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Development of an assessment methodology to evaluate agricultural use of plant protection products for drinking water production from surface waters

A proposal for the registration procedure in the Netherlands

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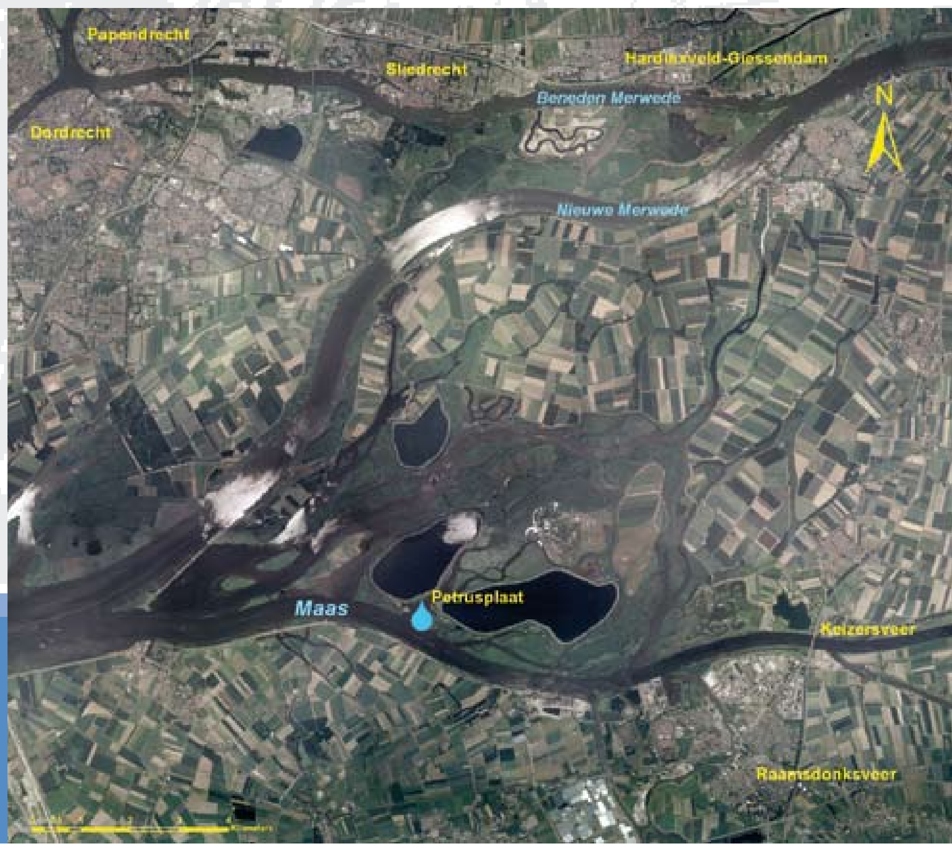

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Development of an assessment methodology to evaluate agricultural use of plant protection products for drinking water production from surface waters

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ABSTRACT

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Two tiers were developed to assess the drinking water standard of 0.1 μg/L at nine locations where surface water is abstracted to produce drinking water in the Netherlands. In Tier I, concentrations at the abstraction points are calculated on the basis of edge-of field surface water concentrations for all crops in the intake area on which the pesticide can be used. The edge-of-field concentrations are corrected to estimate the concentration at the abstraction point by factors accounting for e.g. the relative cropped area of the intake area, degradation and difference in timing of applications. In Tier II, monitoring data are requested and analysed. Tier I was tested with the aid of monitoring data from 2000-2006.

Keywords: drinking water standard, monitoring, pesticides, registration

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Preface

The National Institute of Public Health and the Environment was requested by its national Ministry of Spatial Planning, Housing and the Environment to lead the development of an assessment methodology for drinking water production from surface waters in the Netherlands to be used in the registration procedure of pesticides. This request was a follow-up to the international workshop held at the RIVM, 11 and 12 November 2003.

The remit of the request to the RIVM read:

> *"Purpose*
> *Draft an assessment methodology for this registration criterion that:*
> 1. *can be presented in the EU workshop planned for June 2005*
> 2. *can be applied as an international assessment methodology*
>
> *Basic principles*
> - *Detailed elaboration of the drinking water criterion according to the Uniform Principles (91/414/EEC)*
> - *Elaboration as much as possible according to the other registration criteria: tiered approach, with predictive modelling in lower tiers and use of measured data in higher tiers*
> - *Methodology should fit within the Water Framework Directive developments*
>
> *Working method*
> - *RIVM leads a Working Group composed of RIVM, Alterra, VEWIN and Ctgb*
> - *When lacks of clarity or choices emerge in drafting the assessment methodology, these will be presented to the two ministries of Spatial Planning, Housing and the Environment and of Agriculture, Nature and Food Quality*
> - *The Ministries of Spatial Planning, Housing and the Environment and of Agriculture, Nature and Food Quality decide on the proposals presented."*

A Dutch Working Group developed the assessment methodology including a draft report from April 2005 to December 2006. Then, some changes in the working method of the Working Group were implemented and this report assessing the agricultural use of pestcides was finalised. A second report will appear, assessing the use of pesticides on hard surfaces. The EU-workshop was cancelled in the course of 2005. The second purpose is still valid although the emphasis was put on an approach suitable for the Dutch situation.

About 10 years ago a first attempt was carried out to develop a decision tree approach for the drinking water criterion. More recently some studies were carried out on the possible use of modelling tools (OpdenKamp Adviesgroep, 2001).

The remit implied that the Working Group intended to elaborate the suitable calculation model as mentioned in Directive 91/414/EEC under B. Evaluation, 2.5 Influence on the environment, article 2.5.1.3:

> *"Member States shall evaluate the possibility of the plant protection product reaching surface water under the proposed conditions of use; if this possibility exists they shall estimate, using a* ***suitable calculation model****, validated at Community level, the short-term and long-term predicted concentration of the active substance and of metabolites, degradation and reaction products that could be expected in the surface water in the area of envisaged use after use of the plant protection product according to the proposed conditions of use.*
>
> *If there is no validated Community model Member States shall base their evaluation especially on the results of mobility and persistence in soil studies and the information on run-off and drift as provided for in Appendices II and III. This evaluation will also take into consideration the following information:*
>
> *(i) the specific information on fate and behaviour in soil and water as provided for in Appendix II and the results of the evaluation thereof;*
>
> *(ii) ….*
>
> *(iii) ….*
>
> *(iv) ….*
>
> *(v) where relevant, other authorized uses of plant protection products in the area of envisaged use containing the same active substance which give rise to the same residues;*
>
> *(vi) where relevant, data on the procedures for drinking water* ***abstraction and treatment*** *in the area of envisaged use"*

Later consultations with the Ministeries revealed that possible effects of the purification process as carried out by the drinking water companies should not be taken into consideration, so evaluation should focus on a drinking water standard of 0.1 μg/L. The starting point of the assessment should be the label of the product as mentioned in the GAP.

The Working Group strived towards the development of an assessment methodology fulfilling the following conditions:
1. The concentration ranges used to discriminate between registration, post-registration monitoring and no registration should be sufficiently conservative to allow the intake of surface water for the public drinking water supply.
2. The applied concentration ranges should not inhibit the registration of pesticides that do not negatively influence the public drinking water supply.

Additionally the need for the development of an evaluation method for surface waters intended for the abstraction of drinking water within the registration process of pesticides was stressed by the court case of glyphosate in The Netherlands. In August 2005 there was a court case between the VEWIN (Union of Dutch drinking water companies) and the Dutch Ctgb (Board for the Authorisation of Plant Protection Products and Biocides) on the re-registration of Roundup (active ingredient: glyphosate). The Ctgb's decision for re-registration was judged to be not acceptable and the judge had the opinion that the Ctgb had done insufficient efforts to evaluate the drinking water standard. It was rapidly recognised that this court case may have consequences for the registration of other substances. Therefore the need to develop an assessment methodology was stressed again by the Minstries of of Spatial Planning, Housing and the Environment and of Agriculture, Nature and Food Quality.

Once the Working Group has finished her assessment methodologies Alterra will make a user-friendly software tool for the Ctgb. This tool will facilitate that the assessment methodology will be implemented in an easy and consistent way in the Dutch registration procedure. The tool will calculate the expected pesticide concentration at the nine abstraction points in the Netherlands caused by normal agricultural use (according to GAP) or by use on hard surfaces. It will be developed in 2008 according to the methodology described in this report and the future report evaluating the use on hard surfaces.

The authors of this report thank Wim Beltman and Robin van Leerdam of Alterra for their contributions to this report (all graphical representations of monitoring data and assistance in editting the report).

Summary

A Working Group developed an assessment methodology for drinking water production from surface waters in the Netherlands to be used in the registration procedure of pesticides. The ministries of Spatial Planning, Housing and the Environment and of Agriculture, Nature and Food Quality needed an assessment methodology to elaborate the drinking water criterion according to the Uniform Principles of EU Directive 91/414/EEC concerning placing plant protection products on the market and that also fitted within the Water Framework Directive, 2000/60/EC. Similar to the evaluation of other registration criteria, the methodology should consist of a tiered approach, with predictive modeling in lower tiers and use of measured data in higher tiers. Finally, the ministries specified that a drinking water standard of 0.1 μg/L should be evaluated, i.e. purification by drinking water companies was not to be considered. Only pesticide use according to the label, so, Good Agricultural Practice (GAP), should be evaluated.

The Working Group strived to develop an assessment methodology allowing on one hand the drinking water companies to dispose of surface waters of a good quality and on the other hand not to prohibit the registration of pesticides that do not hinder the drinking water production from surface waters. In this report only normal agricultural use of pesticides is assessed and not pesticide use on hard surfaces.

At present in the Netherlands approximately 40% of all drinking water originates from surface waters. Drinking water is produced at nine locations: Heel, Brakel and Petrusplaat along the river Meuse, Nieuwegein, Amsterdam-Rijnkanaal and Scheelhoek taking in water mainly originating from the river Rhine, Twentekanaal abstracting water originating from the IJssel (branch of the Rhine), but closed since 2003, Andijk abstracting water from the inner IJsselmeer Lake and De Punt abstracting water from the Dutch river Drentsche Aa. In each of the nine abstraction points the 0.1 μg/L standard is regularly exceeded since many years. If too high concentrations are detected, surface water abstraction may stop for several days or even weeks.

To obtain an overview of the current situation all pesticides that had caused surface water intake stops in the past were identified. For these pesticides all monitoring data from 2000 onwards were obtained from the drinking water companies. On January 1st 2000 the 'Lozingenbesluit Open Teelt en Veehouderij' was implemented. This changed considerably the GAPs, including the introduction of crop free zones along watercourses and use of drift-reducing nozzles, and therefore monitoring data from before 2000 were no more relevant. From the 18 substances thus identified we selected those substances which had exceeded the 0.1 μg/L standard more than two times at one abstraction point. Next we plotted their measured concentrations at all abstraction points along the same river as well as at the border, i.e. Lobith for the Rhine and Eijsden for the Meuse. These plots concern bentazone, dichlobenil, diuron, glyphosate, isoproturon, MCPA, mecoprop and metolachlor at Eijsden, Heel,

Petrusplaat and Brakel in the river Meuse, glyphosate and isoproturon at Lobith, Nieuwegein and the Amsterdam-Rijnkanaal along the Rhine, and glyphosate and mecoprop at De Punt in the Drentsche Aa.

To operationalise the risk assessment methodology further the two ministries specified that they wanted to protect each individual abstraction point and that they only wanted to consider pesticide contributions originating from the Netherlands, and not from upstream located countries such as Germany or Belgium. The Working Group developed two tiers: in the first tier the concentration in each abstraction point is calculated and next compared to the drinking water standard, in the next tier measured concentrations at the abstraction points are evaluated and compared to the standard.

In Tier I concentrations at the abstraction points are calculated on the basis of edge-of field concentrations for all crops in the intake area on which the pesticide can be used. Each abstraction point has its own intake area from where all surplus water flows towards the abstraction point. The edge-of-field concentrations consist of concentrations in the FOCUS D3 ditch caused by spray drift deposition calculated by Dutch drift values or by drainage entries calculated by the FOCUS_MACRO model (Jarvis, 1994, 1998), see Appendix 2 for a brief description. The FOCUS D3 ditch is 1 m wide, it has a 30 cm water depth and crops are at a distance of 1.0 to 1.3 m from the water edge for field crops and 3.5 m for fruit trees (FOCUS, 2001). The edge-of-field concentrations are lowered to represent the concentration at the abstraction point by factors accounting e.g. for (i) the relative crop area, i.e. the ratio of the area of the crop and the entire intake area (factor of maximally 0.2-0.3 for crops such as maize, potatoes, cereals or sugarbeets in some intake areas), (ii) market share, reflecting that the pesticide is not used on the entire area of a crop (default factor = 0.4), (iii) difference in timing of applications within the area of use (factor = 0.5), (iv) degradation and volatilisation from the edge-of-field watercourse to the abstraction point and (v) additional dilution by a lake or incoming river (default factor = 1, in Andijk taking in water from the IJsselmeer Lake it is 1/6). The Tier I calculations may be refined, e.g. by substituting the default value of 0.4 by a substance specific market share factor.

The Tier I calculation method assumes that the crop treatments are randomly distributed over the entire intake area and that all parts of the intake area contribute equally their surplus water to the abstraction point. For the abstraction point at Brakel in the Meuse this assumption is not true as the abstraction point is not located in the mainstream of the river but in a branch of the Meuse with a very low flow. The Bommelerwaard discharges its surplus water in this branch and thus treatment of crops in the Bommelerwaard heavily influences the water quality at Brakel. Therefore the abstraction point at Brakel needs an additional evaluation that is specific for the water draining off the Bommelerwaard.

The concentrations of Tier I were aimed to be conservative estimations for the concentrations at the abstraction points in order to protect sufficiently the abstraction points. The Working Group assessed the conservativeness of the individual components of the Tier I calculation method to be neutral or neutral to conservative, and so, their combination resulted in a conservative estimate of the overall Tier I concentrations.

The Tier I calculation method was tested by comparing calculated concentrations with measured ones. To do so, the Working Group defined positive and negative test cases. Positive cases were defined as substance-abstraction point combinations where use of the substance in the Dutch part of the intake area leads to exceeding the drinking water standard at the abstraction point, while for negative cases the drinking water standard is not exceeded. Substances of the test cases should be widely used in the intake area and at least 25 measurements should be available at the abstraction point. Additionally, for positive cases the drinking water standard should be exceeded at least three times in the period 2000-2004 and there should be a plausible relationship in time between the exceedance and the application of the pesticide. Three sound positive test cases and three sound negative cases could be identified for the 18 pesticides mentioned above, that had caused surface water intake stops in the past. The positive cases were MCPA and mecoprop at Brakel and mecoprop in the Drentsche Aa and the negative cases were dicamba, metazachlor and metribuzin at Petrusplaat. In all six cases the calculated Tier I concentration was found to be at the same side of the 0.1 μg/L standard as the monitored concentrations. An additional six negative cases were found at the abstraction point of Andijk in the IJsselmeer Lake. Tier I calculated concentrations of metoxuron, metribuzin and terbutylazin were lower than 0.1 μg/L even before applying the additional dilution facor of 6, but calculated bentazon, MCPA and mecoprop concentrations were only below 0.1 μg/L after having applied the dilution factor. The twelve test cases increased the confidence of the Working Group in the Tier I calculation method.

In Tier II monitoring data are evaluated. The assessment of a compound moves to the monitoring data evaluation tier if the concentration in one of the nine abstraction points, calculated in the first tier (including possible refinements), has a value in the interval 0.1-Y*0.1 μg/L. The factor 'Y' represents a 'safety' factor which size has to be decided upon by the responsible Dutch ministries.

For new substances not passing Tier I, the Working Group developed guidance for Post-Registration Monitoring (PRM). In principle the registrant should procure data for all nine abstraction points. Monitoring frequency is attuned to the mean hydrological residence time in the Dutch part of the intake area, discharging to the abstraction point, which is in the order of magnitude of a few days to a couple of weeks. Monitoring should take place once to twice a week during the application period and the next two weeks, plus once a month up to one year after application or every two weeks in the three monthly period during which leaching is expected. The minimal frequency is 13 times a year. Exceeding the standard once up to no more than 0.15 μg/L was judged to be acceptable. In case of PRM monitoring data of the entire registration period will become available, generally five years. The 90%-ile is calculated for the entire period as well as for each individual year. If the 90%-ile over the five year period exceeds 0.1 μg/L, the registration is at stake. If the 90%-ile for an individual year exceeds the 0.1 μg/L standard a problem analysis should show whether agricultural use according to GAP is the main cause and whether it is possible to adjust the GAP.

The Working Group recommends a 'safety factor' of 5 with respect to the drinking water standard for new compounds, i.e. temporary registration with PRM is granted when a Tier I concentration is in the interval of 0.1-0.5 μg/L and no registration above 0.5 μg/L.

Next, the Working Group recommends to further test the Tier I calculation method after a few years when new monitoring data are available.

1 Introduction

General
In many European countries surface water is used as a source for drinking water in a varying extent. In The Netherlands, for instance, about 40% of the water supply is abstracted from surface water, whilst in the United Kingdom this is even more, about 70%. In other countries surface water is used less extensive but nevertheless important enough, in Portugal for instance surface water is used as source for drinking water up to 20 – 30% of the total water supply. In many countries these percentages are also growing. It is clear that surface waters used as a source for the preparation of drinking water need to be of high quality to assure the health of the general public and to prevent high treatment costs for water suppliers.

91/414/EEC, Plant Protection Directive
Within the pesticides Directive 91/414/EEC and relating Appendices the trigger value for the concentration in surface water used for the abstraction of drinking water has been established. Here, reference is made to 75/440/EEC. In The Netherlands, 75/440/EEC has been implemented using a level of 0.1 μg/L at the abstraction point. However, monitoring has shown that this level often is exceeded in surface waters in general and sometimes also at abstraction points. Water suppliers have to invest in expensive treatment technology or to stop the intake of water for days or even weeks hoping the concentration of the pesticides will decrease with time and the abstraction may be resumed. It has to be kept in mind that surface water, different from groundwater, always has to be treated for the production of drinking water. The quality of the drinking water is assured by the drinking water directive. The discussion under the Water Framework Directive to which level treatment should be taken into account is ongoing.

In the Uniform Principles (Appendix VI of 91/414/EEC) the following is mentioned concerning the protection of abstraction points for the production of drinking water:

> *2.5.1.3. No authorization shall be granted if the concentration of the active substance or of relevant metabolites, breakdown or reaction products to be expected after use of the plant protection product under the proposed conditions of use in surface water:*
>
> - *exceeds, where the surface water in or from the area of envisaged use is intended for the abstraction of drinking water, the values fixed by Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States, ….*

Although in the citation above also relevant metabolites, breakdown or reaction products are mentioned to take into account the Working Group focussed on active substances. It is expected that the methodology could be applied to metabolites as well by taking into account the physico-chemical characteristics and fate and behaviour parameters for the metabolites and follow the decision tree separately. Of

course, sometimes there may be special circumstances to reflect upon in evaluating metabolites.
In the new regulation concerning the placing of plant protection products on the market, that is being prepared by DG SANCO (proposal SANCO/10159/2005) no changes are foreseen with respect to surface waters intended for abstraction of drinking water.

2000/60/EC, Water Framework Directive
Directive 2000/60/EC established a new framework for water policy, including waters used for the abstraction of drinking water. It effectively replaces Directive 75/440/EEC and mentions in its article 22 that Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States shall be repealed seven years after the date of entry into force of the Water Framework Directive (WFD), i.e. seven years after 22 December 2000.

Directive 2000/60/EC explicitly specifies that Member States should identify all water bodies used for the abstraction of drinking water, or intended for such future use. It also specifies that, under the water treatment regime applied, the resulting water should meet the standards mentioned in the two EU Drinking Water Directives 80/778/EEC and 98/83/EC. Finally it stipulates that member States should protect their waterbodies in order to reduce purification treatments and it offers the possibility of establishing safeguard zones to protect waterbodies used for drinking water production.

Article 7, Waters used for the abstraction of drinking water, of Directive 2000/60/EC reads:

> *"1. Member States shall* ***identify****, within each river basin district:*
> - *all bodies of water* ***used for the abstraction of water intended for human consumption*** *providing more than 10 m^3 a day as an average or serving more than 50 persons, and*
> - *those bodies of water intended for* ***such future use****.*
>
> *Member States shall monitor, in accordance with Appendix V, those bodies of water which according to Appendix V, provide more than 100 m^3 a day as an average.*
>
> *2. For each body of water identified under paragraph 1, in addition to meeting the objectives of Article 4 in accordance with the requirements of this Directive, for surface water bodies including the quality standards established at Community level under Article 16, Member States shall ensure that* ***under the water treatment regime applied****, and in accordance with Community legislation, the resulting water will* ***meet the requirements of Directive 80/778/EEC as amended by Directive 98/83/EC****.*
>
> *3. Member States shall ensure the necessary protection for the bodies of water identified with the aim of avoiding deterioration in their quality in order to* ***reduce the level of***

purification treatment *required in the production of drinking water. Member States may establish* ***safeguard zones*** *for those bodies of water."*

Directive 75/440/EEC
The drinking water criterion to which Directive 91/414/EEC and the Uniform Principles of Annex VI are referring is laid down in Directive 75/440/EEC, see also Appendix 1. Directive 75/440/EEC concerns the quality requirements which surface water used for the abstraction of drinking water must meet. For the purposes of this Directive surface water is divided according to limiting values into three categories, A1, A2 and A3, which correspond to the appropriate standard methods of treatment. For pesticides A1 corresponds with a standard of 1 μg/L, A2 with 2.5 μg/L and A3 with 5 μg/L. When implementing Directive 75/440/EEC the Dutch government set a standard of 0.1 μg/L in its legislation for all three categories. The reason for this was that in the drinking water production practice in The Netherlands often a soil passage is included by infiltrating abstracted water in the soil. Using the standard of 0.1 μg/L soil pollution is prevented, which is according to the Infiltration Decree to the Law on Soil Protection.

Dutch working group
A risk assessment methodology to evaluate the concentration in surface waters with respect to the abstraction of water for drinking water purposes is lacking at the moment. However, any implementation of the drinking water criterion will require some kind of assessment.

Therefore, the government of The Netherlands took the initiative to organise an international workshop to bring together the most important stakeholders to discuss the need for and possible methodologies of risk assessment on the drinking water criterion for pesticides in more detail. The workshop was held on 10 and 11 November 2003 in Bilthoven, The Netherlands. A report of the workshop is available (Linders, 2003).

The current document is intended to provide a proposal for a methodology to be used in the registration process of pesticides and was prepared by a Dutch expert group. The group consisted of the following persons:

Paulien Adriaanse (Alterra)
André Bannink (VEWIN, up to January 2008)
Gerard van den Berg (Kiwa Water Research)
Jos Boesten (Alterra, up to December 2007)
Mieke van der Bruggen (Nefyto)
Klaas Jilderda (Nefyto)
Jan Linders (RIVM, chair and secretary up to January 2007)
Willem Merkens (Nefyto, up to January 2007)
Ynze Stienstra (Ctgb)
Ruud Teunissen (Rijkswaterstaat, Waterdienst)
Robert Luttik (RIVM, chair and secretary from January 2007 onwards).

The methodology was developed on behalf the Dutch Ministries of the Environment and Agriculture because of the need to have an instrument available for the registration decision on the topic of the evaluation of the drinking water abstraction. Many complaints on the quality of surface waters in the Netherlands with respect to the concentration of pesticides by water management authorities and drinking water production companies were received at ministerial level. An additional spin-off should be that the methodology developed be used as a contribution to the international discussion on the implementation of the drinking water criterion. The method should be practical and pragmatic, easy to use and sufficiently flexible that it maybe applied to new active substances and existing active substances for which monitoring data maybe available. In addition, the method should be structured as a tiered approach with probably four levels of complexity if needed in the risk assessment. To enable a rather quick development of the decision tree it was decided to first develop the tiers I and IV and to focus on the tiers II and III in a following study phase, if needed. Therefore, this report only deals with the development of the tiers I and IV.

Approach
The Working Group decided to use as much information as was already available in relating areas of risk assessment and methodology, mainly to avoid duplication of work and to increase the acceptability of the proposal. Important topics to consider were estimated to be the amount of pesticide used in a certain area, the distinction between diffuse and point sources, the influence of the Water Framework Directive on the registration decision of PPPs and the role of potential monitoring programs, post-registration for new substances and any other for existing substances.

First, it was considered useful to distinguish between active substances requesting a first registration and substances re-evaluated for a next registration period, especially because of monitoring data that could be available for PPPs, that require re-registration and to start with the substances that are evaluated for registration for the first time, for which are surely no monitoring data available.

Within the risk assessment framework of 91/414/EEC a lot of work has already been done on the estimation of concentrations in surface water based on the results of FOCUS. FOCUS stands for the FOrum for the Coordination of pesticide fate models and their USe. Especially the calculation of the Predicted Environmental Concentrations (PECs) in surface water using the FOCUS Surface Water Scenarios was considered a useful starting point for the subject under investigation (See Appendix 2 and FOCUS, 2001). In addition, the FOCUS Degradation Kinetics Working Group provided additional guidance on the establishment of DT_{50}-values from laboratory and field data (FOCUS, 2006a).

After the application of the FOCUS Surface Water Scenarios estimated concentrations are available in rather primary water courses like a ditch, a pond and a stream for 10 agriculturally representative regions of Europe. The estimations consist of initial concentrations at time point 0 (zero) and several time points after application (up to 100 days). Except for t=0 also time weighted average concentrations are calculated. Concentrations in these FOCUS Surface Water Scenarios were adopted as the starting point in the proposal.

Outline of the report

In the next chapter the current situation in the Netherlands concerning abstraction of surface water for drinking water purposes is described. Next, the generalised risk assessment procedure and the proposed decision tree to evaluate the normal agricultural use of pesticides are discussed in Chapter 3. In Chapter 4 the first tier is described and its calculated concentrations at abstraction points are compared to measured concentrations. The tier dealing with monitoring data is described in Chapter 5 and we end with a discussion, conclusions and recommendations.

2 Current situation in the Netherlands concerning abstraction of surface water for drinking water purposes

2.1 Overview of abstraction points and intake areas

In the Netherlands surface water is abstracted for the production of drinking water at nine locations. Table 2.1 gives an overview of the nine abstraction points and Figure 2.1 presents a map.

Table 2.1 Overview of the nine loactions where surface water is abstracted to produce drinking water in the Netherlands

#	NAME	LOCATION	Abstraction point
1	Scheelhoek	Scheelhoek	Haringvliet
2	Petrusplaat	Biesbosch	Meuse
3	Brakel	Andel	Afgedamde Maas
4	Heel	Heel	Lateraalkanaal
5	De Punt	De Punt	Drentsche Aa
6	Nieuwegein	Nieuwegein-Jutphaas	Lekkanaal
7	Amsterdam-Rijnkanaal	Nieuwersluis	Amsterdam-Rijnkanaal
8	Inlaat Andijk	Prinses Juliana	IJsselmeer Lake
9	Twentekanaal	Elsbeekweg	Twentekanaal

Figure 2.2 shows the intake areas for the nine abstraction points. The intake area of an abstraction point represents the area from where all surplus water is gathered into surface waters flowing towards the considered abstraction point. The location and size of the intake areas is based upon data of Kiwa Water Research, used in the so-called project EDG-M "Evaluatie Duurzame Gewasbescherming" (Van der Linden et al, 2006). The website http://www.kaderrichtlijnwater.nl/uitvoering/nationaal/beschermde-gebieden/ (22 Feb 2008) specifies the surface water abstraction points for drinking water. The intake areas of this website have not been used as they were not finalized in time for the calculations of this report.

