CALIFORNIA RURAL WATER ASSOCIATION
MEMBERGUARD
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RISK COMMUNIQUÉ

A technical reference bulletin by the Risk Control Services Department of the Glatfelter Insurance Group

Submersible Pump Lightning Damage

Recent loss experience has shown us that lightning damage can occur on submersible pumps that have surge protection equipment installed in the control panel arrangement. Deep-well submersible pumps damaged by lightning can be very expensive to remove and repair. They can also cause loss of service.

Case History: What Happened?
One water authority operated systems that were deep-tap submersible units at a depth of 1200 feet. The pump controller with surge protection was located at grade level. The pump and motor were down at the bottom of the well. One would think this depth would provide even more protection against lightning damage than normal.

Although the pump controllers and surge protection were provided at grade level, the lightning strike occurred on the ground away from, but in close proximity to, the well. Electrical currents can—and did—run deep into the ground. How could this happen if the pump system had surge protection? The theory in this case is that the lightning hit the ground, ran deep and sideways, and bypassed the grade-level control panel's surge protection system. The electrical charge then hit the pump motor deep underground, damaging the motor even at 1200 feet down. In this case, the pump motor burned out and had to be removed.

What Were the Consequences?
The repair cost was substantially escalated by the depth of the pumping unit. To get the submersible pump out, a contractor's truck had to pull all the water piping out, section by section, along with the pump and motor. Once the damaged pump motor was removed from the well, it had to be repaired and then tested prior to re-installation. Due to the depth of the well, they needed a heavier, higher-powered truck than anticipated. Wells this deep require extra heavy removal equipment. The truck rigs and labor were much more expensive than would be required to repair a ground-level unit.

How Can Repair Costs Be Reduced?
To reduce the potential for a costly damage to a deep-well submersible pump, some districts have taken the following measures:

- Removing the pumping systems with pump motors from down inside the well.
- Replacing the submersible pump arrangement with vertical turbine units with the motors at grade level, locating them on a concrete pad and equipping the control panel with a surge protection system.
- Grounding the motor to earth ground wire system.

Even pumping systems with grade-level motors on concrete pads that are equipped with surge protection are exposed to lightning damage. Lightning can hit the ground near the pump, go into the ground to the water level, transfer a charge through the water, and send the electrical charge up the pump drive shaft, damaging the grade-level motor. The electrical charge would most likely lessen as it travelled up the drive shaft; in theory, the deeper the well, the less damage to the pump. However, the charge may still be sufficiently strong to damage the motor.

There does not appear to be a fool-proof method of installing these systems in a fashion which eliminates exposure to lightning damage. However, replacing submersible pumps with vertical turbine units and placing them at ground level on concrete pads, installing surge protection, and grounding these systems will help reduce the cost of repairs from lightning damage.