals being the only recurring cost beyond the small electrical load of the feed pumps. Using the existing average flow of one mgd, the Town would need approximately six 275-gallon totes per year.

A cautionary note is that the chemical would increase phosphorus loading at the WWTP by 1 to 2 mg/L, as PO_4. A headworks analysis may be needed to determine whether the WWTP can handle this loading.

The Engineer's Opinion of Probable Project Cost for sequestration is presented in the attached cost estimates. The cost is approximately $100,000. However, this assumes a design/bid/build project. If most of the work can be done by Town staff, costs could be significantly reduced. Also, the contingency accounts for a quarter of the cost. A detailed design should narrow that contingency line item.

Advantages/Disadvantages

Advantages

+ Easily increase capacity with increased pumping rate
+ All equipment and chemicals can be stored in existing Wellfield Control Building
+ Most economical
+ No additional wastewater created
+ Provides treatment for all customers.

Disadvantages

- Potential increase in distribution system corrosion rates
- Increased phosphorus loading at WWTP
- No impact on the current taste/feel of the treated water
- Chemical sequestrant can break down at elevated temperatures.

Ion Exchange

Ion exchange treatment is a process whereby positively or negatively charged ions are removed from water by capturing them on resins coated with ion exchange sites (negatively charged sites for removing cations and positively charged sites for removing anions). Ion exchange is a well-established method for removing hardness from water. Ion exchange equipment manufacturers were contacted for this evaluation and detailed technology recommendations were provided by two of them:

- Hungerford & Terry, Inc. (Hungerford & Terry)
- Calgon Carbon, a Kuraray Company (Calgon).

Gregory Swart, PE
AES Northeast
June 8, 2021

Evaluation

Hungerford & Terry

Hungerford & Terry reviewed the water quality and offered a standard ion exchange system to remove hardness from the water. Their approach would blend treated and untreated water to achieve a target hardness of approximately 80 mg/L. The Hungerford & Terry option primarily consists of two 10-foot diameter inline softening resin vessels. These units would treat 860,000 gallons per day (gpd), with the rest of the daily flow bypassing treatment and being blended with the softened water. This approach would reduce the hardness from 190 mg/L as calcium carbonate to approximately 80 mg/L as calcium carbonate. Discussions with the manufacturer indicate that a system can be obtained that can operate at the 190 psi discharge head of the well pumps. If an ion exchange system is installed at a location other than at the wellfield control building, the hydraulic gradient at that alternate location would dictate the design conditions for the resin vessels. The Hungerford & Terry quote included three Rosemount 8750WD magnetic flowmeters with local input transmitters. These flowmeters will go on the softener inlet, the dilution water, and the strong brine; this will regulate the flow and blending to ensure proper softening.

The estimated wastewater generated by the system is 35,000 gallons per day (gpd). The reported run time between regeneration cycles is 11.5 hours, so the system would regenerate approximately twice per day, generating 17,500 gallons of waste each time. Each cycle, automatically controlled, would include the following steps:

1. 10-minute backwash at 470 gpm
2. 20-minute regeneration with salt solution at 102 gpm
3. 16-minute slow rinse at 74 gpm
4. 27-minute fast rinse at 359 gpm.

The system, at peak flow, would blend 436 gpm of untreated water (190 mg/L as calcium carbonate) with 614 gpm of treated water (2 mg/L as calcium carbonate) to achieve Hungerford & Terry's target hardness of 80 mg/L as calcium carbonate.

Calgon ISEP System

Calgon was contacted for a technology recommendation as they have recently introduced a new product to the market; specifically, their ISEP-IOVSB system. This ion exchange process differs in that the unit operates on a carousel and utilizes a rotary distribution valve that regulates incoming and outgoing process flows for maximum effectiveness. This results in shallower beds with maximum media utilization, as the media will be constantly in use and no media will be an idle state. This arrangement is intended to reduce the chemicals and effluent needed to regenerate and clean the media. The preliminarily proposed system is approximately 27 feet wide by 22 feet long by 18.5 feet tall, but the size may change during detailed design of this treatment option.

The estimated wastewater generated by the Calgon system is 3,100 gpd according to the manufacturer, but Calgon did not provide a detailed regeneration cycle breakdown.

Implementation

An ion exchange system comes with implementation challenges that are not present with sequestration. Neither system can be installed in the current Wellfield Control Building due to insufficient space even if wastewater was not an issue. A building will need to be constructed with access to Town sewers to house the ion exchange system and the salts for the Hungerford & Terry system, or potentially at the wellfield for the Calgon system. The salt will require significant storage space as the systems require approximately 2,500 to 3,000 pounds of salt daily. For a system of this size, the manufacturers recommend a brine saturator. Hungerford & Terry recommend one which could hold approximately two weeks of brine for system regeneration, otherwise the operators would be making up multiple batches of brine every day. A representative saturator would be 10 feet in diameter and 18.5 feet tall before accounting for room above it for hoists, etc. Alternative systems could be investigated as part of a detailed design. Salt can be delivered in 1,000- or 2,000-pound Super Sacks that would then need to be hoisted over the saturator to fill it. Dry storage should be provided for a truckload of Super Sacks as it should reduce delivered costs. Arcadis has assumed space for approximately 30 Super Sacks in the general building layout shown on **Figure 3**. Arcadis' preliminary layout requires a structure at least 70 feet by 42 feet. A Town-owned or -acquired parcel near an adequately sized sanitary sewer would be required. While an ion exchange system is inherently simple to operate, maintaining appurtenant systems like a saturator, water quality testing, and regulating flow splits for blending are expected to add several hours of operator effort per day, on average.

Alternatively, the Calgon system would need a structure approximately 97 feet by 62 feet. This is based on a similarly-size system provided as an example by Calgon (**Figure 4**). It could either be located near a sanitary sewer, or it could be located near the Wellfield Control Building if the wastewater were hauled to the WWTP.

For the Town's application, the key disadvantage of the ion exchange system is the wastewater that will be produced that requires disposal. Hungerford & Terry's calculations show that each regeneration would generate approximately 17,500 gallons of wastewater and there would be at least two regenerations per day (actual run time of 11.5 hours between regenerations). Therefore, 35,000 gallons of wastewater would be generated daily. This quantity is likely too large to consider hauling from a holding tank at the Plant to the Town's WWTP. If an ion exchange facility were located near a sanitary sewer, the WWTP should be evaluated to determine if it can handle the flow spikes that could occur with each regeneration. If the wastewater produced during a regeneration flows directly to the sanitary sewer, 17,500 gallons of wastewater would enter the sewer over approximately 73 minutes. Alternatively, a holding tank could be included, that allows for this volume of wastewater to be released over approximately 12 hours (i.e., the time between regenerations).

The Engineer's Opinion of Probable Project Cost for each of the ion exchange options is presented in the attached cost estimates. The Hungerford & Terry cost is approximately $3,210,000. The Calgon system cost is approximately $7,720,000. While the Calgon system uses advanced technology and can reduce the wastewater generated from ion exchange by approximately 90 percent, the estimated cost is more than double that of the Hungerford & Terry system. Property costs, not included in our estimates, could affect the comparative costs.

Advantages/Disadvantages

Advantages

+ Partially removes hardness to achieve a lower concentration as calcium carbonate (whereas sequestering simply reduces scale formation)

+ Some mineral taste could be eliminated
+ No increase in phosphorus loading at the WWTP
+ Reduction in scaling potential is permanent (whereas sequestering may not protect against excessive scaling in hot water heaters).

Disadvantages

- Higher capital costs
- Higher operation and maintenance costs
- It may not be possible to install the system at the Wellfield Control Building – in that case, operators would need to visit and maintain a separate facility
- If the system is not installed at the Wellfield Control Building, some customers will not receive softened water
- Large quantities of wastewater are produced
- New infrastructure is required.