Figure 2.1. The nine drinking water abstraction points from surface water in the Netherlands.

The nine locations, where surface water is abstracted are Heel, Brakel and Petrusplaat along the river Meuse, Nieuwegein, Amsterdam-Rijnkanaal and Scheelhoek taking in water mainly originating from the river Rhine, Twentekanaal abstracting water originating from the IJssel (branch of the Rhine), Andijk abstracting water from the large inner IJsselmeer Lake and De Punt abstracting water from the little Dutch river Drentsche Aa. Appendix 3 briefly describes the characteristics of each abstraction point, including the main origin of the abstracted surface water. Aerial overviews of the abstraction points have been added as well in this Appendix (Google Earth). Note that except for the abstraction points De Punt in the Drentsche Aa and Twentekanaal, near Enschede, all abstraction points partly receive surface water originating from the Rhine or the Meuse, i.e. from neighbouring countries.

At Brakel water from the Afgedamde Maas, a tributary of the Meuse is abstracted to produce drinking water. The Afgedamde Maas is characterized by a low flow with average residence times of 2 months. The quality of the water in the Afgedamde Maas is strongly influenced by water drained out of the neighbouring polder Bommelerwaard by two pumping stations. The Bommelerwaard polder has an intensive agriculture, partly in glasshouses, and in the past pesticides have been identified in surface waters in this polder (Kruijne, 2002). This means that the Bommelerwaard sometimes strongly influences the quality of the abstracted water at Brakel. Therefore for Brakel, it may be necessary to also calculate the concentration at the abstraction point on the basis of agriculture in the Bommelerwaard only and compare the result of this calculation with the general Tier 1 calculation result. Next the highest value may be selected to assess the risks for the drinking water production in Brakel in a conservative way. This procedure was not followed in this report, so the general Tier 1 Calculation method presented in section 4.1 does not account for this phenomenom. It will be implemented however in the user-friendly software tool to evaluate the drinking water standard. Alterra will develop this tool for the Ctgb in 2008.

The abstraction point in the Twentekanaal has stopped its water intake since August 2003. Recently (March 2008) drinking water company Vitens decided to stop the intake of surfacewater for the production of drinking water definitively. However, the assessment methodology developed in this report still includes the Twentekanaal abstraction point.

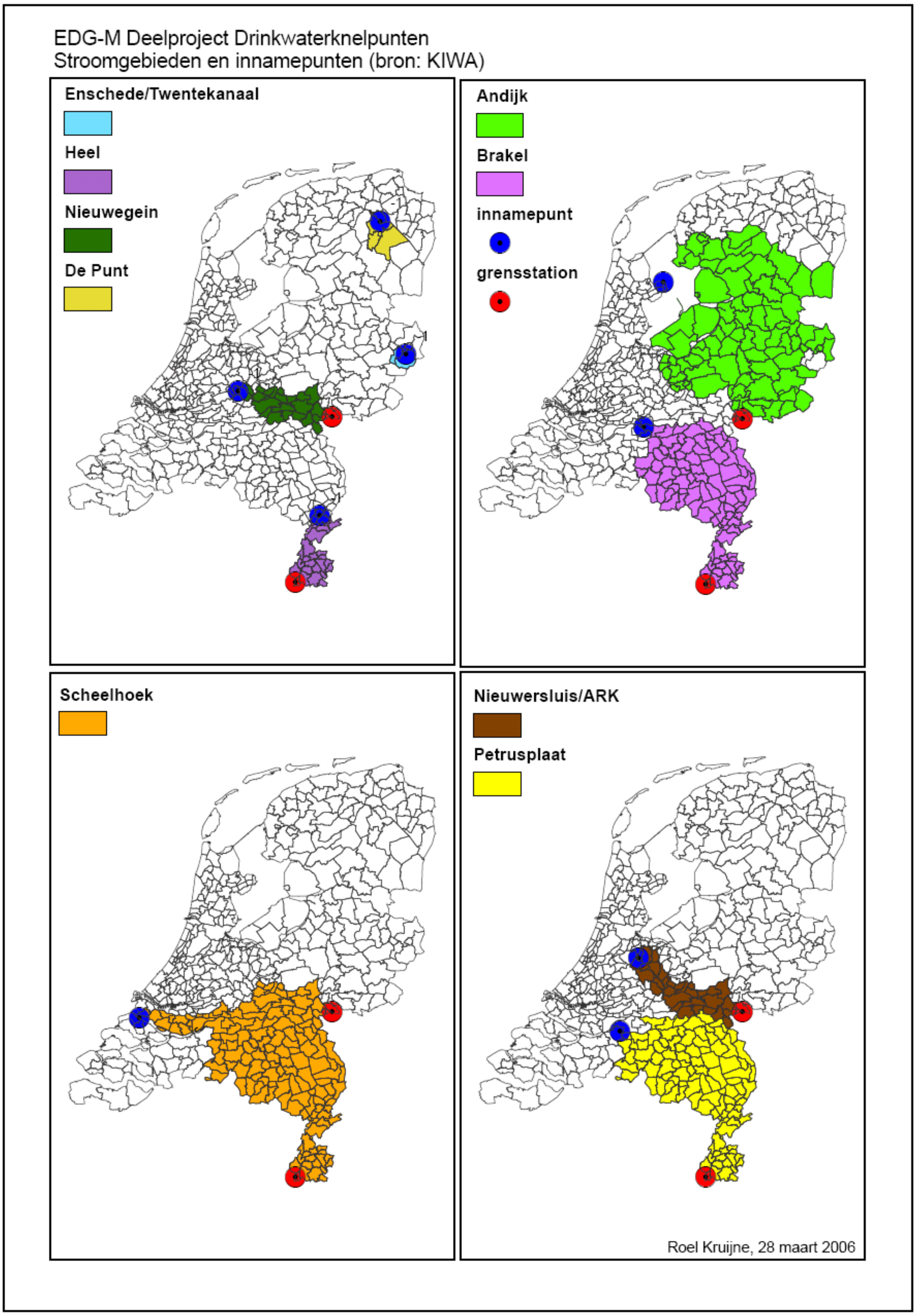


Figure 2.2. Intake areas and drinking water abstraction points (blue dots). Monitoring stations in the rivers Rhine at Lobith and Meuse at Eijsden (the Dutch borders) are indicated by red dots.

2.2 Overview of monitoring data at abstractions points in the period 2000-2006

In each of the nine abstraction points the quality of the abstracted surface water is monitored and the 0.1 μg/L standard is regularly exceeded since many years. It happens that no surface water can be abstracted for several days or even weeks, because too high concentrations have been detected.

In order to get an overview of the current situation the Working Group first identified all pesticides that had caused intake stops at abstraction points in the past, i.e. for which the citerion of 0.1μg/L was exceeded at one or more abstraction points. To do so, they used the list composed by the Dutch project 'Clean sources', containing about 40 pesticides that had led to one or more stops in the intake of groundwater or surface water for drinking water production. Water companies and Ctgb have agreed to update this list on an annual basis.The Working Group selected all pesticides that were relevant for surface water abstraction and also removed those pesticides from the list that are no longer registered in the Netherlands. For the remaining pesticides all available monitoring data from 2000 onwards were obtained from the drinking water production companies. Monitoring data from before 1-1-2000, the implementation of the 'Lozingenbesluit open teelt en veehouderij' (LOTV), are considered not relevant, because of the impact of the LOTV on the GAPs, such as the implementation of crop free zones and drift-reducing nozzles.

In this way 18 substances were selected. The list of 18 substances is given below.

- 2,4-D
- Bentazon
- Chloridazon
- Chlorprofam
- Dicamba
- Dichlobenil
- Dimethenamid-P
- Ethoprophos
- Glyphosate
- Isoproturon
- Malathion
- MCPA
- Mecoprop-P
- Metazachlor
- Metoxuron
- Metribuzin
- S-Metolachlor
- Terbutylazine

At the time the Working Group developed the methodology dimethenamid-P was a relatively new substance for which monitoring data were not yet available. It was added to the list because it was found in surface waters and had a large use area. The list was used for the further development of the tiered approach.

So, for the selected pesticides all monitoring data were gathered. Tables 2.2 and 2.3 present a summary of the monitoring data. Table 2.2 indicates how often the 0.1 μg/L standard was exceeded while Table 2.3 indicates how often the detection limit was exceeded. For all pesticides where more than two times the 0.1 μg/L standard was exceeded at one abstraction point we plotted the measured concentrations at all abstraction points (Appendix 4). The graphs in Appendix 5 up to 24 present the measured concentrations in the nine abstraction points, as well as at the border, Eijsden for the Meuse and Lobith for the Rhine for the selected pesticides. Initially all data for the period 2000 up to 2004 were included, later data for the years 2005 and 2006 were included as well. The graphs for locations in the river Meuse are displayed over two pages, because of the number of available data. Brakel in the river Meuse has been displayed in a separate graph, because concentrations in this abstraction point are heavily influenced by agricultural activities in the Bommelerwaard.

Table 2.2 Monitoring data of pesticides in surface water of eleven locations for the period 2000 up to 2006 included. Number of measurements above 0.1 µg/L with respect to the total number of analyses (n/N). For Twentekanaal abstraction of water stopped in 2003, so there are no monitoring data for 2004, 2005 and 2006.*

	Eijsden	----------------------Meuse --Afgedamde M.			Lobith	-----------------------Rhine --IJsselmeer Lake --Twentekan.				Drentsche Aa
Substance	Eijsden	Heel	Petrusplaat	Brakel	Lobith	Nieuwegein	A'dam-Rijnkan.	Andijk	Twente-kanaal	De Punt
2,4-D	2/88	1/19	4/60	1/190	0/85	0/59	0/80	0/27**	0/40	1/83
Bentazon	1/88	0/19	1/112	3/206	0/85	0/59	0/80	0/70	0/41	0/28
Chloorprofam	0/6**		0/117	0/46		0/3**		0/11		
Chloridazon	6/74	0/4**	3/65	0/52	0/71		0/4	0/31		0/37
Dicamba		0/19	3/73	2/204		0/60	0/93	0/56	0/40	0/29
Dichlobenil		0/19	2/84	3/94		0/39	0/36	0/36	0/101	0/47
Ethoprofos	0/89	0/67	0/92	0/76	0/87	0/50	0/64	0/63	0/97	0/49
Glyfosaat	46/90	20/43	68/139	25/118	19/86	7/77	10/54	0/69		4/85
Isoproturon	7/89	11/219	35/240	0/180	7/134	81/634	1/81	0/83	0/42	0/66
Malathion	0/89	0/8**	0/115	0/183	0/77	0/59	0/71	0/26**		0/49
MCPA	0/88	0/19	3/111	7/207	0/85	0/58	1/80	0/63	0/40	5/82
Mecoprop	1/88	0/19	4/112	6/203	0/85	0/59	1/80	0/64	5/40	10/82
Metazachloor	1/63	0/19	0/122	0/113	0/48	0/48	0/64	0/65	0/101	0/46
Metolachloor	0/63	0/19	5/123	0/163	0/48	0/49	1/74	0/57	0/77	0/47
Metoxuron	0/91	0/68	1/240	0/151	0/134	0/613	0/79	0/61	0/42	0/66
Metribuzin		0/67	0/110	0/183		0/50	0/69	0/59	0/97	0/49
Terbutylazin	0/89	0/67	1/191	0/183	0/87	0/61	0/71	0/60	0/97	0/49

*Scheelhoek (Meuse): glyfosaat (6/62) (2000-2006), chloorprofam (0/8), metazachloor (0/8), metolachloor (0/8), and terbutylazin (0/8) (all four 2005-2006).
** measurements of the period 2005-2006 only

N.B.
The measurements relate to mecoprop en metolachlor, while only the isomers mecoprop-P and S-metolachlor are being considered as critical.
Metolachlor consists of a mixture of the S and R isomers in a ratio of R:S = 1:9.
Mecoprop (i.e. MCPP) partly consists of the active ingredient mecoprop-P.

For a limited number of measurements the detection limit is above 0.1 µg/L:
2,4-D/De Punt: 8 points in time in the period 2002-2004
Chloridazon/Brakel: 7 points in time in the period 2004-2005
Diuron/De Punt: 1-9-2003, 8-9-2003
Glyfosaat/ De Punt: 7-7-2003
Glyfosaat/Eijsden: 7 points in time in the period 2005-2006
Glyfosaat/Lobith: 25-10-2006
Isoproturon/Heel: 149 of the 153 points in time in 2006
Metazachloor/Twentekanaal: all points in time

The monitoring data have been kindly procured by RIWA Maas, RIWA Rijn and Waterlaboratorium Noord.

Table 2.3. Monitoring data of pesticides in surface water at eleven locations for the period 2000 up to 2006 included. Number of measurements <u>above the detection limit</u> with respect to the total number of analyses (n/N).*

	Eijsden	----------------------Meuse --Afgedamde M.			Lobith	-----------------------Rhine --IJsselmeer Lake --Twentekan.				Drentsche Aa
Substance	Eijsden	Heel	Petrusplaat	Brakel	Lobith	Nieuwegein	A'dam-Rijnkan.	Andijk	Twente-kanaal	De Punt
2,4-D	14/88	2/19	24/60	26/190	6/85	3/59	6/80	0/27**	0/40	6/83
Bentazon	23/88	1/19	41/112	81/206	37/85	22/59	61/80	25/70	0/41	1/28
Chloorprofam	0/6**		4/117	0/46		0/3**		1/11		
Chloridazon	12/74	0/4**	12/65	1/52	1/71		0/4	9/31		0/37
Dicamba		1/19	4/73	7/204		0/60	0/93	0/56	0/40	0/29
Dichlobenil		5/19	45/84	52/94		3/39	8/36	1/36	0/101	5/47
Ethoprofos	0/89	3/67	0/92	0/76	0/87	0/50	0/64	1/63	0/97	0/49
Glyfosaat	58/90	32/43	108/139	65/118	49/86	33/77	23/54	9/69		30/85
Isoproturon	46/89	15/219	167/240	45/180	78/134	254/634	9/81	17/83	0/42	0/66
Malathion	2/89	0/8**	0/115	0/183	1/77	0/59	0/71	0/26**		0/49
MCPA	13/88	1/19	42/111	82/207	0/85	13/58	30/80	6/63	0/40	9/82
Mecoprop	14/88	2/19	61/112	92/203	16/85	12/59	65/80	23/64	23/40	18/82
Metazachloor	3/63	2/19	1/122	1/113	0/48	0/48	0/64	0/65	0/101	0/46
Metolachloor	12/63	3/19	41/123	10/163	5/48	0/49	3/74	0/57	0/77	0/47
Metoxuron	8/91	0/68	5/240	0/151	3/134	1/613	0/79	0/61	0/42	0/66
Metribuzin		0/67	0/110	0/183		0/50	0/69	0/59	0/97	1/49
Terbutylazin	5/89	10/67	46/191	11/183	3/87	0/61	0/71	0/60	25/97	3/49

*Scheelhoek (Meuse): glyfosaat (24/62) (2000-2006) and chloorprofam (0/8), metazachloor (2/8), metolachloor (1/8) and terbutylazin (0/8) (all four 2005-2006).
** measurements of the period 2005-2006 only

3 Proposed risk assessment procedure

3.1 General procedure and principles of tiered risk assessment schemes

General procedure

The Working Group followed the generalised risk assessment process as given in Van Leeuwen & Vermeire (2007), in which an exposure concentration is compared to an ecotoxicological acceptable concentration. The drinking water standard of 0.1 μg/L is the ecotoxicological acceptable concentration that should be met. The drinking water standard is not based on toxicological studies, but is a predefined value based on Directive 75/440/EEC. The value does not differentiate between active ingredients.

The concentration assessment is divided into three parts: emission rates, where the emission into the environment is estimated based on the amount used of the substance, the environmental distribution, which is mainly based on physico-chemical parameters such as solubility, vapour pressure, octanol/ water partition coefficient and degradation rates in different media and sorption to soil material. The previous information leads to an estimation of relevant concentrations in the environment and therefore a PEC.

The predefined water quality standards are used as maximum acceptable concentration in the water of a drinking water abstraction point. To determine whether the standard is exceeded the concentration is compared with the predefined drinking water standard. As both estimated final endpoints are concentrations these may be compared directly. The ratio of both gives information on the exceedance of the drinking water standard.

Principles of tiered risk assessment schemes

The concept of tiered risk assessment schemes is to start with simple, conservative tiers and to do only more work if necessary. The general principles of such tiered approaches are (i) lower tiers are more conservative than higher tiers, (ii) higher tiers are more realistic than lower tiers and (iii) lower tiers usually require less effort than higher tiers. A practical aspect is that there has to be some balance between the efforts and the filtering capacity of a tier. For instance, it does not make sense to define a tier that requires 50% of the efforts of the next higher tier, but leads in 95% of the cases to the conclusion that this next tier is needed (Boesten et al, 2006). Another principle is that each tier should evaluate the same entity. In this report each tier specifies an estimation method for the concentration at each of the nine Dutch surface water abstraction points.

3.2 Protection goal and need for two tiered assessment schemes

In order to operationalise the drinking water criterion of EU Directive 91/414 the exact protection goal needs to be defined. It should be clear against which drinking water standard and where the registration requests should be evaluated. In the Netherlands the two Ministries of Spatial Planning, Housing and the Environment and of Agriculture, Nature and Food Quality agreed upon the following protection goal:

In each individual abstraction point the 0.1 µg/L standard should be met.

This implies that already at abstraction, so even before any purification process, the surface water should fulfill the 0.1 µg/L standard. Furthermore they detailed that only Dutch contributions leading to exceeding the 0.1 µg/L standard should be considered, so contributions from neighbouring, more upstream located countries, such as Belgium, Germany, or France, should be excluded. In theory, this means that the 0.1 µg/L standard may be exceeded by a combination of the contributions from abroad and the Netherlands. Monitoring data will reveal whether this situation occurs. In the tiered assessment scheme monitoring data are taken into account, so the situation described above will be tackled in the tier where monitoring data are considered.

Moreover the two ministries explicitly stated that the methodology should be able to evaluate the risks of use of pesticides on hard surfaces for the drinking water production from surface water, next to the risks of use of pesticides in agriculture. The Working Group concluded that this meant that two assessment methodologies needed to be developed, because the type of use and processes leading to entry of pesticides in surface water are very different for use on hard surfaces and use in agriculture. In this report we focus on agricultural use of pesticides only, while use of pesticides on hard surfaces will be treated in a next report.

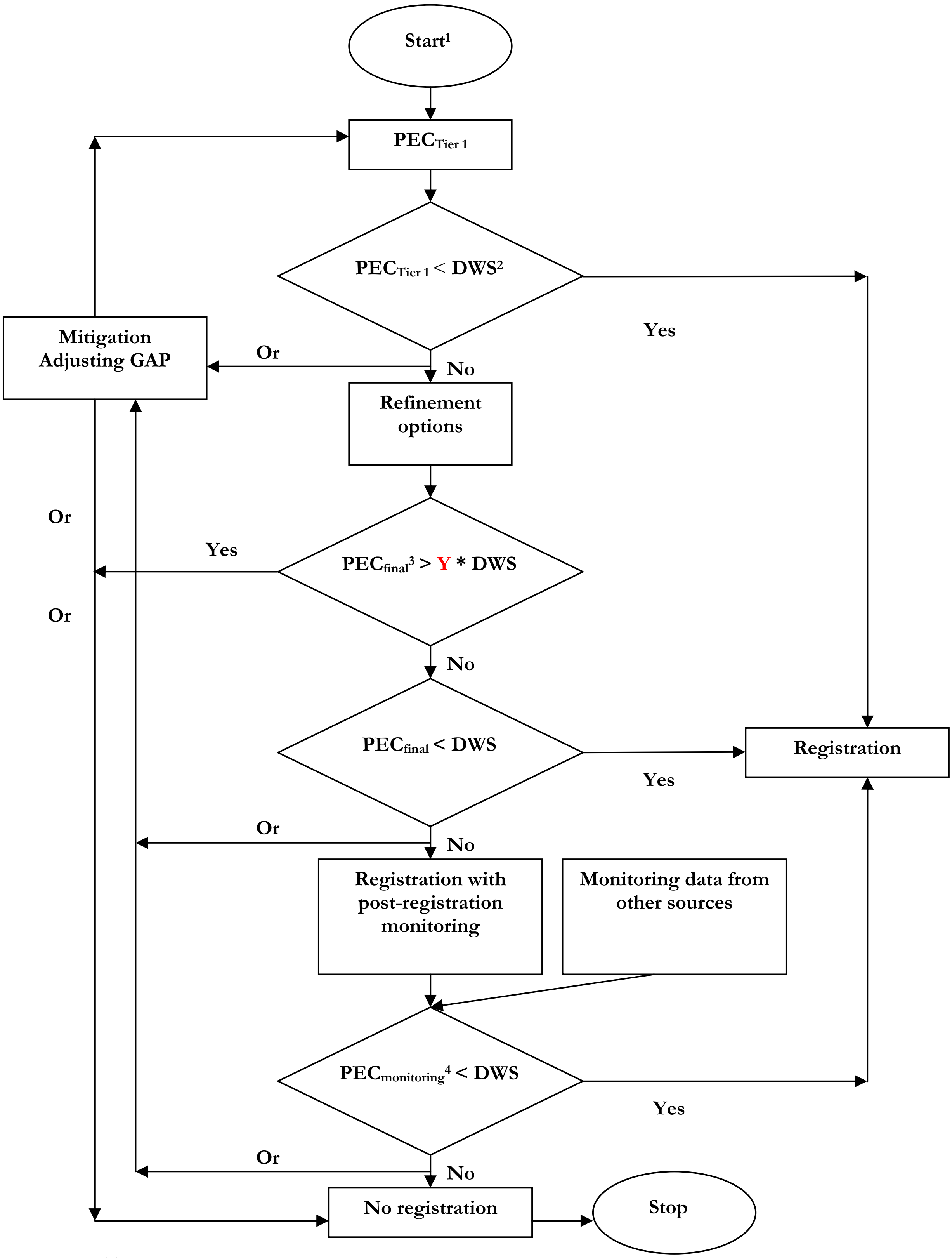
3.3 Proposed risk assessment scheme for agricultural use of pesticides

For agricultural use of pesticides the Working Group developed the risk assessment scheme, presented in Figure 3.1. The scheme applies both to new substances and substances already allowed on the market and for which e.g a re-registration is needed.

The scheme consists basically of two tiers, in which the concentration at the abstraction point is compared to the Drinking Water Standard (DWS) of 0.1 µg/L. The first tier in which the concentration at the abstraction point is being estimated with the aid of calculations is described in Chapter 4. Calculations in this tier may be refined by a number of well-defined options. In the last tier measured concentrations are considered. If a new substance is assessed post-registration monitoring is required and obtained data are evaluated. If an existing substance is re-assessed existing monitoring data from other sources than post-registration monitoring can be considered in the re-registration procedure. Guidelines for setting up post-registration monitoring or assessing monitoring data are given in Chapter 5. The assessment of a substance moves to the monitoring data evaluation tier (Tier II) if the concentration in one of the nine abstraction points, calculated in the first tier (including possible refinements) has a value in the interval DWS -Y*DWS, i.e. 0.1 μg/L -Y* 0.1 μg/L. The factor Y in Figure 3.1 represents a 'safety' factor which size has to be decided upon by the responsible Dutch ministries. This factor is being discussed in Chapter 6 Discussion.

In the proposed assessment scheme a box Refinement options is mentioned.
This box refers to refinements options for the Tier I Calculation method. This box does not intend to represent a higher tier calculation, such as e.g. calculations by a distributed hydrological model, simulating water flow in all watercourses of the intake area up to the abstraction point, coupled to GIS information on crops and application patterns.

The Working Group agreed on a number of options, which they judged to be suitable options for refinements. These are mentioned in section 4.2. The Working Group explicitly states that there should be a balance between the conceptual level of the Tier I Calculations and the refinement options. The Working Group leaves the option open to use the refinements mentioned within the level of current conceptualisation of the intake area and the proposed Tier I calculation method. In view of the simplistic and relatively non-mechanistic concept used to calculate the concentration at the abstraction point, the Working Group did not agree on other refinements. If more details need to be accounted for the Working Group recommends to develop a completely new tier based upon a more mechanistic approach of the relevant processes in the intake area.



1 = This is as well applicable to new substances as to substances already allowed on the market
2 = DWS is the Drinking Water Standard; in the Netherlands this is 0.1 µg/L at the moment when the report was issued
3 = In case no refined assessment has been applied the PEC_{final} is $PEC_{Tier\ 1}$
4 = Before making a decision it has to be analysed whether the substance is of Dutch origin or not

Fig 3.1. Proposed risk assessment scheme to evaluate the drinking water standard in the registration procedure of the Ctgb in the Netherlands. N.B. The factor Y represents a 'safety' factor and is discussed in the chapter Discussion.

4 Tier I - Calculation of concentrations at abstraction points

4.1 Proposed calculation method

The Tier I for the estimation of PEC in surface water intended for the abstraction of drinking water consists of the calculation results of the FOCUS D3 ditch with Dutch drift deposition values and additional assumptions on the use intensity of the substance, the timing of all applications, the dissipation and the additional dilution factor. The use intensity on its turn consists of an estimation of the relative cropped area, the market share and a drift or drainage factor.

In the first tier of the proposed approach the $PEC_{Tier\ I}$ at the abstraction point is calculated according to:

$$PEC_{TierI} = \sum_{all}^{crops} ((PEC_{FOCUS\_NL,D3} \cdot f_{corrFOCUSscen}) f_{use\,intensity}) \cdot f_{timing} \cdot f_{dissipation} \cdot f_{add\_dilution}$$

in which:

$PEC_{Tier\ I}$	=	PEC in surface water at location where it is abstracted for drinking water preparation (µg/L)
$PEC_{FOCUS\_NL,\ D3}$	=	global maximum PEC edge-of-field for the FOCUS D3 scenario with drift deposition according to the Dutch drift tables (µg/L)
$f_{corrFOCUSscen}$	=	correction factor for implicit choices concerning contributing areas made in FOCUS D3 scenario (-)
$f_{use\_intensity}$	=	factor considering the use of the pesticide (-)
f_{timing}	=	factor considering the difference in timing of application within the area of use (-)
$f_{dissipation}$	=	factor considering the dissipation from the edge-of-field watercourse to the abstraction point (-)
$f_{add\_dilution}$	=	factor considering additional dilution, e.g. by considerable water flows entering the intake area, or by lakes via which water travels to the abstraction point.

