

River Basin Management Plans – Groundwater Classification

# Pesticides

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## 1.0 Purpose

This paper describes the method used to assess the Water Framework Directive (WFD) chemical status of groundwater bodies with respect to pesticides.

## 2.0 Background

The WFD requires that groundwater bodies must be classified as good or poor for both chemical status (in relation to a large range of pollution pressures) and quantitative status (in relation to groundwater abstraction pressures).

Potential impacts from pesticides have been considered in the context of four of five tests developed for groundwater body chemical classification, based on WFD requirements and guidance provided at an EC and UK level<sup>1</sup>. The five tests consider groundwater chemical composition with respect to impacts both on the groundwater body itself (including significant potable supplies), as well as on the ecological receptors which depend on it. The worst result from all five tests is taken as the overall chemical status result for each groundwater body.

A range of pesticides (terminology taken to include herbicides and insecticides) are used across Northern Ireland, associated with different land-use from amenity areas to arable land. The dominant land-use across Northern Ireland is pasture/fodder crops.

Monitoring for pesticides has been undertaken in the NIEA groundwater monitoring network, using available data collected between 2000 and 2008. Although a number of pesticides have been detected at various monitoring points, concentrations are generally considerably lower than the Drinking Water Standard (DWS) of 0.1µg/l. On a few occasions concentrations above the DWS have been detected. The NIEA monitoring network included a number of boreholes located within or close to farmyard areas. Hence detections of pesticides as a result of poor handling/disposal practices around the well-head cannot be ruled out in certain cases. Some limited, additional monitoring data on pesticides is available from public water supply boreholes and springs.

The Sniffer diffuse pollution screening tool project (SNIFFER 2006 WFD19), was used to assess certain pesticides with a view to predicting potential loadings to surface waters in Northern Ireland. As part of this assessment process, it was predicted that a proportion (generally very small) of pesticides applied to land would be leached downwards from the upper soil zone and could eventually reach groundwater.

Risks to groundwater from pesticide use include;

- deterioration in general groundwater quality
- impacts on groundwater-dependent surface water quality and ecology
- impacts on groundwater-dependent terrestrial ecosystems (GWDTEs)
- direct effect on specific groundwater abstractions and associated treatment requirements

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<sup>1</sup> UK Technical Advisory Group on the Water Framework Directive. Paper 11b(i): Groundwater Chemical Classification for the purposes of the Water Framework Directive. This paper can be downloaded from the [www.wfd.uk.org](http://www.wfd.uk.org) web site.

Determining whether a surface water body or GWDTE is being impacted by pesticides is a challenge. Detailed regular monitoring for pesticides in surface waters has only been carried out at a limited number of monitoring points to date although considerably more monitoring is underway through the WFD Surveillance Monitoring programme. For surface water bodies which are showing signs of adverse impact, based upon ecological monitoring, pesticide input may be a factor where pesticides are being used within the catchment. However there will generally not yet be sufficient surface water monitoring evidence to determine whether pesticides actually are the cause or a factor. Some preliminary data from spot and passive chemical sampling is indicating that pesticides could be a factor for some ecological impact in certain settings in Northern Ireland.

A variety of factors will influence whether pesticide usage in a particular area will pose a particular risk to the water environment. On a catchment scale, the hydrogeological setting and proximity of sensitive receptors to areas of pesticide usage will obviously be important. Most pesticides in general use today are designed, where good practice usage guidance is being applied, to be taken up by crops and other vegetation and break down in the soil before significant migration beyond the soil zone. In Northern Ireland, where the majority of soils are relatively poorly draining and where there are significant areas underlain by lower permeability superficial deposits, the potential for migration of pesticides to the underlying water table will be limited. There are however certain hydrogeological settings where groundwater is more vulnerable.

In addition to the general application of pesticides to crops and pasture lands, pesticide usage is also associated with amenity areas, domestic gardens and transport routes such as roadside verges and railways lines.

