Water Treatment:
Process Optimization & Cost Reduction

Key Issues:

- Quality of water supply to determine treatment required
- Process Design
  1) Multi-barrier protection (focusing on microbial contamination)
  2) Type of equipment and treatment
- Design of Carbon Adsorbers (ACF)
  1) Equipment design (false bottom, freeboard etc)
  2) Contact time (different time required for free chlorine, THM etc)
  3) Operating conditions
- Activated Carbon (GAC) Quality

Major Problems:

1) Premature breakthrough & service life
2) Channeling (mainly a function of backwashing/bed expansion conditions)
3) Downtime & production capacity
4) Water quality, including microbial contamination
5) Efficiency and cost (both capital and operating)
6) Water consumption

Major Causes:

A) ACF design
B) Backwashing procedure

Cost Items:

- Water supply
- ACF
- Production rate & capacity
- Downtime
- Water usage
- Energy
- Steam
- Labor
- GAC type & quality

Parameters affecting cost:

- ACF size
- ACF design
  - i) Material & construction
  - ii) Floor space & height restrictions
  - iii) Manual vs. automatic operation
  - iv) Freeboard (backwashing efficiency, channeling)
  - v) Underdrain design and operating conditions
  - vi) False bottom and nozzle plates (dead space, microbial contamination, backwashing efficiency)
  - vii) Filtration media (GAC, sand, gravel etc)
  - viii) Contact time (achieve water quality)
- GAC quality
  - i) Adsorption capacity
  - ii) Hardness
  - iii) Density
  - iv) Impurities (water solubles, heavy metals)
  - v) Dechlorination performance
- Preconditioning procedure (downtime, water usage)
- Backwashing procedure (bed expansion, downtime, water usage, channeling, effluent disposal, service life)
- Sanitizing process (energy, efficiency)
- Quality of water supply (pesticides, heavy metals)
- Operating efficiency and service life

Recommendations

1) Conduct analysis of current operating conditions to optimize the process with minimal capital cost

2) Establish design parameters for new water treatment plants to maximize efficiency and performance and minimize cost (both capital and operating)

3) Adopt a standard prototype ACF design that achieves all the necessary cost and performance objectives and will be suitable to be used at any location in the world. We suggest a 2.5 meter diameter ACF with a nominal flow rate of 1500 liters/minute. This will provide the benefit of establishing a standardized ACF design which will enable beverage plants to reduce their capital and operating costs and ensure that the corporate performance requirements are achieved.