It should be noted that the $PEC_{Tier\ I}$ is calculated on the basis of GAP (Good Agricultural Practices). As the tiered approach is intended for regulatory purposes only non point source entries into surface water are considered. The edge-of-field peak concentration of the FOCUS Surface Water Scenario D3 ditch forms the basis for the calculation of the $PEC_{Tier\ I}$. The concentrations are caused by spray drift deposition on the water surface, calculated by Dutch drift values (Ctgb, 2006), or by drainage entries, calculated by the FOCUS_MACRO model (Jarvis, 1994, 1998). The FOCUS D3 ditch is 100 m long and has a rectangular cross-section, 1 m wide and approximately 30 cm deep. Field crops grow till a distance of 1.0 to 1.3 m from the water edge, for fruit trees till 3.5 m. A detailed description of the FOCUS Surface

Water Scenarios can be found in FOCUS (2001). Note that not the FOCUS Drift Calculator, but the Dutch drift tables (Ctgb, 2006) have been used in the calculations. According to the Dutch tables spray drift deposition is 1% for all field crops and 17% and 7% for fruit trees, without and with leaves, respectively.

PECs are calculated for a crop on which the pesticide is used, according to their worst case application pattern in drinking water intake area as described in the GAP sheets and with model parameters from Draft Assessments Reports (DARs), which are available for the evaluating instances of the EU Member States. Global maximum concentrations are calculated for the FOCUS D3 ditch scenario (with Dutch drift deposition) and these are corrected for implicit choices concerning water and pesticide contributing areas made in the FOCUS ditch scenario.
Next these PECs, multiplied by the use intensity factor, are summed up for all crops on which the considered pesticide is used. Fig 4.1 and Table 4.1 illustrate the calculation procedure.

Table 4.1. Example of overview of crops with corresponding $PEC_{FOCUS\_NL, D3}$, FOCUS correction factors, use intensity factors and the time of occurrence of the PECs

Crop	$PEC_{FOCUS\_NL, D3}$ (µg/L)	$PEC_{FOCUS\_NL,D3} * f_{corrFOCUSscen} * f_{use\_intensity}$ (µg/L)	Time of occurrence
Crop A	6.3	0.013	1 May
Crop B	3.0	0.06	15 May
Crop C	2.7	0.012	1 September
Σ all crops		0.085	

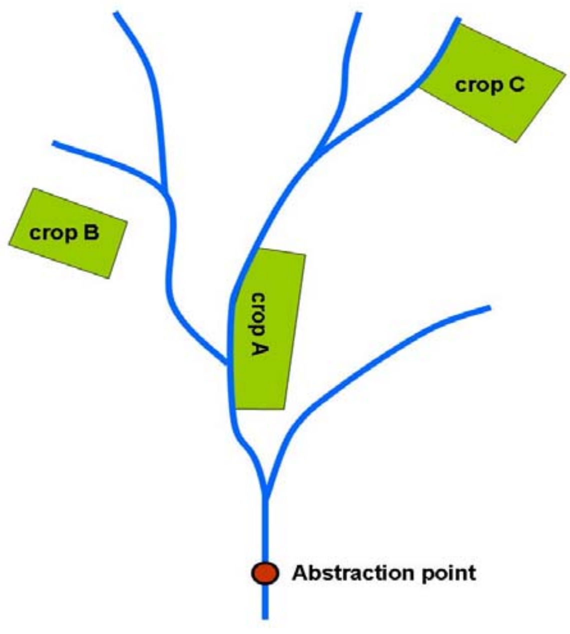


Fig 4.1. Illustration of Tier I calculation procedure: peak concentrations of pesticide X used on crop A, B and C are assumed to arrive at the same moment at the abstraction point, although in reality pesticide X will be used on crop A, B and C at various points in time

Summing up the ($PEC_{FOCUS\_NL, D3}$ * $f_{corrFOCUSscen}$)* $f_{use\_intensity}$ over all crops implies that it is assumed that for the pesticide considered the calculated edge-of-field PECs all arrive at the same moment at the abstraction point, i.e. all PECs have the same travel time from the edge-of-field water to the abstraction point. This results in a conservative estimate of the $PEC_{Tier\ I}$.

$\mathbf{f_{corrFOCUSscen}}$

Correction factor for implicit choices concerning water and pesticide contributing areas made in the selected FOCUS sw D3 ditch scenario: the ditch neighbours a 1 ha treated field and is fed by 2 ha non-treated fields, located immediately upstream of the ditch. So, if drainage causes the peak concentration in the FOCUS ditch the peak has been diluted by a factor of 3, which is undesirable for our purpose here. Therefore we here introduced a correction factor of 3 for the peak concentration, if it is caused by drainage. For peaks caused by spray drift no correction was needed. The value of the correction factor is:

fcorrFOCUSscen = 3 if peak is mainly caused by drainage entries and
fcorrFOCUSscen = 1 if peak is mainly caused by spray drift entries.

$\mathbf{f_{use\_intensity}}$

The use intensity factor accounts for three different phenomena

- The relative cropped area (RCA) factor, i.e. the ratio of the area of the crop considered and the total intake area. The acreage of the different crops is according to the CBS database
- The market share factor reflects that the pesticide will not be used on the total area of a crop. A default value of 0.4 is used. Deviation of this value is possible with valid argumentation.
- The fraction of area which contributes to the most relevant entry route. In case of drift deposition a factor of 0.5 is used, in case of drainage the factor is 1.0.

So,

$$f_{use\_intensity} = RCA \cdot f_{market} \cdot f_{relevant\_contributing\_area}$$

In which:

$$RCA = \frac{area_{crop}}{area_{drw\_abstraction}}$$

With,

RCA	= relative cropped area for a specific crop (-)
$Area_{crop}$	= crop area on which the pesticide is potentially used within the drinking water **intake area** (ha)
$Area_{drw\_abstraction}$	= total intake area of **abstraction point** (ha)
f_{market}	= market share of the pesticide (-)
$f_{relevant\_contributing\_area}$	= fraction of the area contributing to the main entry route 0.5 for drift entries and 1.0 for drainage entries (-)

The Relative Cropped Areas are determined with the aid of the GeoPEARL 1.1.1 crop groupings (Kruijne et al, 2004), with an additional subdivision for Tree nurseries and Fruit culture in large and small trees because of their large difference in spray drift deposition. The intake areas of the nine abstraction points are based upon data of CBS (http://statline.CBS.nl) and Kiwa Water Research, used for the EDG-M study (Van der Linden et al, 2006). Appendix 26 presents the used crop groupings and crop areas.

Application of the RCA factor implies that it is assumed that the entire cropped area contributes equally (in terms of water and pesticide fluxes) to the $PEC_{Tier\ I}$, e.g. a cropped parcel in a remote upstream part of the intake area with no surface water closeby contributes as much water and pesticides to the $PEC_{Tier\ I}$ as a cropped parcel located next to the abstraction point.

It is also assumed in this approach that the cropped area is distributed in a stochastic way in the entire intake area, so, e.g. not all cropped parcels are located next to watercourses.

In addition it is implicitly assumed that 100% of the cropped area is treated with pesticide, and not e.g. only by pest infested areas of a crop. By introducing a market share factor of 0.4 it is assumed that only 40% of the cropped area is treated with the active ingredient considered and that the remaining 60% is treated by other active ingredients or not treated at all. Appendix 25 presents an overview of major crops in the Netherlands and their pests and diseases, as well as pesticides registered and recommended to combat the mentioned pest or disease. By demonstrating that generally 3 or more active ingredients are used this Appendix underpins the default value of 0.4 for the market share factor.

The relevant contributing area factor considers which area effectively contributes to the pesticide loading of the watercourse. For spray drift deposition it is based upon the assumption that watercourses are randomly oriented with respect to the wind direction in the intake area. This implies that approximately half of the watercourses receive spray drift deposition, i.e. the concentration at the abstraction point is multiplied by 0.5 in case spray drift deposition is the main contributing entry route to the concentration.The factor of 1.0 for peaks caused by drainage entries is based upon the assumption that drainage fluxes originate from the entire intake area.

f_{timing}

In reality the pesticide is not applied on the same day on the entire area of crops concerned, but the application is distributed in time during an estimated realistic length of the registered application period. Spray drift entries do not occur at the same day, due to difference in application day across the intake area. Drainage entries may not occur at the same day, due to the rainfall distribution in the intake area, and they do not arrive at the same moment in the abstraction point, due to different travel times. So, there is a dilution of the edge-of-field concentration on its way to the drinking water abstraction point, due to a difference in timing of application (Fig. 4.2). A dilution factor of 2 is proposed, i.e. $f_{timing} = 0.5$.

The following considerations led to this factor:

- for spray drift entries: spray drift enters on the day of application, and the application day varies across the intake area. However the travel time from the edge-of-field ditch up to the abstraction point varies as well, depending on whether the field is located near the abstraction point or farther upstream in the intake area.
- for drainage entries: drainage fluxes generally do not enter at the day of application, but they enter after the first rain showers. Given the size of the intake areas rain showers are distributed in time across the entire area. Moreover, the travel time from the edge-of-field ditch up to the abstraction point varies, depending on whether the field is located near the abstraction point or farther upstream in the intake area.
- In a study in a theoretical polder with 10 plots of 300 * 100 m, arranged in two opposite sets of five plots and intersected by watercourses, a dilution factor of at least 5 was found in most cases between the concentration edge-of-field and the concentration in the main watercourse at the end (Adriaanse et al, 1997). This supports the assumption of a (worst case) dilution factor of 2.

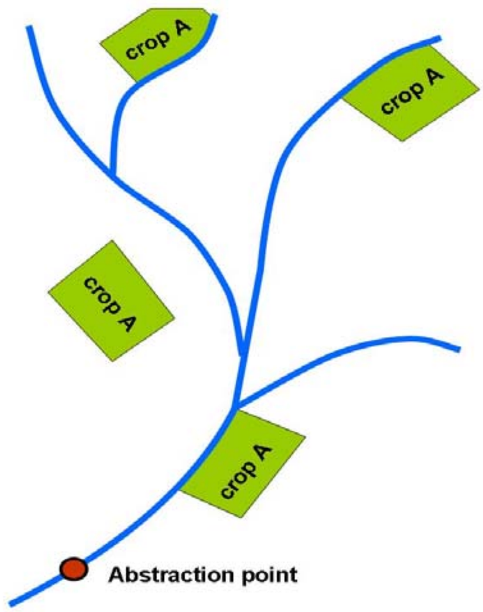


Figure 4.2. Illustration of Tier I calculation procedure demonstrating that edge-of-field concentration peaks do not arrive at the same moment in the abstraction point. A dilution factor of 2 from the edge-of-field concentration to the abstraction point is used, f_{timing} *= 0.5.*

f_{dissipation}
During the travel time from use area to the abstraction point the pesticide concentration decreases due to degradation and volatilisation. The dissipation rate constant can be calculated according to

$$k_{dis} = k_{vol} + k$$

in which

$$k_{vol} = (\frac{1}{k_l} + \frac{1}{K_H k_g})^{-1} \frac{O_x}{A}$$ (Adriaanse et al, 1997)

and

$$f_{dissipation} = e^{-k_{diss} \cdot t}$$

with

$f_{dissipation}$	=	factor accounting for the dissipation of the pesticide in the surface water by degradation and volatilization (-)
k_{diss}	=	dissipation rate constant of the pesticide in surface water (d^{-1})
t	=	time the pesticide is in the water since the last application (d)
k_{vol}	=	volatilisation rate constant of the pesticide from surface water (d^{-1})
k	=	degradation rate constant of the pesticide in surface water (d^{-1})
k_l	=	mass transfer coefficient of the substance in the liquid phase (md^{-1})
k_g	=	mass transfer coefficient of the substance in the gas phase (md^{-1})
K_H	=	Henry coefficient (-)
O_x	=	width of water surface (m)
A	=	cross sectional area of flow (m^2)

For rectangular cross-sections O_x/A equals $1/d$, where d is the water depth. We consider the most relevant water depth, i.e. the water depth of the watercourses where the pesticide has the longest hydraulic residence times. These are the edge-of-field ditches and next level of watercourses and not the larger watercourses near the abstraction points. A water depth of 0.25 m has been estimated on the basis of the assumed water depth for edge-of field watercourses in Adriaanse et al (1997) and in Watersysteemverkenningen (Teunissen-Ordelman et al., 1997). The dissipation rate depends on the temperature of the surface water. In this study we assumed an average water temperature of 15 °C to be representative during the application season. These assumptions result in multiplication factors of approximately 0.85 to 0.99 for non-volatile substances with DT_{50}s exceeding approximately 30 d.

An average travel time from use area to abstraction point is estimated at 6 days, based on a study in the Drentsche Aa (Smidt et al., 2001) for the most downstream part of the Drentsche Aa intake area. It should be taken into account that this is an average value based on the assumption that application only affects the tertiary (smallest) waterways. Application along the major stream close to the intake area will obviously result in shorter travel times; application further upstream in longer travel times.

$f_{add\_dilution}$

The factor accounts for additional dilution of the surplus water gathered in the intake area that travels to the abstraction point. Additional dilution may be caused by river water that enters the intake area from upstream and that does not contain the considered pesticide. It may also be caused by a large lake, via which the surplus water from the intake area travels to the abstraction point. The default value of this factor is 1, i.e. no additional dilution occurs. For the abstraction point in Andijk, that abstracts water from the IJsselmeer Lake the Working Group proposes a value of 1/6. This is estimated by assuming that there is a peak river flow from the IJssel in the IJsselmeer Lake that lasts one week. The average residence time in the IJsselmeer Lake is 3 months (personal communication Ton de Vrieze, Rijkswaterstaat IJsselmeergebied, 12 July 2007), i.e 13 weeks. So, the one week peak is on average diluted 13 times if the entire lake would be considered to be an ideally mixed reservoir. However, not the entire lake may be mixed, because dead zones may exist, where water is not frequently refreshed. If we assume that only about half of the lake would be mixed, the dilution factor is 6, i.e. the $f_{add\_dilution}$ is 1/6. The Working Group agreed to use this value, although Rijkswaterstaat stated that there was no information available that supports this value. See also chapter 6 Discussion. The Working Group considered this value to be a reasonable, conservative estimation as

(i) a peak duration of a week in the IJssel is long and
(ii) only half of the lake contributes to mixing the incoming IJssel water.

The value of 1/6 results in a good correspondence between calculated and monitored concentrations for the three negative cases of bentazon, MCPA and mecoprop in Andijk; without applying the $f_{add\_dilution}$ calculated and monitored concentrations would not correspond (see Figure 4.7 of Chapter 4.6).

4.2 Possible refinements for Tier I calculations.

In the risk assessment scheme presented in chapter 3.3 a box Refinements is shown, indicating that it is possible to refine the calculated Tier I concentrations. The Working Group agreed on the following Refinement options for the Tier I calculations:

- More recent crop acreages than the ones currently used
- More recent delimitation of the intake areas than the current ones, which are based upon the EDG-M study (Van der Linden et al, 2006)
- Substance specific market share factor, f_{market}, instead of the default value of 0.4
- Additional dilution factor, $f_{add\_dilution}$, smaller than the value of 1.0, currently used for all abstraction points except Andijk.

The Working Group did not agree on refining the application patterns, i.e. replacing the worst case application according to the GAP sheets (which is currently used for all crops on which the substance is used) by the application pattern specified for each crop. The Working Group considers this to be an important conservative assumption of the proposed Tier I Calculation method for substances used in more than one crop (see also section 4.3).

4.3 Overview of main assumptions supporting the Tier I calculation method

Below a summary of the main assumptions supporting the Tier I calculation method is presented. Starting point for the calculation of the concentration at the abstraction point is the edge-of-field concentration in the 30 cm deep FOCUS ditch, caused by spray drift deposition and drainage entries. Spray drift deposition is calculated according to the Dutch drift deposition tables of the Ctgb (2006). For all registered uses in the Netherlands the highest application rate and application frequency, resulting in the worst case concentration, should be used.

An implicit assumption of the Tier I Calculation method is that surplus water of the entire intake area flows towards the abstraction point and is mixed before arriving at the abstraction point. This assumption corresponds to reality if the abstraction point is located in the main discharging watercourse of the intake area. As mentioned earlier this is not the case for the abstraction point of Brakel, located in the Afgedamde Maas. The quality of the Afgedamde Maas is heavily influenced by water draining off the Bommelerwaard polder with its intensive agriculture. This abstraction point therefore needs an additional evaluation, considering the Bommelerwaard surplus water only.

Contamination of the surface water close to the abstraction point may be a point of concern. However, the Working Group considered that nearby contaminations are adequately tackled by the proposed Tier I Calculation method, if the contamination is caused by Good Agricultural Practice (which is the remit of the Working Group). Good Agricultural Practice may result in spray drift deposition or drainage fluxes. Spray drift deposits onto the main discharging watercourse will be considerably lower than the 1% of the Dutch drift tables, because spray drift deposits exponentially decrease with distance from the last row of crops on the field. The distance last row of crops to edge of watercourse may exceed the FOCUS value of 1.0 or 1.3 m for field crops or 3.5 m for fruit trees. Moreover the watercourse width largely exceeds the 1 m on which the 1% drift deposition is based. So, the actual deposition on the watercourse close to the abstraction point will be significantly lower than what is calculated in the Tier I. Next, the deposits are mixed in the main watercourse before they arrive at the abstraction point. Drainage fluxes will be mixed into the main discharging watercourse as well. Finally, abstracted water is either gathered in reservoirs or infiltrated, so it is never immediately transformed into drinking water.

The Working Group assembled Table 4.2, summarizing the conservativeness of all assumptions made in the Tier I calculation method. They classified the assumptions into class A, B or C, meaning:
A estimated to represent a 70-80th percentile probability of occurrence,

B estimated to represent a 50th percentile probability of occurrence and
C not conservative or not included in the developed Tier 1 calculations, or significance for calculations results is not clear in all cases.

The Working Group aimed in her Tier I Calculation method to make conservative estimations of the concentrations at the abstraction points. In the current pesticide risk assessment procedures this generally is operationalised by aiming for a 90th percentile probability of occurrence of the target variable. Individual terms, each with their own probability of occurrence, combine into a cumulative, overall probability of occurrence of the target value, i.e. the calculated concentration at the abstraction point. This approach is applied in the similar pesticide risk assessment methodologies, such as the spray drift deposition of a series of events (BBA, 2000) and FOCUS Working Groups (FOCUS, 2000; FOCUS, 2001).

The FOCUS Groundwater Scenarios Working Group agreed that their scenarios should describe an overall vulnerability approximating the 90th percentile of all possible situations and that the vulnerability should be split evenly between soil properties and weather (FOCUS, 2000). After exploratory statistical analysis, the Working Group decided that the overall 90th percentile could be best approximated by using a 80th percentile value for soil and a 80th percentile value for weather. The FOCUS Surface Water Scenarios Working Group used the same concept, but combined more single terms (FOCUS, 2001). Assuming a normal distribution they stated that a series of e.g. six single terms, each with a 70th percentile probability, has an overall 90th percentile probability for the entire season of applications. They also agreed for a series of 8 or more spray drift events that their cumulative overall probability 90th percentile corresponds with a single event percentile of 67th percentile. The BBA (2000) adopted this methodology in her assessment of drift deposition.

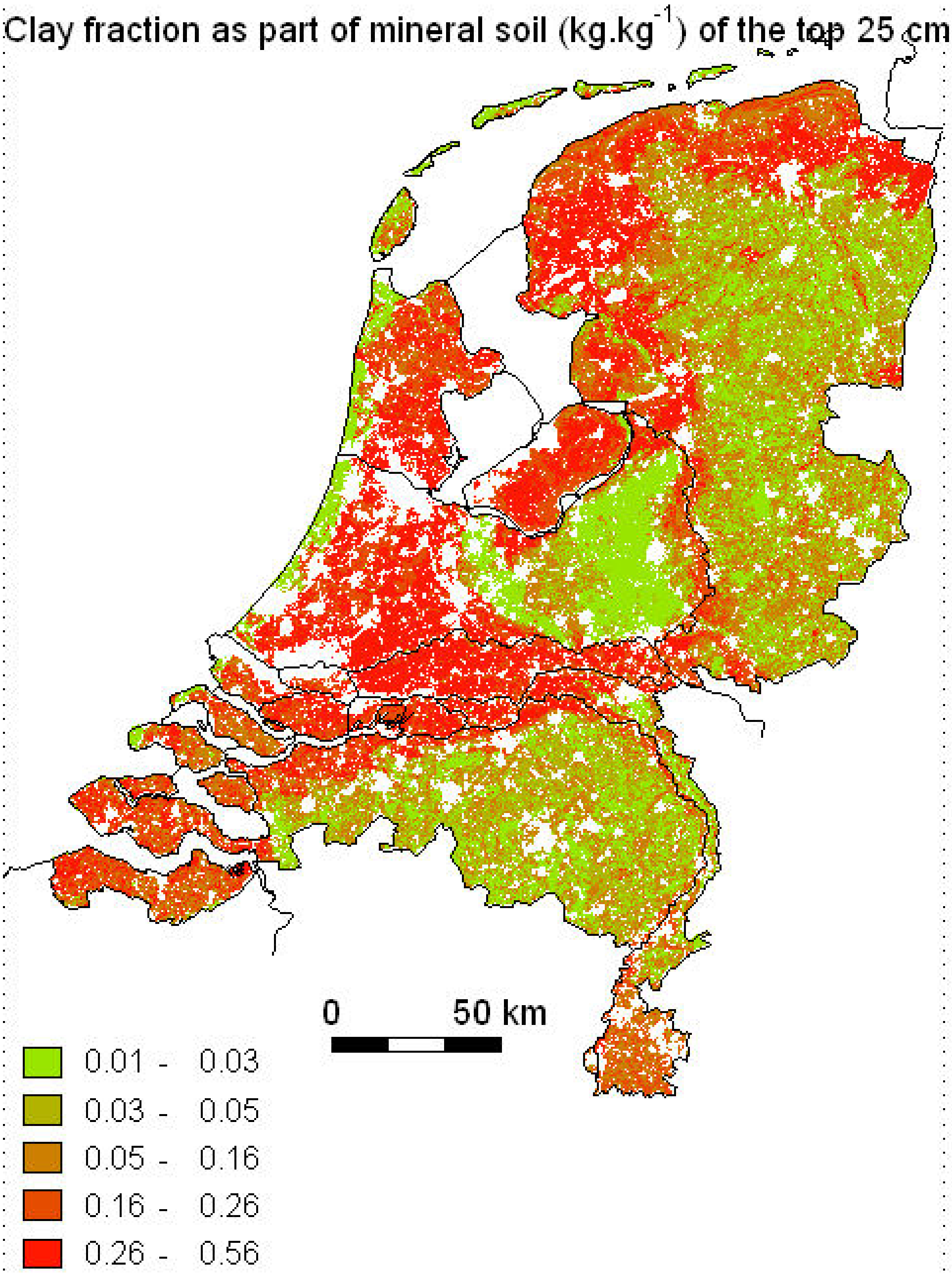
So, the Tier I calculation method presented in this report follows a similar logic for the combination of single terms of the calculation method into a cumulative, overall probability of the concentration calculated in the abstraction point. The Working Group does not consider it statistically valid to attempt to integrate the various worst-case assessments of Table 4.2 into a single value. However, the Working Group estimates that the integration of the individual terms of Table 4.2 does represent a realistic worst-case scenario with respect to the concentration at the abstraction point, in the order of magnitude of a 90th percentile.

Table 4.2. Assessment of conservativeness of assumptions used in the Tier I calculation method

Factor or assumption in Tier-1 eqn	Subfactors	Value or approach	Assessment of conservativeness	Class
sum over all crops			conservative for pesticides applied in different crops; neutral for pesticides in single crops	A or B
Application rate	Worst case appln rate of all crops on which substance is used		conservative for pesticides applied in different crops; neutral for pesticides in single crops	A or B
$PEC_{FOCUS\_NL, D3}$	spray drift: water depth	30 cm	Conservative to neutral: average depth is around 30 cm or more. For the 22 hydrotypes represented in The Netherlands the water depth is 32 ± 14 cm for ditches of 1-3 m wide at their water surface and 46 ± 19 cm for ditches of 3-6 m wide (Massop et al, 2006)	A to B
	spray drift: drift deposition	Dutch drift tables	Neutral to less conservative. Deposition is 0.9-1.9% according to crop (newest data PRI)*, 50th percentile deposition values. On the other hand distance crop-water surface in entire area may be greater than minimal distances of LOTV.	B to C
	drainage	only chromato-graphic transport	Neutral for sandy soils; also neutral for cracking clay soils. Based on clay map of Figure 4.3 no issue for Heel, Twentekanaal, de Punt, Brakel, Scheelhoek, and Petrusplaat; could be issue for Nieuwegein, Amsterdam-Rijn Kanaal and Andijk but unlikely to be an issue at this scale (e.g. because high concentrations probably coincide with high river flows also from non-prefential flow areas).	B
$f_{corrFOCUSscen}$		1 for drift 3 for drainage	neutral: no additional dilution expected	B
$f_{use\_intensity}$	$Area_{crop}$		neutral for main crops but conservative for small crops because of crude GeoPEARL crop groupings	B
	$Area_{drw\_abstraction}$		Neutral	B
	f_{market}	0.4	conservative default based on Nefyto overview but neutral if more realistic value is used as refinement For crops with relatively big areas competition is high and market shares are normally between 5 and 30%. In small crops competition can be lower and market share can be above 40%. The contribution of these small crops to surface water contamination is however much lower then from the bigger crops	A or B
	$f_{relevant\_contributing\_area}$	drift 0.5 drainage 1.0	neutral (to be confirmed by CASCADE simulations) neutral	B

Factor or assumption in Tier-1 eqn	Subfactors	Value or approach	Assessment of conservativeness	Class
f_{timing}		0.5	neutral to conservative: best guess of lowering of peak due to differences in application times for same crop considering a distribution of hydraulic residence times across the intake area (assumption could partly be tested by simulations with Cascade model in course of 2008)	A-B
$f_{dissipation}$	residence time in water	6 d	conservative for Drentse Aa (average travel time for lower third of intake area; range = 1-20 d) and probably conservative for other abstraction points because travel times are longer	A
	water depth for volatilisation calculation	25 cm	neutral, expected to have very small effect; will be changed into 70-80%-ile value of 30-35 cm	B
	temperature in water for volatilisation calculation	15°C	neutral because normal value in spring; probably small effect on result	B
$f_{add\_dilution}$		Default 1, except in Andijk (factor is 1/6)	conservative for all abstraction points except for Andijk *(assuming that Bommelerwaard will be included separately in the risk assessment for Brakel)*	A if factor=1
no emissions from greenhouses		Not included	neutral because probably no significant surface area in intake areas except Bommelerwaard. Emission from glass houses was not considered by this Working Group as a special Working Group for this type of agriculture has recently started in the Netherlands.	B
Atmospheric deposition		Not included	Not conservative, significance not yet clear. May be in range of 0.2-1.6% of appln rate at 1 m downwind distance (FOCUS, 2006b)	C
Overall judgement			***conservative because single terms with probabilities ranging from 50 to 70/80th percentile are combined into an overall probability approximating the 90th percentile***	

* The current deposition data are based upon the deposition for a potato crop, but for other crops, such as cereals and sugar beets that are cultivated with smaller distances last nozzle-edge of water, the drift deposition may rise to 1.3 or 1.9% instead of the 1% for potatoes.



Source: GeoPEARL v 3.3.3; van den Berg, 2008)

Figure 4.3. Clay content of top 25 cm of Dutch soil (source: GeoPEARL v 3.3.3).