DEEP WELL INJECTION

The Town could consider deep well injection as a method of wastewater disposal at the Wellfield Control Building, which would eliminate the need for hauling wastewater to the WWTP. This is considered the least ideal option because the Town will need to acquire additional permitting and adhere to strict regulations. This option also does not guarantee that the wastewater will not eventually affect the aquifer. Given the effort to obtain and maintain permits, Arcadis does not consider deep well injection a feasible solution at this time, especially given the fact that there is no guarantee that the aquifer may not be affected and the Town now relies on this wellfield as their primary source of supply. It does not appear that the risk offsets the benefit.

MEMBRANE TREATMENT AND ZERO LIQUID DISCHARGE

High pressure membrane treatment (nanofiltration or reverse osmosis) could be used to soften the Town's water, but is an expensive, operator-intensive solution that is not justified by any other contaminants in the source water. It also generates a reject stream that would need to be addressed. Even if the stream is only 10 percent of the total daily water, which may be optimistic, that would still be 100,000 gpd. Zero liquid discharge (ZLD) is the strategic wastewater management system that ensures that there will be no discharge of wastewater from treatment. ZLD is achieved through the recycling, recovering, and reusing of process water to ensure a closed loop with no discharge. The adoption of ZLD requires extensive research and an in-depth pilot study because the wastewater generated will not be the same for different processes. Membrane treatment and ZLD were evaluated but deemed unnecessarily expensive and complicated for this application.

Recommendation and Discussion

Based on the information gathered and discussions with vendors and manufacturers, it is Arcadis' opinion that chemical sequestration is the most cost-effective viable solution for managing the hardness in water from PW-1 and PW-2. Either proposed chemical sequestrant would likely minimize scale formation in customers' homes. Arcadis recommends a blended ortho/polyphosphate that would also control corrosion rates in the distribution system. This would need further evaluation during detailed design. The most compelling reasons for implementing

sequestration are: a) it would require minimal planning, and b) the capital cost is much lower than for the other options. Furthermore, there is little risk of negative consequences; although, it is highly recommended that the potential corrosion-related effects be carefully considered beforehand. After reviewing the performance, impacts on corrosion control, and number of customer complaints, the Town could decide whether a more robust removal solution like ion exchange is needed and would be in a better position to plan and arrange financing for a larger capital project.

Regardless of the solution adopted, if one is pursued, the Town will also be required to adhere to regulations in the State Sanitary Code, Part 5 for Drinking Water Supplies (Subpart 5-1 Public Water Systems). This will include notifying the State in writing 60 days prior of any proposed changes and State approval of changes to the Town's corrosion control plan. Given the current regulatory climate with respect to lead and copper, the Department of Health may require the Town to return to routine lead and copper monitoring if it is currently on a reduced schedule and may take other actions deemed appropriate to ensure minimal levels of corrosion, such as revising the Town's optimal water quality parameters.

Attachments:

- Figures 1 through 4
- Engineer's Opinions of Probable Project Costs
- Equipment Information

REF:

