

Impact of Air in Irrigation Pipelines

A common misunderstood concept is how air gets into a pipeline and its effect on the operation of the irrigation system. All irrigators are familiar with the air release valves mounted near the discharge of a pump. When the pump is turned on, the air in the pipeline is discharged from the valve, sometimes watering down those unfortunate enough to be standing in front of it. Many irrigators also are familiar with the air release valves installed at the high point of a pipeline that goes over a hill between the pump and irrigation system. Because these are often in the middle of fields, they have to be farmed around, and many have been broken off or shut off because they are perceived to be a nuisance and an obstacle to field operations. However, they should be maintained and kept working because they are important for proper operation of the irrigation system. Air gets into a pipeline in two main ways. The first is at start-up, when the pipeline is being filled. Much of this air will be pushed down the pipeline, where some will collect in the high points of the pipeline, and the rest will be pushed out through air release valves. If no air release valves are at the high points, the air will create a bubble that will not be pushed out by flowing water, even under pressure. The second source of air is the water. By volume, water contains about 2 percent air, even water from a well. This doesn't sound like much, but consider that this would form a 40-foot bubble in a 2,000-foot pipeline, no matter the pipeline diameter. During pumping, the air will leave the water and contribute to the bubble at the high points of the pipeline. Can this bubble of accumulated air have an impact on the flow through the pipeline? Absolutely. Many irrigators have a hard time understanding this principle, but the bubble of accumulated air acts like a pipeline restriction and can reduce the flow rate and increase the pressure at the pump. In addition, sometimes packets of air will be pushed out of the bubble to flow downstream and create the potential for water hammer (a high-pressure surge) that can damage pipeline joints and connections. The solution is to make sure the air release valves at the pump and on the high points of the pipeline are working and maintained. Air in the water also can affect the operation of the sprinklers on a center pivot. If you notice the sprinklers on the pivot sometimes hiss from escaping air, then air is in water and it probably is accumulating near the top of the gooseneck. This can reduce the flow to the sprinkler head, resulting in uneven water application. The solution is to install a continuous-air-release valve near the pivot point. A continuous-air-release valve will let air out of the system, even under pressure. The valves are readily available from sprinkler manufacturers.

Tom Scherer, (701) 231-7239 NDSU Extension Agricultural Engineer Thomas.Scherer@ndsu.edu