



Treating Drinking Water for Disinfection By-products



Santa Cruz, California has successfully found a way for the City to meet its water quality goals while using process recycled water as part of its supply source. Using the recycled water had caused concern about reliably meeting the U.S. EPA THM/DBP potable water quality standards in its finished water. The City evaluated various aeration treatment processes and chose an E-Z Tray® Air Stripper from EnDiSys as the best fit for meeting their water quality and O&M goals. The E-Z Tray air stripper was installed and its performance has greatly surpassed the City's goals, including up to 90% THM removal.

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The E-Z Tray® Air Stripper is a sliding tray, stainless steel air stripper used to remove volatile organic compounds (VOCs) from contaminated groundwater and waste streams. The exclusive design of the E-Z Tray stripper results in very high removal efficiencies in an easier-to-maintain process unit.



High Flow E-Z Tray Units are certified by NSF to NSF/ANSI Standard 61

High Initial Removal of THMs is the Key to Overcoming Reformation

Trihalomethanes (THMs) can form in drinking water when disinfectant (chlorine) breaks down precursor organic compounds, normally organic solids.

Air stripping is an effective way to reduce THMs dissolved in water. THMs can redevelop after removal through stripping if organic precursors are still available in the presence of residual disinfectant, so high initial removal is important.

Air stripping is a process (governed by Henry's Law) that removes or "strips" volatile organic compounds from contaminated water by contacting clean air with contaminated water across a high surface area, causing the volatile compounds to move from the water into the air. Counter-current flow causes the cleanest air to contact the cleanest water. This ensures efficient *mass transfer* throughout the entire flow path. This is why a true air stripper is much more effective than in tank aeration methods.

EnDiSys Sliding Tray Strippers offer several advantages over other air stripping methods:

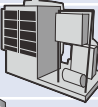
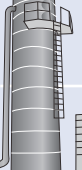



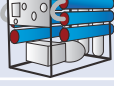
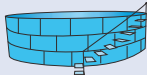
- Easy access for process monitoring and inspection, even while in operation
- Less prone to fouling
- Single person cleaning with simple pressure wash
- Less intrusive at site
- Wide turn-down range
- Typical treatment cost per Kgal for drinking water is \$0.10 - \$0.20 per 1,000 gallons

The Most Cost Effective Way to Treat THMs

There are several competing technologies, but none deliver the efficiency and economy of sliding tray air strippers.

Of the seven technologies commonly used for THM removal from water, most have significant drawbacks, including high capital and/or O&M costs, low THM removal efficiency, and other operational factors.

Three types of air stripping systems offer high removal efficiency, but differ widely in critical aspects of performance and use.

	REMOVAL METHOD	OPERATIONAL FACTORS
	Sliding Tray Air Stripper	Capable of high removal efficiency; low maintenance costs; easy cleaning; small footprint; operating cost is lower electrical.
	Packed Tower Air Stripper	Subject to clogging and/or scale; short circuiting; difficult to clean; high-profile tall structure.
	Stacking Tray Air Stripper	Difficult to clean; large footprint for maintenance access; impossible to observe during operation
	Activated Carbon	Inefficient loading for low concentration contaminants; significant operating costs.
	Oxidation Process	High capital equipment costs; significant operating cost.
	RO / Ultrafiltration	Not always capable of >99% removal; high energy use; some organics can damage membranes.
	Tank Aeration	Low removal efficiency; multiple passes needed.



Storage Tank Aeration is Not the Same as Air Stripping

- Water is circulated within a holding tank and discharged from spray nozzles.
- Nozzles develop significant back pressure (30-40psi).
- Mass transfer occurs as droplets fall through free air.
- Multiple passes are needed to provide significant THM removal.
- 8 passes required to reach 50-60% removal (compare to 60-80% or higher TTHM reduction with 1 pass through an E-Z Tray stripper).

Santa Cruz Meets THM/DBP Challenge with Unique Air Stripping Process

Santa Cruz Case Study

Sliding Tray Air Stripper Meets City's Water Quality and O&M Goals



E-Z Tray air stripper occupies a small footprint behind large pre-treatment clarifiers.

BACKGROUND

The City of Santa Cruz, California depends on surface waters for 95% of its municipal water supply; only 5% comes from groundwater. About 10% of the water stream going into the treatment process comes from recycled water. An engineering study revealed increasing levels of trihalomethanes (THMs) in the reclaimed water, sometimes up to 150-200 ppb.

The presence of trihalomethanes is primarily a byproduct of drinking water disinfection. The increased THM levels in the recycled water were putting Santa Cruz in danger of exceeding the U.S. EPA's maximum contaminant level of 80 ppb in potable water, so the city began evaluating methods to reduce THMs before adding recycled water to the treatment stream.

