

**SACWSD – Water Hardness Advisory Committee (HAC)**  
**August 22, 2017**

**Meeting Summary**

Members of the South Adams County Water and Sanitation District (SACWSD) Water Hardness Advisory Committee (HAC) convened for their fifth meeting - an update meeting. The purpose of the meeting was: to get an update on the pellet system pilot study: the consultant and their plans for the study. (*See appendix A for a list of attendees and appendix B for the agenda*).

**I. SACWSD STAFFING UPDATE**

Jim Jones, SACWSD District General Manager, introduced two staff that will be the key staff for the HAC through the pilot study:

- John Ennis, Project Manager, is a chemist with a lot of experience at SACWSD running key projects; and
- Kipp Scott, Water Systems Manager, leads SACWSD treatment and operations systems, and will provide additional support to the HAC when needed.

Amanda Thomas and Blair Corning, the key staff for the HAC from the start, have moved on to new exciting job opportunities.

**II. PILOT STUDY – SELECTION PROCESS AND CONTRACTOR**

To select a consultant to study a pellet softening system in the district, SACWSD sent a request for proposal to ten firms with water treatment experience, and particularly with pellet softening systems. Two firms submitted proposals, Brown & Caldwell and Carollo Engineers, Inc. (Carollo). Both firms were interviewed by SACWSD staff and Carollo Engineering was selected to conduct the study.

Carollo is an engineering, planning and design firm that focuses solely on water and wastewater facilities. They are based in California with offices in Broomfield and Littleton.

Carollo was selected because of their extensive experience with water treatment facilities and, specifically, with pellet softening systems. They recently completed design and construction on a pellet system now in operation by the Chino Desalting Authority located in Ontario, CA. Carollo has a partnership with RoyalHaskonigDHV, a Dutch company who has 30 years of experience designing and constructing pellet softening plants, has designed and patented components of the pellet softening technology, and has experience treating water similar to SACWSD (high levels of hardness and lower levels of alkalinity; Netherlands source water is similar to the alluvial water treated by SACWSD). Carollo also brought an alternative treatment technology for consideration that was less costly than a pellet softening system: carbonate softening (see below).

### III. PELLET SYSTEM STUDY

The pellet softening system technology (mechanics) for the pilot study is being shipped from the Netherlands and should arrive for installation in late September. The study will use a system which has been used in many pilot studies and is known to produce the same results that a full-scale plant will produce. The study will evaluate the system and results over 30 days in October. At the end of October, the HAC will be invited to the facility to review the technology in person. Carollo will tabulate the 30-day test results, and develop a realistic cost estimate (if the system tests well), and provide the results to the HAC sometime in December.

The study will look at three key elements:

1. Radioactivity in the pellets – Does the waste product contain the high levels of radioactive materials that require it to be classified as radioactive (which requires disposal in a landfill certified to handle radioactive waste)?;
2. Hardness level achieved - Does the system achieve the Board's hardness goal of 115mg/L calcium carbonate (Carollo expects the system to achieve hardness levels lower than the Board's goal, possibly as low as 50 mg/L)?; and
3. Resulting pellet chemistry – Are the generated pellets viable for resale (e.g. based on purity and levels of radioactivity)?

Pellet softening treatment is a three-step process taking water from the source to drinking water at a home:

- First, water goes through the pellet softening system – the pilot plant has a flowrate of about two-gallons a minute and the flow moves upwards through a 2 inch clear column. The pilot column will contain seed material and the calcium carbonate in the water will precipitate (comes out of solution and forms a solid) onto the seed material (the initial seed is approximately 5% of the weight of the final pellet produced, from 0.3 millimeter to 0.9 millimeter).
- Second, it goes through a GAC filter (Granular Activated Carbon filter) to catch any particulates generated in the pellet softening process and carried over to the filter.
- Third, the finished water is disinfected with the addition of chlorine to bring water to drinking water standards. *(Study will not cover this step; if implemented this process will be utilized at the Klein WTP)*

The pilot study will focus on the first two steps – pellet formation and filtration. Water from the study will not be available to the public to taste or use since the system has not been approved by the Colorado Department of Public Health and Environment (CDPHE).

The pellet softening process starts by adding caustic soda, sodium hydroxide solution, to raise the pH of the water. As the source waters flows up through the pellet column, the calcium carbonate will precipitate on the surface of the seed pellet, increasing the size of the seed pellets.

There are two seed types: calcium carbonate or silica sand. These options have a cost difference. Sand is less expensive to use than calcium carbonate, but calcium carbonate will

produce a higher purity pellet and may generate revenue due to the desirable pure calcium carbonate pellet. Carollo will use calcium carbonate seed pellets for the pilot study.

