



CASE HISTORY: City of Chino: Their Road to Nitrate Removal



History

The City of Chino, centrally located in the western portion of the Inland Empire below the San Bernardino Mountains, has seen intense population growth. Back in the 1950s, the city of Chino was a rural agricultural community with < 6,000 residents. Today, Chino is a bustling metropolis of over 70,000 people.

The City of Chino historically has been an agricultural area with heavy emphasis on farm crops, orchards, and dairy farms. The agricultural activities have contributed significantly to the nitrate problem in the Chino Basin via extensive fertilization and livestock activity.

Traditionally, Chino relied on wells producing groundwater from the Chino groundwater basin (Chino Basin) for its water requirements. Chino needed to expand its groundwater production capacity in order to meet the increasing demand which resulted from the city's population growth. Water quality issues associated with nitrate contamination impacted the city's ability to reliably expand this production capacity; therefore, the City supplemented its water sources with the purchase of imported water from the Metropolitan Water District of Southern California (MWD)

Recognizing the problem of nitrate contamination, the City of Chino set up a capital improvement project to add treatment to its existing and new groundwater sources of drinking water. In 2003, the city completed a review of costs, permitability to provide drinking water, and documented performance history with their engineering firm, Stetson Engineers, to provide a direction for nitrate treatment.

Typical technologies such as RO, bioremediation, fixed bed ion exchange, and Calgon Carbon's ISEP® technology were evaluated. Some of the critical criteria included previous installation and operation of a nitrate removal system, existing approval of the technology by the California Department of Health Services (CDHS) and a nearby operating installation. One other major consideration was, at the time, a little-known contaminant that had been showing up in the Inland Empire called perchlorate. Based on those criteria, the City decided to move forward with the Calgon Carbon ISEP® technology.

Why ISEP®?

The ion exchange process is generally more suitable as a well site treatment for nitrate removal than reverse osmosis or a combination of the two. Ion exchange requires lower capital and annual operating costs, has greater reliability, uses less energy, requires no additional well site storage, has higher water recovery, produces more concentrated waste brine, and requires fewer automatic and electric controls. It can be operated on demand as required.

Simple Reliable Continuous Operations

- Ideal for Start/Stop Operation
- Operates at Line Pressure

Flexibility

- Handles Fluctuations in Flow and/or Nitrates by Adjusting the Rotation Rate
- Modular Design Allows for Future Expansion

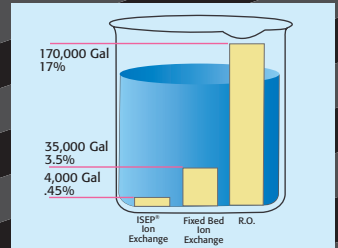
The ISEP® contactor uses a number of ion exchange beds (20 or 30) which are mounted on a rotating carousel. The rotation of the carousel moves the beds slowly through the required sequence of operations which normally includes adsorption, regeneration, rinse, and displacement.

These operations occur simultaneously as the carousel rotates. The different fluids are distributed through a 2-in-1 valve with 20 or 30 ports allowing for either cocurrent or countercurrent and parallel or series flow through the resin beds depending on the requirement. The arrangement allows for continuous flows in all operations.

Rotation is provided by a fractional horsepower motor with low energy consumption. Essentially, there are only two moving parts to the ISEP® (the rotary valve and the turntable) which typically rotate 1-3 times per day.

Why ISEP®?

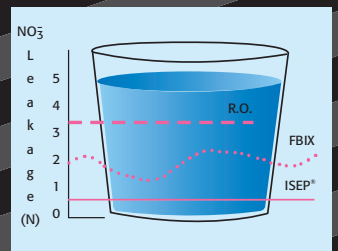
Water Usage



Maximum Water Utilization

- Up to 90% Reduction in Waste Volume
- Increased Water Capacity

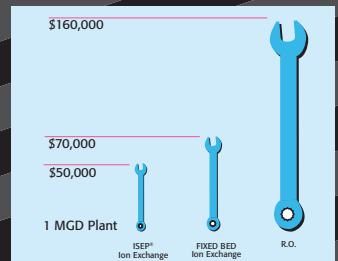
NO₃ in Treated Water



Consistent Water Quality

- Continuous Operation Eliminates Fluctuations in NO₃ levels

Operation & Maintenance



Low Operation and Maintenance Costs

- ISEP® Operates on Fractional H.P. Motor
- 75% Fewer Valves
- Easy to Operate and Maintain
- Consistent waste quality

