Underground water aquifers are a significant source of drinking water. In a recent study, French researchers found that pesticides applied to crops can take many years to sink down through the ground and reach groundwater. This means that they may still be entering aquifers, even after agricultural application has stopped.

Groundwater is found underground in absorbent layers of rock. Understanding how pesticides reach groundwater is essential for monitoring future trends of pollutants in underground water systems.

The Brevilles spring is the principal spring of a small aquifer in northern France. It has not been used for drinking water since 2001 when the pesticide atrazine was found at concentrations exceeding the legal EU thresholds for groundwater and drinking water (0.1 micrograms per litre). Until it was banned in France in 2003, atrazine, and one of its degradation products, deethylatrazine, were the most commonly detected contaminants in groundwater. Atrazine is potentially carcinogenic and could act as an endocrine disruptor in the environment.

Farmers in the area switched to another pesticide, acetochlor, as an alternative to atrazine for weed control in maize. At the same time, pesticides began to be monitored in the groundwater, the unsaturated zone (the zone that extends from land surface to the underlying water table or saturated zone), and the top soil layer of the unsaturated zone. This allowed detailed observations of the effects of replacing one pesticide with another.

The study, partly supported by the EU PEGASE and AquaTerra projects, found that, eight years after the agricultural application of atrazine had stopped, it could still be found in spring water at concentrations above the threshold for drinking water. Atrazine was also detected in the soil layer 7 years after it had ceased to be used. In the unsaturated zone, atrazine did not appear to degrade, unlike acetochlor. In addition, although acetochlor breaks down quickly, both its residues and degradation products remained in the soil for at least a year.

Once in the saturated zone, transfer rates of the pesticides varied widely, depending on the structure of the aquifer, moving at speeds of 50 metres a day through the fastest pathways to just 0.3 metres a day in the deeper layers. As a result, tests for water quality will vary depending on the depth at which water samples are taken.

Even though the Breville spring is located in a small catchment area, the aquifer’s behaviour is complex. Pesticide concentrations in water samples varied widely, implying that measurements taken at one location could not be used to estimate values elsewhere. This aspect should be considered when choosing sampling points to monitor groundwater under the European Water Framework Directive.

The slow remediation time has implications for monitoring and managing groundwater. The researchers suggest that the complexity of such a small scale aquifer, in this case, with no streams or irrigation schemes, demonstrates the need to use models to understand and monitor water flow and contamination at all levels of an aquifer system.

3. PEGASE (Pesticides in European Groundwaters: detailed study of representative Aquifers and Simulation of possible Evolution scenarios) was supported by the European Commission under the Fifth Framework Programme. See: [http://www.eugris.info/displayProject.asp?Aw=PEGASE&Cat=Project&ProjectID=4306](http://www.eugris.info/displayProject.asp?Aw=PEGASE&Cat=Project&ProjectID=4306). AquaTerra was supported under the European Commission’s Sixth Framework Programme. See: [http://www.atempto-projects.de/aquaterra/](http://www.atempto-projects.de/aquaterra/)


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Theme(s): Agriculture, Chemicals, Water