Point source impact from pesticides can also occur where pesticides are disposed off inappropriately. In Northern Ireland, regulations (Groundwater Regulations (Northern Ireland) 2009) are in place to control the disposal of pesticides associated with sheep dip such that disposal areas are selected where it is determined that the risk to the water environment is minimal.

### **3.0 Classification**

This assessment has been undertaken to support the following elements of classification:

#### **Chemical Classification**

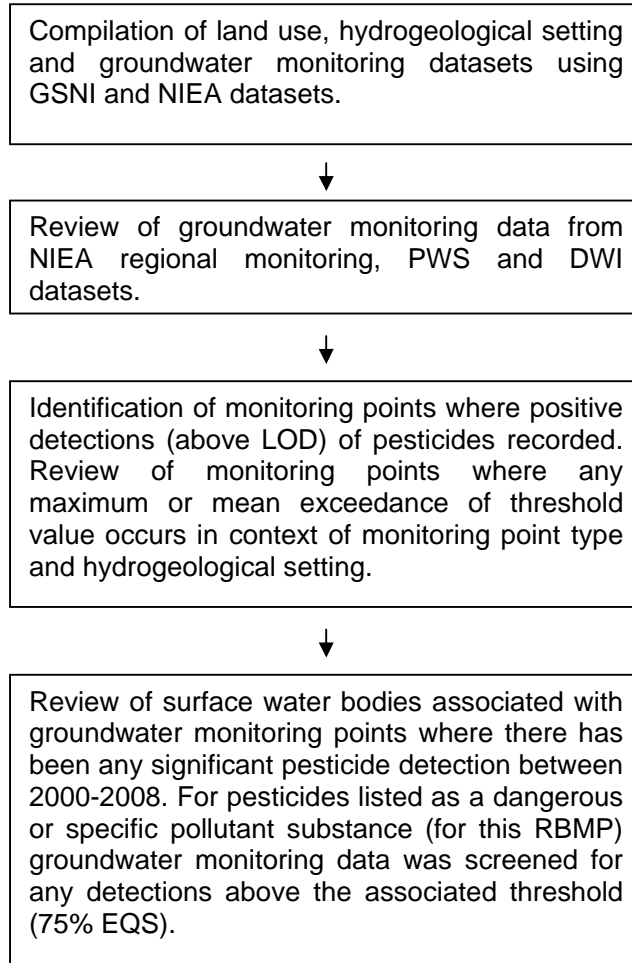
- No significant diminution of surface water chemistry and ecology
- Impact on Drinking Water Protected Areas
- General Assessment of Quality
- Impact on Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

A restricted assessment for surface water bodies has been undertaken as part of the groundwater classification. This has been limited due to the limited amount of surface water monitoring data for pesticides available to date in this River Basin Management Plan (RBMP) period.

Similarly for potential GWDEs (SPA, SAC, ASSIs and NNRs), as limited knowledge is presently available regarding their groundwater dependency and sensitivity to pollutant inputs and limited monitoring data available, the level of assessment possible is limited in this RBMP period.

#### 4.0 Assessment Process

The following assessment process was undertaken, managed within a GIS-based project.



The analysis undertaken as part of the Sniffer WFD19 project indicates that pesticide usage is more significant to the south of Lough Neagh and eastwards into Co Down, including the Ards Peninsula. Some more intensive use areas also exist through the Bann Valley north of Lough Neagh and in the North-West towards Limavady.

Comparison with historical groundwater monitoring data suggests a possible relationship between low intensity of pesticide use and detection of few, if any, pesticide levels at significant concentrations (>0.05µg/l) to the west of Northern Ireland. However it should be noted that monitoring is less intense in this part of NI, partly due to the dominance of poorly productive aquifers and the restricted number

of suitable groundwater sources available for monitoring. In addition one significant river in the west of Northern Ireland has been identified as potentially having pesticide concentrations at levels of concern which indicates that in certain catchments pesticides can be an issue.