ARCADIS Design & Consultancy for natural and built assets

TOWN OF TICONDEROGA

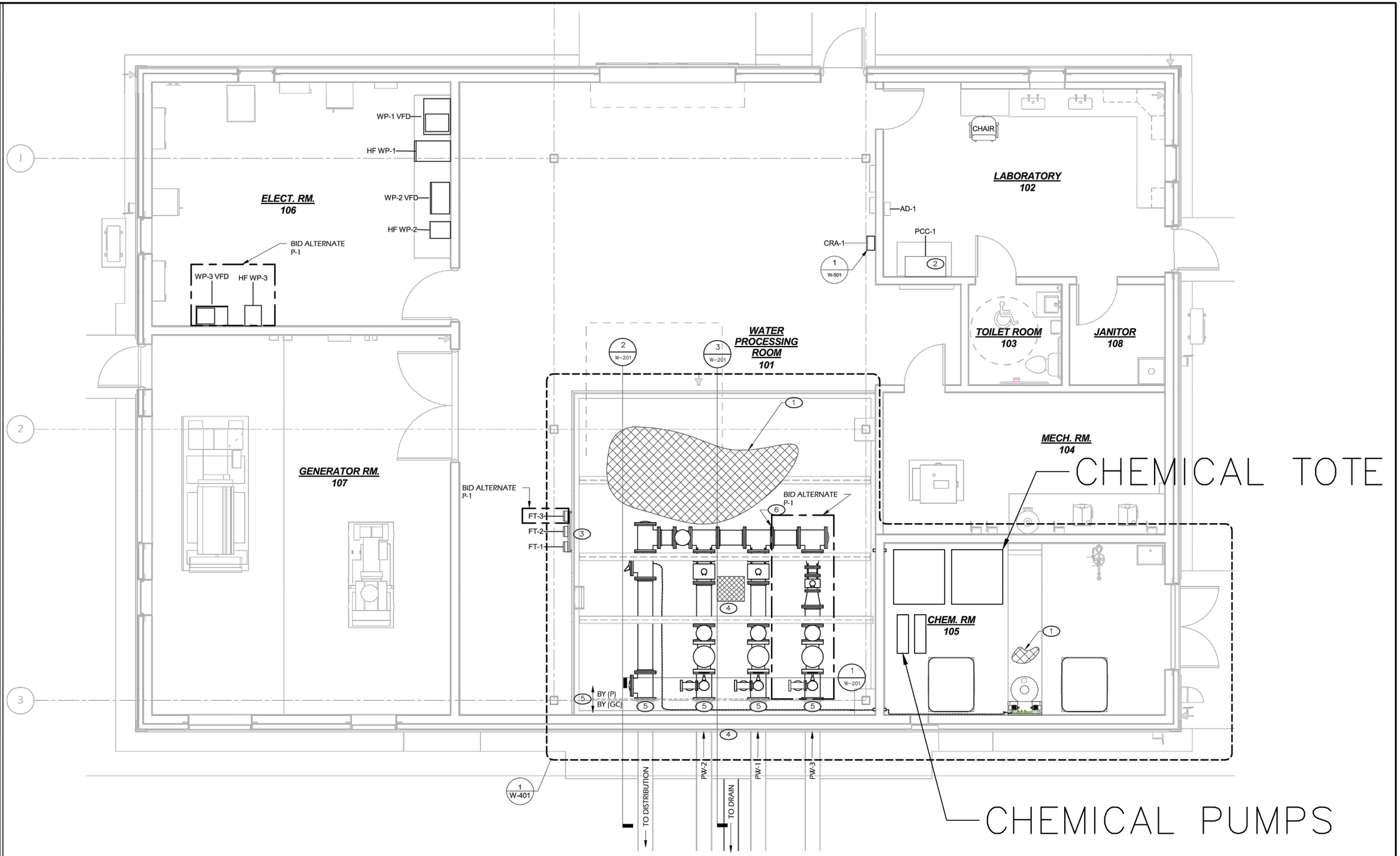
WATER SOFTENING TECHNOLOGY
CONTRACT

WELL FIELD CONTROL BUILDING
SITE OVERVIEW

SCALE: NTS

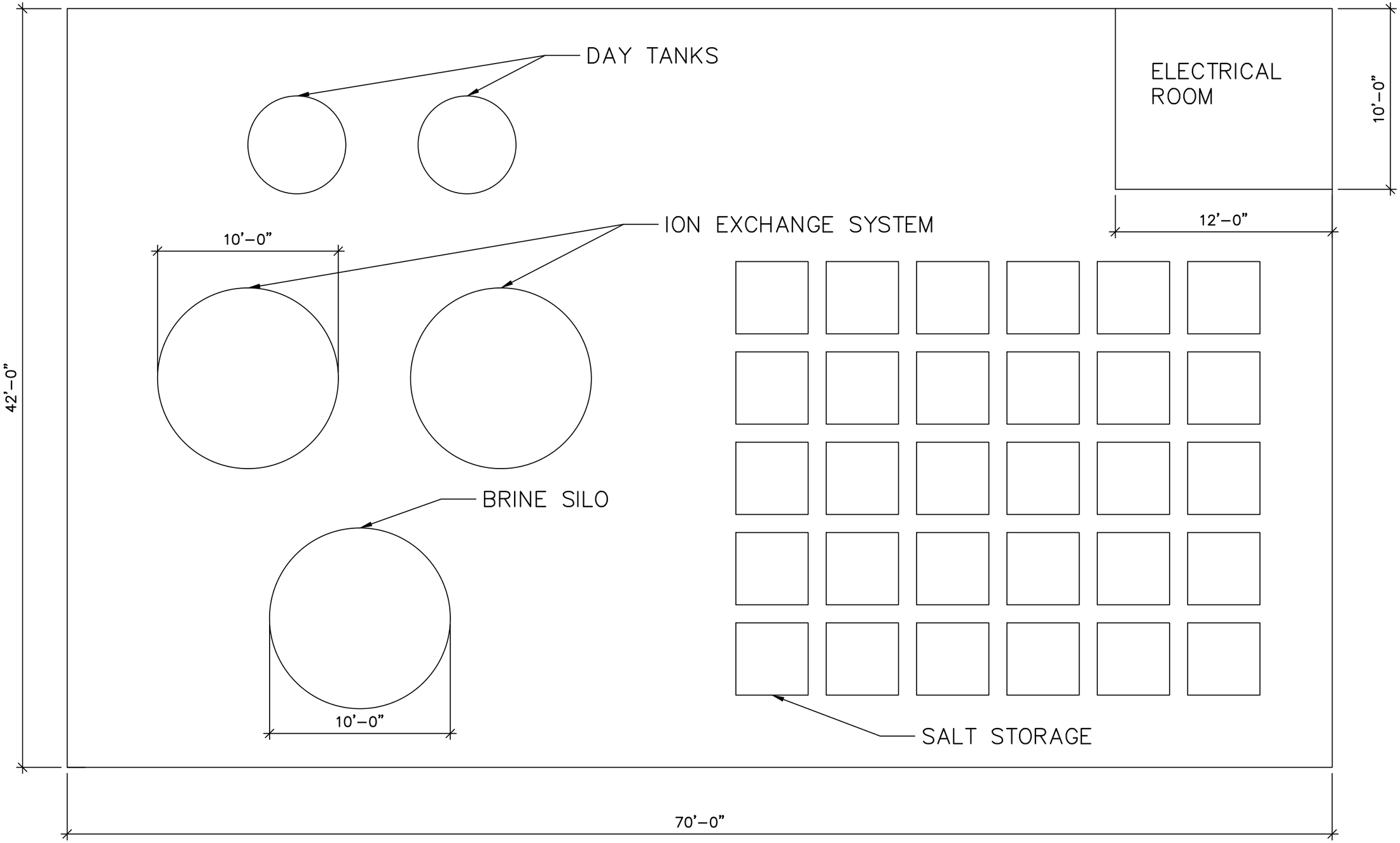
MARCH 2021

FIGURE 1



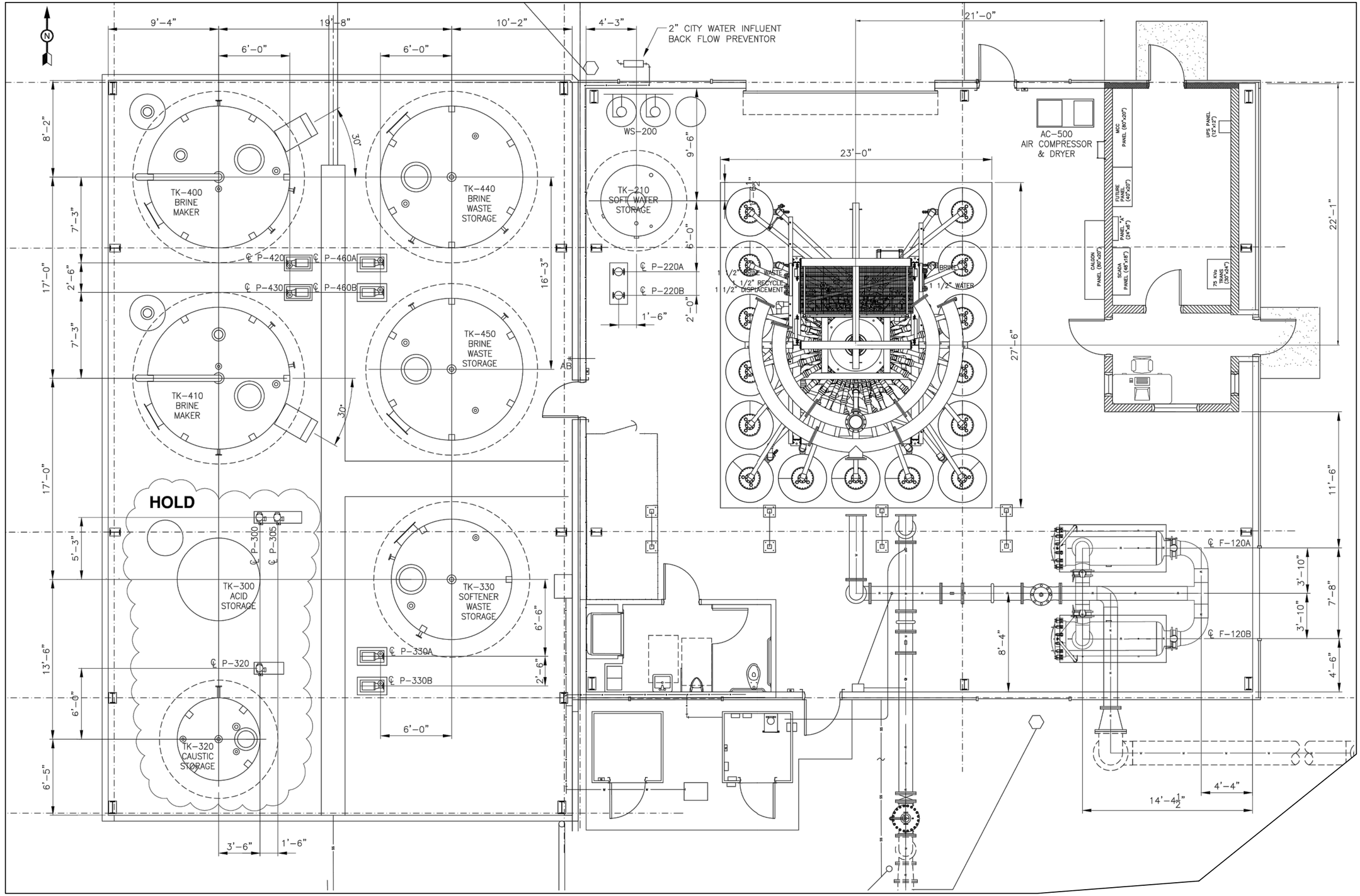
REF:

ARCADIS Design & Consultancy for natural and built assets	TOWN OF TICONDEROGA WATER SOFTENING TECHNOLOGY CONTRACT	WELL FIELD CONTROL BUILDING CHEMICAL SEQUESTRATION SCALE: NTS	MARCH 2021 FIGURE 2



REF:

ARCADIS Design & Consultancy for natural and built assets	TOWN OF TICONDEROGA WATER SOFTENING TECHNOLOGY CONTRACT	WELL FIELD CONTROL HOUSE HUNGERFORD & TERRY SCALE: 3/16" = 1'	MARCH 2021 FIGURE 3



REF:

ARCADIS Design & Consultancy for natural and built assets	TOWN OF TICONDEROGA WATER SOFTENING TECHNOLOGY CONTRACT	WELL FIELD CONTROL BUILDING CALGON ISEP SCALE: NTS	MARCH 2021 FIGURE 4

HARDNESS REDUCTION COSTS
TOWN OF TICONDEROGA
TICONDEROGA, NEW YORK
Chemical Sequestration
Engineer's Opinion of Probable Project Cost

Data Date: 3/17/2021

Description	Quantity	Units	Unit Cost	Total Cost
Chemical Feed Pump	2	EA	$ 16,500.00	$ 33,000
Chemical Feed Appurtenances	1	LS	$ 7,500.00	$ 7,500
Electrical and Reprogramming	1	LS	$ 12,000.00	$ 12,000
Subtotal Construction Costs				**$ 52,500**
Engineering	25%			$ 13,125.00
Legal and Administrative	2%			$ 1,050.00
General Conditions and Insurance	12%			$ 6,300.00
Overhead and Profit	10%			$ 5,250.00
Contingency	50%			$ 26,250.00
TOTAL PROJECT COSTS				**$ 100,000**

Note:

Total project costs are rounded to the nearest $10,000
Costs from RSMeans CostWorks, Vendor Quotations, and Similar Projects
All costs are installed costs
Costs do not include any impacts on construction materials or labor as a result of COVID-19 pandemic
In-line phosphate analyzer not included. Assumes operator testing.