SEARCH FOR A SOLUTION

Their first approach was a packed tower air stripper. Pilot tests showed that the packing was vulnerable to gumming up and clogging, necessitating laborious cleaning. Terry McKinney, Production Superintendent, City of Santa Cruz, says, "We didn't know how we would do maintenance on a tower other than taking all the packing out, which we did not want to do. So that's why the tower was eliminated." (Note: for scale deposits, often the tower is flooded with an acid solution, adding more complication and risk.)

McKinney had an opportunity to observe an E-Z Tray® Air Stripper (U.S. Patent Number 5,518,668) from EnDiSys in use at Ford Ord near Monterey. They gave us a quick rundown on how to pop the trays out. We went with the smaller tray design, the split trays, which is wonderful. They are very easy to clean, and we really haven't had to clean them that much. The air agitation in the aerator keeps the particles in the recycled water from settling."

COMPARISON OF ALTERNATIVES

Santa Cruz considered other tray-type strippers, but decided on the E-Z Tray® stripper.

"We liked the EnDiSys air stripper because of the stainless steel construction, the removable trays, really simple, very straightforward" McKinney says. "The entire EnDiSys unit is NSF approved, where all the other units hadn't received NSF approval."

PERFORMANCE AND COST FACTORS

Capital cost was also a factor in the choice, but one which proved to be no problem, given the wide range of E-Z Tray models and price levels. McKinney says, "We normally get 90% removal. We haven't done a lot of testing on it, but one flow rate was about 300 gallons per minute, 350-ish, and we got 90% re-

moval with this. When we cranked it up to 500 gallons per minute, it went down to about 80% removal. You have the flexibility of looking at stripper size in relation to flow rates, and you can go over the flow rate if you can accept the lower percent removal, and 80% is still fine."

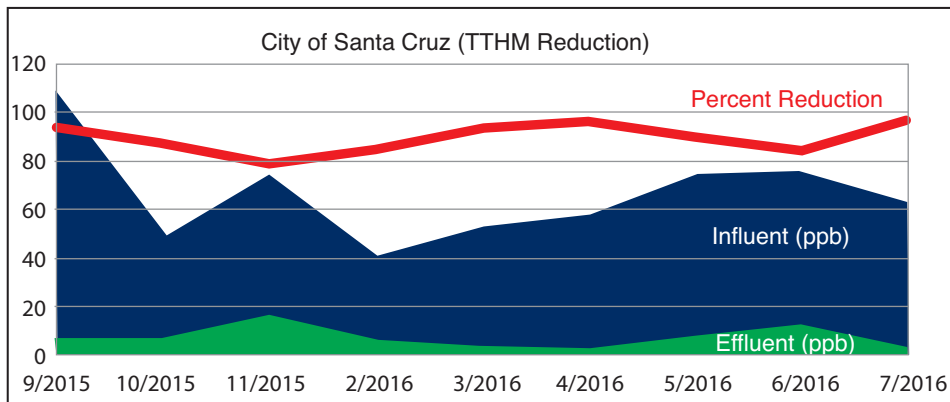
INSTALLATION & CUSTOMER SERVICE

Asked about customer support from the EnDiSys representatives, McKinney replies, "It was great. We put the purchase order through and then worked with one of the design engineers. When the unit arrived, setup was simple. "It was very easy. I mean it's all pretty much self-contained. We did the piping on our end so there were modifications to our clarifier system. Essentially we had inlet valves and outlet valves on it and everything was hooked up. Dialing in the air and getting the air to water ratio where we wanted it was easy. Customer service was exceptional."

LOW MAINTENANCE IS ANOTHER KEY

In addition to ease of cleaning, visual monitoring glass doors was an attraction. McKinney says, "You can certainly see an equal air flow through the unit." The one time they pulled the trays, after 3 months, he reports:

"There was very little sign of organics or anything on them. There was no scaling whatsoever. There was a little slime, typical biofilm you would get in a pipe and it was not detrimental at all. It was just on there; you could feel it, it was slippery, but all the holes were perfectly fine and open."



Plant data for THM Removal in the City of Santa Cruz (CA) drinking water treatment system. Results show consistent THM reductions of 80-96%.