Project

Based on the success of San Gabriel Valley and Valley County Water's ISEP® projects for perchlorate removal, the City decided to use the same "team" with Calgon Carbon as the main contractor and RC Foster as the installation subcontractor. Stetson Engineers acted as civil site engineering company under a separate contract with the City. The contract was signed in August 2003 based on performance criteria and identification of the major project components. Similar to a design/build approach, detailed engineering was completed in phases as the project progressed. Construction was completed in August 2005. The 5,000 gpm treatment plant was started-up for testing in September 2005 and their CDHS permit was approved in early 2006.

ISEP® installation during construction

Commercial plant brine tanks and ISEP® facility



Results

CDHS Permit Testing			
	Inlet	Nitrate Removal Outlet	Perchlorate Removal Outlet
Operation Mode			
Flowrate, Peak (gpm)	2,400*	2,410	2,410
Nitrate (mg/L)	72.8	< 2.5	< 2.5
Perchlorate (ppb)	low or high	< 4 (low)	< 4 (high)
Raw Material Usage			
Salt (dry) (tons/day)	-	4.9	18.6
HCl (32%) (gpm)	-	0.019	0.019
Soft Water (gpm)	-	23	39
Waste Generation			
Spent Brine (gpm)	-	13	31
Spent Brine (% of total)		~0.5	~1.3

* CDHS Permit testing based on operation of Well # 9 only; hence the reduced flow.

After extensive testing and review by the California Department of Health Services (CDHS), the city of Chino's nitrate/perchlorate water treatment plant was approved for use in February 2006. The water treatment plant is currently being operated in a nitrate mode. As designed, the water treatment plant is capable of treating 5,000 gpm. City groundwater wells #5 & #9 located at the water treatment plant site currently produce 4,000 gpm. The water treatment plant can operate with either well on-line (individually) or with both wells flowing at the same time. Improvements to the existing facilities will allow for an additional well to be treated as needed in the future.

"For our nitrate removal project," said Gil Aldaco, City of Chino Water Utilities Supervisor, "the city elected to use Calgon Carbon Corporation to oversee all aspects of the project, thereby relieving the city staff of the considerable time requirements typical of a project of this scale. With the CDHS permit process completed, the water treatment plant is processing high nitrate groundwater, reducing levels to below 2.5 ppm. Perchlorate is below our detection limits.

The addition of the Calgon Carbon Corporation (ISEP®) water treatment plant provides us with the ability to use a high producing groundwater well that had been idled for many years due to poor water quality. The added groundwater supply will help meet the growing water demands of our City. It will add to the reliability of supply and provide us with an ability to decrease purchases of treated water."

Headquartered in Pittsburgh, Pennsylvania, Calgon Carbon Corporation operates 16 manufacturing and equipment facilities and 20 sales and service centers worldwide. For more than 40 years, Calgon Carbon has been at the forefront of municipal drinking water treatment. Using granular activated carbon (GAC) for taste and odor removal, ultraviolet light technology for pathogen control, and ion exchange technology for removing perchlorate and nitrate, Calgon Carbon has been a pioneer in making drinking water safer and cleaner.

Stetson Engineers, Inc. was responsible for all civil site improvement components of the Chino system. Stetson specializes in all phases of water resources engineering, including hydrogeological studies of groundwater basins and rivers, water well design, and water treatment facilities.

RC Foster Corporation provided the civil, mechanical, and electrical site work, and overall system startup assistance for this project. RC Foster is a general engineering contractor and maintenance service provider specializing in construction and maintenance services for the water industry.



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