



EXECUTIVE SUMMARY

ISSUE: Many communities in Illinois have submersible water well pump and motor assemblies with mercury seals. As of July 1st, 2012, communities may not purchase new mercury seal motors due to a new Illinois Public Act.

CONCLUSION: If a submersible motor with a mercury seal is in operation, it may remain in service. Furthermore, maintenance may be performed on a mercury seal motor without violating the act, as long as the mercury seal is not compromised. Determining compliance with the new act and formulating a contingency plan for replacement requires careful review of the existing situation. If you have questions, please contact the person(s) noted at the end of the paper.

ILLINOIS PUBLIC ACT 97-459 (PA97-459)

In recent years, there has been a legislative effort to prohibit the sale and distribution of products containing mercury. The legislation that generally governs products containing mercury is the Environmental Protection Act. Illinois PA97-459 amends the Environmental Protection Act and the Mercury-Added Product Prohibition Act. PA97-459 was passed in 2011 and includes prohibition of the sale and distribution of mercury-containing rings, **seals**, and sensors (emphasis added). Illinois is one of 24 states that ban the sale and distribution of mercury-added products. PA97-459 becomes effective July 1, 2012. If you would like to review the full text of the Mercury-Added Product Prohibition Act, please visit www.ilga.gov/legislation/ilcs/ilcs.asp and click on "Search". Then type "mercury-added product" in the search box below "Search ILCS Act by Name" and select "Go" or contact the authors of this paper.

MERCURY SEALS IN WATER WELL PUMPING EQUIPMENT

Communities that utilize groundwater (wells) as a drinking water source require pumping equipment to draw the water from the well into the water treatment and/or distribution system. In most deep well installations, the pump and motor equipment is submerged beneath the water level in the well and the equipment is suspended from the top of the well by heavy duty water transmission piping. This submersible pump and motor arrangement is commonly used and has a long track record of success.



Submersible Pump and Motor Equipment



Mercury Seals in Water Well Pumping Equipment

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In the water well submersible pump and motor arrangement, the pump motor drives the pump via an interconnecting shaft. The motor provides the energy to turn the shaft, which is connected to impellers in the pumping assembly. The impellers transfer energy from the motor to the water being pumped, so that the water can be conveyed to the treatment and/or distribution system.

The internal electrical components of the motor can be damaged by exposure to water. Components of the motor are designed to be protected from surrounding water in the well. However, a seal is required to prevent water from travelling along the interconnecting shaft from the pumping end to the motor end of the equipment. This seal is typically found near the connection point between the pump and motor. Two types of seals have been commonly utilized in submersible water well pumping equipment: mechanical seals and mercury seals.



Submersible Pump and Motor Equipment

Mechanical seals are typically comprised of multiple components that work together as a system. These components wear and will fail over time. When the seal fails, the pump and motor equipment must be removed from the well and the seal must be repaired. Additional motor maintenance is often required, as well. It can take up to one week to remove and reinstall the equipment. Depending on the nature of the repair work, the pump and motor equipment could be out of service for a period of weeks.

Mercury seals utilize the unique properties of mercury to prevent the pumping end water from entering the motor end of the equipment. Because mercury is a toxic substance, there are many provisions designed to contain it in the motor end of the pump and prevent it from entering the pumped water. This seal requires no wearing parts and typically fails much less frequently than a mechanical seal, which translates into higher reliability and lower maintenance costs. Therefore, the mercury seal option has been popular for many years for submersible pumping applications.