HARDNESS REDUCTION COSTS
TOWN OF TICONDEROGA
TICONDEROGA, NEW YORK
Hungerford & Terry Ion Exchange
Engineer's Opinion of Probable Project Cost

Data Date: 3/17/2021

Description	Quantity	Units	Unit Cost	Total Cost
Ion Exchange Equipment	1	LS	$ 480,000.00	$ 480,000
Treatment Building (70' x 42')	2,940	SF	$ 350.00	$ 1,029,000
Site Work	1	LS	$ 102,900.00	$ 102,900
Subtotal Construction Costs				**$ 1,611,900**
Engineering	25%			$ 402,975.00
Legal and Administrative	2%			$ 32,238.00
General Conditions and Insurance	12%			$ 193,428.00
Overhead and Profit	10%			$ 161,190.00
Contingency	50%			$ 805,950.00
TOTAL PROJECT COSTS				**$ 3,210,000**

Note:

Total project costs are rounded to the nearest $10,000
Costs from RSMeans CostWorks, Vendor Quotations, and Similar Projects
All costs are installed costs
Costs do not include any impacts on construction materials or labor as a result of COVID-19 pandemic
Real estate costs are not included.

HARDNESS REDUCTION COSTS
TOWN OF TICONDEROGA
TICONDEROGA, NEW YORK
Calgon Carbon Ion Exchange
Engineer's Opinion of Probable Project Cost

Data Date: 3/17/2021

Description	Quantity	Units	Unit Cost	Total Cost
Ion Exchange Equipment	1	LS	$ 2,000,000.00	$ 2,000,000
Treatment Building (97' x 62')	6,014	SF	$ 350.00	$ 2,104,900
Site Work	1	LS	$ 210,490.00	$ 210,490
Subtotal Construction Costs				**$ 4,315,390**
Engineering	25%			$ 1,078,847.50
Legal and Administrative	2%			$ 86,307.80
General Conditions and Insurance	12%			$ 517,846.80
Overhead and Profit	10%			$ 431,539.00
Contingency	30%			$ 1,294,617.00
TOTAL PROJECT COSTS				**$ 7,720,000**

Note:

Total project costs are rounded to the nearest $10,000
Costs from RSMeans CostWorks, Vendor Quotations, and Similar Projects
All costs are installed costs
Costs do not include any impacts on construction materials or labor as a result of COVID-19 pandemic
Real estate costs are not included.

Sterling Water Technologies LLC

Technical Information Bulletin
rev. 5/18/12

CP 27 Polyphosphate

- NSF/ANSI STD 60 Certified
- Reduces or eliminates the need for pH adjustment
- Reduces overall treatment costs

Description

Sterling Water Technologies CP 27 is a liquid polyphosphate scale and corrosion inhibitor used primarily in the protection of potable water distribution systems. CP 27 has been specifically formulated to provide excellent sequestering capabilities and for a wide range of general corrosion inhibition needs. When added to the water flow, CP 27 forms a stable, evenly distributed protective film on distribution piping and all surfaces.

Typical Properties

Appearance: Clear colorless liquid
% P-PO4: 26 – 28
Density: 1.35 – 1.43
pH: 5 – 8
Solubility: 100%
Crystallization point: < 20°F
NSF/ANSI STD 60 MUL: 37.0 mg/L

Product Safety Information

CP 27 is a non-hazardous material. However, caution should be taken to prevent ingestion, contact with skin and eyes. It is recommended that safety eye protection, gloves and other personal protection be worn when handling all chemicals.

Principal Uses

- Contributes to general corrosion control
- Sequesters calcium, iron & manganese
- Prevents scale deposits

Packaging and Shipping

CP 27 is available in:
- 30 gallon (340# net weight) N/R poly drums
- 55 gallon (620# net weight) N/R poly drums
- 275 gallon (3000# net weight) N/R totebins
- Bulk – various quantities

Storage and Handling

- Store in a cool, dry, well ventilated area away from incompatible materials.
- Keep containers closed when not in use.
- Do not reuse containers. Empty containers retain product residues which can be hazardous.

Consult the product SDS for specific information regarding handling, storage, safety, and DOT description.

COYNE ENVIRONMENTAL

Marketed and Distributed by:
Coyne Chemical Environmental Services, 3015 State Road, Croydon, PA 19021-6997
215 785-3000 MAIN | 215 785-1585 FAX | **www.coyneenvironmental.com**
orders@coynechemical.com | 800 523-1230 ORDER ENTRY

CARUS WATER



Municipal Drinking Water

CARUS™ 8500 WATER TREATMENT CHEMICAL

DATA SHEET

CARUS™ 8500 water treatment chemical is an effective corrosion inhibitor and sequesterant for use in potable and industrial water systems. The product is a liquid concentrate of exceptional purity, clarity, and stability utilizing a broad spectrum of phosphates for better sequestering and corrosion control.

BENEFITS OF CARUS 8500

• Inhibits corrosion of steel distribution system water lines, iron and galvanized piping, and lead and copper plumbing

• Decreases iron tuberculation to extend the life of the distribution system

• Inhibits lead and copper leaching resulting in lower lead and copper levels in the delivered potable water

• Minimizes the occurrence of microbial-influenced corrosion providing longer life system

• Controls iron and manganese minimizing rusty and dirty water in the system

• Reduces discoloration, staining, and mineral build-up resulting in fewer customer complaints

• Diminishes calcium scale deposits typically seen in hot water lines and heaters

• Saves money by reducing corrosion and scale; lowering chlorine demand and decreasing hydrant flushing, leaks and failures

PROPERTIES AND CERTIFICATIONS

Description:	Clear homogenous liquid
Freezing Point:	Do not freeze
Specific Gravity:	1.35 - 1.41
pH (1% w:w):	5.2 ± 6.2
NSF Maximum Feed Rate:	18 mg/L
NSF/ANSI Standard:	60
Kosher Approved	

NSF

Certified U Kosher Pareve

HANDLING AND STORAGE

CARUS 8500 water treatment chemical should be handled with care. Wear proper protective equipment including goggles, face shield, apron, respirator and proper gloves when handling this product.

Protect containers from physical damage. Store in a cool, dry area in closed containers. In case of accidental release: contain spill by collecting the liquid in a pit or holding behind a dam (sand or soil). Absorb with inert media and dispose of properly. Disposal of all materials shall be in full and strict compliance with federal, state, and local regulations. Consult the SDS for additional safety and handling information.

SHIPPING

CARUS 8500 water treatment chemical is generally considered to be safe and is not classified as hazardous according the US Department of Transportation, Canada TDG, UN, IMDG, or IATA regulations.

COMPATIBILITY INFORMATION

CARUS 8500 water treatment chemical can be stored in high-medium density polyethylene, cross-linked polyethylene, fiberglass reinforced plastic, 316 stainless steel, and glass/epoxy lined steel tanks. Piping materials may include schedule 80 PVC/CPVC piping, clear PVC, and white polyethylene tubing. Pump materials may include ceramic, Teflon, viton, hypalon and PVC liquid end pump materials.

Metering equipment can include diaphragm and peristaltic type metering pumps and other pumps meeting compatibility requirements.

It is not compatible with black iron, mild steel, galvanized metals, aluminum, zinc, copper, lead, brass, bronze, tin, and other base metals.