4.4 Selection of cases to test the Tier I calculation method against monitoring data

To test the Tier I calculation method cases were selected for which the Tier I calculated PEC was compared to measurements at the nine abstraction points of the period 2000 up to 2006 included. For substances with more than two exceedances of the 0.1 µg/L standard the measured concentrations at the abstraction points have been plotted in Appendices 5 up to 24. The abstraction points located in the Meuse have been displayed in two graphs, because otherwise the graphs would contain too many points. Brakel is displayed in a separate graph, because it takes water in from the 'Afgedamde Maas', which is heavily influenced by river flows from the Bommelerwaard.

The Working Group defined two types of cases to test the Tier I calculation method: positive and negative cases. Positive cases are defined as

Substance/abstraction point combinations where use of the substance in the Dutch part of the intake area leads to exceeding the drinking water standard in surface water used for drinking water preparation.

Negative cases are defined as

Substance/abstraction point combinations where use of the substance in the Dutch part of the intake area does NOT lead to exceeding the drinking water standard in surface water used for drinking water preparation.

The selected test cases should fulfill the following two criteria:
the substance must be widely used in the intake area
there should be more than 25 measurements available for the period 2000-2004. (Note that the Working Group added only in a later stage monitoring data for 2005 and 2006.)

Positive cases should fulfill additional criteria:
there should be more than three exceedances in the period 2000-2004
there should be a plausible relationship (in time) between the exceedance and the application of the pesticide
the concentration at the abstraction point should be more than 0.1 µg/L higher than the concentration at the entrance of the water in the Netherlands, so, it is plausible that use in Dutch agriculture leads to exceeding the standard.

According to these criteria the following positive and negative cases were selected. Positive cases:
1. MCPA in the river Meuse along the stretch Eijsden – Brakel, because (see the figure in Appendix 16):
   a. the standard of 0.1 µg/L is exceeded more than three times
   b. the standard of 0.1 µg/L is exceeded two times within a continuous period of 1 year at more than one monitoring sampling time in the years 2001 and 2002;

   c. the standard is more than 2 times exceeded in 3 out of 7 cases
   d. the maximum concentration measured is more than 2 times the concentration at Eijsden in 3 out of the 7 cases exceeding 0.1 μg/L. At Eijsden the measurements have taken place in the same periods the standard was exceeded at Brakel. At Eijsden MCPA has been found, but less than the standard, in 3 out of 4 years that measurements at Brakel were above the standard. Therefore, there is also a contribution of MCPA from Belgium;
   e. at Heel only 11 measurements were carried out in the period 2002 – 2004. The standard was not exceeded, only one value of 0.05 μg/L was determined. The measurements at Heel for 2000-2004 support the hypothesis that MCPA found at Brakel does not originate totally from Belgium. In 2005 and 2006 MCPA was more regularly analysed at Heel, but only once it exceeded the 0.1 μg/L.
2. mecoprop in the Drentsche Aa (see the figure in Appendix 24) because:
   a. the standard of 0.1 μg/L is exceeded in 8 times out of the 56 measurements;
   b. the standard was exceeded 6 times in 2003, thus during a continuous period;
   c. only one measurement in 2000 is higher than 2 times the standard of 0.1 μg/L;
   d. the Drentsche Aa is not influenced from abroad, therefore Dutch use of mecoprop results in exceeding the standard
3. mecoprop at Brakel (see the figure in Appendix 18) because:
   a. the standard of 0.1 μg/L is exceeded in 6 times out of the 203 measurements;
   b. In at least 5 of these 6 cases the increase in concentration between Eijsden and Brakel is more than the 0.1 μg/L, so it is due to use of mecoprop in Dutch agriculture
4. metolachlor in the river Meuse at Petrusplaat (see the figure in Appendix 19) because:
   a. the standard is exceeded in 5 times out of 123 measurements,
   b. exceedances took place in June/July 2001, 2002 and 2003, so during the application period of metolachlor;
   c. at Eijsden no metolachlor was determined (0/63); therefore, the contribution was due to Dutch use.

At first sight the Working Group classified isoproturon in the river Rhine along the stretch Lobith – Nieuwegein also as a positive case. The graph of Appendix 22 shows that

5. isoproturon in the river Rhine along the stretch Lobith – Nieuwegein:
   a. more than 3 times the drinking water criterion is exceeded. In 81 of the 634 measurements the concentration is above 0.1 μg/L;
   b. the standard is exceeded within a continuous period of more than one year at more than one sampling point during the years 2000, 2001 and 2002;
   c. 28 out of 81 exceedances are more than 2 times the standard.

At Lobith in 7 out of 134 measurements the concentration measured is more than 0.1 μg/L. The highest concentrations measured at Nieuwegein are more than a factor of 2 higher than the highest concentration measured at Lobith in the same period. These periods are 2nd quarter of 2000, 1st and 4th quarter of 2002 and 4th quarter of 2003. Therefore, isoproturon determined at Nieuwegein is for more than half

originating from the Netherlands and leads to a rise in concentration of more than 0.1 μg/L.
However, more information was gathered about this substance – abstraction point combination (see section 4.6.1). This led to the final conclusion that isoproturon at Nieuwegein is not a positive case, because it is not isoproturon use in the Netherlands that results in exceeding the 0.1 μg/L standard.

Glyphosate in the Drentsche Aa is also classified as a positive case, but this is caused by the use of glyphosate on hard surfaces. So glyphosate in the Drentsche Aa is not used as a test case for the Tier I calculation method for agricultural use in this report.

A number of negative cases were identified by the Working Group. In a negative case measured concentrations are below 0.1 μg/L. As stated above the negative cases should fulfil the requirements of (i) the substance concerned must be widely used in the intake area and (ii) more than 25 measurements should be available for the period 2000-2004. In this way nine negative cases could be established:
River Meuse:
dicamba at Petrusplaat
metazachlor in Petrusplaat
metribuzin in Petrusplaat
River Rhine:
bentazon in Andijk
mecoprop in Andijk
MCPA in Andijk
metoxuron in Andijk
metribuzin in Andijk and
terbutylazine in Andijk.

4.5 Input data for the selected test cases and description of calculations

Eleven substances fit in the selected positive and negative cases. Their physico-chemical properties were collected, if possible from their List of endpoints available at http://europa.eu.int/comm/food/plant/protection/evaluation/exist_subs_en.htm
and otherwise by making use of data procured by the Dutch Ctgb. The data were critically reviewed, e.g. with respect to sorption coefficient in relation to pH. Table 4.3 lists the physico-chemical properties used for the Tier I PEC calculations. MCPA was included, although we know that its use on hard surfaces may contribute to its measured presence in surface waters. (Glyphosate is included in this table, but, as stated before, it was not included in the Tier I calculations in this report as this substance is known to enter surface water mainly by its use on hard surfaces and not by its use on agricultural crops.)
So, the original list of 18 substances, mentioned in chapter 2.2 was reduced to the 11 substances (including glyphosate) mentioned in Table 4.3.

Table 4.3. Overview of physico-chemical properties of the 10 substances used for calibration of Tier I plus glyphosate

```
* Summary of used pesticide property data
* (version 24/11/2006)
*
* DT50-w            = half-life time for water from water-sediment study [d]
* DT50-s & T_s      = half-life time for water-sediment system [d] & temperature [K] from water-sediment study
* DT50-b & T_b      = half-life time for soil [d] & temperature [K] from soil study
* Kom_mn            = arithmetic mean Kom value [L/kg]
* Kom_pH            = median Kom value in pH 7-8 range for pesticides with pH dependent sorption [L/kg];
*                     for pesticides with pH dependent sorption Kom_pH is given;
*                     if the sorption is not pH dependent the value is -999
* Freund            = Freundlich coefficient [-]; DEFAULT = 0.9
* Solub & T_sol     = Solubility [g/L] & temperature at which this is determined [K]
* M_mass            = Molar mass of pesticide [g]
* Psat & T_vap      = Saturated vapour pressure [Pa] & temperature at which this is determined [K]
*
* NB:  - default for missing data = -999
*      - for calculations the worst case Kom is used, i.e. the Kom in pH range 7-8, where this value is available
*
```

* id#	pesticide	source_data	DT50-w	DT50-s	T_s	DT50-b	T_b	Kom_mn	Kom_pH	Freund	Solub	T_sol	M_mass	Psat	T_vap
*			[d]	[d]	[K]	[d]	[K]	[L/kg]	[L/kg]	[-]	[g/L]	[K]	[g/mol]	[Pa]	[K]
01	Isoproturon	DAR	42	133	293	11.9	293	60.3	-999	0.9	0.0702	293	260.3	2.8e-6	293
02	Metribuzin	draft_DAR	41	48.5	293	11	293	21.5	-999	1.1	1.28	298	214.3	1.21e-4	293
03	MCPA	DAR	13.5	16.9	293	24	298	43	24.5	0.9	0.395	298	200.6	4e-4	305
04	MCPP	DAR	-999	-999	-999	12	283	16.6	12.9	0.9	6.6	293	214.6	1.6e-3	298
05	MCPP-P	DAR	36.5	45	293	7.2	293	-999	12.9	0.9	0.86	293	214.65	2.3e-4	293
06	Metolachlor	draft_DAR	9	48	293	14.5	293	133	-999	0.9	0.48	298	283.8	3.7e-3	298
07	Dicamba	Ctgb	34	45	293	5	293	5	5	0.9	4.51	293	221	2.21e-3	293
08	Terbutylazin	Ctgb	18.5	56.5	293	111	293	130	-999	0.9	0.0085	293	229.7	4.68e-5	293
09	Bentazone	DAR	-999	716	293	45	293	30	15	0.9	0.57	293	240.3	1.7e-4	293
10	Metoxuron(†)	Ctgb	-999	73	293	8	293	73	-999	0.9	0.678	293	228.7	4.3e-3	293
11	Metazachlor	Ctgb	-999	33	293	18	293	49	48.5	0.9	0.030	293	277.8	4.7e-5	293
12	Glyphosate	DAR	-999	-999	-999	-999	-999	-999	-999	-999	-999	-999	-999	-999	-999

†) The Kom_mn value used for Metoxuron is the median Kom value in the total available range

For the 10 substances we calculated the $PEC_{Tier\ I}$ by first simulating the FOCUS scenario for Dutch drift deposition numbers and next feeding the selected edge-of-field PEC into a Fortran program for the Tier I calculation as described in chapter 4.1. All calculations were performed for the D1 and D3 FOCUS ditch scenarios as initially, they were judged to represent the Dutch situation best.

Detailed description of calculations
The so-called GAP sheets were collected to establish the registered use of the 10 selected substances on crops in the Netherlands (Appendix 27 – 36). The D1 and D3 FOCUS surface water scenarios contain a limited number of crop groupings, for D1 these are only winter or spring cereals, spring oil seed rape and grass/alfalfa, while for D3 possible crop groupings are winter and spring cereals and oil seed rape, field beans, legumes, maize, potatoes, sugar beets, bulb, leafy and root vegetables, grass/alfalfa and pome/stone fruit. So all crops mentioned in the GAP sheets were categorized into these FOCUS surface water crops groupings in order to be able to calculate concentrations for the D1 and D3 ditches. Appendix 37 gives an overview of the relationship between the Ctgb crops (mentioned in the registration application forms) and the crop groupings existing in the D1 and D3 FOCUS surface water scenarios. We selected the worst case application pattern of all crops mentioned in the GAP sheet that were combined into one FOCUS crop grouping. These data were introduced in SWASH. They are presented in Appendices 38 to 47. Next the FOCUS_MACRO model was run for all selected crop-substance combinations to simulate drainage entries into surface water. Spray drift entries were determined with the aid of the Dutch drift table (Ctgb, 2006) and next PEC and TWA7d values for the D1 and D3 ditch scenarios were calculated by the FOCUS_TOXSWA_2.2.1 model (Beltman et al., 2006). TWA7d concentrations represent the maximal time-weighted average concentrations calculated with a moving time window for the entire FOCUS simulation period. The results of these simulations are presented in Appendix 48 up to 57. They present details about (i) the crops for which the simulations were executed (ii) the peak and time weighted average concentrations over a period of 7 d, TWA7d, and (iii) their main contributing entry route (spray drift deposition or drainage). These Appendices are input files for the Fortran program, which calculates the concentrations at the nine abstraction points on the basis of the edge-of-field concentrations.

Furthermore the crops of the GAP sheets were categorized into the GeoPEARL crop groupings, presented in Appendix 37, to be able to calculate their relative crop areas. Appendix 58 presents the f_use_intensity and the RCA (Relative Cropped Area) factors are presented in Appendix 59. The data of Appendix 59 show that 'Grass' covers the largest surface areas, followed by 'Cereals', 'Sugar beets ' and 'Potatoes' in most intake areas. The $f_{add\_dilution}$ factor was not included in all calculations. Only for the evaluation of the six negative cases in the Andijk abstraction point it was considered, so after having finalized all calculations.

Appendices 60 up to 69 present the final calculation results, the estimated concentrations in the nine abstraction points. The results show that the edge-of-field concentrations may be diluted by a factor of 2 to 3 up to a factor of 30 or more, on their way towards the abstraction points.

4.6 Comparison of calculated and monitored concentrations

Initially, PEC calculations were done for the D1 and D3 FOCUS ditch scenarios, being the most representative and protective scenarios of the existing FOCUS ditch scenarios for agriculture in the Netherlands. Tier I concentrations were calculated on the basis of their instantaneous global maximum concentrations or their maximum 7d time weighted average concentrations (Appendices 48 to 57).

We compared the calculated concentrations at the abstraction points with the monitored concentrations, considering only measured concentrations above 0.1 μg/L, because the calculated $PEC_{Tier\ I}$ concentrations represent realistic worst case concentrations and not average concentrations at the abstraction points. In Table 4.4 the 13 selected positive and negative cases are compared. In grey cells correspondence is not satisfactory: the simulated and monitored concentrations are not on the same side of the 0.1 μg/L standard.

Next, we assessed which $PEC_{Tier\ I}$ (based upon the D1 or D3 global maximum or TWA_{7d} concentration) corresponded best with the monitored concentrations. We found that the D3 ditch peak concentration represents best the monitored concentrations for positive and negative cases at the abstraction points (Table 4.5). Therefore the D3 ditch global maximum peak concentration was selected in the calculation of the concentration in the nine abstraction points, the $PEC_{Tier\ I}$.

Table 4.4. Overview of monitored concentrations and simulated concentrations for selected substance - abstraction point combinations. In this table $PEC_{Tier\ I}$ have been calculated on the basis of four different edge-of-field concentrations, namely the D1 and D3 ditch peak and maximum TWA7d concentrations. Grey cells correspond to cases where simulated and measured concentrations do not correspond, i.e. are not both smaller or greater than 0.1 ug/L. (The factor $f_{add\_dilution}$ = 1 for all abstraction points.)

	$PEC_{Tier\ I}$ (µg/L)				PEC monitoring (µg/L) *
	D1 peak	D1 TWA7d	D3 peak	D3 TWA7d	
Positive cases					
MCPA in the Meuse: N.B. MCPA is also used on hard surfaces, so part of the substance found in surface water may have entered via runoff from hard surfaces.					
Brakel	16.1	15.0	0.179	0.037	7/207 in (0.12-0.42)
Isoproturon in Lobith-Rhine					
Nieuwegein	1.4	1.3	0.029	0.003	81/634 in (0.11-0.51)
Mecoprop in Drentsche Aa					
Drentsche Aa	2.7	3.3	0.18	0.029	10/82 in (0.11-0.25)
Brakel	1.4	1.9	0.12	0.021	6/203 in (0.13-0.38)
Metolachlor in the Meuse					
Petrusplaat	0.091	0.048	0.076	0.010	5/123 in (0.15-0.20)
Negative cases					
Bentazon in Lobith-IJsselmeer Lake					
Andijk	11.4	11.1	0.57	0.38	(0/70)
Dicamba in the Meuse					
Petrusplaat	0.40	0.39	0.036	0.014	0/30 in 2000-2004 and 3/73 in (0.25-1.1) in 2000-2006
MCPA in Lobith-IJsselmeer Lake N.B. MCPA is also used on hard surfaces, so part of the substance found in surface water may have entered via runoff from hard surfaces.					
Andijk	28.6	27.7	0.31	0.065	0/63
Mecoprop in Lobith-IJsselmeer Lake					
Andijk	1.5	2.5	0.21	0.035	0/64
Metazachlor in the Meuse					
Petrusplaat	1.5	1.5	0.024	0.005	0/122
Metoxuron in Lobith-IJsselmeer Lake					
Andijk	0.028	0.015	0.027	0.003	0/61
Metribuzin in the Meuse and in Lobith-IJsselmeer Lake					
Petrusplaat	0.57	0.56	0.008	0.001	0/110
Andijk	0.83	0.81	0.012	0.002	0/59
Terbutylazin in Lobith-IJsselmeer Lake					
Andijk	1.5	1.5	0.030	0.004	0/60

* (n/N in (a-b) with n - number of measurements in interval a-b µg/L for positive cases or n/N < 0.1 µg/L with n – number of measurements above 0.1 µg/L for negative cases, and N – total number of measurements at abstraction point)

Table 4.5. Overview of correspondence between monitored concentrations and calculated concentrations at the abstraction points for the 4 positive and 9 negative selected cases. The numbers correspond to the number of cases where both monitored and calculated concentrations at the abstraction point were either above or below the 0.1 µg/L drinking water standard

$PEC_{Tier\ I}$ estimated based upon:	Positive case	Negative case	Total of positive and negative cases
D1 ditch peak	4	1	5
D1 ditch max TWA7d	4	1	5
D3 ditch peak	3	6	9
D3 ditch max TWA7d	0	8	8

Next, we compared the calculated $PEC_{Tier\ I}$ (so based upon the D3 ditch global maximum concentration) into more detail with the concentrations measured at the abstraction points for the positive cases (Fig. 4.4). In three of the five cases, namely MCPA at Brakel and mecoprop in Drentsche Aa and mecoprop at Brakel, the $PEC_{Tier\ I}$ is calculated to exceed the 0.1 µg/L standard and this corresponds to the monitoring data. However, for isoproturon at Nieuwegein and metolachlor at Petrusplaat the simulated $PEC_{Tier\ I}$ concentrations are below 0.1 µg/L standard, while the monitoring data indicate that the 0.1 µg/L standard was exceeded in a number of cases. In Chapter 4.6.1. and 4.6.2. we consider the two cases not showing correspondence into more detail.

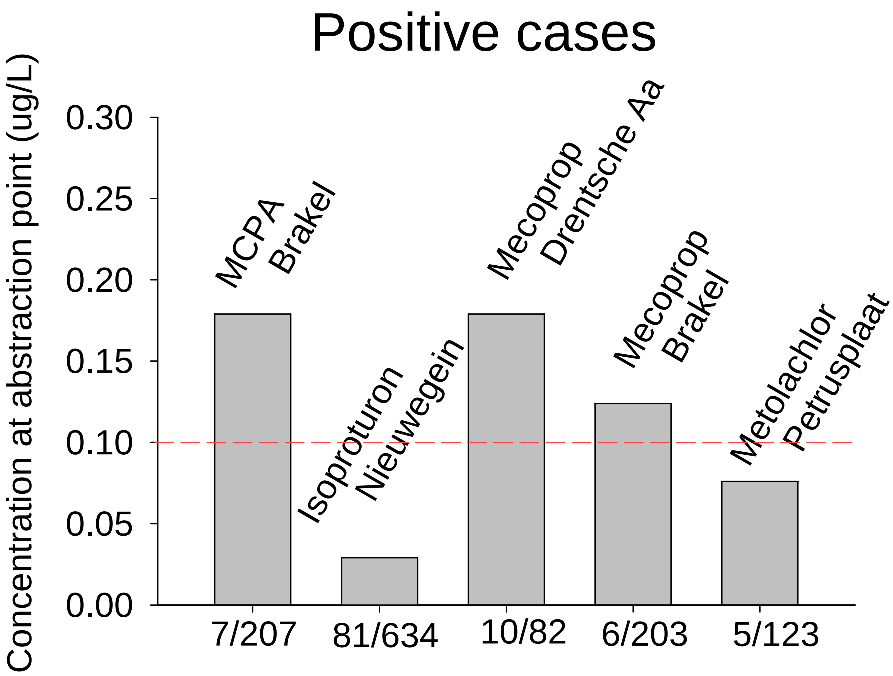


Figure 4.4. Calculated concentrations for the five cases intially classified as positive cases, i.e the selected substance - abstraction points combinations where use in the Dutch part of the intake area leads to exceeding the 0.1 µg/L standard at the abstraction point. The numbers under the bars indicate the number of values above the 0.1 µg/L standard divided by the total number of measurements at the abstraction points. Values refer to the period 2000 up to 2006 included. (Calculations include a factor $f_{add\_dilution}$ = 1 for all abstraction points).

4.6.1 Isoproturon at Nieuwegein (Rhine)

For isoproturon in the Rhine a RIZA report (Breukel et al, 2002) investigated the occurrence and causes of the presence of isoproturon in the Rhine, including the stretch Lobith-Nieuwegein. It stated that in normal situations the river flow in the Bovenrijn is about 2000 m^3/s, while only about 20 m^3/s is added by lateral inflow at the stretch Lobith-Nieuwegein. These numbers indicate that relatively little water originates from the Netherlands and that Dutch agriculture should contribute a large isoproturon mass to the river water in order to exceed the 0.1 µg/L value in Nieuwegein, if the concentrations are below the 0.1 µg/L in Lobith. This seems not very plausible. The authors state in their report that loads and concentrations measured in Nieuwegein originate almost entirely from Germany, and result from diffuse pollution resulting from agricultural use in Germany. They based their conclusions on detailed monitoring data in both Lobith and Nieuwegein, as well on monitoring data in the German tributaries immediately upstream of Lobith, the Lippe and the Erft, which both showed elevated isoproturon concentrations. So, the resolution in time of the data presented in Appendix 22 for isoproturon in Lobith proved to be insufficient. Therefore, initially the Working Group was unable to show that the exceedance existed already in Lobith and thus originated from abroad. So, initially the Working Group erroneously concluded that probably the use of isoproturon in the Dutch part of the intake area leads to exceeding the 0.1 µg/L standard in Nieuwegein, but the final conclusion is that isoproturon at Nieuwegein is not a positive case, because it is not plausible that isoproturon use in the Netherlands leads to exceeding the 0.1 µg/L standard. This conclusion increased the confidence of the Working Group in their calculation method, as the calculation method resulted in a concentration lower than 0.1 µg/L.

4.6.2 Metolachlor at Petrusplaat (Meuse)

Measured concentrations of metolachlor at Petrusplaat do not correspond with the Tier I calculations. Therefore, the Working Group re-examined the monitoring data of Appendix 19. Figure 4.5 presents the five measurements above 0.1 µg/L in Petrusplaat, on which the Working Group classified metolachlor in Petrusplaat as a positive case. It also presents the measured concentrations in Eijsden as well as the dates on which the samples were taken. Distance between Eijsen and Petrusplaat is approximately 150 km, which implies that water travels a certain period between Eijsden and Petrusplaat. Figure 4.6 presents the river flow in the Meuse during the periods the five exceedances were measured. These are in the range of 40 to 100 m^3/s. These are the lower end values for river flows at Eijsden, which may rise up to a few 100 m^3/s during the autumn and winter months with peak river flows up to 1500-2500 m^3/s. At low river flows locks in the Meuse are most of the time closed trying to maintain the water level to enable shipping. Therefore the travel time of the water between Eijsden and Petrusplaat varies between several days up to several weeks. This means that three measurements in Eijsden, 11 June and 9 July in 2002 and 10 June in 2003, do not represent the concentration measured in Petrusplaat at those same dates. For the measured 0.15 µg/L concentration at 10 July 2001 in

Petrusplaat, no corresponding measurement in Eijsden exists. So, for all five measured exceedances in Petrusplaat no corresponding measurements in Eijsden exist. Therefore, it is impossible to make sound conclusions whether the increased metolachlor concentrations in Petrusplaat are due to Dutch contributions or whether the metolachlor originated from locations upstream of Eijsden. The Working Group concluded that metolachlor in Petrusplaat is a positive case that is too 'weak' to invalidate the Tier I calculation method for the concentration at the abstraction point, which is presented in section 4.1.

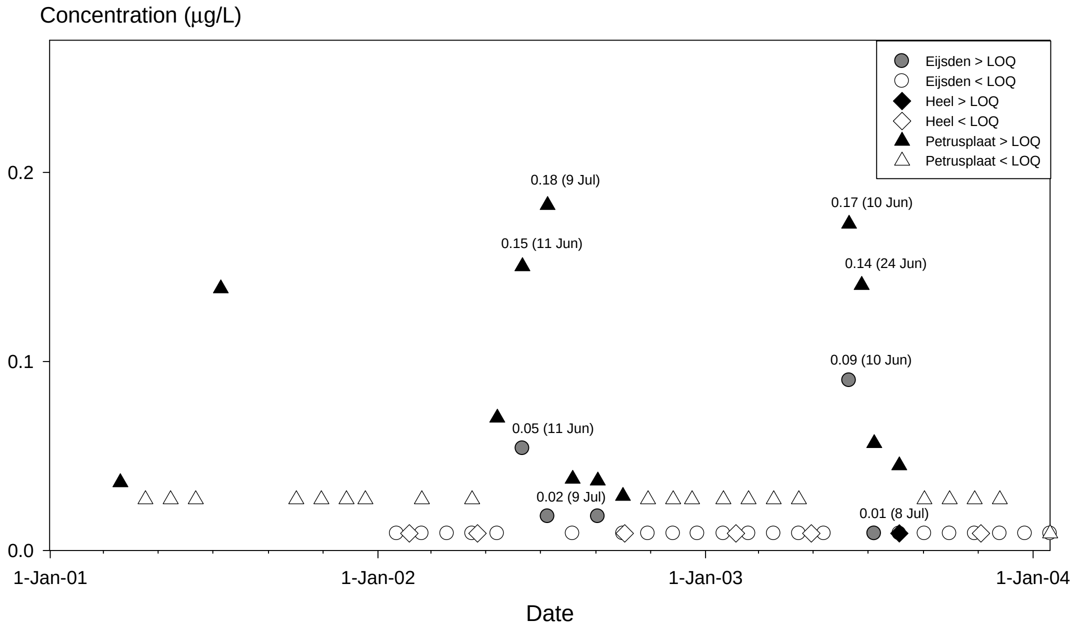


Figure 4.5. Concentrations S-metolachlor in the Meuse, measured at Eijsden, Heel and Petrusplaat. During the entire monitoring period 2000-2006 the 0.1 µg/L standard was exceeded five times at Petrusplaat; the concentration values and dates of exceedances in 2002 and 2003 are indicated in this graph. Four measurements in Eijsden close to or at these dates have been marked as well. (S-metolachlor, the active isomer, corresponds to 0.9 measured concentration metolachlor)*

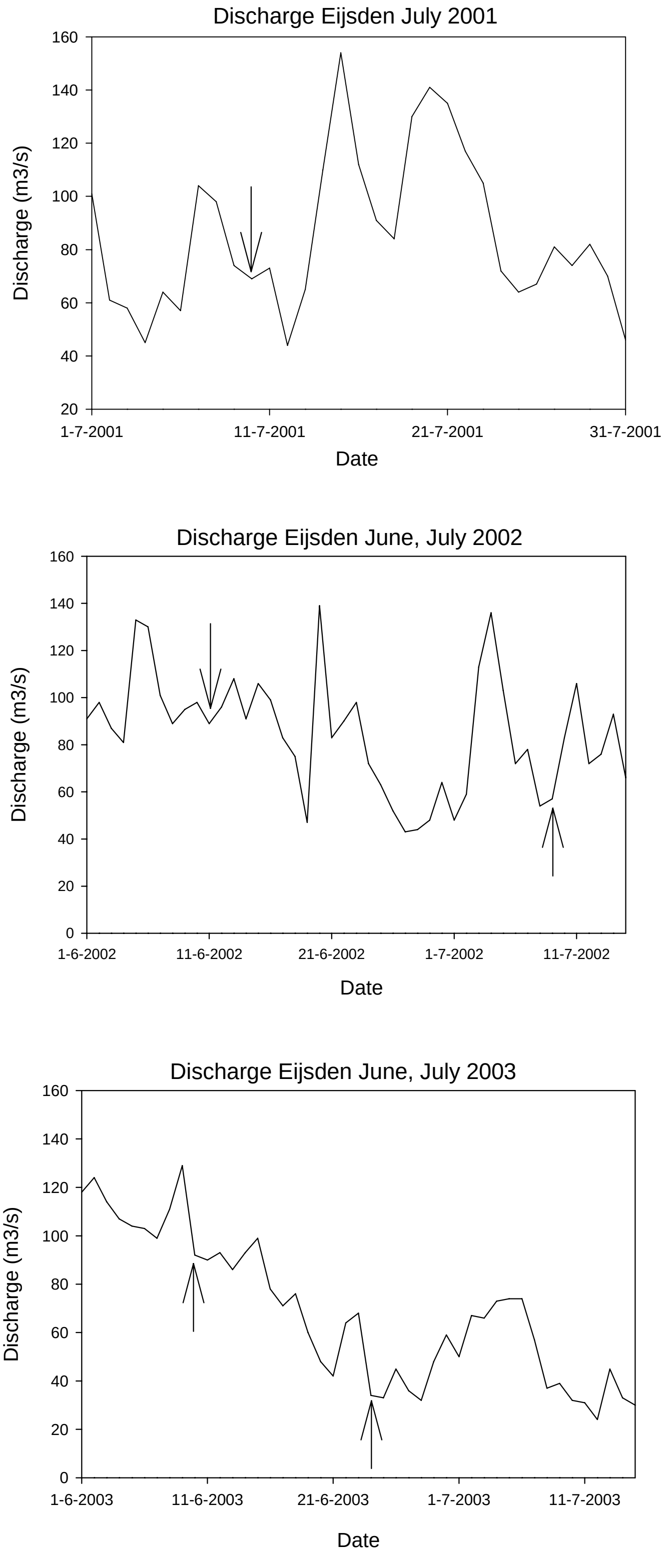


Figure 4.6. River flow of the river Meuse at Eijsden. The arrows indicate the river flow at the dates metolachlor concentrations exceeded the 0.1 µg/L standard at the more downstream location of Petrusplaat.

