

WATER TREATMENT OVERVIEW

(reference: pages 30-32) *Volume I*

I. Problems with raw water:

Most of the raw water available for human consumption in the United States has one or more undersirable qualities which cause the water to be either unsafe for human consumption or unpleasant for human consumption.

Conditions which cause water to be unsafe for human consumption are called toxic conditions.

Conditions which cause water to be unpleasant are called aesthetic problems.

A. Causes of Unsafe Water:

A variety of natural and man made conditions can make water unsafe. The major ones are:

1. Biological Contamination:

Water may contain disease causing organisms. Disease causing organisms are called pathogenic organisms.

- a. Surface water-virtually all rivers and streams contain biological contaminants which could be pathogenic. The source of the biological contamination includes bacteria from the wastes of animals contained in runoff entering upstream. It may also include bacteria from human wastes contained in untreated or partially treated sewerage entering up stream.
- b. Ground Water- A properly constructed and operated well should be secure from biological contamination. However, faulty well construction can allow seepage from septic tanks and runoff to contaminate the ground water with biological contaminants

Disinfection is the process used to kill pathogenic micro-organisms.

2. Chemical Contamination:

Streams and rivers may be polluted by toxic chemicals discharged into them and also by pesticides running off of farm land.

Wells may be contaminated by man made chemical wastes improperly disposed of in landfills and by pesticides percolating downward to the water table. During the percolating process the ground water may also dissolve toxic natural chemicals contained in the various layers of soil and rock.

A variety of processes can be used to treat chemical contaminants to remove or destroy them. These processes include softening, demineralization (or deionization), air stripping, adsorption, and oxidation.

3. Turbidity:

Turbidity is cloudiness in water caused by clay, silt, micro organisms, decaying plant material, and man made solids. Excessive turbidity makes water look bad. The worst thing about turbidity is that it can interfere with disinfection by harboring bacteria and by increasing chlorine demand.

The processes used for removing turbidity are coagulation-flocculation, settling, and filtration.

4. Radioactivity:

Radioactive materials can enter the water sources from natural minerals but, usually they come from some human activity connected with nuclear weapons testing and building or nuclear power generation.

The same processes used for removing chemical contaminants are also used for removal of radioactive contaminants.

B. Causes of Unpleasant Water:

1. TASTES and ODORS:

All waters have distinctive tastes due to their natural mineral content. However some tastes can be very unpleasant.

When unpleasant tastes are present they are usually much more offensive in warm water than in cold water.

Chlorination can also aggravate (worsen) many taste and odor situations.

Tastes and odors can be caused by man made contamination such as phenol, or by natural effects such as algae or hydrogen sulfide (rotten egg) gas.

Treatment processes to control tastes and odors include aeration, adsorption, clarification, and oxidation.

2. Color:

Undesirable color in water can be due to a number of natural causes including algae, decaying plant material, and excessive iron and manganese.

Processes that are used for color removal include coagulation-flocculation, filtration, adsorption, oxidation, and sequestration.

All of the treatment processes mentioned above will be explained in much greater detail during the remainder of this course.

3. Record keeping requirements: Specify what records of the analysis must be kept and for how long.
4. Reporting requirements: Specify what routine and unusual data must be reported to the enforcement agency (DHHR) and when the public must be notified of non-compliance.

VI. Specific Regulations: See the chart enclosed with the text book.

VII. General: In general the regulations cover contaminants which have been widely found in water and are either from the raw source water or from industrial (or municipal) sources. Their purpose is to force communities to provide safe drinking water by choosing proper sources of water, putting in appropriate treatment processes, and/or taking steps to control ongoing man made contamination.

The drinking water regulations are not designed to control criminal activity such as sabotage which is already covered under other laws. For example, there are no MCL's for cyanide or LSD.

DRINKING WATER REGULATIONS

- I. Origin of Regulations: In 1974 the Safe Drinking Water Act became law. It gave the U.S. Environmental Protection Agency (U.S.EPA) the responsibility for:
1. Conducting research to determine what is necessary for safe drinking water.
 2. Promulgate (make) drinking water regulations which would result in safe water.

The first regulations under the act went into effect on June 24, 1977. Since then there have been periodic revisions which are ongoing. For that reason the regulations are called interim regulations.

- II. Who is Covered by Regulations: All public water systems either serving at least 25 members of the public or having 15 service connections.

Two types of public water systems are:

1. Community Water Systems: Used by same people year round. Example, a city water works.
2. Non-Community Water Systems: Used by temporary users. Example, a campground water system.

- III. Who Enforces the Regulations: On a national basis the U.S. EPA is responsible for enforcing the regulations. However each state may choose to do its own enforcement if it gets approval from U.S. EPA. To get this approval the state must do all of the following things:

1. Pass a set of state regulations at least as tough as the EPA regulations.
2. Get EPA certification of its laboratories and enforcement staff and procedures.

A state which has such a primary enforcement program is called a primacy state.

Louisiana is a primacy state. The La. Department of Health and Human Resources (DHHR) is the state agency which enforces the regulations here. DHHR monitors all the public water systems in the state then reports to the regional office of the U.S. EPA.

In states that are not primacy states, the U.S. EPA monitors the public water systems.

IV. Groups of Regulations: There are two groups of drinking water regulations which have been issued under the authority of the Safe Drinking Water Act. They are called the National Interim Primary Drinking Regulations and the National Secondary Drinking Water Regulations

1. National Interim Primary Drinking Water Regulations: These regulate contaminants which may be toxic (harmful to human health) and have the full force of law throughout the entire United States.
2. National Secondary Drinking Water Regulations: These regulate contaminants which may cause water to be unpleasant rather than unhealthy (such as taste, odor, and color). It is optional on a state by state basis whether or not the secondary regulations must be followed. In Louisiana the secondary regulations are only recommendations.

V. Things Covered by the Regulations:

1. Maximum contaminant levels (MCL's): Specify the maximum allowed concentration of each regulated contaminant.
2. Sampling and analysis: Specify how often and from where samples are to be collected for each regulated contaminant and what analysis procedures must be followed.

WELL PRODUCTION

The HYDROLOGIC CYCLE

WELL CONSTRUCTION

DEFINITIONS:

Static Water Level

Pumping Level

Drawdown

Zone of Influence and Cone of Depression

TYPICAL WATER TREATMENT PLANT

