Your Name

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Course Number

Date

Title: Lead in Drinking Water

**Introduction**

Adult humans are 60% water and 90% of human blood is also water. Drinking water and staying hydrated is essential for bodily functions. There are countless reasons a human body needs water; it relieves oxygen, cushions the brain and other tissues, delivers needed oxygen in the human body and forms saliva and mucus. Thus, water is essential for body functions; on the other hand, drinking unhealthy water can become the reason of many waterborne diseases. Drinking contaminated and dirty water makes one vulnerable to a number of diseases such as diarrheal diseases, malaria, worm infections, etc. Unsafe drinking water has always been an issue and it stems from the lack of access to clean drinking water, poor hygiene practices, and unimproved sanitation. According to the World Health Organization, contaminated drinking-water results in almost 500,000 deaths every year ("WHO | Unsafe Drinking-Water, Sanitation, and Waste Management"). Lead contamination also makes a major issue; it makes the drinking water unhealthy and it is a serious threat to human health in all cases. This paper seeks to explore this issue and the health risks associated with lead-contaminated water alongside methods and techniques to prevent the ratio of lead in drinking water.
**What is the issue of lead in drinking water?**

Lead is a chemical element and it is denoted by the symbol 'Pb,' and it originates from the word *plumbum*. The varying amounts of lead can be found in gasoline, paint, food containers, and water pipes. Some amount of lead is commonly found in the drinking water, nevertheless drinking water results in the smaller exposure to lead. Drinking water exposes one to lead, and eventually, lead is stored in the human body. It is a toxic metal and causes numerous health issues to humans. In rare cases, lead gets into drinking water as a consequence of pesticides being owing to the industrial activity and contaminated groundwater and soil. However, the most common source of lead into the drinking water is from the water pipes and household plumbing. Lead can also be found in water supplies if one has lead pipework supplying your property, especially if the pipework has been disturbed. Most water companies replace their side of the connection. That is why lead is an important concern for the homes relying on either private or public water supply. Owing to the chemical properties of water, it dissolves lead from the lead pipes in the pipes through which it travels by a process called "corrosion."

Pipes, faucets, and plumbing fixtures are the most common causes of lead in the drinking water. Not much lead comes out of lead water pipes because metallic lead isn’t that active a metal. Nonetheless, if those pipes corrode for any reason (as in Flint, Michigan water crisis, it was due to chemicals in the water), then lead ions will contaminate the water. Drinking water travels through the pipes from the main sources to the homes and contains lead with it. In addition, water pipes and fixtures that were made prior to 1986 might contain a high content of lead (*CDC - Lead - Sources of Lead - Lead in Drinking Water*). The plumbing material, when going through a chemical reaction and dissolves a way of metal from the pipes in the water, results in lead contamination. This chemical reaction is more severe when the water has a low content of minerals and high acidity. The amount of lead that enters into water is based on following factors, the water temperature, alkalinity or acidity of the water, the existence of protective scales or coverings in the pipes, the kinds and quantities of minerals in the water, the total of wear in the pipes, the quantity of chemical that water comes into contact with, and the amount of time the water stays in pipes.

With increase in the corrosivity of water, amount of lead corroded in the water generally increases from the plumbing of metal. The content of calcium carbonate coupled with the high acidity of water allows for water corrosivity control. In addition to the presence of these two factors, many other factors can lead to an increase in water corrosivity. Hard water has a high concentration of magnesium and calcium is more corrosive, whereas the soft water having a low content of calcium and magnesium is less corrosive. Moreover, cold water is less corrosive as compared to warm water. Grounding electrical connection to water pipes is a common practice and it also increases corrosion in water. However, any water can contain a quantity of lead.

**Health Risks and Environmental Issues**

Lead is a toxic metal and it is very harmful to human health. In fact, there is no safe level of lead in the human body. It definitely becomes the primary reason for many health issues and concerns in children, adults and older adults as well. High level of lead in the drinking water of children can lead to many health issues in children such as organ failures, major neurological damage, coma and ultimately death as well (*Water Research Center - Lead in Drinking Water and Water Testing*). Low level of exposure to lead can result in hearing loss, learning infirmities, inhibit growth among the children; it can also contribute to gastrointestinal disease or flu generally deemed as the signs of lead poisoning.

The symptoms of lead poisoning amid kids are fatigue, vomiting, constipation, cramps, irritability, poor appetite, trouble sleeping, and fatigue, etc. Contrasting other chemicals in the water, lead accumulates in the human body over time and it eventually gets into the human brain, kidneys, bones, and other key organs, increasing the corrosive health impacts for the person being subject to lead exposure. Lead can be deposited in the child's blood and in the bones for many years (*Water Research Center - Lead in Drinking Water and Water Testing*). Kids of less than 6 years old can suffer from growth issues, mental retardation, and other serious health disparities if they've consumed enough lead, renal damage, and even death. EPA estimates only 20% of a child's exposure to lead comes from drinking water. High exposure to lead through drinking water is associated with decreased blood levels as well (Brown and Margolis).

For the past 2500 years, humans have been facing the issue of lead contamination from many sources; one of them is water. Irrespective of the source of lead in human food and water, it is very damaging to human tissues (Tranel and Kimmel). Humans' consumption of meat, bird, or any other animal having a lead shot poses several health issues (Tranel and Kimmel). As lead is stored in the bones of humans, it releases during pregnancy and can impact the bones of fetus, reducing its growth or in some cases resulting in premature births. Besides health issues, lead pollution is also adversely impacting the environment. Large amount of lead emitted by lead smelters and mining results in poor environmental health (Singh and Li).

**Prevention of Lead contamination of water**

Lead at trace levels is universal in our environment; it is not only present in water but also in soil, air, and food. It is tremendously important to avoid lead-contaminated drinking water. Why drinking water contains arsenic and lead, is because water reaches our home after traveling through pipes that are connected; the pipes that are not properly maintained and comes from the corrosion of older fixtures (“Lead in Drinking Water”). Thus when water passes through the leaded pipes, it might also carry the lead particles or different other contaminants, making it impure. Thus, in order to make the water free from impurities and safe for consumption, one can use a water purifier. One must scout through the various list of water purifiers and install the one most suitable.

There is a wide range of methods that can be used to eradicate lead from drinking water and these methods range from cost-effective to expensive. If the concentration of lead is low in drinking water, it can be reduced by flushing the plumbing system. If water remains in contact with the plumbing materials, it is essential to flush before drinking (“Lead in Drinking Water”). Though this method is not helpful in complex plumbing systems, the pump's metal parts must be checked for corrosion. In order to reduce corrosivity in the water, acid-neutralizing filters are also very effective; they add calcium and increase the pH level of water. Activated alumina filters and the process of reverse osmosis can purify drinking water from lead and other chemicals. Granular activated carbon (GAC) filters are also used for lead eradication, yet their efficiency is doubtful. Furthermore, one of the most expensive methods to get rid of lead from the water is to renew the entire plumbing system, with the new components. PVC or plastic pipes can be effective, according to National Sanitation Foundation (NSF). Sorption materials (Bayoxide E33, GEH and CFH 0818) revel excellent results in terms of removal of lead from water. Bayoxide E33 is most efficient in making water lead free.

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