A pellet softening system can use caustic soda or lime (calcium hydroxide) to cause the calcium carbonate to move. The study will utilize caustic usage for several reasons:

- If lime is used in the pellet softening process, it adds calcium to the source water. SACWSD's water doesn't have enough carbonate to remove the additional calcium, therefore soda ash would need to be added to the process to provide the carbonate needed to reach the hardness goal (lower the calcium).
- There is also a cost consideration. While caustic soda is more costly up front (\$400 a ton with a lot of price volatility, versus lime at \$150 a ton) the lime method of pellet softening adds costs during the process (it needs soda ash), during filtering (produces more particulates to be filtered out), and for disposal (doubles the residuals generated).
- SACWSD is already familiar with caustic soda. It is already used in the SACWSD process (experience and equipment).

Carollo's study will also include looking into resale options. They will begin with a known distributor from the Chino Desalting Authority project, Specialty Minerals, who has informed Carollo that there are twelve companies in the Denver area who could potentially use the pellets. One factor for possible resale is the whiteness/purity of the pellet. The pellets could be used for concrete block, drywall, or porcelain. Porcelain requires a high purity or whiteness but also has the highest resale value for the pellets.

#### **IV. ALTERNATIVE TECHNOLOGY FOR CONSIDERATION – CARBONATE SOFTENING**

***What does it do?*** The impacts of hard water stem from the calcium carbonate in the water that precipitates out and leaves a film on home fixtures and appliances (scaling). The carbonate softening treatment removes only the carbonate from the water. Without as much carbonate in the water, calcium will remain in solution and not precipitate as much calcium carbonate, greatly reduce scaling.

***How does it do that?*** First the process lowers the pH of the water converting carbonate into free carbon dioxide. The lower pH allows the free carbon dioxide to be stripped from the water by aeration.

***Why look at this alternative system?*** The carbonate system is less expensive, maybe half the cost of a pellet system. It also has lower operation and maintenance costs. Although it doesn't lower the chemical hardness levels (numbers), it would decrease the impact of hardness precipitation in homes. This system decreases scale build up on appliances, lengthening the life of hot water heaters and appliances. Aeration treatment is also an effective treatment for the removal of volatile organic compounds (VOC), which could eliminate the need for the current GAC contactors at the Klein Water Treatment Plant.

***What are some known concerns with carbonate softening?*** One possible problem is taste; will the water's taste improve with a carbonate system or not (data in the literature is limited).

If not, the system may not be worth the cost savings. Another concern is this alternative doesn't lower the hardness level; this system will not remove calcium, so a test for hardness will result in similar results as what currently exists. Because the carbonate system uses aeration there maybe air emission permit requirements (for VOCs and carbon dioxide). Also, it is unknown at this time how corrosive the water might be after carbonate treatment. Just like any other treatment change, the corrosivity of the water would need to be tested and appropriate measures taken to ensure a non-corrosive water supply.

**Results of HAC Taste Test?** HAC members were given six water samples and asked to rate them from 1-5:

1. I would be very happy to accept this water as my every day drinking water
2. I am sure that I could accept this as my every day drinking water.
3. Maybe I could accept this as my every day drinking water.
4. I could not accept this water as my every day drinking water.
5. I can't stand this water in my mouth and I could never drink it.

The six samples included two samples from Denver water (first and fifth), two SACWSD water after blending with Denver Water (third and sixth), and two carbonate softened water without blending with Denver Water (second and fourth).

The HAC averaged results of the taste test:

- Denver water – 2.5 “sure/maybe accept this water as my everyday drinking water”
- SACWSD water – 3 “maybe accept this water as my every day drinking water”
- Carbonate softened water – 3.4 “maybe/can't accept this water as my every day drinking water”

The results don't show significantly worse taste so it is worth continuing to consider this alternative. If the taste test had resulted in 4.5/5 average rating, that would have been a bigger indicator that this alternative would make taste worse and therefore not worth pursuing.

Comments from the HAC:

- The water samples were slightly chilled; taste test are better done at room temperature (although the EPA standard method which was being followed required a temperature of 15 degrees C which is below room temperature).
- The taste test was conducted too quickly to make final judgments on the results.
- We need a larger random sample of taste tests to be able judge whether to remove carbonate softening from consideration (or not).
- Concern: The largest amount of complaints are about water hardness and if carbonate softening doesn't decrease the number, not sure it would be worth it, although the system would decrease the impacts of hardness if not the number.

Questions and Answers:

- *Question:* Why would the first taste of the carbonate softened water taste salty, but the second one did not?  
*Answer:* Many external factors could impact taste the second time, including comparing to the sample before, someone making a face (or not), etc.

