

Water Wells That Breathe

"Suckers and Blowers"

Prepared for the Canadian Ground Water Association /
Association canadienne des eaux souterraines

What are water wells that "breathe"? For the most part, these water wells are nothing more than an inconvenience, and in some cases they are even useful, as when local people use observations associated with these "suckers and blowers" to predict the weather. But in other rare instances, suckers and blowers may prove to be deadly.

What exactly is happening in these water wells? Essentially, as atmospheric pressure rises, air flows into the water well. When atmospheric pressure drops, the air exits the water well. In some cases and at some times, the volume of air moving into and out of the water well can be enormous; indeed, the effect created is one of breathing.

Very little attention has been paid to this phenomenon in the past. The condition is known to exist in many water wells in Alberta and in at least one water well in northeastern British Columbia. However, this condition may be linked to the death of two teenagers and the near death of their father, in central Alberta in July 1999. A link may also exist between this type of water well and the death of two other people in 1970, also in central Alberta.

A water well that breathes requires a specific condition in the water well. Typically, the water well has a surface casing and a top of completion interval that is above the non-pumping water level in the water well. In addition, it is necessary to have unsaturated permeable rock above the water level and below the top of the completion interval.

When the unsaturated permeable rock is exposed to the completion interval, air can move into or out of the rock, depending on changes in pressure. When atmospheric pressure rises, there is a flow of air into the water well and back into the unsaturated permeable rock. The volume of air depends on many factors, including the magnitude of the pressure change, the permeability of the exposed rock and the size of the permeable reservoir into which the air is flowing.

Because the airflow is in response to changes in atmospheric pressure, a water well that is blowing signifies

an approaching low-pressure system. On the other hand, if the same water well is sucking, this signifies the approach of a high-pressure system. A symptom of this type of water well in the winter, in Alberta, is that with the high pressure there is a flow of cold air into the water well, causing the water line in the pitless adapter to freeze.

Other than observing the flow of air into or out of the water well, there has been no real concern with these water wells.

However, follow-up investigations of the water well pit in which the two teenagers lost their lives have shown that the problem is low oxygen levels in the air in the water well pit. Other than the low oxygen levels, the only other gas anomaly is the nitrogen content, which has been recorded at concentrations in excess of 90%.

At this time, there are too little data to understand the mechanisms of oxygen depletion and how they might relate to the initial observations. However, if water wells that breathe do have the potential to generate a lethal air supply, then the problem deserves serious attention. The groundwater database for Alberta shows that 12,000 water wells -- 9% of the water wells in the province -- have the non-pumping water level below the top of the completion interval. What we do not know is how many of these 12,000 water wells have permeable rock between the top of the

completion interval and the non-pumping water level, and how many are completed in water well pits.

The new Water Act of Alberta prohibits water wells having a surface termination in pits. This legislation acknowledges the danger that water well pits pose to individuals and to personal property, and that water wells in pits provide a pathway for groundwater contaminants. Unfortunately, the water well pit, in addition to being a suitable place to store vegetables, provides a convenient frost-free area from which the landowner's water system can operate. These two points can be appealing when the potential danger that lurks is unknown.

