



# Environmental Fact Sheet

## LEAD LEACHING FROM SUBMERSIBLE WELL PUMPS

### Introduction

Lead is an element that is found in air, food, paint, dust, soil, and drinking water. The Environmental Protection Agency estimates that on average, we receive 15 to 20 percent of our total lead intake from drinking water. Lead exposure has been associated with a wide range of risks including delays in normal mental and physical development, impaired learning abilities in young children, and at extreme exposure levels, irreversible damage to the brain.

This fact sheet is concerned with drinking water submersible well pumps. Some submersible well pumps are made of stainless steel and plastic components but the majority are constructed with brass fittings contained in a cast brass housing. While the plastic and stainless pumps do not pose a problem with lead leaching, EPA is concerned for residents of homes and other buildings with submersible well pumps made with brass fittings, because the brass alloys used in such pumps contain lead. These pumps have the potential to leach high levels of lead into drinking water, especially if the water is soft and corrosive.

### What Is A Submersible Well Pump?

A submersible well pump is typically four inches in diameter and is specially designed to fit into a water well pipe. Lead can leach into drinking water when water sits in contact with the brass in the pump. This could create a health risk with the water pumped into the home or other building by the pump.

### Is There A Certification Program For Well Pumps?

NSF International (NSF) is an independent certification and testing organization in the areas of environmental and public health. NSF develops voluntary standards for various products and provides testing and certification against those standards. ANSI/NSF Standard 61 is part of the NSF Drinking Water Additives Program and it addresses the health effects concerns of indirect water additives, including lead. Section 8.0 of Standard 61 outlines the requirements for various mechanical plumbing devices that contact drinking water, including submersible



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well pumps. Currently, one brand of pump has been evaluated, test and certified by NSF against Standard 61, Section 8.0. Others have applied for Certification and are being evaluated.

### **What Is The Environmental Protection Agency Doing?**

Although EPA does not regulate individual home water wells, it does regulate public water systems, those serving 15 or more connections or those that regularly serve at least 25 individuals, to monitor for lead and install corrosion control treatment if lead is found in excess of 15 parts per billion lead in more than 10 percent of homes tested. EPA is in the process of testing lead leaching levels from submersible well pumps. Laboratory and statistical analysis of the lead leaching data will be performed to determine to what extent lead leaching from water pumps poses a public health concern to anyone using them.

### **What Should You Do?**

If you are uncertain about the composition of your pump, or you know it contains brass components, you should get your drinking water tested. Select a certified laboratory in your area and be sure to follow the proper EPA sampling protocol. The protocol can be obtained from EPA's Safe Drinking Water Hotline (800-426-4791). EPA's Safe Drinking Water Hotline can provide you with the name, address, and phone number of your State lab certification officer. They, in turn, can provide a list of State-certified laboratories.

If your submersible well pump was installed within the last year, EPA advises you to drink bottled water while you wait for the results of the laboratory analysis. EPA's action level for lead is 15 parts per billion. If the test results indicate that your drinking water has lead levels above the action level, there are several steps you can take. There are a number of cartridge and reverse osmosis filtering devices that are available to remove lead from drinking water at the tap. NSF International evaluates and certifies both bottled water and drinking water treatment devices, the latter with regard to lead reduction performance. Lists of certified products are available from NSF upon request. The Water Quality Association (WQA) can provide advice on treatment units for specific uses at home. As a last resort, you may want to replace the existing water pump with a stainless steel model. However, this option is expensive, and still may not eliminate all the lead in your drinking water, because some of the lead produced by the pump may have settled out in different parts of the home's piping. In addition, other components of the home plumbing system, such as solder, brass fittings, and faucets are also potential sources of lead.

### **For More Information**

For more information about lead in drinking water, contact the EPA Safe Drinking Water Hotline at 800-426-4791 or the National Lead Information Center at 800-424-LEAD. For more information about the NSF drinking water additives, bottled water, or drinking water treatment unit programs contact NSF International at 3475 Plymouth Road P.O. Box 130140 Ann Arbor, MI 48113-0140 (313)769-5106. WQA can be contacted at (708)505-0161, ext. 270.

## **QUESTIONS AND ANSWERS ABOUT LEAD AND SUBMERSIBLE WELL PUMPS**

Drinking water from wells using submersible pumps made of brass or bronze may contain lead at levels that could pose risks to human health. This document uses a question and answer format to address issues that may concern the affected public.