CARUS CORPORATION — ONE COMPANY, ENDLESS SOLUTIONS

CORPORATE HEADQUARTERS | 315 Fifth Street, Peru IL 61354 | Tel +1.815.223.1500 / 1-800-435-6856 | Fax +1.815.224.6697 | Web: www.caruscorporation.com | E-mail: salesmkt@caruscorporation.com

CARUS EUROPE | Calle Rosal 4, 1-B | Oviedo, Spain 33009 | Tel +34.985.785.513 / Fax +34.985.785.510

rev. 07/17
Form PH 15203

RESPONSIBLE CARE® OUR COMMITMENT TO SUSTAINABILITY

CARUS®

CARUS
WATER



Municipal Drinking Water

CARUS™ 8500 WATER TREATMENT CHEMICAL

DATA SHEET

SHIPPING CONTAINERS

5 gallon (58 lb) Jerrican
Made of high density polyethylene (HDPE). Weighs 3.31 lbs. (1.5 kg).
The net weight is 58 lbs. (26.3 kg).

15 gallon (173 lb) Drum
Made of high density polyethylene (HDPE). Weighs 6 lbs. (2.72 kg).
The net weight is 173 lbs. (78.5 kg).

30 gallon (345 lb) Drum
Made of high density polyethylene (HDPE). Weighs 12.2 lbs. (5.5 kg).
The net weight is 345 lbs. (156.5 kg).

55 gallon (633 lb) Drum
Made of high density polyethylene (HDPE). Weighs 20.5 lbs. (9.21 kg).
The net weight is 633 lbs. (287.1 kg).

SHIPPING CONTAINERS

275 gallon (3163 lb) IBC (Intermediate Bulk Container)
The IBC has a 2 inch (5.08 cm) butterfly valve with NPT threads in bottom sump. Weighs 123.2 lbs. (55.9 kg). **The net weight is 3163 lbs. (1435 kg).**

Bulk quantities up to 3500 gallons are available.

Other containers may be available, contact Carus Corporation at 800-435-6856 for details.

CARUS VALUE ADDED

LABORATORY SUPPORT

Carus Corporation has technical assistance available to answer questions, evaluate treatment alternatives, and perform laboratory testing. Our laboratory capabilities include: consulting, treatability studies, feasibility studies, and analytical services.

FIELD SERVICES

As an integral part of our technical support, Carus provides extensive on-site treatment assistance. We offer full application services, including technical expertise, supervision, testing, and feed equipment design and installation in order to accomplish a successful evaluation and/or application.

CARUS CORPORATION

During its more than 100-year history, Carus' ongoing emphasis on research and development, technical support, and customer service has enabled the company to become the world leader in permanganate, manganese, oxidation, and base-metal catalyst technologies.

CORPORATE HEADQUARTERS | 315 Fifth Street, Peru IL 61354 | Tel +1.815.223.1500 / 1-800-435-6856 | Fax +1.815.224.6697 | Web: www.caruscorporation.com | E-mail: salesmkt@caruscorporation.com
CARUS EUROPE | Calle Rosal 4, 1-B | Oviedo, Spain 33009 | Tel +34.985.785.513 / Fax +34.985.785.510

rev. 07/17
Form PH 15203

CARUS®

HUNGERFORD & TERRY, INC.

PREPARED FOR: BENJAMIN POWERS- WATER RESOURCES ENGINEER- ARCADIS

PREPARED BY: CHRISTOPHER RALPH
SALES REPRESENTATIVE

December 31, 2020

Attention: Benjamin Powers- Water Resource Engineer- Arcadis

Reference: 10' Diameter Softener System
Hungerford & Terry Inc. – Budgetary Proposal #BDJ123120

Benjamin,

In response to your request, Hungerford & Terry, Inc. is pleased to submit the attached Budgetary Proposal BDJ123120 for your consideration. This proposal provides for two (2) 10' diameter softener system per below specifications

This proposal is budgetary and is formulated using the available information. The design may be subject to change as more information becomes available. The specifications provided within is intended for securing funding for the project and contains contingency pricing to account for changes that may be necessary as the project progresses. Firm pricing will be available on bid day or upon request per intent to purchase.

We very much appreciate the opportunity to submit this proposal and we hope that it meets with your favorable consideration. Should you have any questions or need for additional information, please feel free to contact our local representative at the address and telephone number listed below, or this writer at our home office in Clayton, New Jersey.

Very truly yours,

HUNGERFORD & TERRY, INC.

Christopher Ralph
Sales Representative

J. ANDREW LANGE, INC
Michael T. Mele
6010 Drott Drive- Suite B
East Syracuse, NY 13057
Ph: 315-437-2300
Fax: 315-437-5935
mmele@jalangeinc.com

1. System Information

Design Flow Rate:	**615**	**GPM**
Max System Usage:	430,000	Gal/24 hours
Number of Softeners:	2	
Diameter:	10	Feet
Straight Shell:	103	Inches
Filter Capacity:	100	%
Flow Rate:	7.8	GPM/sqr. ft.
Media Depth:		
Resin	36	In
Gravel:	4	in
Brine Usage/Regen	2,031	Gal
Salt/Regen	1,434	Lbs.

2. Water Analysis

Fe:		mg/L
Mn		mg/L
H2S:		mg/L
pH:	7.7	Units
Temp:	11.8	Degrees C
Hardness:	190	mg/L as CaCO3
Alkalinity		mg/L as CaCO3
SiO2:		mg/L
NH3N:		mg/L
Other:		

3. SCOPE OF SUPPLY

Water Softener System:

Softener Tanks:

Two (2) 120 inch OD x 103 inch straight shell softener tank designed in accordance with the following:

- 100 psi design pressure.
- ASME code section VIII construction with stamp.
- Constructed with SA-516 grade 70 steel.
- One (1) 14 inch x 18 inch elliptical manway.
- Necessary flanged pad or nozzle type connections.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs.
- Tank interiors will be sandblasted (SSPC-SP5) and lined with a Tnemec N140 finish paint system.
- Tank exteriors will be white metal sandblasted (SSPC-SP5) and painted with one primer coat of Tnemec Hi-Build Epoxoline II Series N69F.

Tank Internal Distributors:

Two (2) Header lateral inlet distributor/waste collectors with schedule 80 PVC pipe with lateral arms ending with upturned elbows.

Two (2) Header lateral brine inlet distributor of schedule 80 PVC pipe construction with PVC brine valves.

Two (2) Hub (polypropylene), with wrapped curved radial laterals (schedule 80 PVC) underdrain distributors.

Notes:

1. The tank inlet and underdrain distributors will be shop installed prior to shipment. The brine inlet distributor is to be field installed by the contractor as the media is placed into the units.

Resin:

Two (2) 4 inches graded gravel support beds, plus bottom head fill.

Two (2) 60 inch bed of Purolite C-100-E.

Softener Valve Nest Exterior:

Two (2) Bray Series 30 butterfly control valves with wafer style cast iron bodies, nylon coated discs, metal reinforced EPDM seats, with Bray Series 70 electric motor operators with auxiliary limit switches and anti-condensation heaters for:

- Inlet
- Outlet
- Backwash inlet
- Backwash outlet
- Rinse

Bray Series 30 butterfly valves with wafer style cast iron bodies, nylon coated discs, metal reinforced EPDM seats and manual gear operators for:

- Inlet isolating
- Outlet

Flow-Tek series 80 stainless steel ball valves with threaded bodies and manual lever operators for:

- Tank drain
- Air vent isolating

Apco model 200A or equal automatic air vent valves with threaded cast iron bodies and stainless steel floats for:

- Tank air vent

Simtech Tru Union PVC ball valve with Bray series 70 electric actuator for:

- Brine inlet

Flow Equipment:

Three (3) Rosemount 8750WD magnetic flowmeter with local input transmitter for:

- Softener inlet
- Dilution water
- Strong brine

System Piping:

Schedule 80 PVC pipe with socket weld fittings.