In Figure 4.7 the negative cases are considered into more detail than in Table 4.4. Figure 4.7 shows that in six of the nine negative cases (namely dicamba, metazachlor and metribuzin in Petrusplaat and metoxuron, metribuzin and terbutylazin in Andijk) the $PEC_{Tier\ I}$ is calculated to be lower than the 0.1 μg/L standard and this corresponds to the monitoring data. However, in three negative cases the calculated concentrations are above the 0.1 μg/L standard. All three cases concern the abstraction point in Andijk, where surface water is abstracted from the IJsselmeer Lake for drinking water production. The $PEC_{Tier\ I}$ values of Figure 4.7 were obtained with $f_{add\_dilution}$ is 1 (its default value), so dilution in the IJsselmeer Lake is not taken into account in the shown values. When we do apply the dilution factor of 6 however, correspondence in all six cases in Andijk is good and so the Tier I calculation method results in a satisfactory correspondence between measured and calculated concentrations at abstraction points.

The Working Group realised however that the Tier I calculation method was tested for only two abstraction points, Petrusplaat and Andijk. Therefore the Working Group reconsidered the selection of negative cases in chapter 4.4, trying to find one or more negative cases. Linuron in the intake areas of the Meuse, Lobith-Rhine and Drentsche Aa might have been a candidate, but it was left out because it has no substantial use in the intake areas mentioned, and so, it is not a valuable negative case. So, the Working Group was unable to identify more negative cases than the nine cases presented in Figure 4.7.

Note that the negative case at Petrusplaat is a negative case on basis of the 2000-2004 monitoring data. In 2005 and 2006 three measurements are above the 0.1 μg/L standard. However, dicamba was not analysed at the border, in Eijsden. Therefore it is not possible to establish whether Dutch agriculture did (e.g by an increase in maize with dicamba treatments) or did not result in exceeding the 0.1 μg/L standard. So, dicamba at Petrusplaat cannot be classified as a positive case. Based upon the five years 2000-2004 with no concentrations exceeding the 0.1 μg/L standard, the Working Group decided to keep dicamba in Petrusplaat as a negative case for the period 2000-2004.

So, taking the additional dilution in the IJsselmeer Lake into account for six of the nine cases, correspondence in the nine negative cases is good.

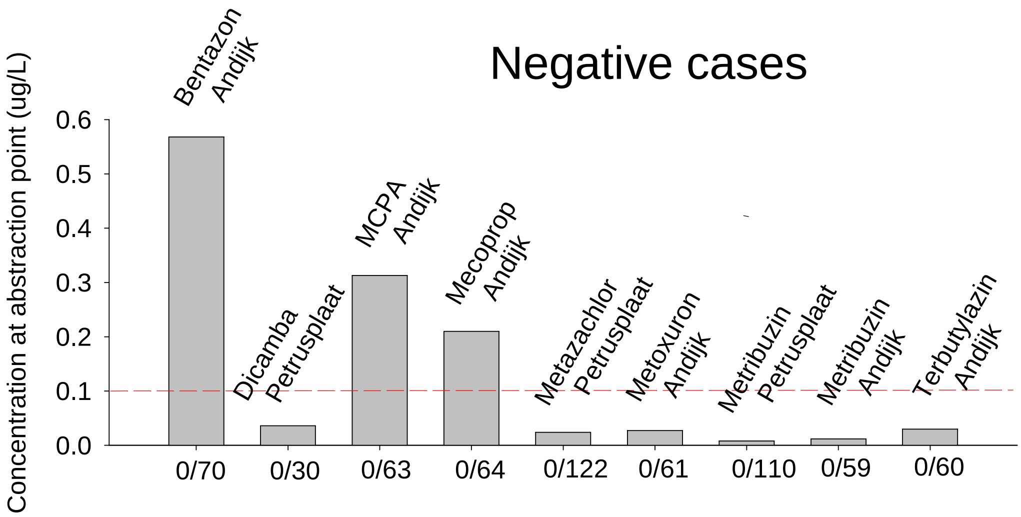


Figure 4.7. Calculated and measured concentrations for the nine negative cases, i.e. the selected substance - abstraction points combinations where use in the Dutch part of the intake area does NOT lead to exceeding the 0.1 µg/L standard at the abstraction point. The numbers under the bars indicate the number of values above the 0.1 µg/L standard divided by the total number of measurements at the abstraction points. Values refer to the period 2000 up to 2006 included, except dicamba – Petrusplaat, where values from 2000 up to 2004 included are given. (Calculations include a factor $f_{add\_dilution}$ = 1 for all abstraction points).

4.7 Conclusions

Initially five positive cases were identified by the Working Group. One positive case (isoproturon at Nieuwegein) turned out not to be a good positive case as more detailed information showed that isoproturon in the Rhine originated from Germany and so, in fact it did not fulfill the criteria for being a positive case. The other positive case (metolachlor at Petrusplaat) was too weak for a good test of the calculation method, because there were no corresponding measurements at the border to confirm that the metolachlor found at Petrusplaat originated from Dutch agriculture and not from Belgium or other countries. For the remaining three positive cases calculated $PEC_{Tier\ I}$ concentrations exceed the 0.1 µg/L standard, similar to the concentrations monitored at the abstraction points for the period 2000-2006 and the concentrations result from Dutch contributions. So, calculation results correspond with the monitoring results.

Nine negative cases were identified by the Working Group. Six of these were however located in Andijk, where water is abstracted from IJsselmeer Lake. This abstraction point is a less suitable case for testing the Tier I calculation method, as the dilution in the IJssemeer needs to be estimated. By adding the $f_{add\_dilution}$ factor of 1/6 to the Tier I Calculation method the Working Group attempted to take the IJsselmeer Lake into account. Next to Andijk, only three other negative test cases remained, all at Petrusplaat. For these three cases, calculated $PEC_{Tier\ I}$ concentrations are below the 0.1 µg/L standard, similar to the concentrations monitored at the abstraction points for the period 2000-2006. So, in these three cases the calculation results correspond well with the monitoring results.

The final conclusion is that the Working Group could only identify six relatively strong cases to test the proposed calculation method for Tier I Agricultural use, after scrutinizing all available monitoring data for the period 2000-2006 of the nine abstraction points in the Netherlands. Three positive cases and three negative cases were tested. In all these six cases calculated Tier I concentrations at the abstraction point were on the same side of the 0.1 μg/L standard as the monitored concentrations. An additional six negative cases were found at the abstraction point of Andijk in the IJsselmeer Lake. Tier I calculated concentrations of three substances were lower than 0.1 μg/L even before applying the additional dilution facor of 1/6, but concentrations of three other substances were only below 0.1 μg/L after having applied this factor. So, the proposed calculation method seems a satisfactory calculation method for the first tier of an assessment procedure for pesticides with respect to the drinking water standard.

In view of the limited number of test cases available, the Working Group recommends that every 2 or 3 years the monitorings data of all nine abstraction points are scrutinized to try to identify additional test cases in order to further test the calculation method.

Finally, the Working Group would like to mention that it studied into more detail only those negative or positive cases that did not show the expected correspondence between calculated and monitored concentrations. So, it did not study into more detail the cases where correspondence was as expected. An important item in this respect is the travel time from the border to the abstraction point. This travel time depends upon the river flow and water management practices such as opening or closing the locks in the river and therefore it is variable. The Working Group did not consider detailed data on travel times to check whether measured concentrations at the border and the abstraction points concern the same water mass. Therefore, the Working Group does not exclude, that more detailed study of e.g. travel times, would reveal that some cases might be weak or unsuitable test cases for the Tier I Calculation method.

5 Tier II - Monitoring data

5.1 Monitoring programmes for registered pesticides

5.1.1 Introduction

In Tier II monitoring data are evaluated (see Chapter 3.3). For new compounds, not passing Tier I, a temporary registration may be given, next to the need to monitor concentrations in surface waters post-registration. The Working Group formulated requirements for Post-Registration Monitoring (PRM) in Chapter 5.2. For compounds already used in agriculture and applying for re-registration monitoring data may already exist. The existing monitoring data need to be evaluated, this is treated in Chapter 5.3. Chapter 5.1 gives an introduction into existing monitoring programmes and purposes and some relevant EU Directives.

In the EU Member States several authorities have carried out monitoring programmes to gain insight in the state of pesticide pollution in their country. In the Netherlands for instance monitoring has been carried out by the Ministry of Transport, Public Works and Water Management, and by regional water boards. In addition, monitoring of pesticides is considered very important by the Dutch Association for the Production of Drinking Water (VEWIN) and individual water production companies analyse periodically their own surface water sources for the abstraction of water intended for the production of drinking water. The relevant data for the current analysis in the framework of the development of a decision tree for drinking water abstracted from surface waters were provided by VEWIN, the individual water production companies, the Ministry of Transport, Public Works and Water Management and the regional water boards.

5.1.2 Monitoring and Legislation of pesticides

Several EU Directives identify the need and use of monitoring results for pesticides. The Drinking Water Directive, originally dated in 1980, has been updated in 1998 with the adoption of 98/83/EC, which defines the standards for pesticides in drinking water. It says that the individual pesticides should not occur in drinking water at a concentration higher than 0.1 μg/L and the total pesticide concentration (sum) should be less than 0.5 μg/L. It has never been made clear how to sum up the concentration of pesticides in surface water, whether or not a simple addition of concentration with different units was considered allowed.

The Council Directive 75/440/EEC defined the criteria for surface water intended for the production of drinking water depending on the level of purification. No level has been defined for individual pesticides, only a sum of total pesticides was indicated (See Appendix 1). With respect to the development of an evaluation tool for the drinking water criterion it was decided that the criterion as laid down in the

Dutch legislation should be followed. Effects of treatment technologies were therefore not taken into account.

In the list of priority substances of the Water Framework Directive (WFD) (2000/60/EC) only two individual pesticides are mentioned that are registered in The Netherlands. Nevertheless, pesticides belong to the group for which monitoring may be appropriate unless it can be shown that a specific substance is not causing concern. An important instrument within the WFD is the possibility to carry out monitoring programmes for substances of concern. There are three categories defined how monitoring could be carried out:

- status and trend monitoring. The aim of the status and trend monitoring is to offer an addition or confirmation of the effect evaluation procedure, an effective and efficient set-up of the monitoring programmes in future or finally to give an evaluation of changes on the long term in the natural circumstances and the human activities.
- operational monitoring. Operational monitoring is needed to define the status of the water bodies for which possibly anthropogenic activities may cause an exceedance of environmental standards, or to evaluate the programmes of measures for these water bodies, or to discover possible discharges of substances of the priority list.
- investigative monitoring. This form of monitoring is carried out if it is unclear why standards are exceeded, if according to the Status and trend monitoring aims are not reached or if there is still no Operational monitoring programme defined.

When monitoring data are to be taken into account in the evaluation of the permissibility of pesticides, these should meet certain criteria. The most important requirements are that the measurements must be reliable and that the causal relationship with the (agricultural) authorised application must be plausible. In other words, it must with reasonable certainty be possible to establish a causal relationship between the use in compliance with legal instructions for use and the monitoring concentration of a pesticides in the environment.

5.1.3 Monitoring and Registration

As shown above it is often difficult to relate a concentration of a pesticide, that exceeds a certain drinking water standard, to the actual application of that pesticide. In such cases it may be necessary to perform a specific research to establish this relation. If a relation between the application of a pesticide and the concentrations measured in surface waters can be identified specific measures may be taken to reduce the levels of the substance under consideration in these surface waters. Then, the monitoring programme is part of the registration procedure and considered in line with the post-registration monitoring described below for new substances. In the Water Framework Directive the monitoring points will become important. A substance may receive a label on relevancy of intake area. Therefore, it is quite important for the sector, especially when a broad spectrum pesticides is needed, not to receive such a label.

5.2 Requirements for Post Registration Monitoring Data

5.2.1 Introduction

The instrument of post-registration monitoring (PRM) is a higher tier instrument of the registration process and is used in a few cases at the re-registration of substances. It is proposed that PRM will also be used as a final decision making option if substances do not meet the criteria as defined in this report for the estimation of the concentration at abstraction points for the abstraction of surface water intended for the production of drinking water. The proposal is depicted in the decision tree, see Chapter 3. It should be kept in mind that PRM can only be requested for new pesticides, for which the risk assessment process shows the need for PRM, or for already registered substances if there has been established a problem for the drinking water abstraction.

The preliminary evaluation system for drinking water from surface water uses a tiered approach with two Tiers. The aim of this advice is to describe the main approach of the evaluation for the monitoring Tier. The burden of proof at this Tier is laid down at the registrant. The registrant and the drinking water companies deliver the measurement data to Ctgb[1]. In addition they inform each other on the results with at least a summary of all results in which the individual analyses are recognisable. The monitoring data are subject to data protection within the framework of the registration process at Ctgb. In agreement with the registrant appointments can be made on the use of the monitoring data outside the registration dossiers.

Ctgb receives every year from the drinking water companies a list of active substances of pesticides that have been determined in concentrations higher than 0.1 μg/L. The drinking water companies receive yearly from Ctgb a list of active substances of plant pesticides for which the monitoring Tier has been shown necessary.

5.2.2 Where to monitor?

There are at the moment nine abstraction points in the Netherlands laid down in the register of protected areas under the Water Framework Directive (Fig. 2.1). Monitoring should take place at the abstraction points in the intake area where according to Tier I problems may occur or where measurement data are already available that have shown problems. If the registrant is able to prove using a risk evaluation that research at less abstraction points is still representative for all abstraction points where measurement data are needed or the measurement data may be considered as worst case, it is considered appropriate to use only measurements at these representative abstraction points. If appropriate, e.g. in case of upstream use, also measurements are carried out at the other relevant points in the intake area under consideration, e.g. at the national border (Lobith/Eijsden).

1 In case the Water Framework Directive may result in an obligation to monitor by the water managers at the point of intake also these data are exchanged.

5.2.3 How frequently should be monitored?

The mean hydrological residence time in the Dutch part of the intake area flowing to an abstraction point is in the order of magnitude of a few days to a couple of weeks. This is the reason for the following frequency of monitoring:

a) once to maximally twice a week in the period of application and during the two successive weeks after the application (in case of spray drift or point sources of discharge);
b) every month up to a year after application and every two weeks in the three monthly period in which leaching may be expected, unless it can be justified that it is not necessary (in case of a contribution via e.g. drain pipes);
c) the minimal frequency is 13 times a year.

5.2.4 How to monitor/analyse?

Abstraction points are generally large water systems. Therefore it is considered that it is sufficient to take random samples in the water abstracted. It has to be demonstrated that the sampling method used and the related method of extraction and analysis lead to a good recovery of the substance. This means that *Level of Quantification* (LOQ)[2] needs to be at the level of 0.05 μg/L. The sampling, extraction and analysis have to be performed under GLP requirements. All values in between *Level of Determination* (LOD)[3] and LOQ are set to the actual values measured. If the actual concentration measured has not been reported, use 0.5 * (LOQ + LOD). All samples lower than LOD are set to 0.5 * LOD.

5.2.5 In which year to start monitoring?

The percentage of surface area treated in the intake area plays a role in Tier I. Normally, it takes several years before a new substance is well established in the market and so, the percentage treated area reaches its maximum or 'equilibrium'-level a few years after its introduction on the market. Nevertheless, the monitoring should start at the first year, unless the registrant shows based on Tier I and based on the expected percentage of area treated that the first two years risks for the drinking water abstraction may reasonably be ruled out. In that case, the monitoring may start in the third year.

5.2.6 How to judge whether a substance will exceed the drinking water standard?

The Working Group proposes to follow the policy below. The protection aim of the drinking water standard is that every single abstraction point is protected. For the

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[2] A pratical LOD is the lowest level at which an analyte can be reliably detected in matrix at more than ~90% of the time (FOCUS, 2006)

[3] A practical LOQ is justified by demonstrating acceptable recovery and precision data for control samples fortified at that level (FOCUS, 2006)

purpose of the registration evaluation, the protection of each single abstraction point, according to Appendix I of the Decree on Quality Standards and Measurements in Surface Waters (BKMO), the following guidance is valid:

Taking into account the response to the question whether or not the quality assurance standards are fulfilled it has to be shown whether or not the standard has been exceeded. The following cases should not be taken into consideration:

a) the standard is exceeded because of extreme weather conditions or extreme hydrodynamic circumstances as may be concluded from high concentrations of suspended matter,

b) the standard is exceeded once per calendar year and per parameter for parameters that have to be measured 12 times a year, if at least 11 sampling points are available amongst which standards were not exceeded as mentioned under a) and if the standard was not exceeded by more than 50% of the standard.

The minimum number of measurements in a calendar year is thirteen (13). If, because of exceptional circumstances, less than 13 measurements are available the maximum value is taken as the guidance value. In cases where 12 measurements are available the approach under b) will be followed, where exceeding 50% of the standard means that the maximum should be smaller than 0.15 μg/L. If more than 13 measurements are available the 90-percentile is calculated for the calendar year under consideration and a deviation is taken from what has been pointed out under b). In case of post-registration monitoring (PRM), five (5) years of successive monitoring should become available[4] preceding the termination of the registration period, unless the registration period is shorter than 5 years. For the whole period the 90-percentile is calculated as well as the 90-percentile for each individual year. If the 90-percentile over the 5-year period exceeds the 0.1 μg/L then the registration is at stake. If one or several percentiles of the individual years exceed the standard then a problem analysis will be carried out. Also one single case of exceeding the 0.1 μg/L will lead to a problem analysis. If the problem analysis concludes that the exceedance has been caused by an application according to the Good Agricultural Practice (GAP) the GAP should be adapted. The problem analysis will be sent to the Steering Committee for Plant Protection Products and Biocides and/or National Water Policy Committee (LBOW).

The level of 90% was chosen by the group because it is a realistic worst case approach, not only for the 5-year period but also for the individual years. If it is not possible anymore to adjust the GAP the registration is withdrawn.

5.3 Evaluation of existing monitoring data

As described in 5.1.1 en 5.1.2 several authorities and the Dutch drinking water production companies carry out monitoring programmes in surface waters. In these programs Water Boards and the Ministry of Transport, Public Works and Water Management focus on the quality of surface water on a local and national scale. Drinking water production companies are mainly focussed on the quality of surface water at drinking water abstraction points. Many thousands of measurements in surface water become available this way every year. The measurements from these

[4] Covering all meteorological circumstances.

monitoring programs may be taken far away downstream from the location where pesticides are actually applied. However, many measurements are actually done from samples taken close to agricultural area.

In general. monitoring data in surface waters are used for two purposes. The primary target is to determine whether the quality of the surface water meets the standards set for drinking water production and the goals of the European Water Framework Directory (WFD). The second target is to evaluate the drinking water standard. The Dutch Association for the Production of Drinking Water (VEWIN) informs the Dutch Board for the Authorisation of Plant Protection Products and Biocides (Ctgb) every year on pesticides that are found in concentrations higher than the drinking water standard of 0.1 μg/L. Also, monitoring data may be very helpful in the evaluation of agricultural use of pesticides. Moreover, high concentrations of pesticides near an abstraction point might be a signal that there is a risk to the public, using drinking water that is prepared from this surfacewater. Measurements in agricultural area can be very helpful to determine what the reason is for exceeding the drinking water standard at the abstraction point.

In the Netherlands two useful tools are developed to make a sound evaluation, based on monitoring data. A guideline is available on how to perform monitoring of pesticides in surface water and there is also a guidance on how to make a problem analysis to reveal the cause of the pesticide pollution. Both tools are developed by the Ministry of Transport, Public Works and Water Management, together with the water authorities and the Dutch Crop Protection Association. The guidelines help users to gather stepwise information that assists in underpinning the causal relationships between measurements in surface water and the application of pesticides. If it is concluded that the exceedance of the drinking water standard is caused by an application in accordance with the principals of Good Agricultural Practice (GAP), the GAP should be adapted. The results of the problem analysis will be sent to the Steering Committee for Plant Protection Products and Biocides and/or National Water Policy Committee (LBOW).

6 Discussion

The Tier I Calculation method only considers agricultural use according to Good Agricultural Practices

In this report an assessment scheme has been developed to evaluate the use of pesticides in agriculture according to Good Agricultural Practices only. This implies that e.g. use not following the instructions of the label is not evaluated by the proposed Tier I Calculation method. Nor are accidental releases e.g. spills running off farmyards or water originating from tank cleaning or other point sources evaluated. Emission from glass houses was not considered by this Working Group as a special Working Group for this type of agriculture has recently started in the Netherlands.

The Tier I Calculation method only considers the entry routes of spray drift deposition and drain pipes

Pesticides may enter surface waters by various routes after being used in agricultural fields. In the proposed Tier I calculation method pesticides only enter the water by spray drift deposition or by drainage via drain pipes. So entrance of pesticides by runoff or associated to eroded soil has not been considered to be of significant relevance for the Netherlands. Nor has atmospheric (dry or wet) deposition of pesticides been included.

Why are only a limited number of refinements agreed by the Working Group?

The Working Group judges that there should be a balance between the conceptual level of the Tier I Calculations and the refinement options. In view of the simplistic and relatively non-mechanistic way in which the Tier I Calculation method calculates the concentration at the abstraction point, the Working Group agreed on a limited number of refinements only as mentioned in chapter 4.2.

The Tier I Calculation method calculates the expected pesticide concentration at the abstraction point

The proposed Tier I Calculation method calculates the pesticide concentration expected to occur at the abstraction point. So, concentrations at any other location within the intake area are not assessed. The reason is that the Calculation method is aimed to evaluate the formulated protection goal, which is the pesticide concentration at the abstraction point, and not somewhere else.

Is the scientific underpinning of a value of 1/6 for the fadd_dilution for Andijk sufficient?

Not all Working Group members agreed to the value of 6 for additional dilution at Andijk, (i.e. additional dilution factor, $f_{add\_dilution}$, at Andijk = 1/6). Rijkswaterstaat IJsselmeergebieden came up with a quick estimate of 1.5 and could not support a value of 6. This is based upon the fact that 70% of the water from the IJsselmeer Lake originates from the IJssel, which results in a dilution of 1.5 (Ton de Vrieze, personal communication, 15 Feb 2008). He stated that in a realistic worst case situation mixing is low and depends on the wind. If the wind blows from the East with wind-force 8 a pollution will arrive in about 1.5 d in Andijk, if the wind blows from the East with wind-force 5 a pollution will take about twice as long to arrive in Andijk. Rijkswaterstaat IJsselmeer was not able to come up with a more detailed calculation method to estimate the value of the $f_{add\_dilution}$ factor.

What is the likelihood that a new substance will pass Tier I for all abstraction points?
The Working Group did not assess this. It is possible that one of the abstraction points will results in high Tier I concentrations for many pesticides.

Does the Tier I Calculation method result in a conservative pesticide concentration at the abstraction point, even in 'water-rich' areas in the Netherlands?
The Calculation method contains a factor 0.5 to take into account that only half of the watercourses receive spray drift deposition. The question may arise whether this factor of 0.5 might underestimate the spray drift deposition in areas with very dense networks of watercourses. Based upon the comparison between monitored and calculation concentrations made so far, the Working Group has no indication that the proposed Tier I Calculation method is not conservative enough. The effect of areas with dense watercourse networks may be small, as such areas never cover the entire intake area. Moreover, the proposed Tier I Calculation method contains other conservative elements that may counterbalance the effect of 'water-rich' areas.

See Chapter 4.1: if spray drift deposition is the most relevant entry route for the peak concentration the use-intensity factor of the Tier I Calculation method includes a factor 0.5 based upon the assumption that loading of a ditch at a certain point in time (assuming the application date is the same in the entire area) cannot take place concurrently from areas located left and right from the ditch due to wind blowing from a certain direction.

Size of 'safety' factor in proposed risk assessment scheme for use in Dutch registration procedure is proposed to range in order of 2 to 10, not 100 (See Fig 3.1, Chapter 3.3, PEC final > <u>factor</u>*DWS)
The size of the 'safety' factor to be used when comparing the estimated $PEC_{Tier\ 1}$ at the abstraction point with the drinking water standard has been extensively discussed in the Working group. The Working Group judged a range of 2 to 10 reasonable, and not up to 100. Below we list all arguments, mentioned in the Working Group discussions.

The following discussion points relate to the scientific soundness of the proposed Tier I Calculation method (see Table 4.2 of Chapter 4.3).
key factors in the assessment of degree of conservativeness are (i) the application rate – worst case GAP for each of the relevant crops, (ii) spray drift deposition – 50^{th} percentile and neutral to less conservative for a number of crops and (iii) no additional dilution by the river water crossing the border taken into account.

the overall assessment of conservativeness pointed to approximating an overall 90^{th} percentile probability of occurrence, and not a considerable higher level, e.g. above 95^{th} percentile. So the Working Group considers that the concentration represents realistic worst case conditions and not extreme worst case conditions.