With respect to potential local impacts on specific surface water bodies, where groundwater monitoring is detecting any significant pesticide concentrations ( $>0.05\mu\text{g/l}$  (50% Drinking Water Standard (DWS)) some further consideration has been given to these local catchments. In the absence of any detailed historical pesticide monitoring for surface waters in Northern Ireland, for those river water bodies where pesticides in groundwater have been recorded at significant concentrations within their catchments, the GQA biological classification was reviewed. The biological classification was taken to be the closest available proxy that may identify a cumulative impact on ecological communities from a diffuse catchment pollutant such as pesticide. Based upon the 2004 biological GQA classification, for the relevant river water bodies, none of the significant groundwater pesticide detections coincided with a classification lower than 'fair'. In most cases the classification was in the 'fairly good' or 'good' category.

Four of the most commonly detected pesticides in groundwater were atrazine, diuron, MCPA and MCPP where levels in excess of  $0.075\mu\text{g/l}$  (75% of DWS) were identified on occasion.

Scientists from NIEA Natural Heritage were consulted in order to determine if there was any known evidence or concern with respect to potential impact on the associated ecology of potential GWDTEs from elevated pesticides.

Pesticides have been monitored in groundwater by NIEA on a regular basis since 2000. Where pesticides are found at significant concentrations in boreholes, their presence is generally intermittent over the sampled period.

More persistent pesticides do seem to occur in some areas at very low concentrations suggesting that application control and storage and disposal management could be improved further.

## **5.0 Outcome**

On the basis of all the assessments carried out to date no groundwater bodies have been determined to be at "poor status" for this River Basin Management Plan (RBMP) period.

It is not considered justified to identify any groundwater body at poor status based upon the general chemical test for individual pesticides. This is in part based upon the availability of monitoring data, the generally large size of groundwater bodies and the inconsistent pattern of detections in terms of both pesticide substance found and concentration at individual monitoring points. No specific analysis has been undertaken for 'total pesticide' concentrations at monitoring points but application of aggregation of mean values would return a value significantly below the threshold.

For DWPA sources, no mean concentration above the threshold value and/or upward trend was identified with available data.

Based upon the analysis undertaken and given that surface water classification to date only identifies potential direct impacts from pesticides for a very limited number of water bodies, it is considered that it is not appropriate to undertake formal status determination at this stage although risk has been considered. More comprehensive and representative surface water and groundwater pesticide monitoring data will be available to review during the RBMP period.

Pesticides have been monitored in groundwater by NIEA on a regular basis since 2000. Where pesticides are found at significant concentrations in boreholes, their presence is generally intermittent over the sampled period.

The dataset gives some reassurance that pesticide concentrations in groundwater generally do not exceed the 0.075 µg/l threshold value. More persistent pesticides do seem to occur in some areas at very low concentrations suggesting that application control and storage and disposal management could be improved further. For the groundwater body-wide General Quality Assessment (GQA) the existing data does give some confidence that this is not a problem at this scale, especially given the relatively large size (potential for dilution) of groundwater bodies in areas where pesticide usage is likely to be greater. However until further WFD monitoring data becomes available a default low confidence has been assigned. The determination of whether or not portions of groundwater bodies, especially where the relevant land-use coincides with high groundwater vulnerability, could be contributing to a 'pesticide' impact on surface waters or GWDTE must have a low confidence until there is an improved understanding of river-aquifer interaction and surface water monitoring and surface water classification is progressed. It should be noted that groundwater threshold values will vary for different pesticides depending on the pesticide specific EQS and surface water body type.

## **6.0 River Basin Planning Cycle**

Information from groundwater monitoring and surface water monitoring collected during the RBMP period, along with more detailed analysis of pesticide usage will enable this assessment to be refined.

### **References**

SNIFFER 2006. WFD19 Screening Tool to Identify and Characterise Diffuse Pollution Pressures - Phase 2 ([www.sniffer.org.uk](http://www.sniffer.org.uk))

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