### UNITS AND CONVERSION FACTORS

- 1 cubic foot of water weighs 62.3832 lb
- 1 gallon of water weighs 8.34 lb
- 1 liter of water weighs 1,000 gm
- 1 mg/L = 1 part per million (ppm)
- 1% = 10,000 ppm
- feet² = square feet and feet³ = cubic feet
- 1 mile = 5,280 feet (ft)
- 1 yard = 3 feet
- 1 acre (a) = 43,560 square feet (ft²)
- 1 acre foot = 325,851 gal
- 1 yard = 3 feet
- 1 mile = 5,280 feet (ft)
- 1% = 10,000 ppm
- 1 gm = 1,000 milligrams (mg)
- 1 grain per gallon (gpg) = 17.1 mg/L
- 1 lb = 7,000 grains (gr)
- 1 pound (lb) = 454 grams (gm)
- 1 L = 1,000 milliliters (ml)
- 1 kg = 2.20462 lb
- 1 Liter of water weighs 1 kg
- 1 gallon of water weighs 8.34 lb
- 1 cubic foot of water weighs 62.2 lb
- 1 cu ft = 7.48 gal
- 1 acre ft = 325,851 gal
- 1 ft = 0.3048 m
- 1 m = 3.28084 ft
- 1 mile = 1,609.34 m

### CHLORINATION

**Dosage, mg/l** = (Demand, mg/l) + (Residual, mg/l)

(Gas) lbs = Vol, MG x ppm or mg/L x 8.34 lbs/gal

HTH Solid (lbs) = (Vol, MG) x (ppm or mg/L) x 8.34 lbs/gal

Liquid (gal) = (Vol, MG) x (ppm or mg/L) x 8.34 lbs/gal

% of Chemical in Solution = (Dry Chemical, lbs) / (Vol, MG) x (ppm or mg/L) x 8.34 lbs/gal

Specific Gravity = Chemical Wt. (lbs/gal) / 8.34 lbs/gal

% of Chemical = (Dry Chemical, lbs) / (Dry Wt. Chemical, lbs) + (Water, lbs)

**GPD** = (MGD) x (ppm or mg/L) x 8.34 lbs/gal (ppm purity) x Chemical Wt. (lbs/gal)

**GPD** = (Feed, m³/min x 1,440 min/day) / (1,000 mL/L x 3,785 L/gal)

### SOLUTIONS

**Lbs/Gal** = (Solution %) x 8.34 lbs/gal x Specific Gravity / 100

**Lbs Chemical** = Specific Gravity x 8.34 lbs/gallons x Solution(gal)

**Specific Gravity** = Chemical Wt. (lbs/gal) / 8.34 lbs/gal

### VOLUME

**Rectangular Basin, Volume, gal** = (Length, ft) x (Width, ft) x (Height, ft) x 7.48 gal/ft³

**Cylinder, Volume, gal** = (0.785) x (Dia, ft)² x (Height, ft) x 7.48 gal/ft³

**Time, Hrs.** = (Pumping Rate, GPM) x 60 Min/Hr

**Supply, Hrs.** = Storage Volume, Gals / (Flow In, GPM - Flow Out, GPM) x 60 Min/Hr

### PUMPING

1 horsepower (Hp) = 746 watts = 0.746 Kw = 3,960 gal/min/ft

**Water Hp** = (GPM x (Total Head, ft)) / (3,960 gal/min/ft)

**Brake Hp** = (GPM x (Total Head, ft)) / (3,960) x (Pump % Efficiency)

**Motor Hp** = (GPM x (Total Head, ft)) / (3,960) x Pump % Eff. x Motor % Eff.

### SCADA

4 mA = 0 to 20 mA analog signal

(live signal mA - 4 mA offset) x process unit and range (16 mA span)
### FILTRATION

**Filtration Rate (GPM/sq.ft)** = \( \text{Filter Production (gallons per day)} \div \text{(Filter area sq. ft.)} \times (1,440 \text{ min/day}) \)

**Loading Rate (GPM/ sq. ft.)** = \( \frac{\text{(Flow Rate, GPM)}}{\text{(Filter Area, sq. ft.)}} \)

**Daily Filter Production (GPD)** = \( \text{(Filter Area, sq. ft.)} \times \text{(GPM/sq. ft. x 1,440 min/day)} \)

**Backwash Pumping Rate (GPM)** = \( \text{(Filter Area, sq. ft.)} \times \text{(Backwash Rate, GPM/sq. ft.)} \)

**Backwash Volume (Gallons)** = \( \text{(Filter Area, sq. ft.)} \times \text{(Backwash Rate, GPM/sq. ft.)} \times \text{(Time, min)} \)

**Backwash Rate, GPM/ sq. ft.** = \( \frac{\text{(Backwash Volume, gallons)}}{\text{(Filter Area, sq. ft.)} \times \text{(Time, min)}} \)

**Rate of Rise (inches per min.)** = \( \frac{\text{(Backwash Rate gpm/sq.ft.)} \times 12 \text{ inches/ft}}{7.48 \text{ gal/cu.ft.}} \)

**Unit Filter Run Volume, (UFRV)** = \( \frac{\text{(gallons produced in a filter run)}}{\text{(Filter Area sq. ft.)}} \)

### CHEMICAL DOSAGE CALCULATIONS

*Note: (% purity) and (% commercial purity) used in decimal form*

**Lbs/day gas feed dry** = MGD x (ppm or mg/L) x 8.34 lbs/gal

**Lbs/day** = MGD x (ppm or mg/L) x 8.34 lbs/gal x % purity

**GPD** = \( \frac{\text{MGD x (ppm or mg/L) x 8.34 lbs/gal}}{\text{(% purity) x lbs/gal}} \)

**GPD** = \( \frac{\text{MGD x (ppm or mg/L) x 8.34 lbs/gal}}{\text{(commercial purity %) x (ion purity %) x (lbs/gal)}} \)

**ppm or mg/l** = lbs/day x % purity x lbs/gal

### C•T CALCULATIONS

\( C \cdot t = (\text{Chlorine Residual, mg/L}) \times (\text{Time, minutes}) \)

**Time, minutes** = \( \frac{C \cdot t}{\text{(Chlorine Residual, mg/L)}} \)

**Chlorine Residual (mg/L)** = \( \frac{C \cdot t}{\text{(Time, minutes)}} \)

**Inactivation Ratio** = \( \frac{\text{(Actual System C•t)}}{\text{(Table “E” C•t)}} \)

**C•t Calculated** = \( \frac{T_{10} \text{ Value, minutes} \times \text{Chlorine Residual, mg/L}}{100} \)

**Log Removal** = \( 1.0 - \frac{\% \text{ Removal}}{100} \times \log \text{key} \times (-1) \)

### SEDIMENTATION

**Surface Loading Rate, (GPD/ sq. ft.)** = \( \frac{(\text{Total Flow, GPD})}{\text{(Surface Area, sq.ft.)}} \)

**Detention Time** = \( \frac{\text{Volume}}{\text{flow}} \)

**Detention Time hours** = \( \frac{\text{volume (cu ft) x 7.48 gal/cu ft x 24 hr/day}}{\text{Gal/day}} \)

**Flow Rate** = \( \frac{\text{Volume}}{\text{Time}} \)

**Weir Overflow Rate, GPD/L.F.** = \( \frac{\text{(Flow, GPD)}}{\text{(Weir length, ft.)}} \)