

Student Research - SR 2023.001

Tiered risk assessment frameworks for transformation products in drinking water for humans and livestock

30 January 2023

Remi Hoencamp
Toxicology & Environmental Health
Graduate School of Life Sciences, Institute for Risk Assessment Sciences, Utrecht University

Supervised by

Milou Dingemans
KWR - Chemische Waterkwaliteit en Gezondheid

Deon van der Merwe
Animal Health Services, Deventer
Oklahoma State University, Stillwater, Oklahoma

Many different types of substances can contaminate surface water, for example active substances from plant protection products or biocides. As surface water is also used directly for drinking livestock and to produce drinking water for humans, it is essential to investigate any potential health risks for both humans as well as for livestock animals. For this purpose, toxicological risk assessments are performed. This student research project focused on including a particular hazard in such assessments, the formation of transformation products. Transformation products can be formed in the environment or in water treatment, and can remain unknown if not specifically addressed.

A literature study on tiered risk assessments for substances used in agriculture demonstrated that some approaches in these assessments are particularly useful to evaluate transformation products. Tiered risk assessments consist of multiple levels ('tiers') to evaluate risks in a step-by-step manner. In general, lower tiers are more conservative, and higher tiers have more complex information requirements. The results showed that there are several specific methods used often to evaluate hazards in tiered risk assessments for active substances in agriculture. Generally there is not a lot of hazard (toxicity) information for transformation products. Therefore, the threshold of toxicological concern (TTC) approach and quantitative structure-activity relationship (QSAR) approach are considered the most applicable. Both of these methods do not require experimental toxicity studies but are based on the chemical structure of the compound.

Safe levels in drinking water are generally based on safe intake concentrations (tolerable daily intake) established by thorough toxicological research. Literature research revealed that for livestock only few of such values are defined. It was explored if maximum residue limits (MRLs) that protect health of consumers of animal products could be used to derive water quality guidelines for livestock. Combining the MRL derived guidelines with the guidelines for the animal itself has the potential to result in water quality guidelines that protect both human and animal health. This is in line with the One Health principle which is that the health of people is connected to the health of animals and the environment. This method can be further developed in future research, as well as consideration of potential implementation of such water quality guidelines for livestock.

More information: Milou Dingemans

Keywords: Tiered risk assessment, Transformation products, Water quality, Guidelines, Livestock