- *Question:* Does carbonate softening add salt?  
*Answer:* No. Overall it does not increase the total salt, although sodium increases as the carbonate decreases.
- *Question:* How much Denver water would be blended into SACWSD water?  
*Answer:* Approximately 25%.
- *Question:* Will the carbonate softening system help with the life of home softeners and appliances?  
*Answer:* Yes, by removing the carbonate that moves into a home system the calcium carbonate build up/scaling impacts would be much less.
- *Question:* What are the corrosion impacts of the carbonate system?  
*Answer:* We will test for corrosion impacts, but it is possible that phosphates would need to be added. Either alternative (carbonate or pellet) may require corrosion control processes.
- *Question:* Are others using the carbonate system?  
*Answer:* No, not solely by itself, but Reverse Osmosis (RO) systems utilize the carbonate removal and air stripping processes to treat the water produced by the RO treatment process. Brighton's RO system has a similar aeration system to carbonate softening.
- *Question:* Have you/Carollo ever worked on a carbonate softening system?  
*Answer:* Yes, in Tampa, FL there is currently a pilot study being performed to determine the effectiveness of carbonate softening. The system is a tower with media that has lots of surface area creating turbulence/air flow, as well as air blown into it. Because it doesn't take a lot of horsepower to run there is little head loss and therefore low energy costs.

## V. NEXT STEPS

Based on the schedule for the pilot study, barring no unforeseen issues, the HAC schedule will be:

- October(end), 2017 – HAC Meeting – Meet at the treatment facility to learn more about the technology, any initial results (if available) and possibly do a taste test of pellet softened water.
- December (early), 2017 – HAC Meeting – Understand the results of the study and develop an initial recommendation for public comment/input.
- January, 2018 – HAC Public meeting – The HAC will gather input from the public on a possible ways to address hardness.
- February, 2018 – HAC meeting – Build agreement on a final recommendation to the Board.

## **APPENDIX A: Attendance**

### **HAC Members Present:**

- Brett Burrough, Business-North
- Danny Thomas, Resident-South
- Elaine Hassinger, Tri-County
- Glenn Murray, Resident-North
- Jessica Monahan, Resident-North
- Jim Jones, District General Manager
- Pamela Sprattler, Resident-South
- Robyn Jeffords, Resident-North
- Steven Erwin, Resident-North
- Tina Dorf, Business
- William Frew, Business-North

### **Observers:**

- Betty Thomas, Resident
- Brendan Binns, Resident-South
- Joy Bishop, Resident-South
- Gene Leffel, Resident-South
- Blair Corning, *(no longer SACWSD staff)*

### **Staff & Consultants:**

- Kipp Scott, SACWSD, Water Systems Manager
- John Ennis, SACWSD, Project Manager for Pilot Study
- Byron Jefferson, SACWSD, Administrative Services Manager
- Vincent Hart, Carollo Engineers, Inc., Inc., Project Manager
- Will Sarchet, Carollo Engineers, Inc., Project Engineer
- Jody Erikson, JSE Associates (Facilitator)

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## **APPENDIX B: Agenda**

### **SACWSD – Water Hardness Advisory Committee (HAC)**

**August 22, 2017**

District Office, 6595 E 70th Ave, Commerce City, CO 80022

**Objective:** Update on pilot study – meet the contractor and learn elements of the pilot study

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**6:05 Welcome & Introductions & Taste Test**

**6:30 Break – Dinner**

**6:45 Update: Pilot Study and SACWSD Plan**

- **Contractor – Process and Selection of Engineering Firm** – *Kipp Scott, SACWSD*
- **Study schedule** – *Kipp Scott*
- **What they will study** – *John Ennis, SACWSD PM & Carollo Engineers, Inc., Inc*
  - Pellet Pilot Study elements and process – *Vincent Hart, Carollo Engineers, Inc.*
  - Alternate treatment technology option to be evaluated (carbonate softening) - *John Ennis SACWSD Chemist II*

- How does it compare with the other options the HAC has reviewed
- What is needed (info.) to better understand this type of treatment
- Taste Test Results

**8:00 Next Steps - Estimated HAC schedule**

- October(end) - HAC Meeting (at treatment facility)– Learn more about the technology, taste test Pellet Softened water, and if available, any initial results
- December (early) - HAC Meeting – Understand the results of the study and develop an initial recommendation for public comment/input
- January 2018 - Public meeting - HAC to gather input
- February 2018 - HAC meeting – Build agreement on a final recommendation to the Board

**8:30 Adjourn**