### **Extent of the Problem**

#### **1. How did EPA become aware of this problem?**

In laboratory tests, several models of new, previously unused submersible pumps with brass and bronze components have been found to leach high levels of lead into the water that comes in contact with these pumps. The findings of these tests indicate cause for concern to users of such pumps and a need for further research. EPA is not aware of data from field studies designed specifically to collect information on the extent of lead leaching from brass and/or bronze submersible pumps.

#### **2. Who may be affected?**

Anyone who gets drinking water from a well with a submersible well pump that has brass or bronze parts may be affected. Most likely this includes people who get their drinking water from individual, household wells. People who get their drinking water from large Public Water Systems are not likely to be affected because of dilution effects from high flow rates and treatment at the water plant.

People with individual wells will need to test the water themselves (see Questions 12 through 16, below). Although Public Water Systems are required by the Lead and Copper Rule to monitor for lead at household taps, your home may not have been included in the sampling. If you are concerned, you can contact the water system to find out when/if monitoring occurred and what lead levels were found in your community. People who have submersible pumps that are made of plastic and stainless steel components are not affected since pumps made out of these materials should not leach lead.

#### **3. What is a submersible well pump?**

A submersible well pump is a water pump in which the pump is submerged in the water that is pumped. The usual well-pumping depth is 40 to 500 feet. The four-inch diameter submersible pumps are the most commonly used pumps in private wells, as well as in very small Public Water Systems.

**4. What factors influence how much lead can leach from submersible well pumps?**

The amount of lead that may leach from a submersible well pump can vary, depending on how much brass or bronze is used, how the brass or bronze parts are made, the age of the pump, and the corrosivity of the water. If you cannot tell for sure that your pump contains brass or bronze parts, the manufacturer should know; also the pump manual or brochure may also have this information. See Question 7. All but a few brands of submersible pumps use brass or bronze components that can leach lead. The only way for you to determine if your submersible well pump is leaching lead is to have your water tested. See Questions 12 through 16 for more information on how to take a tap water sample from your home.

**5. What is EPA doing about lead leaching from submersible well pumps?**

EPA is in the process of testing lead leaching from five major models of four-inch diameter submersible well pumps. The five models include four models made with brass fittings, and one model made with stainless steel and plastic components. EPA will evaluate the extent of lead leaching from these submersible pumps and determine whether the performance standard for well pumps established by NSF International requires modification. If so, EPA will provide technical information and recommendations to NSF International. NSF International is an independent certification and testing organization in the areas of environmental and public health. NSF International develops voluntary standards for various products and provides product testing and certification against those standards.

**6. What is brass (also called bronze in some products)?**

Brasses and bronzes are metal alloys containing copper and zinc. Although not a major component of these alloys, lead is typically added to copper and zinc to improve the machinability of the alloy. Many pump casings and other parts of submersible pumps currently on the market are made of lead-containing brass or bronze.

**7. How can I tell if my submersible well pump has parts made of brass or bronze?**

To find out if a submersible well pump has components that are made of brass or bronze, you should check with the manufacturer of the well pump. If you get your water from a Public Water System, you can contact the system to see if it uses submersible well pumps that are made of brass or bronze. The telephone number for your Public Water System will be printed on your water bill. If you are unable to determine whether a submersible pump contains brass or bronze from either of these sources, you should have your tap water tested

to see if lead is leaching into your water, and determine its source. The presence of lead in public water supply systems is most likely due to from the plumbing rather than from the pump. See Questions 12 through 16 for more information on how to take a tap water sample from your home.

**8. What about non-submersible pumps?**

EPA has not collected data regarding whether non-submersible well pumps leach lead, nor is EPA aware of data collected outside the Agency. The problem with lead leaching from submersible pumps has to do with brass or bronze fittings and casings which are in constant contact with water. Hand pumps or single stage shallow well pumps that contain brass or bronze components that are in constant contact with the well water could also leach lead. If you suspect that a non-submersible pump contains brass or bronze parts, you should have your water tested. See Questions 12 through 16 for more information on how to test your water.

