

Lead Contamination of Public Water Systems (RV-11154)

Course Description

Lead contamination of drinking water is a major topic of concern across the country, particularly in areas with aging lead pipes. Lead contamination in Flint, Michigan; Washington, DC; and Newark, New Jersey, has focused attention on America's decaying pipes. At least \$384 billion of improvements are needed to maintain and replace essential parts of the country's water infrastructure to through 2030, according to the US Environmental Protection Agency. While these improvements are underway, treatment technologies can be utilized to significantly limit the migration of lead into the potable water supply. This interactive online course will describe these technologies and opportunities for implementation.

Course Objectives

By the end of this course, you will be able to:

- Describe the effects of lead contamination on the human body
- Describe how lead gets into drinking water
- Discuss how to prevent lead contamination in water
- Describe phosphate treatment technologies for potable water systems
- Describe the issues surrounding the Flint, Michigan event

Introduction – 5 minutes

Potential lead contamination from drinking water presents a significant health risk. Notable examples of lead contamination include a crisis in Flint, Michigan, a city that, for a variety of reasons, failed to protect its citizens from the dangers of this toxin.

- Course Overview

Lead Effects on the Human Body – 10 minutes

Engineers and other professionals in the water treatment industry typically focus on meeting a published standard promulgated by state or federal environmental agencies. Little thought is given to the range of harmful effects that may be experienced if such treatment standards are not met; therefore, it may be useful to consider the potential detrimental effects of lead exposure to help prevent problems before they occur.

- Lead Effects Overview
- Neurological Effects from Lead Exposure
 - Effects on Children
 - Effects on Adults
- Renal Effects of Lead Exposure
- Hematological Effects
- Endocrine, Gastrointestinal & Cardiovascular Effects of Lead Exposure
 - Endocrine Effects
 - Gastrointestinal Effects
 - Cardiovascular (Hypertension) Effects
- Reproductive & Developmental Effects of Lead Exposure
 - Developmental Effects
- Other Potential Effects of Lead Exposure

How Lead Gets into Drinking Water – 5 minutes

Lead is not typically found in surface or groundwater. Lead enters the drinking water supply primarily via direct contact with components of the distribution system, more specifically in the small amount of piping, called service lines, between the water main and the home.

- Where is Lead Found?

How to Prevent Lead Contamination – 5 minutes

Water treatment plants can add several phosphate-based chemicals that prevent migration of lead from pipes and related appurtenances. Phosphate-based compounds are some of the few substances that can be added to water systems that will significantly improve the quality. In fact, EPA has approved more than 200 phosphate-based products suitable for drinking water treatment applications.

- Chemical Treatment
- Treatment Objectives
- Water Characteristics

Phosphate Technologies – 5 minutes

All simple phosphates and polyphosphates used in potable water treatment systems are manufactured from phosphoric acid that comes from mined processed phosphoric rock. Phosphoric acid is created by either wet processing or dry furnace processing. Wet processing requires sulfuric acid to dissolve the phosphate rock. The phosphate produced by this wet processing is utilized by agricultural fertilizer manufacturers.

- Overview of Phosphate Treatment for Potable Water Systems
- Functions of Orthophosphates/Polyphosphates

Guidelines for Phosphate Technology Selection – 15 minutes

Zinc Orthophosphates provide the most successful and complete corrosion inhibition. Zinc orthophosphates have been used to effectively prevent colored water caused by bleeding tuberculation. This technology is very effective in treating aggressive water that does not require iron and manganese sequestration.

- Zinc Orthophosphates & Straight Orthophosphates
- Polyphosphates and Phosphate Blends
 - Ortho Polyphosphate Blends
 - Linear Chain Polyphosphates
 - Silicate Phosphate Blends
- Results

Product Selection – 5 minutes

The most prevalent phosphate compounds utilized for potable water treatment include orthophosphates, zinc orthophosphates, zinc polyphosphates, ortho poly phosphate blends, linear chain (poly) phosphates, and silicate phosphate blends. The primary advantages and limitations of each are provided.

- Primary Advantages

Corrosion and Chemical Inhibitors – 5 minutes

Through an image, a depiction of how each chemical compound functions in metal pipes in a water distribution system is shown in this section of the course.

- Factors Which Affect Corrosion

Case Study – 5 minutes

This section of the course details the massive public health crisis in Flint, Michigan stemming from lead leaching into the water supply. Many, however, may not be aware of just how quickly the problem manifested after water chemistry was ignored, a failure that would have catastrophic results. The review of this case is insightful.

- Flint Michigan

Conclusion – 5 minutes

Throughout this course, the opportunity to investigate solutions to one of the most damaging conditions imaginable was given—the poisoning of tap water that reaches our homes.

- Summary and Implications

Resources

- References