Operating Cost for CIX Water Recycling Systems

The primary operating costs consist of labor, regeneration chemistries and wastewater, bag filter change-outs, electricity, waste treatment, and periodic resin and carbon replacement. The below costs apply to a 10 gpm CIX1000S, with stated assumptions for input costs and based upon documented operating parameters for the CIX, assuming 24-hour operation 26 days per month at 10 gpm flow.

Labor

- Assuming an hourly wage of $12 per hour and a routine daily operating requirement of 1.5 hour, labor expense would be **$468 per month.**

Electricity

- Assuming system is operating on 460V 3Ph power, and estimating electricity cost is $0.10 per KWH, the cost per month to operate the feed and repressurization pump is **$35 per month.**

Bag Filters

- Assuming change out is once each week for both of the two 20-inch 5 micron bag filters, the cost assuming the filters cost $5 each would be **$40 per month.**

Resin Replacement

- It's conservatively assume a change-out is required every 4 years. With a total of 5 cubic feet of cation resin costing $100 per ft3, and anion resin costing around $250 per ft3, each change out will cost you $1,750 in materials plus one days labor at $150 plus disposal (assuming 2.5 drums of waste) costing $150 each, for a total replacement cost of $2,275 or **$47 per month.**

Carbon Replacement

- Assuming carbon is replaced every 6 months as recommended the material cost for 3 ft3 is about $180 plus ½ day labor at $75 for a total change out expense of $255 or **$42 per month.**

Regeneration chemistry

- This is based upon a cost of $0.24 per lb for 50% NaOH and $0.24 for 32% HCl, and assuming 2 regenerations per day of both the cation and anion vessels, which is a maximum frequency of regenerations we recommend for a CIX system.

- Each cation regeneration consumes 3.5 gallons of HCl, costing $2.40 per gallon, $8.40 per regeneration, or $16.80 per day. Each anion regeneration consumes 1.8 gallons of NaOH at $3.05 costing $5.49 per regeneration or $10.98 per day. Their combined cost is **$722 per month**.

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Water Loss for resin regenerations and carbon backwashes

- It is assumed that one carbon backwash will be performed each week, consuming approximately 80 gallons of city water, for a total of 320 gallons pr week which will need to be waste treated prior to discharge. Assuming a combined water/sewer cost of $4 per 1,000-gallons and wastewater treatment costs of $15 per 1,000-gallons, their combined cost is **$6 per month**.

- Each cation regeneration produces 85 gallons of wastewater and each anion regeneration produces 95 gallons of wastewater. Assuming two regenerations per day of each, a total of 9,360 gallons per month of wastewater would be generated, costing $37 per month for lost DI water and $140 for wastewater treatment costs (assuming a treatment cost of $15 per 1,000 gallons), for a cost of **$177 per month**

Total Operating Cost for CIX1000S

- As detailed above, the total operating cost is estimated at $1,537 per month.

- Assuming 24 hour per day x 26 days per month, 374,400 gallons of rinsewaters would be processed each month, with 9,700 gallons lost to backwashing and regeneration for a total volume of DI water produced of 364,700.

- $1,537/364,700=$0.00421 or **$4.21 per 1,000 gallons of DI water** produced

Comparison with Alternatives

- While every facility is somewhat different, it's our experience that the average expense for chemical precipitation of wastewater in metal finishing facilities is approximately $15 per 1,000 gallons or nearly 400% greater than recycling rinsewater. Assuming discharge and treatment of 374,400 gallons, **the expense for conventional treatment is $5,616 per month.**

- The expense to produce deionized water through service exchange is difficult to estimate since inlet TDS is highly variable and the use or not of reverse osmosis make a significant difference in the cost for service exchange. On balance, it is anticipated that the combination of reverse osmosis followed by Service DI would have an operating cost somewhat less than recycling by ion exchange although use of "back-end" reverse osmosis is strongly discouraged because of the potential for membrane fouling which would greatly increase the overall operating cost due to the need for membrane replacement.

350 Engel St, Escondido, CA 92027 • 760.294.1888 • waterinnovations.net