**9. Didn't the Lead Ban prohibit the amount of lead in well pumps?**

The Lead Ban, passed by Congress in 1986, affects all Public Water Systems and requires that only "lead free" pipe, solder or flux may be used in the installation or repair of (1) Public Water Systems, or (2) any plumbing in a residential or non-residential facility providing water for human consumption, which is connected to a Public Water System. "Lead free" means that solders and flux may not contain more than 0.2 percent lead, and that pipes, pipe fittings and well pumps may not contain more than 8.0 percent lead.

The Lead Ban does not apply to private wells, although manufacturers of submersible pumps are generally following the 8.0 percent lead limit anyway. However, EPA has found that submersible pumps are still leaching lead into water even though they have no more than 8.0 percent lead and meet the Lead Ban's definition of "lead free".

**10. What is the definition of a Public Water System (PWS)?**

Public Water System means a system for the provision to the public of piped water for human consumption, if such a system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. A Public Water System is (1) any collection, treatment, storage and distribution facilities under control of the operator of such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. (40 CFR § 141.2)

**11. Are there any EPA regulations for water quality in private wells?**

The Federal regulations under the Safe Drinking Water Act apply to Public Water Systems. These regulations do not apply to private wells serving individual households. Individual States may regulate well water quality. Most States have building codes which affect well construction practices. Many individuals with private wells use the EPA's regulations for Public Water Systems as guidance for the quality of their well water. Two publications, *Citizen Monitoring: Recommendations to Household Well Users* (EPA 570/9-90-006, dated April 1990) and *Drinking Water From Household Wells* (EPA 570/9-90-013, dated September 1990) are available by contacting the Safe Drinking Water Hotline at 800-426-4791.

**Steps for the Consumer**

**12. How can I tell if there is lead in my drinking water?**

Detecting lead in drinking water requires that the water be tested. Since the EPA has regulated lead in drinking water supplied by Public Water Systems, the Agency has specified which methods are approved for testing lead. EPA recommends the use of a lab that is certified to perform these specific tests on drinking water. The Safe Drinking Water Hotline at 800-426-4791 can provide a phone number in each State that you can call and request a list of laboratories certified to test lead in drinking water.

**13. Are there any home test kits that can be used to check lead in drinking water?**

There are no home test kits that are EPA approved to test for lead. EPA recommends a State Certified Laboratory for testing lead in drinking water. To obtain a list of laboratories in your area, you can contact the Safe Drinking Water Hotline at 800-426-4791 for the telephone number of your State Certification Officer who will provide you with this list.

**14. What is the sampling protocol I should follow to test my water for lead supplied from an individual well?**

Household water supplies from individual wells include various designs. Most systems include a storage tank, where water is held before it is distributed through the house. To determine the contribution of lead from the plumbing including faucets and solder, collect a 250 ml (one quarter of a liter, or about 8.5 ounces) sample. This sample should be collected after the water in the plumbing has sat motionless for several hours (e.g., first thing in the morning) without allowing the water to run first. This is called a "first-draw sample".

To determine the highest probable amount of lead that you may be exposed to originating from a submersible pump, a 250 ml sample should be collected mid-morning after allowing the water to run for 30 seconds. This sample should be collected from the outlet of the storage tank, before the water contacts other household plumbing (solder, brass fittings, faucets), to assure the sample will not contain lead from other household sources. This is called a "flushed sample". Lead in your drinking water may be also contributed from the lead solder and brass faucets and fittings in the interior plumbing.

15. **Didn't the Lead and Copper Rule require first-draw samples (i.e., ones that have been taken from a tap that has not been used for at least 6 hours)? Why is this sampling protocol different?**

Unlike the tap water testing protocol under the Lead and Copper Rule, EPA's recommended protocol for submersible well pumps is devised to measure the highest probable amount of lead that you may be exposed to in your drinking water which has originated from the submersible pump. Since the lead leaching from a submersible pump is likely to be found in the well water, and diluted by the water in the storage tank, before the well water is pumped into the household plumbing, you should take a sample for lead from the discharge end of the holding tank to determine how much lead the well pump is contributing to the water entering your home. (If you do not have a storage tank, you should sample from the faucet closest to the well). We recommend that you should take the water sample mid-morning. By this time, sufficient water has passed through the system to flush out the water that has been standing in the pipes and get the water from the well that contains lead leached from the well pump overnight. If you want to see if your pipes are also contributing lead to your drinking water, you should take both a first draw and a flushed sample. A 1-liter first draw sample is required by the Lead and Copper Rule because the Rule is trying to determine how much lead is leaching from plumbing inside a home (i.e., from lead pipes, solder, flux, faucet fixtures, etc.) as well as from the distribution system. See Question 14 for the sampling protocol.

