Pesticides and their metabolites in European surface and groundwater: Evaluating regulations and approaches to environmental monitoring

M. Al Ramahi[1#], G.O. Hughes[2,3], S. Mayer[1], A. Terry[2]

[1] Bayer AG, Crop Science Division, Monheim am Rhein, Germany; [2] Cambridge Environmental Assessments, Boxworth, UK; [3] GeoSpatial Analytics, Wolverhampton, UK
#Corresponding author: mahmood.alramahi@bayer.com

Introduction

Regulation designed to protect the environment and consumers is constantly evolving driven by the need to consider new scientific knowledge as well as increase harmonization between different regulations. While harmonisation may simplify some aspects of regulatory requirements it also potentially leads to additional complexity, data requirements, and issues of interpretation. One such area is environmental safety assessment utilising environmental monitoring data. Interpretation of such data should be based on scientifically robust environmental quality standards to avoid incorrect conclusions and sub-optimal risk assessment/management decisions. Defining substance specific quality standards or water treatment removal efficiencies requires additional effort as does ensuring they are applied in the correct situation, like only for water intended for the abstraction of drinking water.

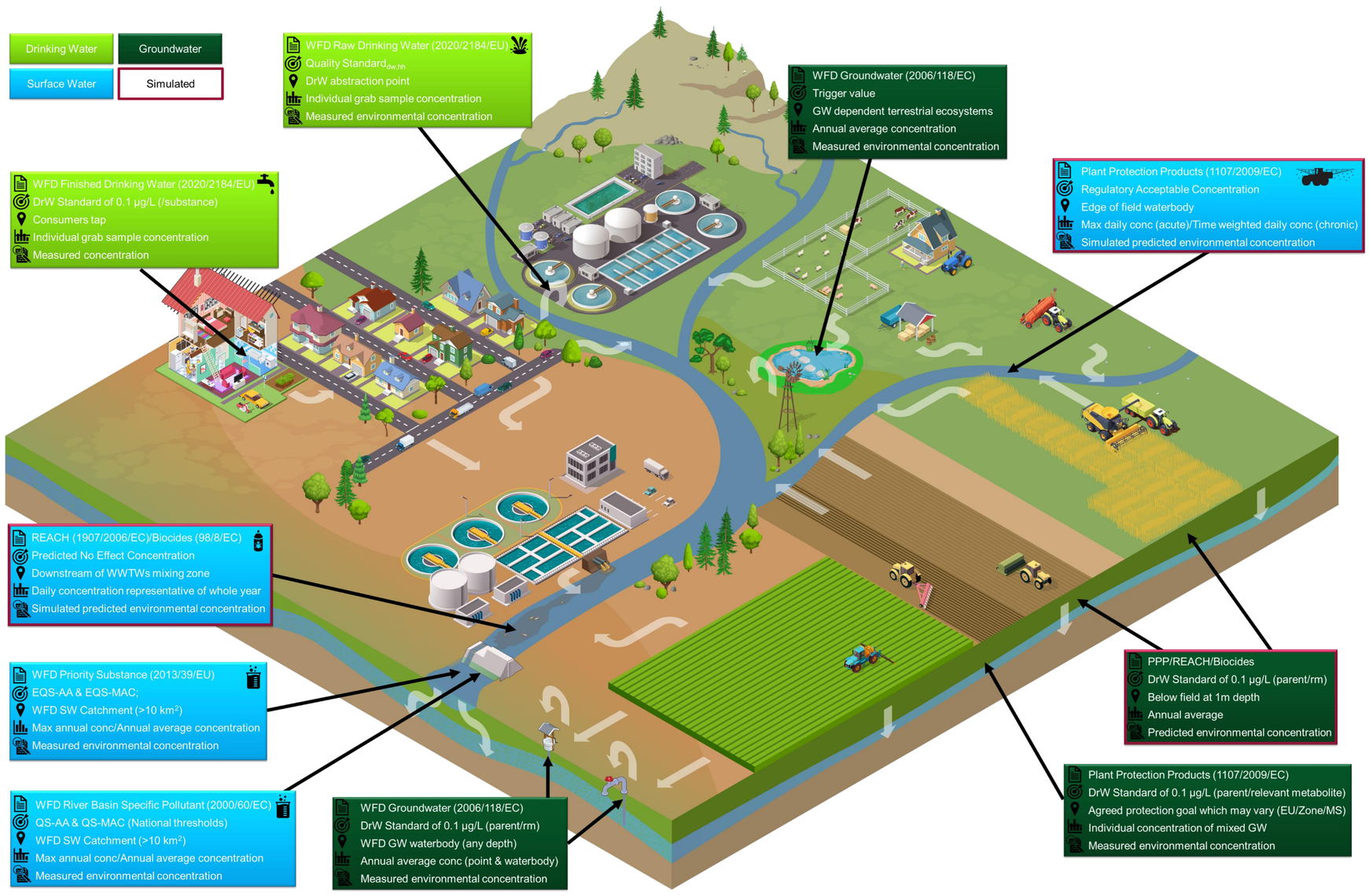


Figure 1: Illustration of water monitoring locations given their regulatory drivers

Observations

WFD Raw Drinking Water

Quality Standard$_{dw,hh}$ e.g. 1 µg/L

DrW abstraction point

Individual grab sample concentration

Measured environmental concentration

For treatment removal of 90%

$$QS_{dw,hh} = \frac{DrW\ threshold}{F_{not\ removed\ by\ treatment}} = \frac{0.1\ \mu g/L}{0.1} = 1\ \mu g/L$$

WFD Clean Drinking Water

DrW Standard of 0.1 µg/L (/substance)

Consumers tap

Individual grab sample concentration

Measured concentration

Sampling after treatment but location could be during storage, conveyance or at point of delivery provided compliance is not compromised

Figure 2: Raw and finished drinking water risk assessment comparison

Challenge: The location of drinking water abstraction sites is not readily available.