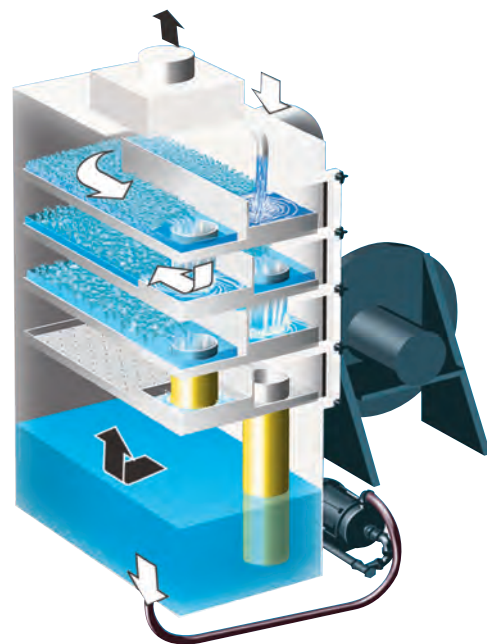


High Flow E-Z Tray
Air Strippers are certified
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"EnDiSys E-Z Tray® Air Stripper is the first self-contained air stripper that has earned certification from NSF International, demonstrating EnDiSys dedication to enhancing water quality," said Theresa Bellish, Business Unit Manager for NSF International. For the details on the certification, visit www.endisys.com/air-stripper-model/

How it Works

As contaminated groundwater enters through the top of the air stripper, millions of air bubbles are forced by blower pressure up through the perforated trays. This creates a turbulent froth zone with an extremely high air-to-liquid surface area for mass transfer of volatile organic compounds (VOCs) from liquid to air. Using the froth instead of a conventional tower packing delivers high VOC removal efficiencies even under fouling conditions, and it is easier to inspect and maintain.



E-Z Tray® Stainless Steel, Removable Tray Air Stripper Specifications

Model No.	Max. Flow Range gpm (Lpm)	Dry Weight lbs. (kg)	Oper. Weight lbs. (kg)	Shell Dimension DxWxH in. (cm)	Trays Per Tier lbs. (kg)	Active Area ft. ² (m ²)	Nominal Air Flow cfm (m ³ /min)	Add'l Space for Tray Removal* in. (cm)
24.4	1-250 (4-946)	2,100 (953)	3,980 (1,805)	75 x 59 x 84 (191 x 150 x 213)	8 x 60 (8 x 27)	17.5 (1.63)	1,300 (36.8)	72 (183)
24.6	1-250 (4-946)	2,599 (1,179)	4,926 (2,234)	75 x 59 x 104 (191 x 150 x 264)	12 x 60 (12 x 27)	17.5 (1.63)	1,300 (36.8)	72 (183)
36.4	1-375 (1,420)	3,200 (1,451)	6,085 (2,760)	75 x 98 x 96 (191 x 249 x 244)	4 x 60 (4 x 27)	26.3 (2.4)	1,900 (53.8)	72 (183)
36.6	1-375 (1,420)	3,900 (1,769)	7,532 (3,416)	75 x 98 x 116 (191 x 249 x 295)	6 x 60 (6 x 27)	26.3 (2.4)	1,900 (53.8)	72 (183)
48.4	1-500 (1,893)	5,000 (2,270)	12,500 (5,670)	124 x 76 x 96 (315 x 193 x 244)	16 x 60 (16 x 27)	27 (2.51)	2,600 (73.6)	72 (183)
48.6	1-500 (1,893)	5,500 (2,495)	13,000 (5,897)	124 x 76 x 116 (315 x 193 x 295)	24 x 60 (24 x 27)	27 (2.51)	2,600 (73.6)	72 (183)
72.4	10-750 (2,839)	6,400 (2,903)	14,600 (6,622)	149 x 98 x 100 (378 x 249 x 254)	4 x 60 (4 x 27)	52.5 (4.88)	3,800 (108)	2 x 72 (2 x 183)
72.6	10-750 (2,839)	7,800 (3,538)	15,100 (6,849)	149 x 98 x 120 (378 x 249 x 305)	6 x 60 (6 x 27)	52.5 (4.88)	3,800 (108)	2 x 72 (2 x 183)
96.4	10-1,000 (3,785)	11,000 (4,990)	25,000 (11,340)	149 x 124 x 100 (378 x 315 x 254)	32 x 60 (32 x 27)	54 (5.02)	5,200 (147)	2 x 72 (2 x 183)*
96.6	10-1,000 (3,785)	11,500 (5,216)	30,000 (13,608)	149 x 124 x 120 (378 x 315 x 305)	48 x 60 (48 x 27)	54 (5.02)	5,200 (147)	2 x 72 (2 x 183)*

Standard construction is 304 SS, other alloys upon request. *Allow additional space for accessory components (blower, piping, etc.).



Test drive an E-Z Tray Air Stripper online at
EnDiSys.com/air-stripper-model/

to determine how efficiently you can remove THMs, or

Call (763) 428-5075

to speak with an Applications Specialist and find out how you
can start treating Disinfection By-products
and keep them from reforming.

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