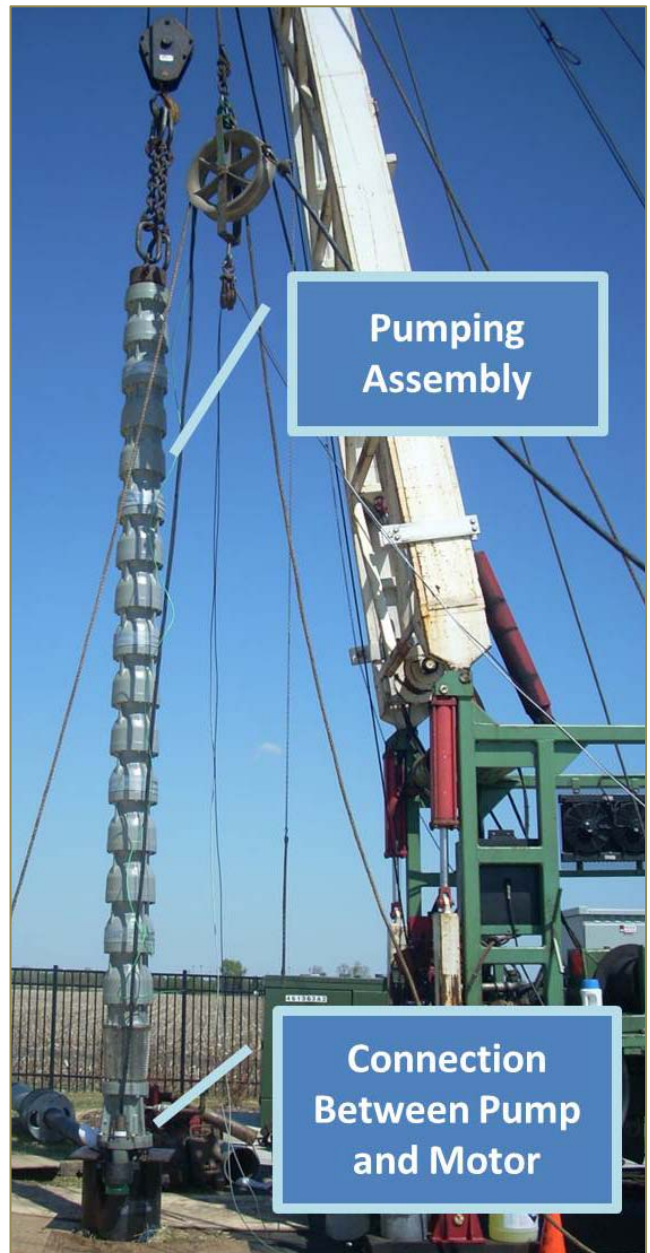


HOW DOES THIS AFFECT YOU?

The mercury seal in submersible water well pumping equipment is a proprietary design by Flowserve/Byron Jackson and is exhibited in their type H motors. These motors have been installed in water wells for decades in many communities in Northeastern Illinois. However, PA97-459 will prohibit the selling, offering to sell, or distribution of mercury seals in Illinois after July 1, 2012. This includes the Flowserve/Byron Jackson type H motors, due to their use of mercury seals. Therefore, communities will not be able to purchase Flowserve/Byron Jackson type H motors after July 1, 2012. Other States had enacted similar legislation prior to Illinois. Due to this general movement and other factors, Flowserve/Byron Jackson has announced that they will cease to manufacture the type H motors.

It is important to note that PA97-459 does not require the removal and replacement of existing Flowserve/Byron Jackson type H motors. Any of these motors that have been purchased prior to July 1, 2012 and have no mercury seal defects can be operated, installed, and reinstalled indefinitely. Routine motor maintenance, including maintenance on a mercury seal that does not require the replacement of the seal, is permissible and the motor can be reinstalled and operated without regulatory consequence. Furthermore, if a community has a spare Flowserve/Byron Jackson type H motor that it has purchased prior to July 1, 2012; it can be installed and operated without consequence.

While this legislation calls attention to a potential risk of utilizing equipment with a mercury seal in a water well, the fact remains that the Flowserve/Byron Jackson type H motors are NSF certified for use in public water supply systems. When mercury seals do fail, the mercury is contained in the seal while the motor is in the well. There is a potential for the mercury to leak out of the seal when the pump and motor are removed from the well for maintenance. Contractors performing the maintenance work should have procedures in place to prevent



Submersible Pump and Motor Installation



the leakage of mercury from escaping back into the well or onto the ground and should be knowledgeable on the proper handling and shipping requirements.

If a Flowserve/Byron Jackson type H motor is inoperable or the mercury seal has been compromised and the motor must be replaced with a new motor, communities have a few viable options:

1. Purchase and install a mechanical seal motor. There are a number of companies that manufacture mechanical seal motors, including Flowserve/Byron Jackson, Sunstar, Indar, Hitachi, and Pleuger. There are differences between each manufacturer's motor including mechanical seal materials and configuration, as well as water-filled and oil-filled motor designs. The particulars of each manufacturer's motor should be investigated prior to purchase to ensure that the motor will meet the needs and goals of the application.
2. Install a spare Flowserve/Byron Jackson type H motor that was purchased prior to the July 1, 2012 deadline. Consideration must be given to whether the spare motor is sized appropriately for the application. The physical size of the motor in relation to the pump and well sizes is one important consideration. Power rating of the motor in relation to the existing electrical gear is another important consideration.
3. Convert the mercury seal into a mechanical seal and reinstall the modified motor. This has not been a common procedure to date and Flowserve/Byron Jackson is currently investigating the logistics of this conversion. The cost and time required for the conversion would have to be weighed against purchase and installation of a new mechanical seal motor.

WHAT CAN YOU DO NOW?

It is recommended for a community that utilizes the Flowserve/Byron Jackson type H motor to have a contingency plan in place for the future replacement of these motors. As noted above, the three viable replacement options at this time are to install a spare Flowserve/Byron Jackson type H motor, purchase and install a new mechanical seal motor, or convert the mercury seal into a mechanical seal and reinstall the modified motor. There are a number of important issues for communities to consider for their contingency plan. Most importantly, the motor must meet the physical requirements and goals of the application. Communities will also want to consider the capital cost and anticipated operation and maintenance costs for each motor option. Finally, communities should consider the impact of a well motor failure on their water system operations. For instance, how long can the water system keep pace with demand without the use of each well?

The purchase of a new mechanical seal motor upon motor failure or conversion of a mercury seal to a mechanical seal are options that will likely take weeks to accomplish before the well can be put back into service. A temporary pump could be installed in the meantime, but the cost to install and remove a temporary pump is significant. Installation of a spare motor, whether it be mercury or mechanically sealed, will allow the well to be put back into service within days of motor failure.



The contingency plan should take a holistic and specific approach to analyze the importance of each well in the communities' water system. Using this approach, a plan for the replacement of each of the affected well motors can be devised.

WHO TO CONTACT IF YOU WANT MORE INFORMATION

EEI's Environmental Group has extensive water well experience, including the evaluation of water well pump and motor assemblies. If you would like to discuss how this new legislation affects your water works system, please contact Stephen Dennison (sdennison@eeiweb.com) or Jeff Freeman (jfreeman@eeiweb.com) either via email or by phone at (630) 466-6700.