16. **How do I evaluate my test results?**

EPA's action level for lead in drinking water is 15 parts per billion (ppb, or  $\mu\text{g/L}$ ). If test results indicate that your tap water contains lead above 15 ppb, there are several steps you can take. First, determine the source of lead as best you can. This can be done by taking a first draw sample followed by a flushed sample as described in Question 14.

If you have a submersible well pump that contains brass or bronze and the flushed sample has a lead level above 15 ppb, the problem is likely to be the pump. Under these circumstances, steps you can take to reduce your exposure

to lead include installing a home water treatment unit, using bottled water, or replacing the submersible well pump with a pump that does not contain brass or bronze. See Question 18 for additional information.

If the lead level is above 15 ppb in the first draw sample, but not in the flushed sample, the lead is likely to be coming from components of your household plumbing (e.g., lead piping or solder, or brass faucets). If this is the case, anytime the water in a particular faucet has not been used for several hours, flush your cold-water pipes by running the water until it becomes as cold as it will get. (This could take as little as five to thirty seconds if there has been recent heavy water use such as showering or toilet flushing. Otherwise, it could take 2 minutes or longer.) The more time water has been sitting in your home's pipes, the more lead it may contain.

**17. Will boiling water remove lead?**

Boiling water does not remove lead. Consumers are sometimes directed to boil water by their Public Water System if there is known or suspected contamination of the public water supply by microorganisms. Boiling water kills or inactivates bacteria and viruses that can have adverse health effects on humans. During boiling, water evaporates which concentrates any lead that may be in the water.

**18. What can I do to protect myself and my family from exposure to lead from submersible pumps?**

You can take several steps to reduce your exposure to lead in drinking water if you determine that you have lead in your drinking water above EPA's action level of 15  $\mu\text{g/L}$  (equivalent to parts per billion). You can

- Install a Point-of-Use treatment device that removes lead. For more information on which types of treatment devices remove lead, contact the Water Quality Association at 708-505-0160 or NSF International at 313-769-5106; and/or
- Use bottled water for drinking and cooking. Make sure that you use a brand that does not contain lead, however. For more information on bottled water, you can contact the Food and Drug Administration at 301-443-4166, NSF International at 313-769-5106, or the International Bottled Water Association at 703-683-5213; or
- Replace the submersible well pump with a pump that does not contain lead (such as stainless steel and plastic).



**19. Which bottled water is the best for me to drink?**

Bottled water is regulated by the Food and Drug Administration (FDA), not EPA. For information on bottled water you can contact the FDA's Consumer Affairs Office at 301-443-4166. Information is also available from the International Bottled Water Association (IBWA) at 703-683-5213, and NSF International which certifies bottled water at 313-769-5106.

**20. Which Home Water Treatment Units remove lead?**

Generally speaking, systems using reverse osmosis remove substantial amounts of most inorganic chemicals including lead. Several systems using charcoal filters also remove lead. However, there are many brands and manufacturers of water filters. EPA neither approves nor endorses home water treatment units nor does EPA conduct laboratory tests to determine whether a unit functions as designed and/or claimed. Two reliable sources of information about water filters are the NSF International and the Water Quality Association which are described above.

**21. Will water softeners affect the amount of lead in drinking water?**

Water softeners are devices that are attached to the plumbing at the point just after the plumbing enters the home. This is called point-of-entry (point-of-use is when the device is attached to a faucet inside the home). These devices soften the water by removing minerals (primarily calcium and magnesium) that cause the water to be hard. Water softening will also remove the lead that typically leaches from submersible well pumps. Preliminary tests of water softeners indicate that they will not affect the corrosivity of the water. Unlike water softened by a water softener, naturally occurring soft waters are mostly corrosive.

**22. What is soft water?**

Hard water and soft water are relative terms. Water is considered soft if it has low total dissolved solids, low in divalent minerals (primarily calcium and magnesium). Water with total hardness (calcium and magnesium salts and to a lesser extent iron salts are the major causes of hardness in water) concentrations from 0 to 75 mg/l is considered soft, 75 to 150 mg/l is considered moderately hard, 150 to 300 mg/l is considered hard, and over 300 mg/l is considered very hard. Hard water slows down the cleaning actions of soaps and detergents and when heated will deposit a hard scale in cooking pots and in hot water pipes.

