DW Module 5:
Disinfection
Answer Key

Exercise

1. List the common bacteria, viruses and intestinal parasites that contaminate drinking water.

Ans: Common bacteria include: *Salmonella*, *Shigella*, *Bacillus Typhosus*, *Salmonella Paratyphi* and *Vibrio Cholerae*.

Common viruses include: enteroviruses, andenoviruses and reoviruses.

Common intestinal parasites include: *Entamoeba Histolytica, Giardia Lamblia, Ascaris Lumbricoides* and *Cryptosporidium*.

2. List five types of chemical disinfectants.

Ans: Liquid chlorine, hypochlorite, chlorine dioxide, chloramines and ozone.

3. Match the regulation from the following list with its appropriate description in the column on the right.

Information Collection Rule
Long Term 1-Enhanced Surface Water Treatment Rule
Ground Water
Stage 2 Disinfectant and Disinfection Byproduct Rule (DBP Stage 1)
Long Term 2-Enhanced Surface Water Treatment Rule
Interim Enhanced Surface Water Treatment Rule
Stage 1 Disinfectants and Disinfection Byproduct Rule (DBP Stage 2)
Total Coliform Rule
Surface Water Treatment Rule

Regulation	Purpose of Regulation
Ground Water Rule	This rule provides guidelines for identifying ground water sources at risk for contamination and guidelines for taking corrective action.
Interim Enhanced Surface Water Treatment Rule	This rule primarily addresses the reduction of risk from *Cryptosporidium* by limiting the turbidity levels of filter effluents.

Long Term 1-Enhanced Surface Water Treatment Rule	This rule requires all systems serving fewer than 10,000 people to achieve at least 99% removal or inactivation of *Cryptosporidium*.
Total Coliform Rule	This rule sets the monitoring and compliance requirements for coliform bacteria.
Information Collection Rule	It required large public water suppliers to undertake monitoring of microbial and disinfection byproducts in their water systems.
DBP Stage 1	This rule set maximum contaminant level goals and maximum contaminant levels for trihalomethanes, five haleocetic acids, bromate and chlorite.
Surface Water Treatment Rule	This rule required all surface waters or ground waters under the influence of surface waters to provide filtration and/or disinfection of the source to meet 3 log removal or inactivation of *Giardia Lamblia* cysts and 4 log removal or inactivation of enteric viruses.
Long Term 2-Enhanced Surface Water Treatment Rule	This rule is anticipated to propose treatment techniques to improve control of microbial pathogens, specifically including C*ryptosporidium*. The techniques are to consider the risks of treatment for *Cryptospodrium* versus the potential for generation of disinfection byproducts.
DBP Stage 2	The purpose of this rule is to assess information and research that was not fully considered in the Stage 1 process or that has only been available since 1998, as it relates to microbial standards to protect public health.

☑ What size clearwell is required to provide 3.0 log removal of Giardia if the flow rate through the water treatment plant is 3 million gallons per day, the pH is 7.0, the temperature of the water is 10^{o} C and the chlorine residual is 2.0 mg/L? Assume that the clearwell baffling efficiency is 70%.

Ans: Consulting Table 3.1 indicates that the CT required under these conditions is 124 mg/L-minutes. Use the above equation to determine the storage required.

$$\text{CT (mg/L-minutes)} = \frac{\text{Capacity (Gallons)} \times \text{Baffling Efficiency (\%)} \times \text{Chlorine Residual (mg/L)}}{\text{Flow (gpm)}}$$

$$\text{Capacity (Gallons)} = \frac{\text{CT (mg/L-minutes)} \times \text{Flow (gpm)}}{\text{Baffling Efficiency (\%)} \times \text{Chlorine Residual (mg/L)}}$$

$$\text{Capacity (Gallons)} = \frac{124 \text{ (mg/L-minutes)} \times 2{,}082 \text{ (gpm)}}{0.70 \text{ (\%)} \times 2.0 \text{ (mg/L)}}$$

Capacity (Gallons) = 184,400 (Gallons)

Exercise

1. Maintenance of residual levels of 0.2 mg/L at the end of a distribution system is a good indication that the system is disinfected.

Ans: True

2. Water mains taken out of service for inspection or repair do not need to be disinfected prior to being placed back in service.

Ans: False

3. All new water treatment plants, rehabilitated portions of existing plants, facilities that have been taken out of service for maintenance or in general, facilities that are subject to contamination, shall be disinfected prior to placing into service.

Ans: True

4. What is dechlorination?

Ans: It is the physical or chemical removal of chlorine residual from water prior to its discharge to receiving streams. This includes both free and combined residuals

5. List five methods of dechlorination.

Ans: Detention ponds, aeration, sunlight, activated carbon and chemical compounds.