Notes:

1. All pipe supports for the interconnecting piping are to be furnished by the purchaser.

2. All valves, etc. will be furnished with the manufacturer's standard painting. PVC piping will not be painted.

All system face and interconnecting piping will be furnished with the required bolts, studs, nuts, and gaskets as follows:

Bolts: ASTM A307 Grade B plated carbon steel.
Studs: ASTM A307 Grade B plated carbon steel.
Nuts: ASTM A563 plated steel heavy duty hex.
Gaskets: Shore A70 or equal, 1/8 inch thick.

Brine System Valving:

Two (2) Simtech VB series or equal true union PVC ball valve with lever operator for:

- Strong brine isolation
- Dilution water isolation

Two (2) Simtech VQ series PVC ball check valve.

- Strong brine
- Dilution water

Two (2) Simtech VB series true union PVC ball valve with Bray series 70 electric actuators for:

- Strong brine shutoff
- Dilution water shutoff

Two (2) Asahi or equal PVC globe valves with socket weld bodies for:

- Strong brine rate set
- Dilution water rate set

Four (4) Georg Fischer model 514 PVC Diaphragm valves for:

- Treated water rate set
- Common backwash rate set
- Rinse
- Water bypass

One (1) Penberthy or equal PVC eductor

Softener Auxiliary Equipment:

Pressure Equipment:

Two (2) Rosemount model 2051 pressure sensors.

Four (4) Ashcroft model 1279SS pressure gauges for the tank inlet and outlets with 4.5 inch diameter dials and stainless steel bourdon tubes.

Four (4) Sets of polypropylene supply tubing.

Four (4) Sets of manual isolating valves.

Four (4) Sets of sampling valves.

Brine Day Tank:

One (1) 66" ID x 54" tall FRP open top tank with internal collector.

One (1) Flowline model LU-81 or equal ultrasonic level transmitter.

One (1) Simtech VB series PVC ball valve with Bray series 70 electric motor actuator for:

- Brine tank fill

Two (2) Simtech VB series PVC ball valve with manual lever operator for:

- Brine tank fill isolating
- Brine tank discharge isolating

Softener Control Panel:

One (1) Hoffman NEMA 4, wall-mount type electrical control panel of ANSI 61 grey painted steel construction complete with an Allen Bradley MicroLogix 1400 series Ethernet programmable controller, Automation Direct #EA9-10CL C-More 10" diag. color TFT touch screen OIT, and all required nameplates, Phoenix Contact #UT-6 series terminal blocks, internal type "MTW/THWN/THHN" triple-rated stranded copper wire, Phoenix Contact 120VAC surge suppressor, Phoenix Contact Ethernet surge suppressor, Red Lion/Ntron #104TX Ethernet switch, Phoenix Contact UNO series 24VDC power supply, Allen Bradley #700-HK series interposing relays, Panduit Type "G" gray wire duct, Phoenix Contact heat-shrink white wire sleeves, GFCI duplex receptacle, UL-508A label, and etc.

Notes:

1. The Softener Control Panel will be completely shop wired, skid mounted and tested prior to shipment.
2. All interconnecting wiring, conduit/fittings, and wire terminations between the Softener Control Panel and remotely located electrical equipment are to be furnished and installed by the contractor.
3. The Softener Control Panel will be provided with all I/O and programming to control the softeners along with the accessories listed in this proposal. PLC and OIT programming software packages are not included in this proposal.
4. Spare parts for the Softener Control Panel are not included in this proposal.
5. The Softener Control Panel will have a spare port on the Ethernet Switch to communicate with the customer's SCADA System via Ethernet/IP protocol.
6. All instrumentation not specifically listed in this proposal shall be by others.
7. H&T will submit our standard electrical drawing package, which includes ladder logic drawings, external and internal panel view drawings, electrical equipment lists, PLC system architecture drawing and electrical wiring diagrams showing both internal/external wiring.
8. All engineering and drafting required for field interconnecting conduit, cable list and sizing, conduit supports and maps of interconnecting electrical installation, conduit and trays shall be supplied by others. All engineering and drafting required for customer's ground grid system shall be by others.
9. Contractor will need to provide a 20A, 120V-1PH-60Hz power feed to the control panel.
10. All automatic and manual controls, status, and alarms shall be via the OIT screens.

5. System Notes

System Software/Programming equipment:

Programming integral to the operation of the equipment supplied by Hungerford & Terry, Inc. will be performed by Hungerford & Terry, Inc. using AB Rockwell RSLogix PLC programming software and Automation Direct C-More OIT programming software. Should the customer wish to purchase a registered copy of programming software, please contact the H&T sales department for a quote.

Shop Assembly:

Skid number 1 will include softener tanks, with all piping, valves, and auxiliary equipment installed, NEMA 4 control panel with rigid galvanized conduit and liquidtight flexible steel conduit to each electrical item.

Hungerford and Terry, Inc. Standard Surface Preparation & System Painting:

Misc. Equipment:

The exteriors surfaces of all misc. valves, pumps, etc. will be furnished with the manufacturer's standard prime coat painting or standard prime and finish painting.

Finish Painting:

Finish painting of all equipment furnished by Hungerford & Terry, Inc. is to be field applied by the installation contractor


CalgonCarbon®
Pure Water. Clean Air.
Better World.
Superior Sugar Refining with ISEP® Technology

Decolorization of Raw Sugar

Sugar cane is the primary feedstock for the world's sugar supply, but sugar cane must be harvested, milled and refined to produce sugar. Refining is a multi-step process and decolorization is one of the important unit operations in the production of liquid and crystalline sugar. Sugar colorants can come from natural components in the cane plant or be developed during processing. Typically, colorants are non-polar, anionic in nature and span a wide range of molecular weights. Some examples of sugar colorants include polyphenols, melanoidins and products from hexose degradation. With increasing consumer and market demands for higher quality sugar, refineries must adopt cost-effective means to remove color bodies from cane sugar.

Decolorization of raw sugar for the production of high-grade sugar products is typically performed with the assistance of a range of media such as bone char, activated carbon and ion exchange resins. There are a number of factors that influence a refinery's decision to adopt a certain technology or combination of technologies, and, in many cases, ion exchange resins offer the lowest capital and operating costs for both large and small applications.

Calgon Carbon Corporation (CCC) is a world leader in offering ion exchange technology for sugar decolorization and deashing. CCC has supplied commercial plants for these processes using IonSEParator (ISEP®) technology for over 20 years. Our continuous ISEP® technology is reliable, versatile and cost-effective, compared to alternative technologies and fixed bed systems.

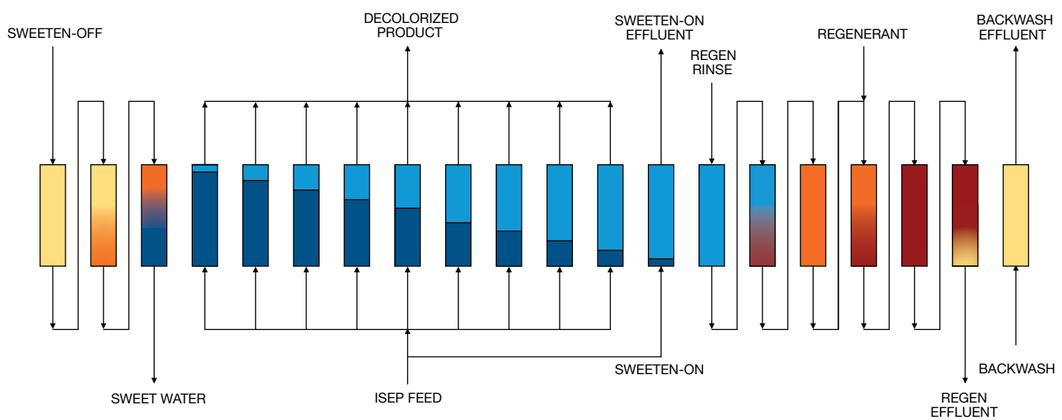
Benefits of Using ISEP® Continuous Ion Exchange Resin Technology for Decolorization

Improvements in the efficiency of macroporous strong base anion (SBA) resins, along with lower capital and operating costs, have increased the acceptance of ion exchange technology for secondary decolorization in many refineries. A single SBA resin, or a combination of acrylic and/or styrenic resins, provides broad and effective color removal, and Calgon Carbon's continuous ISEP® system is the most flexible and efficient option for applying these resin technologies for decolorization.

