CLAIMS

1. A method of treating water with an ion exchange bed in a water treatment system, the method comprising:

introducing water to be treated into the ion exchange bed of the water treatment system to produce treated water;

calculating a current exchange daily average flow rate of water through the water treatment system for a current period of time;

calculating a cumulative daily average flow rate of water through the water treatment system including calculating the exchange daily average flow rate of water for a plurality of periods time between a plurality of instances of replacing the ion exchange bed;

determining an estimated number of days remaining to exhaustion of the ion exchange bed during the current period of time based on the current exchange daily average flow rate and the cumulative daily average flow rate;

generating a request for replacement of the ion exchange bed based on the estimated number of days remaining; and

transmitting the generated request for replacement of the ion exchange bed to a central server.

2. The method of claim 1, wherein determining the estimated number of days remaining comprises determining a weighted daily average flow rate involving applying a greater weighting to the cumulative daily average flow rate than a weighting applied to the current exchange daily average flow rate.

3. The method of claim 2, wherein determining the weighted daily average flow rate includes performing a calculation as follows:

$$F_{weighted} = [(w_{cumulative}) \times (F_{cumulative})] + [(w_{current}) \times (F_{current})]$$

wherein,

$F_{weighted} = weighted\ daily\ average\ flow\ rate,$

$F_{current} = current\ exchange\ daily\ average\ flow\ rate,$

$F_{cumulative} = cumulative\ daily\ average\ flow\ rate,$

$0.5 \leq w_{cumulative} \leq 0.9,$

$0.1 < w_{current} < 0.5,$

$w_{cumulative} + w_{current} = 1.$

4. The method of claim 3, wherein $0.2 < w_{current} < 0.4$.

5. The method of claim 4, wherein $w_{current}$ is about 0.3.

6. The method of claim 1, wherein the water treatment system is located at a first site and the method further comprises determining whether to replace the ion exchange bed of the water treatment system at the first site and a second ion exchange bed of another water treatment system at a second site in a same service trip.

7. The method of claim 6, wherein determining whether to replace both the ion exchange bed of the water treatment system at the first site and the second ion exchange bed of the another water treatment system at the second site in the same service trip includes weighing a cost associated with regenerating the ion exchange bed from the first site and the ion exchange bed from the second site against a cost associated with different service trips to the first and the second sites.

8. The method of claim 6, wherein the water treatment system is located at a first site in a network of a plurality of different sites each including at least one water treatment system having an ion exchange bed, and the method further comprises determining a subset of ion exchange beds of the plurality of sites to be replaced in a same service trip.

9. The method of claim 1, wherein calculating the cumulative daily average flow rate of water includes calculating a prior period average daily flow rate of water

through the water treatment system for a time period including a predetermined number of instances of replacing the ion exchange bed immediately preceding the receipt of indication of replacement.

10. The method of claim 9, wherein calculating the prior period average daily flow rate of water includes applying a greater weight to flow rates of water through the ion exchange bed closer in time to the current period than to flow rates of water through the water treatment system further in time from the current period.

11. The method of claim 1, wherein determining the estimated number of days remaining to exhaustion is further based on a current tank capacity of the ion exchange bed and an average conductivity of the water for a current period.

12. The method of claim 1, further comprising:

measuring a conductivity of the water to be treated during a current period;

determining a current average conductivity of water to be treated during the current period; and

wherein determining the estimated number of days remaining to exhaustion is further based on the determined current average conductivity.

13. The method of claim 12, wherein determining the estimated number of days remaining to exhaustion comprises performing a calculation as follows:

$$D_{remaining} = \frac{\left(\frac{TC_{current}}{(\rho_{current} * (conductivity\ TDS\ conv)/grains\ conversion))}\right)}{((w_{cumulative} * F_{cumulative}) + (w_{current} * F_{current}))}$$

where,

$D_{remaining} = estimated\ number\ of\ days\ remaining\ to\ exhaustion,$

$TC_{current} = current\ tank\ capacity,$

$\rho_{current} = current\ daily\ average\ conductivity,$

$0.5 \leq w_{cumulative} \leq 0.9,$

$F_{cumulative} = cumulative\ daily\ average\ flow\ rate,$

$0.1 < w_{current} < 0.5,$

$F_{current} = current\ average\ flow\ rate,$

$w_{cumulative} + w_{current} = 1,$

$conductivity\ TDS\ conv = conductivity\ conversion\ factor\ in\ ppm,$ and

$grains\ conversion = grains\ conversion\ factor\ in\ grains\ per\ gallon.$