This points towards a ‘safety’ factor on the conservative, i.e. lower side of the proposed range of 2-10.

Discussion points related to the structure of the proposed assessment scheme were:

the comparison between the $PEC_{Tier\ 1}$ at the abstraction and the drinking water standard is done after possible refinements and therefore the factor should be relatively strict, i.e. low. Others disagreed to this point because the Working Group judged only a limited number of refinements acceptable (see Chaper 4.2).

another point mentioned in favour of a relatively strict factor is that the concentrations of Tier I are close to the monitored concentrations, so, there is no indication for a less strict ‘safety’ factor.

More political-socially driven discussion points were mentioned as well. The following items were mentioned:

it should be avoided that the assessment method leads to ‘false positive’ cases, i.e. that substances would be registered in the Netherlands, for which drinking water companies need to make considerable efforts and investments to produce drinking water that fulfill the drinking water standard. Therefore, the ‘safety’ factor should be relatively strict, i.e. have a low value such as 2, or 5.

it should be avoided that the assessment method leads to ‘false negative’ cases, i.e. that substances would be not registered in the Netherlands, while their use would not lead to exceeding the drinking water standard at any of the nine Dutch abstraction points. Therefore, the ‘safety factor’ should have a not too low value (5), but a higher value, i.e. 10.

it is possible to consider the toxicological effect of a substance in the size of the ‘safety’ factor, e.g. a factor of 2 for more toxic substances and a factor of 5 for less toxic substances.

generally speaking a tiered assessment scheme contains various steps going from conservative and cheap to more realistic, less conservative and more expensive. This offers registration applicants the possibility to proceed to a higher tier assessment in case the first, conservative tier cannot be passed. In the current assessment scheme there is however only one tier, implying that not passing this tier means no registration. In order to avoid ‘false negative’ cases the factor should not be selected at a too low value.

7 Conclusions and recommendations

Conclusions

The Working Group developed an abstraction point specific assessment methodology, with concepts that are applicable in other countries than the Netherlands.

The Working Group operationalised the basic principle mentioned in her remit that the methodology should fit within the Water Framework Directive developments by considering measured data in her proposed procedure for registration. In the highest tier monitored concentrations are taken into consideration, either by requiering a post-registration monitoring program, or by considering already existing data from third parties.

The Working Group assessed that the proposed Tier I Calculation method does not represent too 'realistic worst case situations' mentioned in EC Directive 91/414. The Tier I Calculation Method does not build the probability of occurrence up to an extreme level, e.g. above 95th percentile (see Chapter 4). It aims at evaluating a 90th percentile probability of occurrence concentration at the abstraction point. In pesticide risk assessment procedures it is generally accepted that the phrase 'realistic worst case situations' is operationalised by evaluating a 90th percentile exposure (e.g FOCUS, 2001; FOCUS 2000). Note that applying a 90th percentile implies that in some cases the observed concentrations at the abstraction points may be higher than those calculated. An example, mentioned by some Working Group members, may be a small agricultural area that discharges into the main headstream close to the abstraction point.

Monitoring for registration purposes should allow making plausible whether a causal relation exists between the agricultural use and exceeded standard at the abstraction point. The registrant is responsible to procure monitoring data and the data should allow an evaluation of the agreed protection goal, namely protecting every single abstraction point. Exceeding the standard once, if it is lower than 0.15 μg/L is acceptable in case of 12 or 13 measurements per year. If more measurements exist, the 90th percentile should be evaluated. The guidelines proposed by the Working Group follow the Decree on Quality Standards and Measurements in Surface waters (BKMO) as close as possible.

The proposed calculation method is satisfactory for the first tier of an assessment procedure for pesticides with respect to the drinking water standard. Twelve substance-abstraction point combinations confirmed that the concentrations calculated in Tier I corresponded with measurements. For six strong test cases calculated Tier I concentrations at the abstraction point were on the same side of the 0.1 μg/L standard as the monitored concentrations. An additional six test cases were at Andijk, abstracting its water from the IJsselmeer Lake. In three cases calculated concentrations were lower than 0.1 μg/L even before applying the additional dilution facor of 1/6, but in the three remaining cases calculated concentrations were only below 0.1 μg/L after having applied the dilution factor.

Recommendations

The Working Group recommends not to develop any other, intermediate tiers for the risk assessment scheme, but to first gain experience with the current tiers. A possible intermediate tier might consist of distributed hydrological modelling, that should be intake area specific. It is anticipated that developing such an intermediate tier represents a considerable research effort, larger than what has been done by the Working Group so far.

The Working Group made calculations for the test case substances only, so we did not obtain insight in the consequences of the Tier I calculation method for the entire range of registered substances in The Netherlands. We therefore recommend to apply the Tier 1 calculation method to more substances; especially those substances that could potentially exceed the drinking water standard should be assessed, e.g. substances with high application rates and extensive use areas.

The Working Group recommends to replace the spray drift deposition data as soon as better data are available, because the current data represent neutral to less conservative conditions.

The Working Group recommends a value of 5 for the 'safety' factor Y when comparing the estimated $PEC_{Tier\ 1}$ at the abstraction point with the drinking water standard. This means that when $PEC_{Tier\ 1}$ is within the range of 0.1-0.5 μg/L a temporary registration may be granted in combination with a requirement for Post Registration Monitoring. If the $PEC_{Tier\ 1}$ is higher than 0.5 μg/L registration can not granted in view of the Drinking water standard.

Although the Working Group made an inventory of all relevant pesticides concerning the production of drinking water from surface water, only 12 suitable cases could be identified to test the developed Tier 1 Calculation method. After further study only 6 cases were judged to represent strong cases and were retained. Therefore, the Working Group recommends that every 2 or 3 years the monitoring data of all nine abstraction points are scrutinized to try to identify additional test cases in order to further test the calculation method. In this way also the 'safety' factor Y can be re-evaluated as soon as more experience has been gained with the proposed risk assessment scheme. Points of considerations for changing the selected factor could be whether post-registration monitoring revealed high concentrations at abstraction points.

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List of abbreviations

Abbreviation	Meaning
BKMO	Decree on Quality Standards and Measurements in Surface Waters
CBS	Central Bureau of Statistics (Netherlands)
Ctgb	Board for the Authorisation of Plant Protection Products and Biocides (The Netherlands)
DAR	Draft Assessments Report
DG SANCO	Directorate-General for Sanitation and Consumer products
DT50	Degradation time for 50% of the substance, generally in days
EU/EEC/EC	European Union/Economic European Community/European Community
FOCUS	Forum for the coordination of pesticide fate models and their use
g	Gram
GAP	Good Agricultural Practice
HTB	Handbook for the Registration of Pesticides (Netherlands)
Kom	Soil liquid partition normalised to organic matter (dm^3/kg)
L	Litre
LBOW	National Water Policy Committee (Landelijk BeleidsOverleg Water)
LNV	Dutch ministery of Agriculture, Nature and Food Quality
LOD	Level of Determination
LOQ	Level of Quantification
LOTV	Decree on Discharges of Open Cultures and Cattle Farms (Lozingenbesluit Open Teelten en Veehouderij)
LTO	Agriculture and horticulture Organisation (Netherlands)
MACRO	Macropore flow model (model to calculate drainage contribution)
MOS	Margin of Safety
MTR	Maximum Tolerable Residue (µg/L)
PAT	Pesticide Application Timer (process to determine the application)
PEC	Predicted Environmental Concentration (µg/L)
PPP	Plant protection products
PRI	Plant Research International (department of Wageningen University and Research Center)
PRM	Post Registration Monitoring
PRZM	Pesticide Root Zone Model (model to calculate runoff contribution)
RCA	Relative Cropped Area
RIVM	National Institute for Public Health and the Environment
RIZA	Institute for Inland Water Management and Waste Water Treatment (Netherlands)
SWASH	Surface Water Scenario Help (interface around FOCUS scenarios)
SWS	Surface Water Scenario Working Group
t	Time
TER	Toxicity Exposure Ratio
TOXSWA	TOXic Substances in WAter (calculation model for PECs)
TWA	Time Weighted Average
UP	Uniform Principles (Appendix VI of 91/414/EEC)
USES	Uniform System for the Evaluation Substances
VEWIN	Association of Dutch Water Companies (Netherlands)
VROM	Ministry of Housing, Rural Planning and Environment (Netherlands)
VWS	Ministry of Public Health, Welfare and Sports (Netherlands)
WFD	Water Framework Directive

Appendix 1 Tables abstracted from Council Directive 75/440/EEC concerning surface water standards in relation to applied treatment regime

Table A1.1. Mandatory characteristics for surface water intended for the abstraction of drinking water (Appendix II of 75/440/EEC)

Treatment regime applied	A1 Simple	A2 Normal	A3 Intensive
Total pesticides (µg/L)	1	2.5	5

Table A1.2. Description of categories A1, A2 and A3, being standard methods of treatment of surface water into drinking water

Category	Description of treatment
A1	Simple physical treatment and disinfection, e.g. rapid filtration and disinfection
A2	Normal physical treatment, chemical treatment and disinfection, e.g. pre-chlorination, coagulation, flocculation, decantation, filtration, disinfection (final chlorination)
A3	Intensive physical and chemical treatment, extended treatment and disinfection, e.g. chlorination to break-point, coagulation, flocculation, decantation, filtration, adsorption (activated carbon), disinfection (ozone, final chlorination)

Appendix 2 Exposure estimation according to FOCUS SWS

The FOCUS system

The surface water and sediment calculations developed by FOCUS include three progressively refined tiers of evaluation, ranging from initial spreadsheet-based evaluations of potential aquatic concentrations to more detailed mechanistic calculations of drift, runoff, erosion and field drainage loaded into a series of small water bodies (FOCUS, 2001). The initial simulations, termed Step 1 by FOCUS, involve the calculation of a single time series of aquatic concentrations resulting from loading a fixed percentage of the land-applied application rate into an adjacent ditch. Step 2 calculations refine these initial estimates by allowing the simulation of an actual time series of loading events as well as using crop-specific drift values and considering geographic variations in runoff, erosion and drainage. Step 3 calculations are performed using an overall calculation shell called SWASH which controls models simulating runoff and erosion (PRZM), leaching to field drains (MACRO), spray drift (internally in SWASH) and finally aquatic fate in the receiving water bodies, ditches, ponds and streams (TOXSWA). The Step 3 simulations provide detailed assessments of potential aquatic concentrations in a range of water body types in up to ten separate geographic and climatic settings. The resulting surface water concentrations provide regulators and registrants with improved estimates of the potential aquatic concentrations of agricultural chemicals that could result from labelled product use.

In FOCUS SW the PAT tool is designed to ensure applications provide a 'reasonable challenge' in terms of proximity to rainfall. It also eliminates the possibility of applications occurring on rainfall days.

Detailed explanations of the FOCUS SWS models as well as the modelling scenarios, key assumptions, required modelling inputs and model outputs are provided in the respective FOCUS modelling reports (FOCUS, 2002). The FOCUS surface water and groundwater models have been placed on a website (viso.ei.jrc.it/focus/index.htm) where they can be freely downloaded. Users who register with the site are provided with limited technical support and periodic training courses in the use of the FOCUS models are offered by various groups.

The FOCUS Surface Water Scenario Working Group was set up to develop scenarios for the estimation of PECs in surface water depending on the amount of active substances used. A complicating aspect of the Surface Water Scenario Working Group was that the input routes of plant protection products' active substances were depending on the area of use in the European Union and could be of different nature. Figure A2.1 shows the finally selected sites that were considered to represent a wide agricultural area in the European Union. As input routes were defined drainage, runoff and drift. Additional to the modelling of the input routes a modelling of the fate in surface waters itself had to be determined. In Figure A2.2 the structure of the calculation methods is indicated using the different models selected and relating to these input routes, drainage, runoff and drift. Finally, it was chosen to parameterise one model for each input route and one model for the concentration determination in the receiving waters, which were also thought to be of different nature, as there is a variety in types of surface waters. Three types were distinguished a ditch, a stream and a pond, each of which had different hydrological characteristics. The models applied in this context are also supposed to describe the state-of-the-art in their own scientific field and therefore considered to be appropriate for application within the FOCUS framework.

The models proposed by the FOCUS Working Group are the following:
1. Drift calculator. The drift calculator is used to determine the amount of drift after the application of a product according to the label and dependent of the application technique. The drift calculator is based on drift research carried out in Germany and reworked to make them applicable for a wider range of application situations. The main governing parameters determining drift are wind speed, boom height and droplet dimensions.
2. MACRO. The Swedish model MACRO (macropore flow) is used to determine the contribution of drainage to the concentration level in surface waters. The model is describing the leaching process of chemicals to lower depths in soil due to the water movement. It can take into account macropore flow as it distinguishes between different dimensions of soil particles.
3. PRZM. The US model PRZM (Pesticide Root Zone Model) is used to determine the effect of runoff and erosion to the concentration in surface waters. The model was validated quite extensively in the US for different runoff situations. It is based on the Modified Uniform Soil Loss Equation (MUSLE), which is an experimental equation not necessarily describing physical processes.
4. TOXSWA. Finally, the Dutch model TOXSWA is used for estimating the resulting concentration in the three types of surface waters, ditch, stream and pond. TOXSWA stands for TOXic Substances in WAter and is able to deal with the combined input of the processes described above in a dynamic way. This means that the resulting concentration is calculated as a function of time.

An additional tool in FOCUS Surface Water Scenarios is the Pesticide Application Timer (PAT). PAT takes care of an optimal timing of the application. The main reason for the introduction of PAT is to make the application independent of the user. Registration authorities have the idea to use realistic worst-case situations and applicants may want to use best cases. By using PAT both possibilities are excluded and the application is only dependent on the rainfall pattern as it is inserted in the meteorological file of the scenario. The application takes place within a user defined application window and preferably about 2 days before a rainfall event. If that is not possible than a 1-day window is used. The procedure to always find a solution is described in FOCUS (2001).

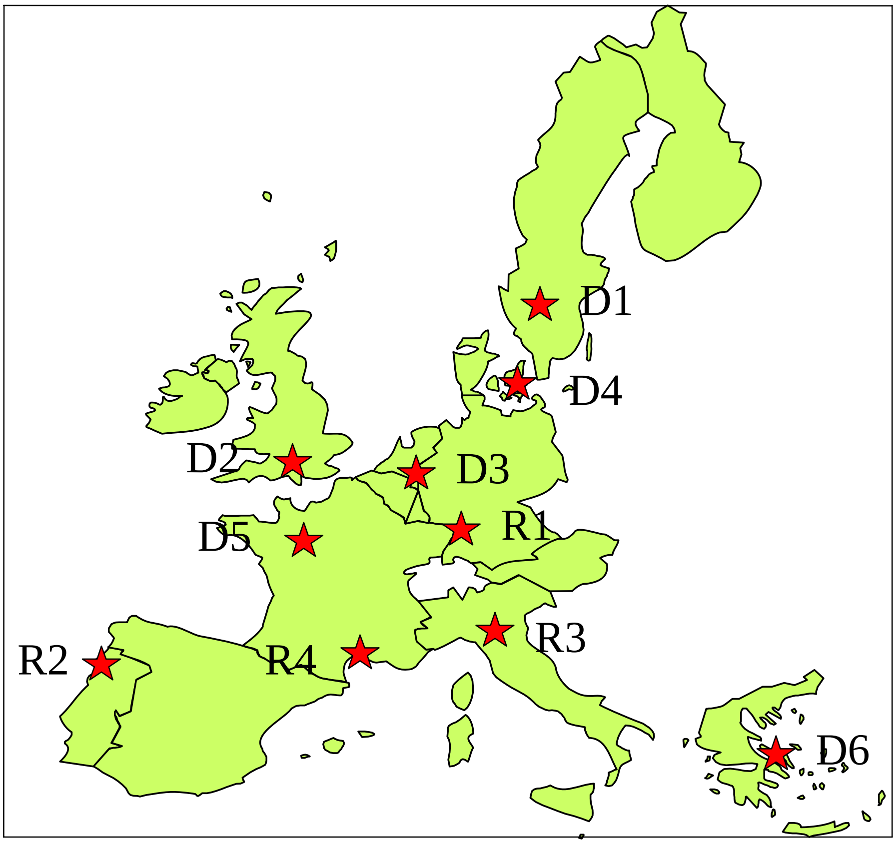


Figure A2.1. Ten representative EU scenarios for surface water PEC calculations (D = drainage, R = run-off).

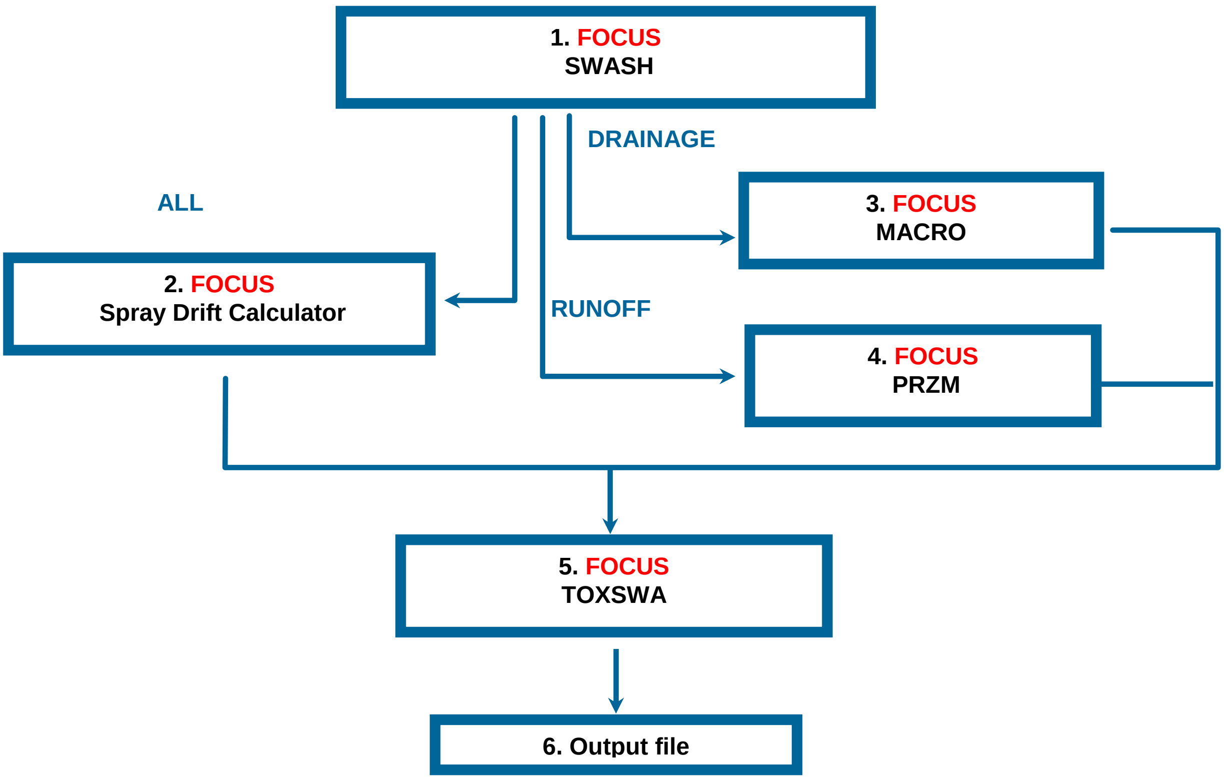


Figure A2.2. Operational structure of FOCUS Surface Water Scenarios

The surface water system does not allow an individual application of the models. They have to act in harmony, so to say. In Figure A2.2 the way of working is indicated using the different models in the right order. The FOCUS SWS group has defined a governing shell called SWASH to take care of the correct application of the system. The user is guided through the system by SWASH, which stands for Surface WAter Scenarios Help.
Finally, in Figure A2.3 the relevance of scenario D3 is illustrated for the Dutch situation. As can be seen from this figure several parts of the Netherlands are considered to have valid conditions for this scenario (FOCUS, 2001).

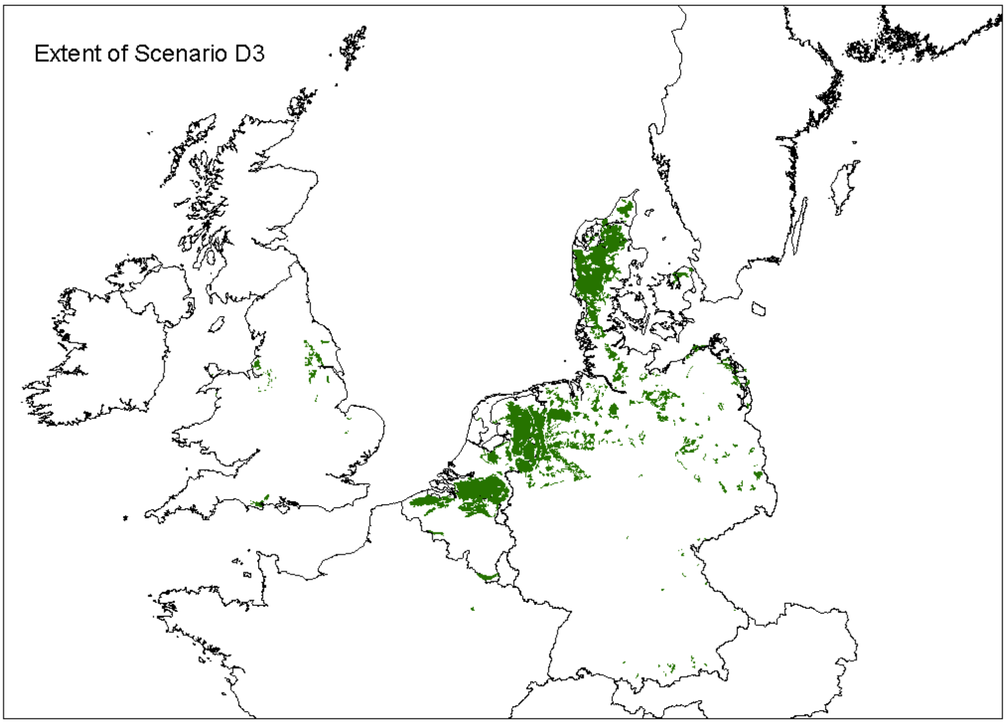


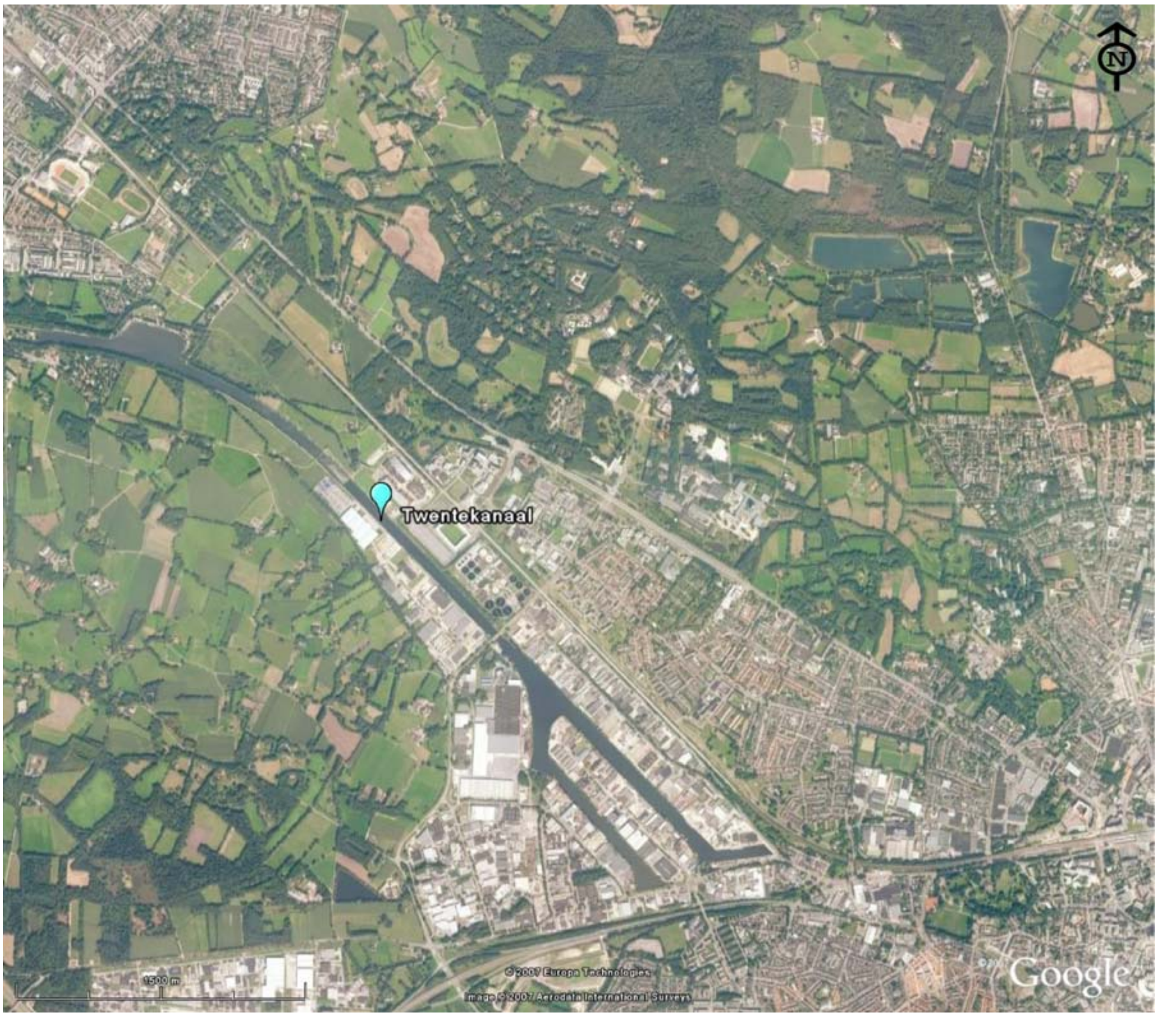
Figure A2.3. Extent of scenario D3 in the European Union.

Appendix 3 Description of the nine locations where surface water is abstracted for the production of drinking water in the Netherlands

<u>Korte beschrijving drinkwater innamepunten</u>
Deze bijlage is opgesteld en aangeleverd door KIWA Water Research

PWN: Andijk
PWN neemt in Andijk in de kop van Noord-Holland oppervlaktewater in uit het IJsselmeer. Het IJsselmeer is het grootste zoetwatermeer van Nederland. Het heeft een oppervlakte van 113.600 ha, een gemiddelde diepte van 4.4 m en een verblijftijd van 3-5 maanden. Het spuiregime van het IJsselmeer is gericht op handhaving van het streefpeil. Water wordt hoofdzakelijk aangevoerd via de IJssel (70 %) en het Zwarte Water (10 %) en via de spuisluizen in de Afsluitdijk geloosd op de Waddenzee (zie Beheersverslag Rijkswateren IJsselmeergebied 2002-2004; RWS, 2006). PWN heeft twee innamepunten aan het IJsselmeer die op ongeveer een kilometer afstand van elkaar liggen (WPJ en Andijk). Het ingenomen water wordt in het waterwinstation 'prinses Juliana' in Andijk voorgezuiverd, waarbij onder andere gebruik gemaakt wordt van een bekken met een verblijftijd van 40 dagen. Een deel van het ingenomen water wordt na zuivering direct naar klanten in Noord-Holland gedistribueerd. De rest wordt in het duingebied bij Castricum en Heemskerk geïnfiltreerd (via open en diepinfiltratie). Hoewel het IJsselmeer een lange verblijftijd heeft, is aangetoond dat (chloride) pieken in de Rijn en IJssel ook, na circa 3-4 weken, worden aangetroffen bij Andijk.

