



DEPARTMENT OF
ENVIRONMENTAL
QUALITY

Drinking water, submersible pumps, and mercury seals: A potential problem

Groundwater supplies about 95% of Idaho's drinking water. The pumps used to supply ground and surface water play an important role in water distribution systems.

Probably the most commonly used water pump in Idaho is the submersible pump, which is used mostly for pumping groundwater. The larger, higher capacity wells generally use the vertical turbine pump, however, some surface water wells are also fitted with high capacity submersible pumps.

Submersible pumps

The submersible pump is a pump and motor combination designed to be placed entirely below the water surface, and is typically four inches or larger in diameter and specially designed to fit into a water well casing.

All pumps used for drinking water employ some type of a seal, between the pump and motor, to prevent the water being pumped from entering the motor and causing a short circuit. The majority of pumps use some type of a mechanical seal, but the design of some submersible pumps incorporate a mercury seal.

Submersible pumps with a mercury seal are a concern because of the possibility of contamination if the seal is broken and the mercury spills into the well. Mercury is a dangerous contaminant because exposure can permanently damage the brain, kidneys, and developing fetuses.

This handout examines the necessary precautions system owners and operators should take if they are using mercury seal pumps.

Recent mercury spills in Idaho

In the past, some public drinking water systems in Idaho have experienced mercury seal breakages. Seal breakages can be the result of in-well failure, but spills frequently occur when the pump is pulled for repairs. In separating the pump from the motor, the seal may be accidentally broken spilling mercury into the well.

In April 1993, when the pump at one of the city of Coeur d'Alene's wells stopped working, the city sent a contractor out to remove the pump for repair. When the contractor separated the pump from the motor, about eight pounds of mercury from the seal accidentally spilled into the well.

The city shipped the motor out for repair and then attempted to recover the mercury from the bottom of the well. When this was unsuccessful, the city sealed the mercury off from the rest of the well using bentonite ("driller's mud").

The dangers of mercury

Pure mercury is a liquid metal (sometimes referred to as quicksilver) used to make products such as thermometers, switches, and some light bulbs. Mercury is also used in seals in some submersible water pumps.

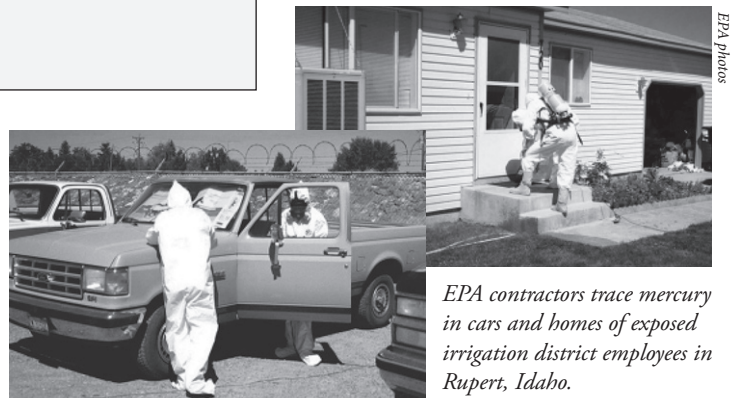
Although metallic mercury may look fun to play with, mercury can evaporate into a toxic, odorless, colorless gas when exposed to air. If inhaled or absorbed over time, mercury vapors can result in tremors, insomnia, headaches, and can damage the brain, central nervous system, and other organs. Children, babies, and pregnant women are especially at risk.

You can help reduce mercury incidents by purchasing mercury-free products and correctly disposing of products that contain mercury.

Contact your local landfill or DEQ regional office for proper disposal in accordance with local, state, and federal laws.

After the rebuilt motor was reinstalled, tests showed mercury in the range of 50 ppb (parts per billion) (the MCL [maximum contaminant level] is 2 ppb). So the city took the next step and began flushing the well and, with DEQ approval, discharging into the sanitary sewer. Within a month, tests showed the levels were back to non-detect and the well went back on-line.

In August 2000, near Rupert, Idaho a mercury spill occurred involving, in this case, a turbine pump. About 12 pounds of mercury spilled from the pump's bearing seal when an irrigation district removed the pump for maintenance. Five irrigation district employees attempted to clean up the mercury spill by hand. Later that day the employees unknowingly tracked the mercury home, but immediate action by EPA resulted in remediation within hours of several vehicles and two homes.