Calgon Carbon's ISEP® system easily lends itself to a variety of resin combinations, process configurations, construction materials and layout choices. The ISEP® system has proven to use up to 50% less water than competitive fixed bed systems, while at the same time using up to 50% less resin. In addition, chemicals consumed and waste volumes generated during the resin bed regeneration are dramatically reduced due to the counter-current, multi-pass nature of the continuous system.

Calgon Carbon has installed more than 650 continuous ISEP® installations in more than 40 applications since 1990.

Typical Decolorization ISEP® Process Flow Diagram



The core of every ISEP® system is a rotary distributor that continuously directs the feed, wash, regeneration and rinse streams through the media cells. This configuration ensures that all media is in active duty and the process is advanced through each operation one step at a time, with a step time proportional to the color removal load required.

Syrup Deashing Options in an ISEP®

A recent focus of the sugar industry has been low invert liquid sugar, and the ISEP® system is ideal for this application. An ISEP® deashing system offers the process advantage necessary to prevent invert formation and additional color degradation often generated in traditional fixed bed technologies, while also eliminating the potential need for a mixed bed ion exchange resin system with its complicated and difficult regeneration process. ISEP® systems have been used for decades in syrup deashing services from corn to beet to cane operations. The ISEP® rotary distributor technology has stood the test of time and has proven to improve efficiencies and reduce cost. The flexibility of an ISEP® system allows for optimization for both high and low ash and color loads by simply adjusting the valve rotation speed.

ISEP® Continuous Ion Exchange Advantages

- Improved efficiency
  - Counter current contact
  - Counter flow regeneration
  - High ionic/color loading
- Reduced media inventory
  - No dormant media
- Reduced operating costs
  - Less media
  - Less water
  - Fewer chemicals
  - Less waste
- Steady-state operation
  - Consistent product and effluent quality
  - Concentrated products and effluents
- Reduced manpower — typically less than one operator per shift
- Reduced space requirements
- Chemical regeneration — a major cost reduction compared to thermal regeneration

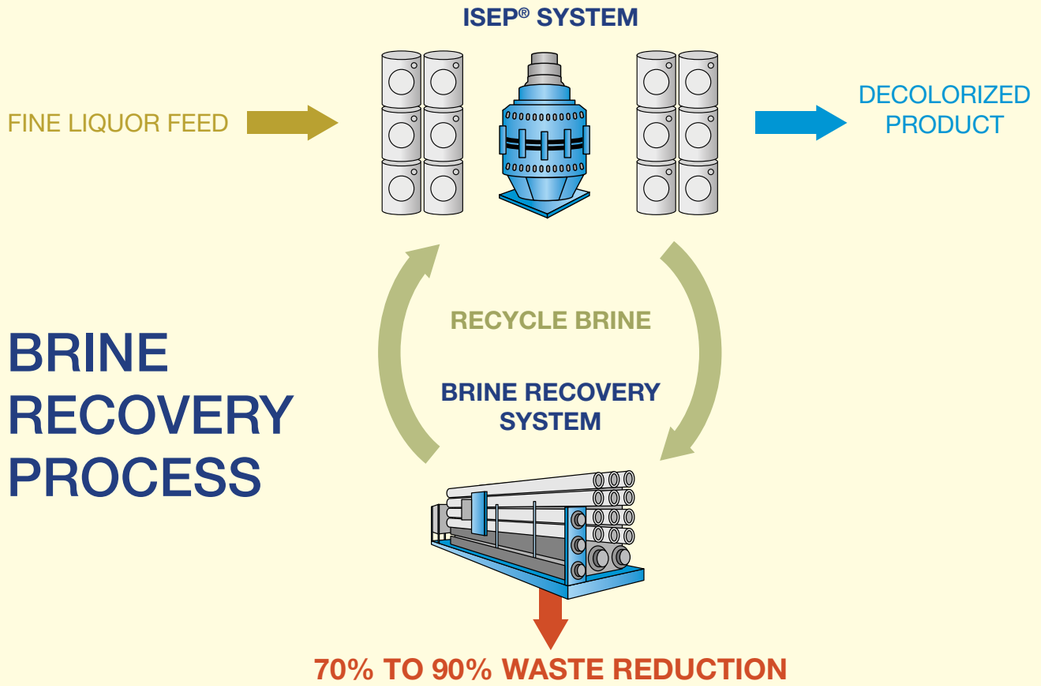
Ion Exchange Decolorization with Brine Recovery

There are many advantages to selecting an ion exchange system over other technologies for cane sugar decolorization. However, one of the few challenges related to an ion exchange system is the waste from the resin regeneration process. When an ion exchange resin is exhausted with colorants, the resin must be regenerated for re-use. Regeneration is accomplished by passing a caustic brine solution through the resin, resulting in a concentrated brine effluent. Historically, the brine effluent would be disposed of as waste and a new brine solution would be prepared for each regeneration cycle. However, new technology has made it economically feasible to recycle the brine effluent.

Calgon Carbon's continuous ISEP® technology produces significantly less waste brine effluent than fixed bed systems. While the ISEP® process will still generate some waste brine effluent, refineries can reduce salt usage and waste volume by up to 90% by utilizing the appropriate brine recovery system.

Nanofiltration systems are being used commercially to recycle the brine effluent produced during the regeneration process. The utilization of nanofiltration is proven to reduce both salt and water consumption. Studies have shown that the use of a brine recovery system reduces the operational costs of an ion exchange decolorization system by over 50% and makes the process more environmentally friendly. By combining the use of continuous ion exchange with nanofiltration membranes for brine recovery, cane sugar refineries can significantly reduce the already favorable operational costs of continuous ion exchange.

BRINE RECOVERY PROCESS



Operational Cost Comparison for Two Typical Decolorization Systems

Basis: 800 TPD Raw Sugar Plant with 600–800 ICUMSA Feed Color and Brine Recovery

	Back-End Refinery		Stand-Alone Refinery	
	Refined Sugar Using Fixed Bed IX Technology	Refined Sugar Using Calgon Carbon's ISEP® Technology	Refined Sugar Using Fixed Bed IX Technology	Refined Sugar Using Calgon Carbon's ISEP® Technology
Average Operating Time Per Year	210 days	210 days	365 days	365 days
Life of Resin Used in the Process	4 years	4 years	2.3 years	2.3 years
Resin Required	55 cubic meters	18 cubic meters	55 cubic meters	18 cubic meters
Amortized Costs of Resins/Media	$80,000 USD	$26,000 USD	$139,000 USD	$46,000 USD
Cost of Sweetwater Evaporation, Rinse Water, Waste Water	$171,000 USD	$66,000 USD	$297,000 USD	$116,000 USD
Cost of Other Acids/Chemicals	$106,000 USD	$54,000 USD	$185,000 USD	$94,000 USD
Other Operational Costs	$67,000 USD	$50,000 USD	$116,000 USD	$87,000 USD
Total Costs	$424,000 USD	$196,000 USD	$737,000 USD	$343,000 USD
Annual Sugar Production	168,000 MT	168,000 MT	292,000 MT	292,000 MT
PER METRIC TON COST	**$2.52**	**$1.17**	**$2.52**	**$1.17**

54% Lower Operating Cost Using an ISEP®

Ion Exchange in Combination with Activated Carbon

Many sugar refineries are using a combination of ion exchange resins and granular activated carbon to meet their treatment objectives and overall product quality. In these applications, the granular activated carbon will perform the primary (gross) decolorization of the feed, and the feed will then be polished using an ion exchange resin. In addition to improving product quality, this combination results in longer service cycles for the activated carbon and ion exchange resin.