**23. What is corrosion? What is corrosive water?**

Corrosion is commonly defined as an electrochemical reaction in which metal erodes or is destroyed by contact with elements such as air, water or soil. Corrosive water is a term used to describe the ability of certain waters to wear away metals. The important characteristics of water that may affect its corrosiveness to metals include the following:

- **Acidity** is a measure of the water's ability to neutralize alkaline materials. Water with acidity or low alkalinity tends to be more corrosive than less acidic water. Water with pH less than seven is acidic. (In some instances waters with pH above 7 may still be corrosive).
- **Conductivity** is related to the amount of dissolved minerals in the water. An increase in conductivity promotes the flow of electrical current and increases the rate of corrosion.
- **Oxygen** is oxygen dissolved in water. Oxygen may either be a corrosive agent or protect against corrosion.
- **Carbon dioxide** is carbon dioxide dissolved in water. Carbon dioxide forms carbonic acid, which tends to attack metal surfaces. Also the higher the levels of carbonic acid in water, the higher the acidity of the water.
- **Water Temperature** is the temperature of the water. Experience indicates that the higher the water temperature, the higher the corrosion rate for lead
- **Silt & sand** is the amount of silt and sand present in water. Silt and sand causes the erosion of protective films on metal surfaces. The higher the water silt and/or sand content, the higher the erosion and corrosion rate.

## **Health Effects of Lead**

### **24. What are the health effects of drinking water that contains lead?**

All people are susceptible to the risk of lead contamination, but children are especially vulnerable. Children are sensitive because their bodies are still developing, and they absorb and retain more lead than adults. Even at very low levels of lead exposure, children can experience reduced I.Q. levels, impaired learning and language skills, loss of hearing and reduced attention spans. At higher levels, lead can cause damage to the brain and central nervous system, interfering with both learning and physical growth. In adults, lead can also raise blood pressure a small amount. Women of child-bearing age are also at risk. Lead can cause impaired development of the fetus, premature births, and reduced birth weights, and at extremely high exposure levels, fertility problems and miscarriages.

### **25. Should I have my child's blood tested for lead?**

Many local health departments have lead testing programs. Contact your local health department or physician for information on how to get your child's blood tested for lead. The only way to know for sure if your children have elevated blood-lead levels is to have them tested. The Centers for Disease Control and Prevention (CDC) recommend testing at 12 months of age, and, if resources allow, at 24 months. Screening should start at 6 months if the child is at risk of lead exposure. In some States, more frequent screening is required by law.

### **26. If my blood level is high, does this mean the drinking water is bad?**

Not necessarily. Lead comes from many sources, including household surfaces with old lead paint, household dusts and soils contaminated by lead paint or past emissions of leaded gasoline, lead crystal glassware or imported or old pottery, some imported food cans, printing on the outside of plastic bags, and other sources such as some imported crayons.

### **27. What organizations can I contact for more information?**

The organizations listed below can provide more information on the following subjects:

- **Bottled Water:** The Food and Drug Administration regulates bottled water. To find out about their standards call 301-443-4166. You may also contact the International Bottled Water

Association (IBWA) at 703-683-5213 or NSF International at 313-769-5106.

The International Bottled Water Association is an independent, not-for-profit organization which can provide information about international standards. Call them at 703-683-5213.

NSF International is an independent certification and testing organization in the areas of environmental and public health. NSF International may be contacted at 313-769-5106.

- **Water Filters:**

NSF International offers objective third-party evaluation of water filters and will provide a list of brands which have been certified. You can reach this foundation at 313-769-5106.

The Water Quality Association can provide advice on water filters for specific uses at residential, commercial, industrial and institutional settings. This independent, not-for-profit association's phone number is 708-505-0160.

- **Lead:**

Additional information on lead, lead poisoning, health effects on children, testing your home for lead paint and state contacts, call the National Lead Information Center at 800-424-LEAD.

- **Pumps:**

If you get your water from a Public Water System, contact the system that supplies your drinking water to find out if any wells outfitted with lead-containing submersible pumps are used. The name and phone number of the Public Water System is usually printed on the water bill. If you are served by a municipal system, a phone number should also be located in the government listings of the local phone book.