Vitens: Twentekanaal
Vitens neemt sinds de jaren vijftig van de vorige eeuw oppervlaktewater in uit het Twentekanaal (kanaalpand Hengelo-Enschede) voor de productie van drinkwater. Het Twentekanaal wordt voornamelijk gevoed met water uit de IJssel. Het kanaalpand tussen Hengelo en Enschede is een stilstaand watersysteem dat ongeveer 5 km lang en is maximaal 3-5 m diep en 50 m breed. Het water uit het Twentekanaal wordt via voorzuivering aan de Elsbeekweg, gevolgd door bodempassage en nazuivering aan de Weerseloseweg, geschikt gemaakt voor gebruik als drinkwater. Opgemerkt wordt dat momenteel de inname onderbroken is als gevolg van een brand op het nabijgelegen Vredestein complex in augustus 2003. Recentelijk (maart 2008) heeft Vitens besloten de inname van oppervlaktewater uit het Twentekanaal definitief te staken.


N
Twentekanaal
1500 m
© 2007 Europa Technologies
Image © 2007 Aerodata International Surveys
Google

Evides: Petrusplaat
Evides neemt oppervlaktewater in aan het Gat van de Kerksloot (nabij het bekken De Gijster). Het monitoringspunt van Evides (en Rijkswaterstaat) ligt stroomopwaarts bij Keizersveer. De kwaliteit van het ingenomen water is globaal vergelijkbaar met die bij het monitoringspunt (in het verleden is jarenlang zowel bij Gat van de Kerksloot als bij Keizersveer gemeten; uit deze gegevens kwam geen noemenswaardig verschil naar voren – pers comm T. Suylen, Evides). Het gemiddelde en maximum debiet van de Maas bedraagt zo'n 350 m^3/s respectievelijk 2000 m^3/s, gebaseerd op de gemeten afvoer bij Keizersveer (gegevens 2000-2004 uit www.waterbase.nl). De inname wordt gestopt wanneer de restafvoer van de Maas < 25 m^3/s (en uiteraard ook wanneer de concentratie van specifieke stoffen een bepaalde grenswaarde overschrijdt). Er zijn in de Biesbosch drie voorraadbekkens (De Gijster, Honderd en Dertig en Petrusplaat) met een totale inhoud van bruto 86,5 Mm^3 en netto 53,9 Mm^3. De verblijftijd in de bekkens is in totaal ca. 5 maanden. Er vindt in de bekkens géén menging met grondwater plaats.

Evides: Scheelhoek

Evides neemt oppervlaktewater in uit het Haringvliet. Haringvlietwater bestaat afhankelijk van de waterverdeling voor 70-80 % uit Rijnwater en voor 20-30 % uit Maaswater. Het gemiddelde en maximum debiet van het Haringvliet bedraagt zo'n 750 m^3/s, respectievelijk 6500 m^3/s nabij de Haringvlietsluizen (gegevens 2000-2004 uit www.waterbase.nl). De sluizen zijn bij het huidige lozingsprogramma gesloten tijdens vloed en bij lage rivierafvoeren om indringing van zout water in het Haringvliet te voorkomen en de drinkwaterfunctie te beschermen. Na implementatie van het Kierbesluit zal het innamepunt stroomopwaarts worden verplaatst naar het eind van een kanaal dat door de Noordrand van Goeree-Overflakkee gaat lopen en dat gaat dienen voor de watervoorziening voor de landbouw en het drinkwater (ruwweg tegenover de uitstroom van het Spui). De waterverdeling in zuidwest Nederland is vrij ingewikkeld. Zo kan bij lage afvoeren 'achterwaartse verzilting' van het Haringvliet optreden door aanvoer van relatief zout water via het Spui en de Dordtsche Kil. Innamestops vinden alleen plaats wanneer concentraties van specifieke stoffen (veelal chloride) een bepaalde waarde overschrijden. Het ingenomen water wordt na een voorzuivering in Ouddorp in de duinen van Ouddorp en Haamstede geïnfiltreerd.

DZH: Brakel

DZH neemt sinds 1976 water in vanuit de Afgedamde Maas in Brakel. Dit is een zijtak (12 km lang) van de Maas. De Afgedamde Maas wordt gekenmerkt door een geringe stroming en een verblijftijd van gemiddeld 2 maanden. Het fosfaatgehalte wordt actief teruggebracht door dosering van ijzersulfaat (en zuurstof) in de rivier. In de normale situatie wordt water uit de Afgedamde Maas verpompt naar de Waal aan de andere kant van de sluizen om lekkage van Waalwater naar het innamepunt te voorkomen. Mocht zich in de Maas een verontreiniging voordoen, dan wordt het transport van water naar de Waal gestaakt. Hierdoor ontstaat een stroming van de Waal naar de Maas, waardoor tegendruk ontstaat op het punt waar de Bergsche Maas de Afgedamde Maas passeert. De afvoer van de (Bergsche) Maas is af te leiden uit debietgegevens van Keizersveer of Lith (deze zijn vergelijkbaar). De waterkwaliteit in de Afgedamde Maas wordt sterk beïnvloed door lozingen vanuit de Bommelerwaard via twee poldergemalen. Het ingenomen water uit de Afgedamde Maas wordt naar Bergambacht getransporteerd, waar het water wordt voorgezuiverd. Het voorgezuiverde rivierwater wordt vervolgens getransporteerd via twee grote buizen naar het duingebied tussen Monster en Katwijk en geïnfiltreerd in de duinen via zogenaamde infiltratieplassen, waar het water gemiddeld twee maanden verblijft.

Waternet: Amsterdam-Rijnkanaal

Waternet neemt water in vanuit het Amsterdam-Rijnkanaal nabij Nieuwersluis ten behoeve van aanvulling van de Waterleidingplas (voornamelijk gevuld met kwelwater uit de Bethunepolder). Het gaat hier om een relatief kleine onttrekking. Het Amsterdam-Rijnkanaal is te beschouwen als een langzaam stromend water. Het gemiddelde en maximum debiet van het Amsterdam-Rijnkanaal bij Weesp (stroomafwaarts gelegen van het innamepunt) bedraagt zo'n 30 m^3/s, respectievelijk 165 m^3/s (gebaseerd op gegevens 2000-2001 van Rijkswaterstaat).

Waternet: Nieuwegein

Waternet onttrekt te Nieuwegein circa 4 m^3/s aan het Lekkanaal. Het gemiddeld debiet door het Lekkanaal bedraagt 7,7 m^3/s door inlaat van water uit de Lek en schutverliezen bij de Prinses Beatrixsluizen, hetgeen een langzame stroming veroorzaakt. De Nederrijn en Lek zijn gestuwd om voor de scheepvaart voldoende diepgang te garanderen. Het gemiddelde en maximum debiet van de Lek bij Hagestein bedraagt zo'n 300 m^3/s respectievelijk 1900 m^3/s (gegevens 2001-2006 uit www.waterbase.nl). De waterbalans van de Nederrijn-Lek is beschreven in het RIWA rapport Rijn-Alarm-model bij gestuwde Nederrijn-Lek (Van Mazijk, 2005). Tijdens gemiddelde afvoersituaties, vindt aanvoer van water uit de Nederrijn en de Lek plaats naar het Lekkanaal. Tijdens laagwatersituaties, waarbij het peil op de Waal min of meer gelijk is aan het stuwpeil van Hagestein, vormt het Betuwepand van het Amsterdam-Rijnkanaal een open verbinding tussen de Waal en de Lek. Dan is het stoftransport via de Waal en het Betuwepand van het ARK qua omvang vergelijkbaar met het transport via de Nederrijn en Lek. Daarnaast kan ook water via de Prinses Irenesluis – Amsterdam-Rijnkanaal – Lekkanaal het innamepunt van het pompstation ir. Cornelis Biemond bereiken. Via twee transportleidingen wordt voorgezuiverd water getransporteerd naar en geïnfiltreerd in de Amsterdamse Waterleidingduinen.

WML: Heel

WML onttrekt sinds 2002 bij Heel grootschalig oppervlaktewater uit het Lateraalkanaal. Dit kanaal ligt parallel aan de Maas en wordt middels een sluizencomplex boven-strooms van Linne van de Maas afgetakt. De waterafvoer via dit kanaal ter hoogte van Heel is afhankelijk van het aantal schuttingen en varieert van 3,4 m^3/s in perioden dat er spaarzaam geschut wordt, o.a. als de afvoer van de Maas gering is, tot ca 7 m^3/s als er normaal geschut wordt. De Maas is een regenrivier met grote afvoerverschillen. De jaargemiddelde afvoer bij Borgharen-Dorp is ca 230 m^3/s (gegevens 2000-2006 uit www.waterbase.nl). Perioden met een lage basisafvoer van 8 à 10 m^3/s en perioden met hoge afvoeren van > 1000 m^3/s komen vrijwel elk jaar voor. De maximum afvoer van de Maas in de periode 2000-2006 bedroeg ongeveer 2500 m^3/s. Het water uit het Lateraalkanaal komt via een retentiebekken in het proces- en voorraadbekken, De Lange Vlieter, met een inhoud van 25 miljoen m^3. Vervolgens stroomt het door de oever naar een 30-tal putten waar het wordt onttrokken en naar het zuiveringsgebouw wordt gepompt om verwerkt te worden tot drinkwater. Bij Heel wordt niet continu water ingenomen; normaal wordt in de avond- en nachturen water ingelaten, indien het bekken niet op streefpeil is. De inlaat kan uit voorzorg gesloten worden, zelfs enkele weken zonder dat dit aan de productiezijde wordt gemerkt.

Waterbedrijf Groningen: De Punt
Waterbedrijf Groningen neemt oppervlaktewater in uit de Drentsche Aa. De Drentsche Aa is een regionaal stroomgebied dat volledig gelegen is op Nederlands grondgebied. Het water in de Drentsche Aa bestaat voornamelijk uit afstromend regenwater en kwelwater. Het debiet van de Drentsche Aa wordt gemeten bij Schipborg, stroomopwaarts van het innamepunt. Het gemiddelde en maximum debiet van de Drentsche Aa bedraagt zo'n 2 m^3/s respectievelijk 13 m^3/s (meetgegevens Waterbedrijf Groningen). Bij De Punt wordt continu water ingenomen; incidenteel wordt de inname aangepast vanwege een laag debiet of kwaliteit (voornamelijk kleur). Na inname wordt het water opgevangen in een mengbekken met een verblijftijd van ongeveer een maand.

Appendix 4 Graphs for seven substances, based on monitoring data of pesticides in surface water in the period 2000 – 2006

Graphs of substance/intake area combinations out of the Meuse are only depicted if more than two positive cases (above 0.1 µg/L) were measured at the abstraction points in the period 2000-2004. The graphs are extended with measurements from 2005 and 2006.

Table A4.1. Overview of substance/intake area combinations, which are depicted in a graph (marked with a '+') and number of positive cases (above 0.1 µg/L) for the other combinations. This overview is based on data in the period 2000-2004.

Substance	Meuse-Petrusplaat	Meuse-Brakel	Lobith-Rhine	Lobith – IJsselmeer Lake	Twentekanaal	Drentsche Aa
Bentazon	+	+	0 pos	0 pos	0 pos	0 pos
Dichlobenil	+	+	0 pos	0 pos	0 pos	0 pos
Diuron	+	+	2 pos	Geen data	0 pos	0 pos
Glyfosaat	+	+	+	0 pos	0 pos	+
Isoproturon	+	+	+	0 pos	0 pos	0 pos
MCPA	+	+	1 pos	0 pos	0 pos	1 pos
Mecoprop	+	+	2 pos	0 pos	0 pos	+
Metolachloor	+	+	2 pos	0 pos	0 pos	0 pos

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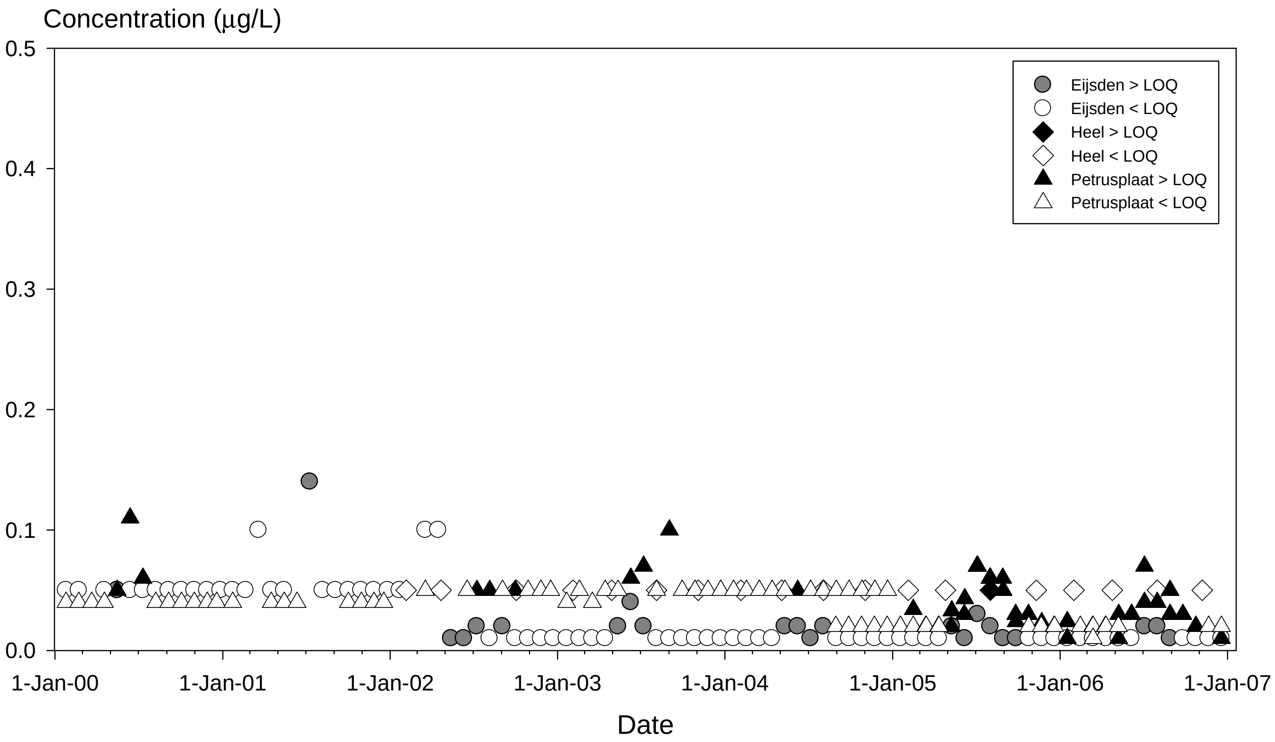
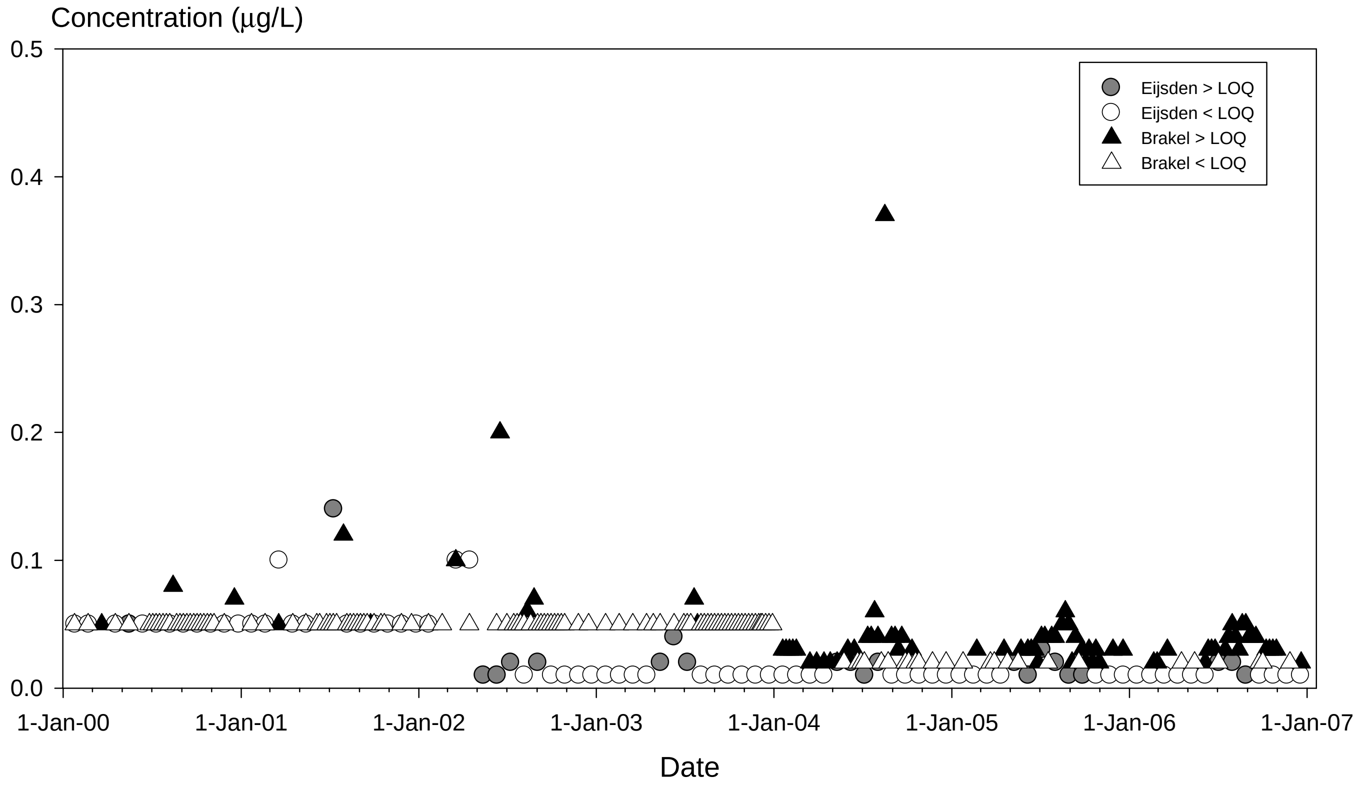
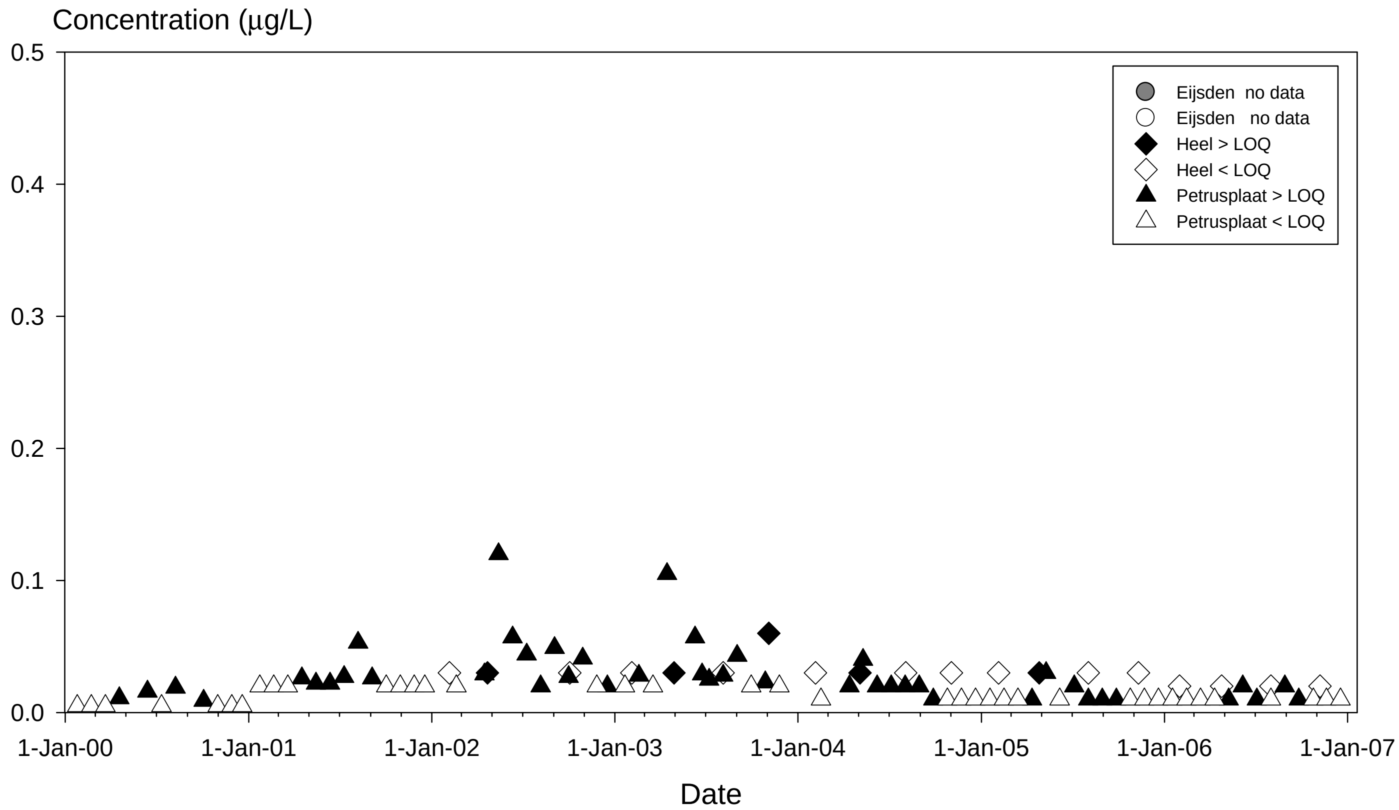
Appendix 5 Bentazone in the Meuse, abstraction points Heel and Petrusplaat



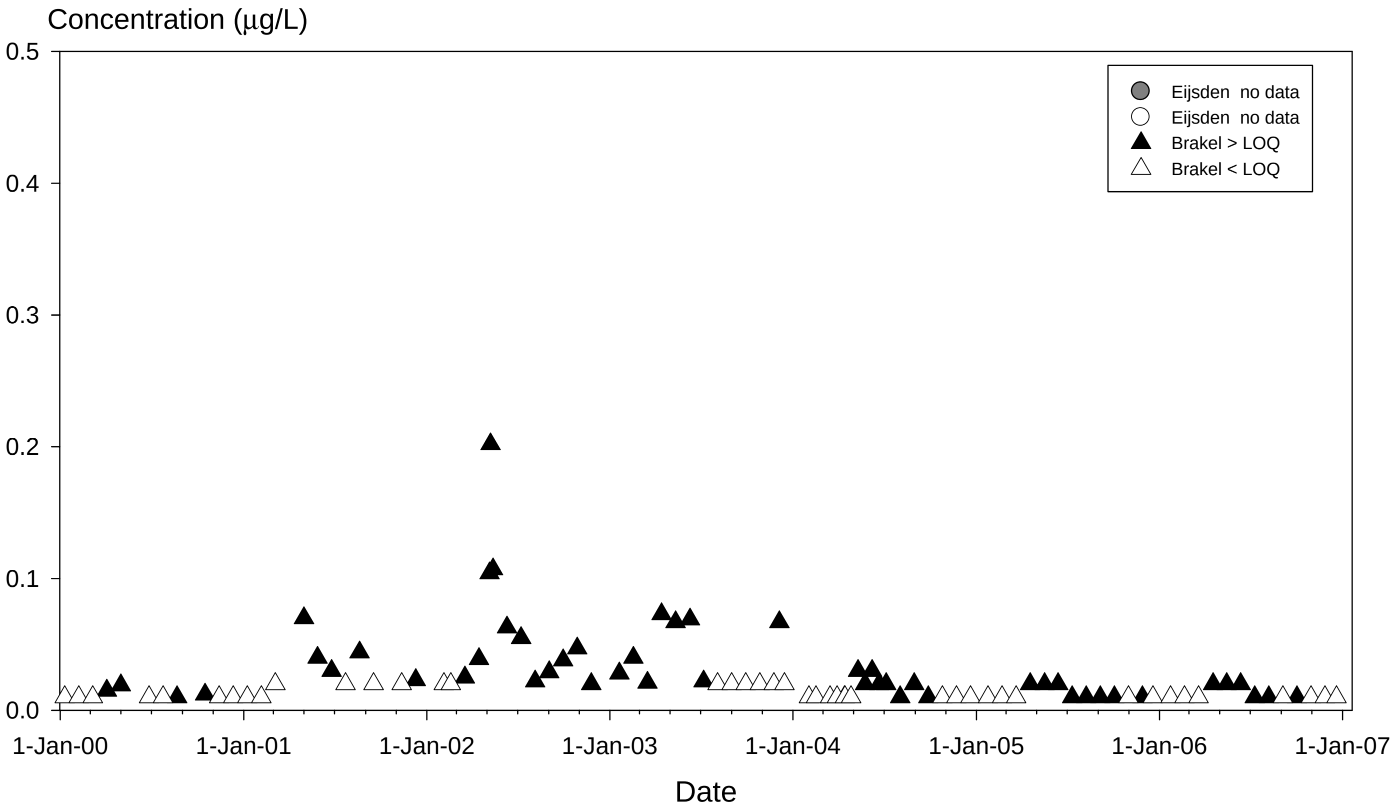
Appendix 6 Bentazone in the Meuse, abstraction point Brakel