Activated carbon removes color by physically adsorbing color molecules as a result of intermolecular attractions or forces inherent to the carbon surface. The surface forces create a stronger attraction between the carbon surface and the color molecule than between the color molecules and the sugar liquor. Activated carbon is not specific for any type of color, but performs good overall gross color removal. Further, the massive effective surface area of activatedcarbon allows for a large quantity of color to be removed without exhausting the adsorbent.

As a global leader in activated carbon and ion exchange systems, Calgon Carbon is uniquely positioned to provide the best solution for achieving the treatment objectives of sugar refineries.

Calgon Carbon is the preferred solutions provider for state-of the-art continuous ion exchange systems.

Calgon Carbon's Rotary Valve Distributor Technology

At the heart of every ISEP® system is a single, multi-port, rotating distributor valve that directs all incoming and outgoing streams with the most flexibility and efficiency of any system available. The advanced valve technology indexes at a specific rate using a minimum of moving parts, thereby increasing reliability and system up-time. The multi-port distributor is configurable for any number of processes from ion exchange, chromatography, adsorption to even media cycle testing. In essence, the rotary valve technology is an elegant continuous media contactor. The flexibility goes even further because the valves can be configured for either moving bed (ISEP® technology) or simulated moving bed technology (ISEP®-IOVSB technology).

In the traditional ISEP® technology, the cells are mounted on a turntable powered by the valve or by a separate dedicated drive, while, in the ISEP®-IOVSB technology, the cells are mounted directly on the floor and the rotation is simulated.

The choice of ISEP® rotary valve configuration for a particular application is determined by:

- Process design
- Flow rate
- Spacial considerations
- Overall benefit to customer
- Economics

The extreme flexibility afforded by the rotary valve allows for use of any design of cell from a higher aspect ratio to a lower aspect ratio cell for shallow bed technology. The use of shallow beds with good distribution further results in maximum media utilization and reduced pressure. In every ISEP® system, the media is constantly in use, with none of the media in an idle state, and this high resin utilization results in a much lower media inventory than compared to conventional ion exchange systems. Counter-current and counter-flow regeneration and rinse steps, along with low media volume, combine to reduce the amount of chemicals and effluent required to regenerate and clean the media.

Calgon Carbon's Advanced Rotary Valve Distributor ISEP®–IOVSB

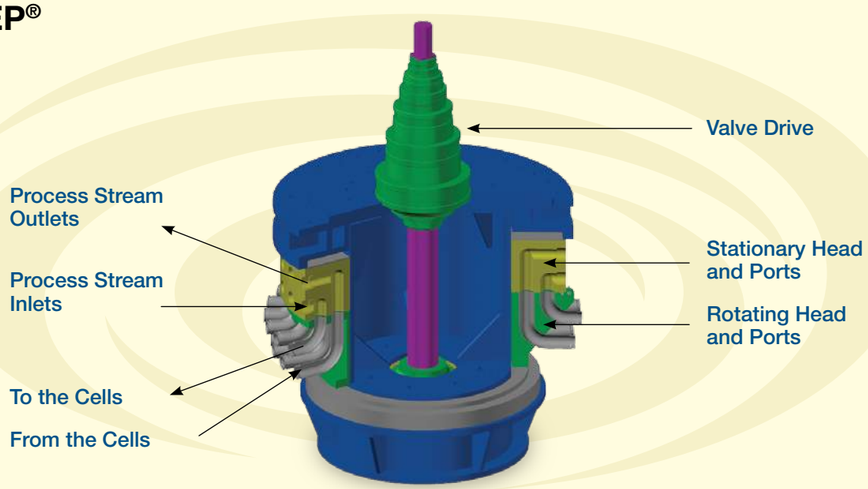
The ISEP®-IOVSB configuration of the rotary distributor is the latest offering by CCC, and precludes the need for a turntable while still maintaining the advantages of Calgon Carbon's ISEP® continuous ion exchange technology. When developing a new rotary valve, it was essential that Calgon Carbon maintain the design parameters that have made the ISEP® such a success over the last 25 years. This objective meant preserving the symmetry, simplicity and flexibility inherent in the ISEP® system while offering a rotary valve that allowed for stationary beds. In addition to the stationary bed component of the design, the IOVSB valve also allows many variations in layout that can better fit within the refineries' space constraints. Along with improved layout, the IOVSB version can improve access and reduce overall installation cost and maintenance.

By maintaining flow symmetry throughout the ISEP®-IOVSB valve design, all process connections sequentially index through the stationary cells with no loss of flexibility. All potential process configurations such as up-flow, down-flow, series or parallel flow are determined by exterior piping to the valve and not the valve proper. This allows one valve design to be used for any number of applications and installations with minimal spare parts. The ISEP®-IOVSB is also extremely beneficial in applications with variable conditions resulting in flow configuration changes, a feature not available in competing rotary valves of limited flexibility. Valve symmetry also results in reduction of liquid sealing surfaces. The ISEP®-IOVSB valve has only two simple planar surfaces compared to complicated competing rotary valves of annular faces with multiple O-ring seals.

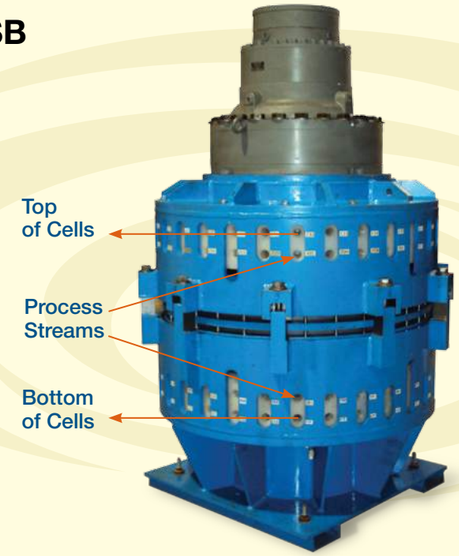
All the parameters of Calgon Carbon's ISEP® valve were maintained in the ISEP®-IOVSB rotary valve:

- Truly continuous process flow
- More flexible equipment layout
- Use of traditional stationary columns
- Reduced maintenance
- Reduction in spare parts inventory

ISEP®



ISEP®-IOVSB



About Calgon Carbon

Calgon Carbon Corporation is an industry leader through unmatched innovations in the purification, separation, and concentration of liquids and gases. Throughout our history, Calgon Carbon has been a pioneer in creating new products, systems and services from the infancy stages to global commercialization. As the industry forerunner in activated carbon, ultraviolet light disinfection/oxidation and ion exchange technology, Calgon Carbon provides cutting-edge purification solutions in more than 700 distinct market applications, from purifying sweeteners and pharmaceuticals, air and water, to separating gases and removing mercury emissions from coal-fired power plants.

Each year, hundreds of municipalities, government agencies, and food, biotech, chemical and pharmaceutical manufacturers turn to Calgon Carbon to solve their purification challenges. Technical experts are available to help choose the most cost-effective methods to apply its technologies in air, water, process purification, food and beverage production, site remediation and marine water treatment. Its goal is to help customers reduce the time and expense associated with maintaining purification systems. Protecting the environment is a vital responsibility. The quality of our lives depends on the purity of the air we breathe, the water we drink, and the food we eat. Calgon Carbon is dedicated to providing solutions to address environmental needs.

Pure Water. Clean Air. Better World.

Calgon Carbon's Processing Solutions

Calgon Carbon offers superior processing options using not only regenerable and non-regenerable ion exchange and adsorbent resins, but also silica gels, activated carbon and molecular sieves based on the unique application. Since 1990, manufacturers and industries have discovered the exceptional value of Calgon Carbon's continuous ISEP® equipment technology for separating, purifying and synthesizing materials. With more than 450 installations in more than 40 applications, ISEP® continues to prove that it is capable of solving complex problems economically.

Calgon Carbon Corporation

Ion Exchange Technologies

3000 GSK Drive
Moon Township, PA 15108

USA

Phone: 1-800-422-6700

Email: info@calgoncarbon-us.com

www.calgoncarbon.com