EPA contractors trace mercury in cars and homes of exposed irrigation district employees in Rupert, Idaho.

EPA photos

Precautions to take when repairing submersible pumps

To remove a submersible pump, it is often necessary to break the pump down into several components. If the pump is disassembled directly below the seal, mercury may be exposed and spill into the well and the drinking water.

Operators should follow the best management practices listed below if they are using a mercury seal pump:

- **Be aware of mercury seals in your system.** Check to see if any submersible well pumps used in your system contain a mercury seal. Equipment specifications or manuals, pump manufacturers, and vendors will be the sources of this information.
- **Read instructions before pulling a mercury seal pump.** Consult the pump manual for removal instructions if a pump must be pulled for repair or maintenance. (Most failures of submersible pumps are due to electrical problems with the motors.)

Pumps can often be broken down into sections for easier removal. Disassembly may expose the mercury seal; incorrect disassembly may cause mercury to spill. Use a barrier, such as an impermeable tarp, to protect the well-head in case of spill.

- **Purchase a mercury spill kit.** Have a mercury spill cleanup kit on site and train staff in its use. Mercury spill kits are available commercially and will usually include a small pump, nitrile gloves, and sponges impregnated with a special material to absorb mercury, which can be used to wipe up the area of a small spill.
- **Educate staff.** Train staff in safe mercury management, spill clean-up processes, and safe disposal procedures.
- **Consider replacing mercury seal pumps.** When feasible, replace equipment with non-mercury alternatives. (Some pump companies will convert a pump with a mercury seal to a mechanical seal.)
- **Know how to dispose of mercury.** Dispose of mercury and mercury-containing equipment according to federal, state, and local regulations. Check with your local landfill or DEQ regional office for assistance in identifying disposal and recycling options.



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*Note: Provided for information only. DEQ does not endorse any particular brand, product, service, or company.

Costs involved as well as health hazards

Not only are there health hazards associated with mercury spills, but cleanup and disposal costs figure in as well. Cleanup costs associated with mercury spills can include incident response and worker decontamination (as in the Rupert incident), and cleanup, removal, and disposal of the mercury from the well and surrounding soils.

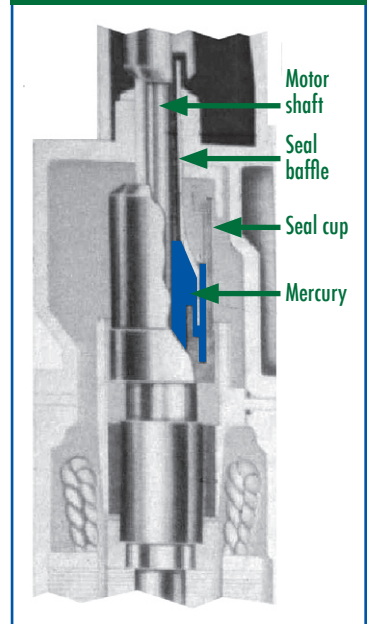
If mercury spills into the well, the existing well may need to be sealed and a new well drilled resulting in additional costs. Communities also may need to supply emergency water supplies for customers.

Summary

Are submersible pumps with mercury seals a thing of the past? Not necessarily, because there are still older pumps in use that contain mercury seals. And there is one major manufacturer of submersible pumps that continues to sell a pump model with a mercury seal (the firm also sells submersible pumps with mechanical seals).

As old mercury seal pumps malfunction and they are repaired or replaced, there is always the danger of a mercury spill into the drinking water well when removing the pump. Eventually, mercury contamination of a well may not be the problem that it once was as mercury seal pumps are replaced by pumps with mechanical seals. In the meantime, if systems are still using pumps with mercury seals, they must take the precautions discussed above to protect themselves and their customers. ■

Cutaway of Submersible Pump showing location of mercury seal



Idaho's Rules for Public Drinking Water Systems do not mention mercury seals, but Question #14 on DEQ's "Drinking Water Well House and Equipment Design Checklist" for the design of new facilities asks if the system is using submersible pumps with mercury seals. If the system checks "yes" the checklist asks if there are "procedures for removing pumps to prevent loss of mercury in the system's operation and maintenance manual."