Development: The recast Drinking Water Directive requires water supply chain risk assessments are conducted (June ’27) necessitating the georeferencing of abstraction points and the digitisation of catchment boundaries.

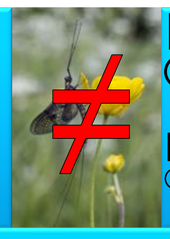
REACH/Biocides

Predicted No Effect Concentration

Downstream of WWTWs mixing zone

Daily concentration representative of whole year

Simulated predicted environmental concentration



WFD Priority Substance/River Basin Specific Pollutant

EQS-AA & EQS-MAC; QS-AA & QS-MAC

WFD SW Catchment (>10 km^2)

Max annual concentration/Annual average concentration

Measured environmental concentration

Plant Protection Products

Regulatory Acceptable Concentration

Edge of field waterbody

Max daily conc (acute)/Time weighted daily concentration (chronic)

Simulated predicted environmental concentration

Figure 3: Characterisation and use of thresholds in risk assessment

Challenge: Consistency in derivation and use of threshold values within different regulations and regulatory processes.

Development: The responsibility for EQS derivation moving from JRC to ECHA is an acknowledgement of this issue.

Conclusions

Increasing complexity of regulations and associated technical guidance documents potentially leads to simplifying assumptions being made by regulatory agencies seeking to be able to follow the potentially inconsistent guidance. While overly precautionary assessments based on simplification may be expedient and ultimately protective of the environment, they may have additional consequences like the withdrawal of economically important products with favourable risk-benefit profiles or the costs of continued monitoring for low(er) risk substances. There is a need for better and more harmonised guidance accompanied by quality controlled, documented datasets and environmental quality endpoints coupled through decision support tools that ensure state of the environment assessments are conducted in a consistent manner and in accordance with the regulation and available guidance.

© Bayer | Crop Science Division | M. Al Ramahi | April 2023