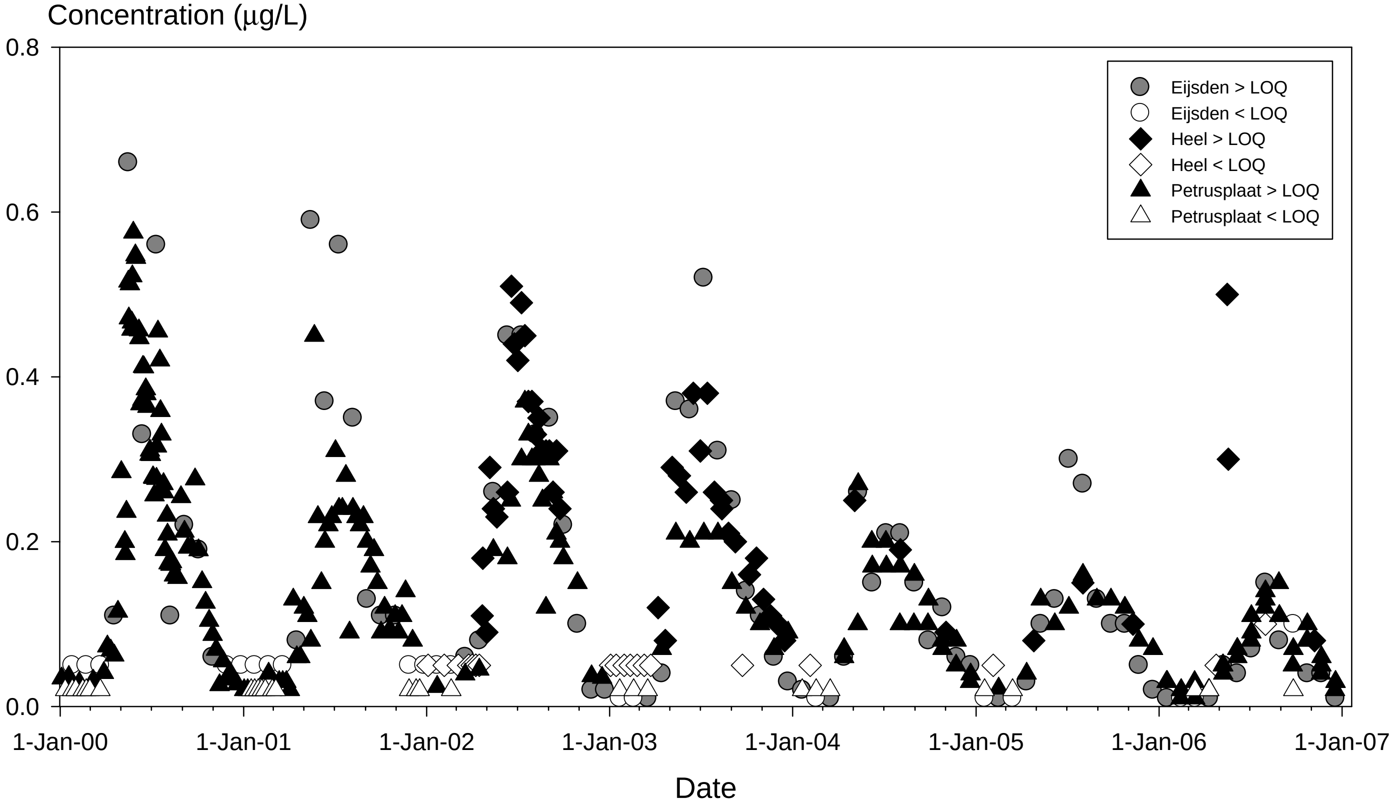
Appendix 7 Dichlobenil in the Meuse, abstraction points Heel and Petrusplaat



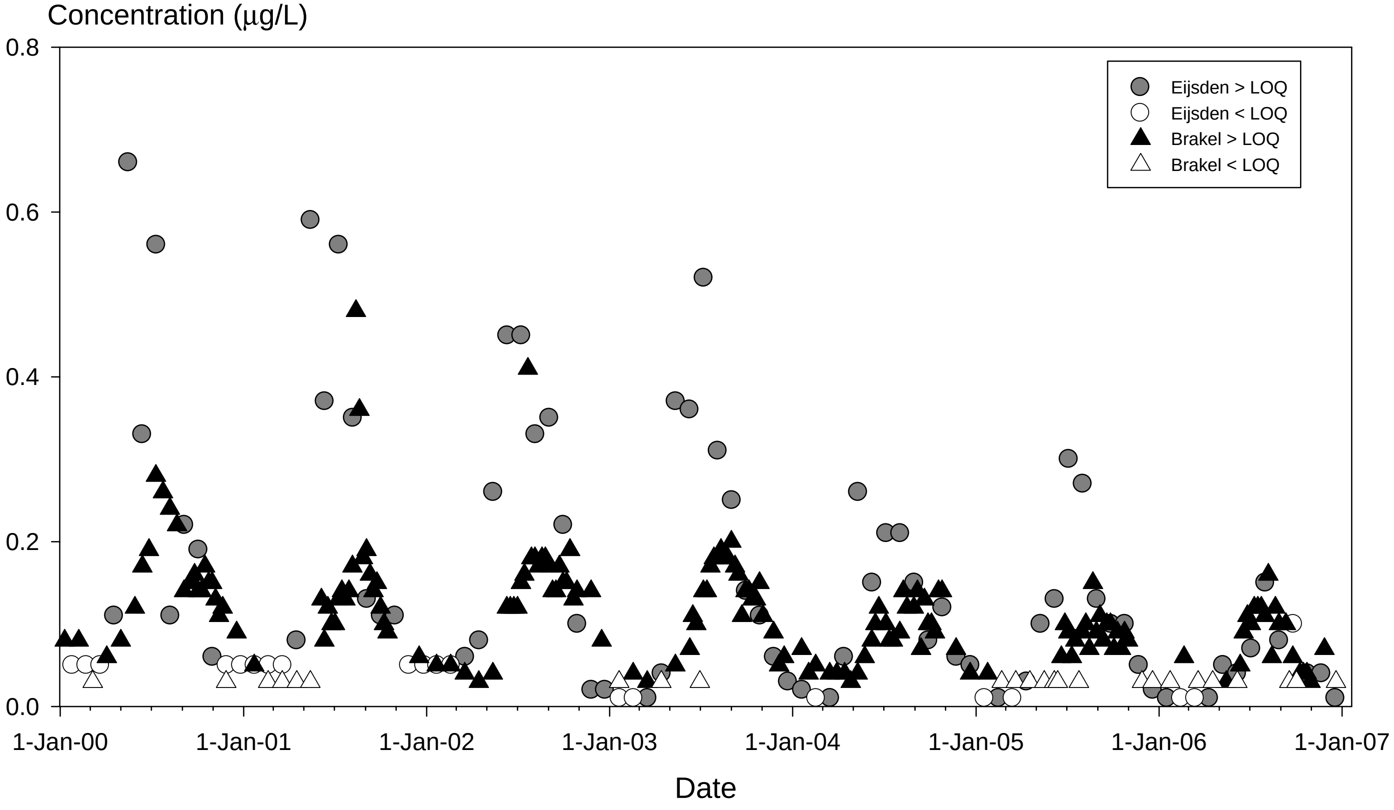
Appendix 8 Dichlobenil in the Meuse, abstraction point Brakel



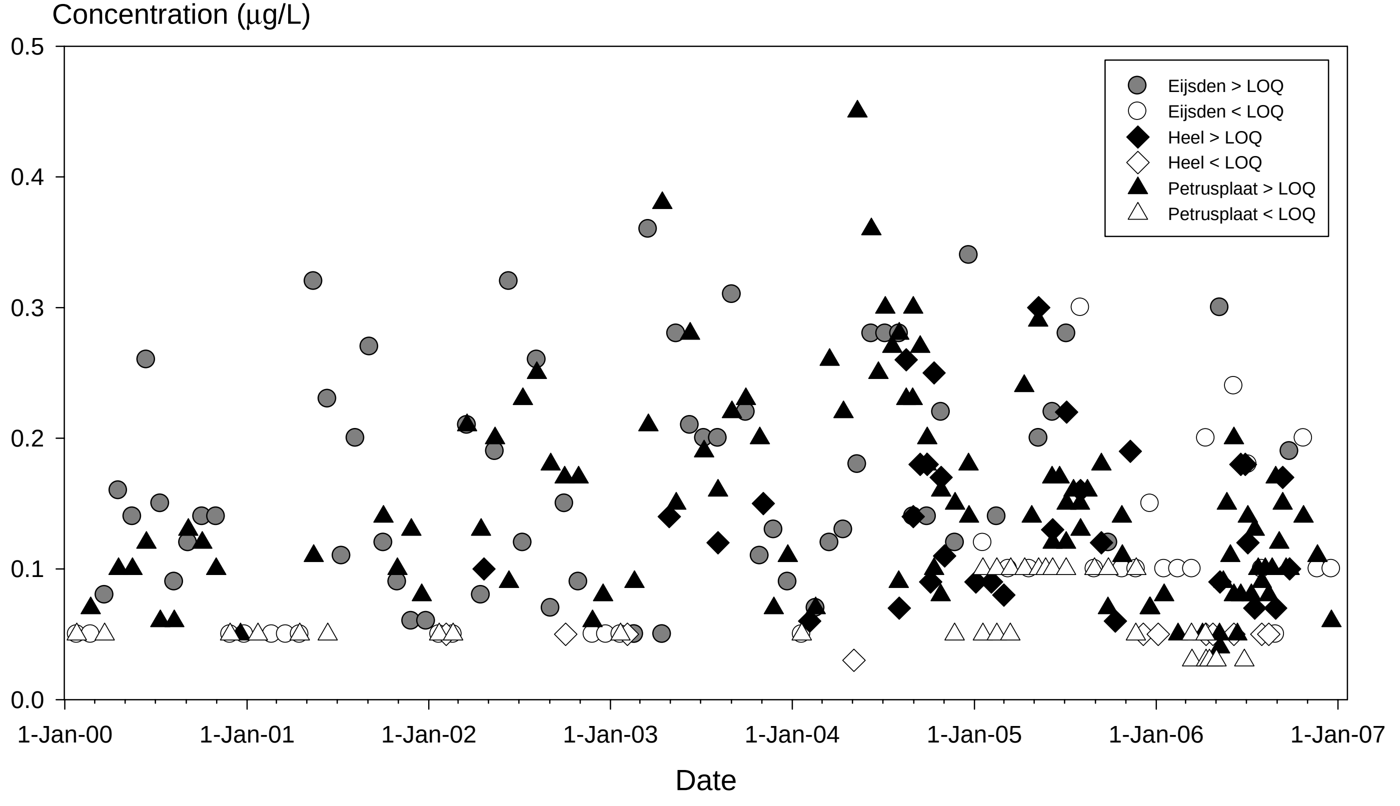
Appendix 9 Diuron in the Meuse, abstraction points Heel and Petrusplaat



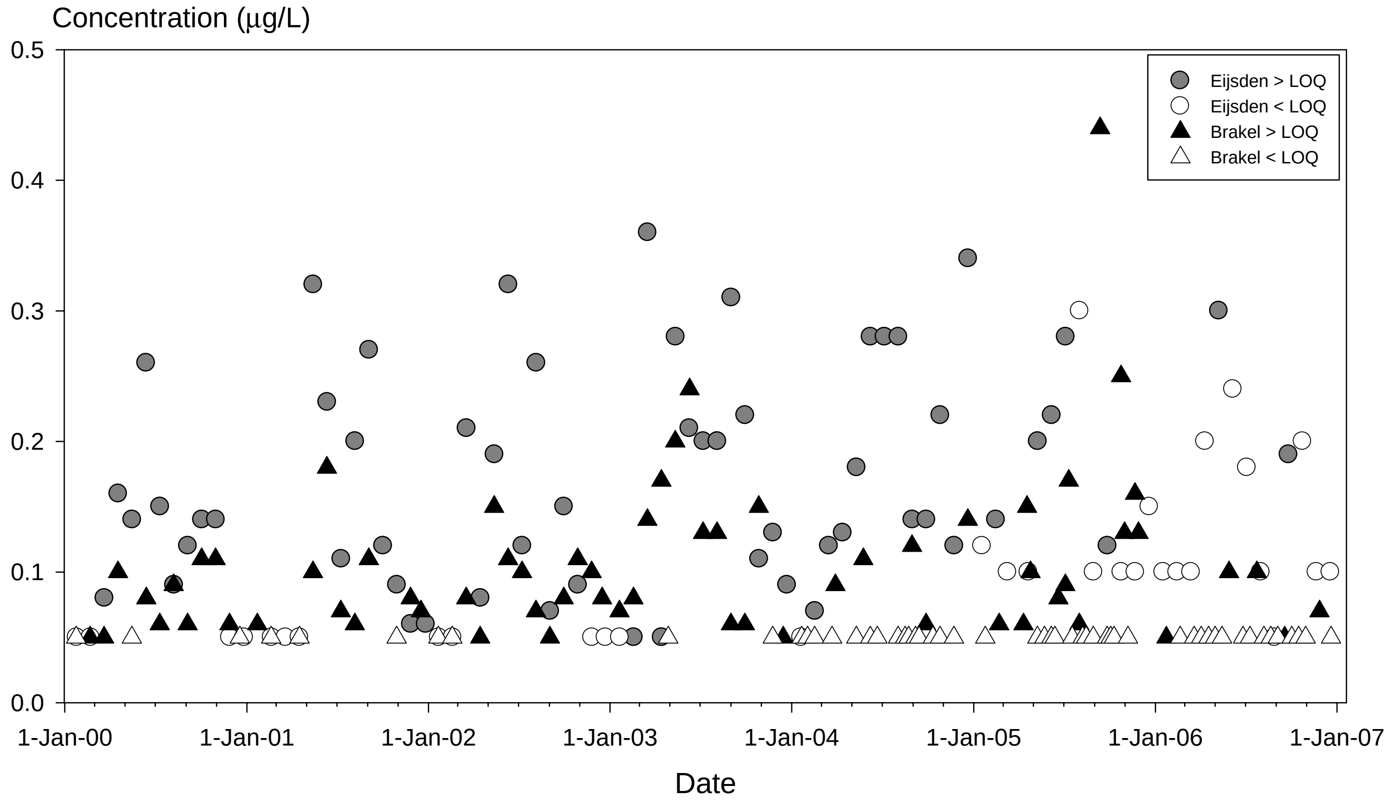
Appendix 10 Diuron in the Meuse, abstraction point Brakel



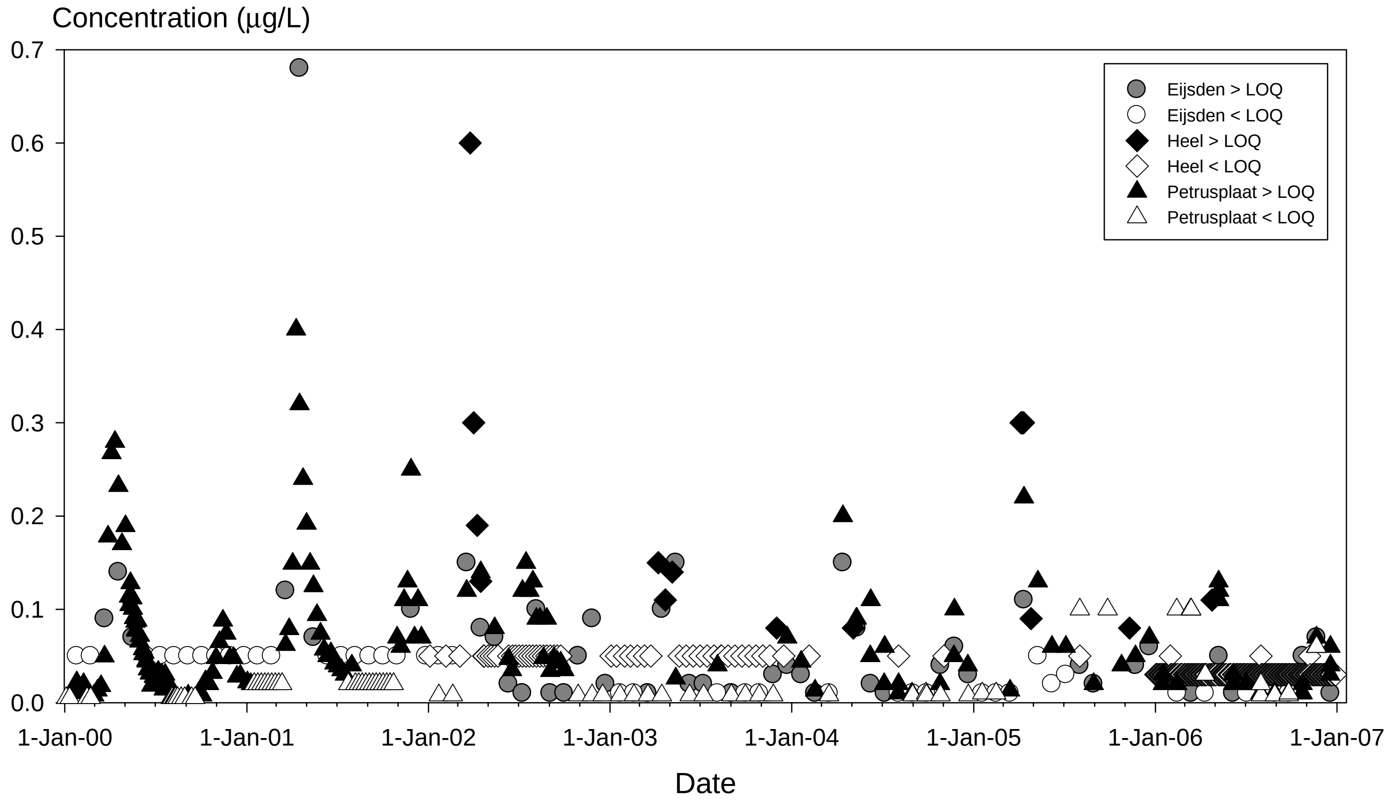
Appendix 11 Glyphosate the Meuse, abstraction points Heel and Petrusplaat



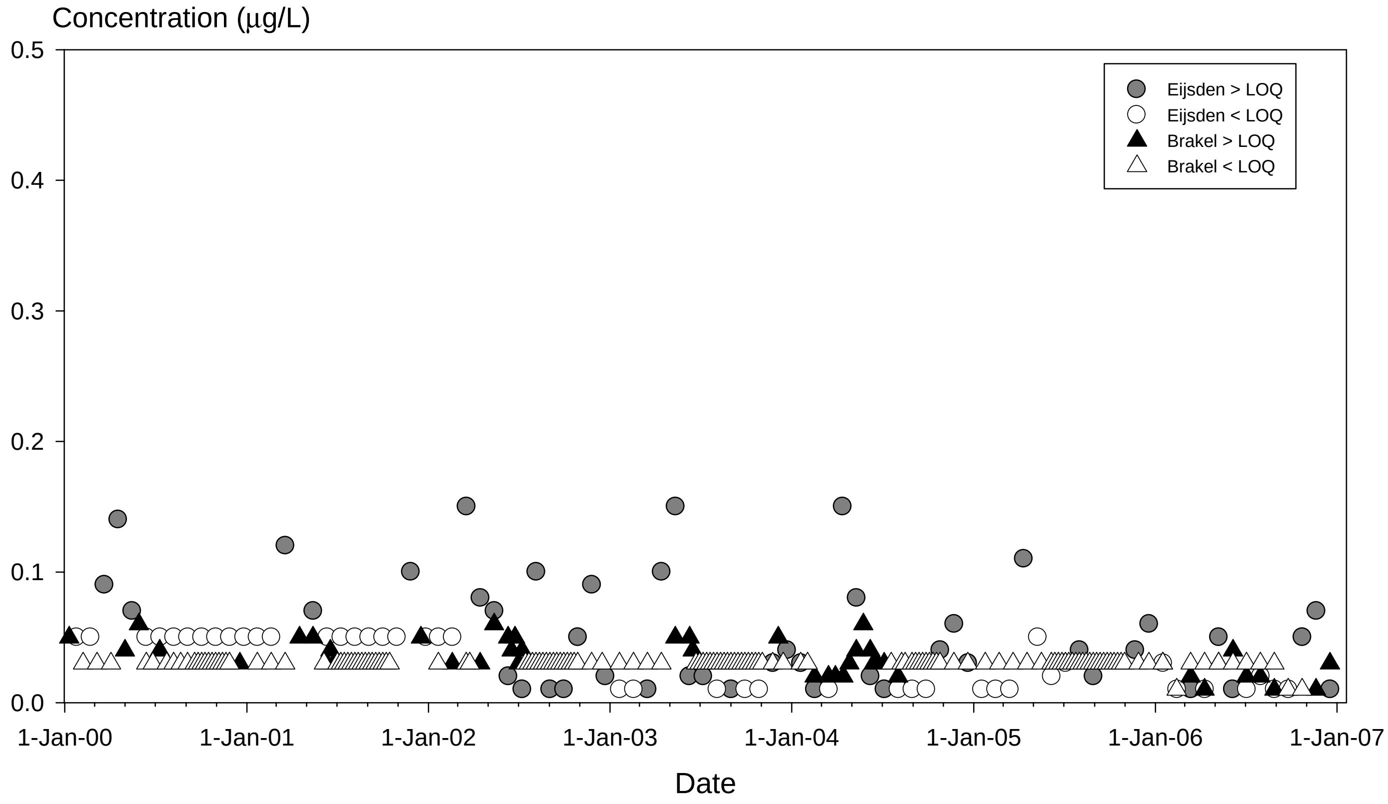
Appendix 12 Glyphosate in the Meuse, abstraction point Brakel



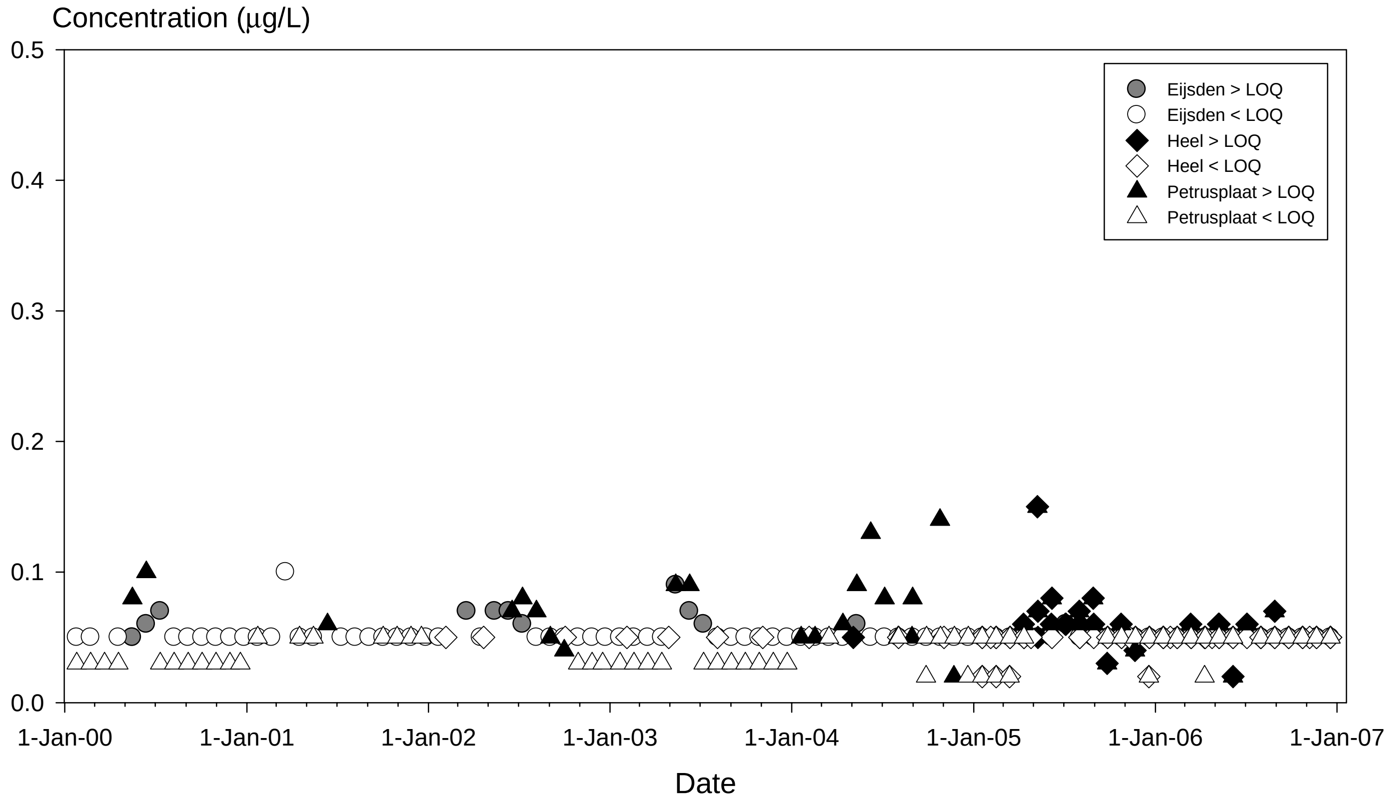
Appendix 13 Isoproturon in the Meuse, abstraction points Heel and Petrusplaat



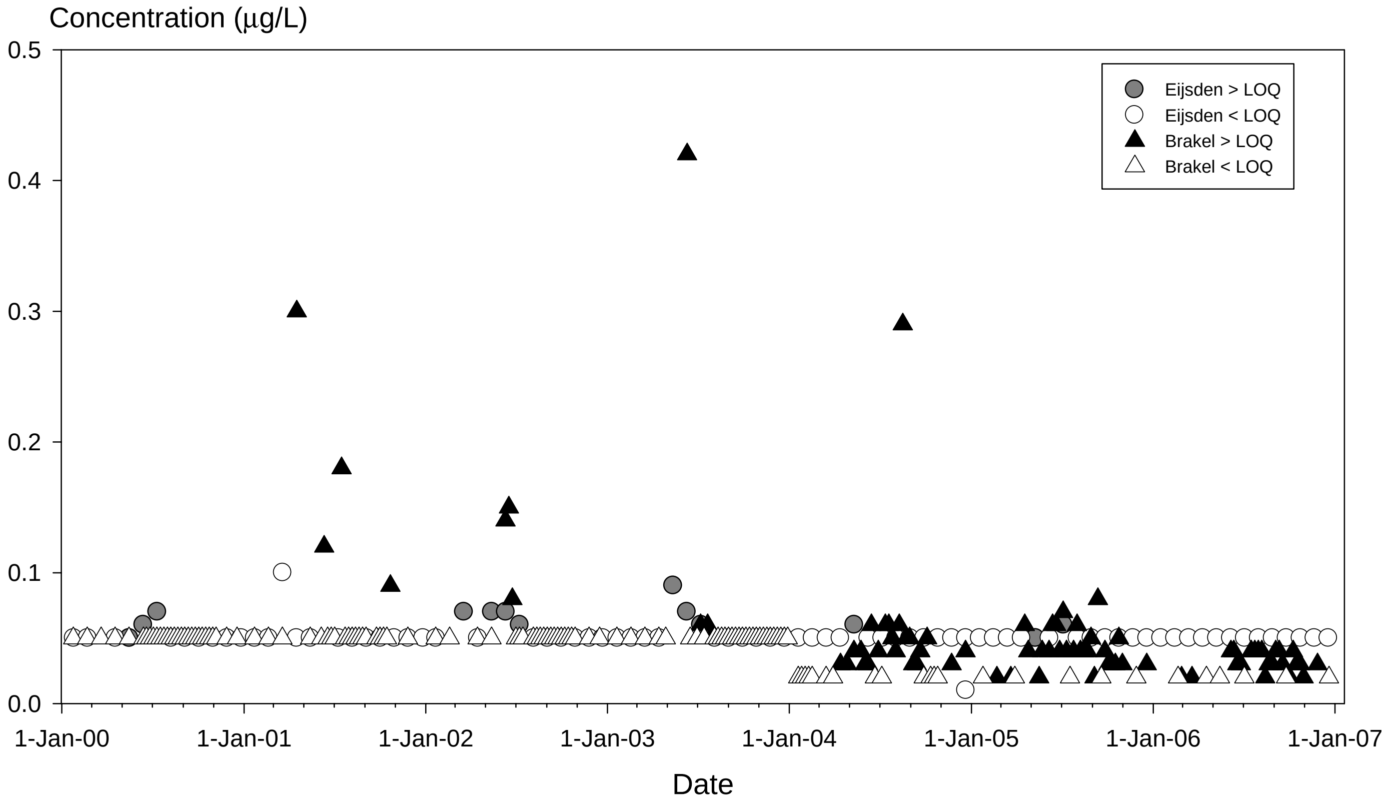
Appendix 14 Isoproturon in the Meuse, abstraction point Brakel



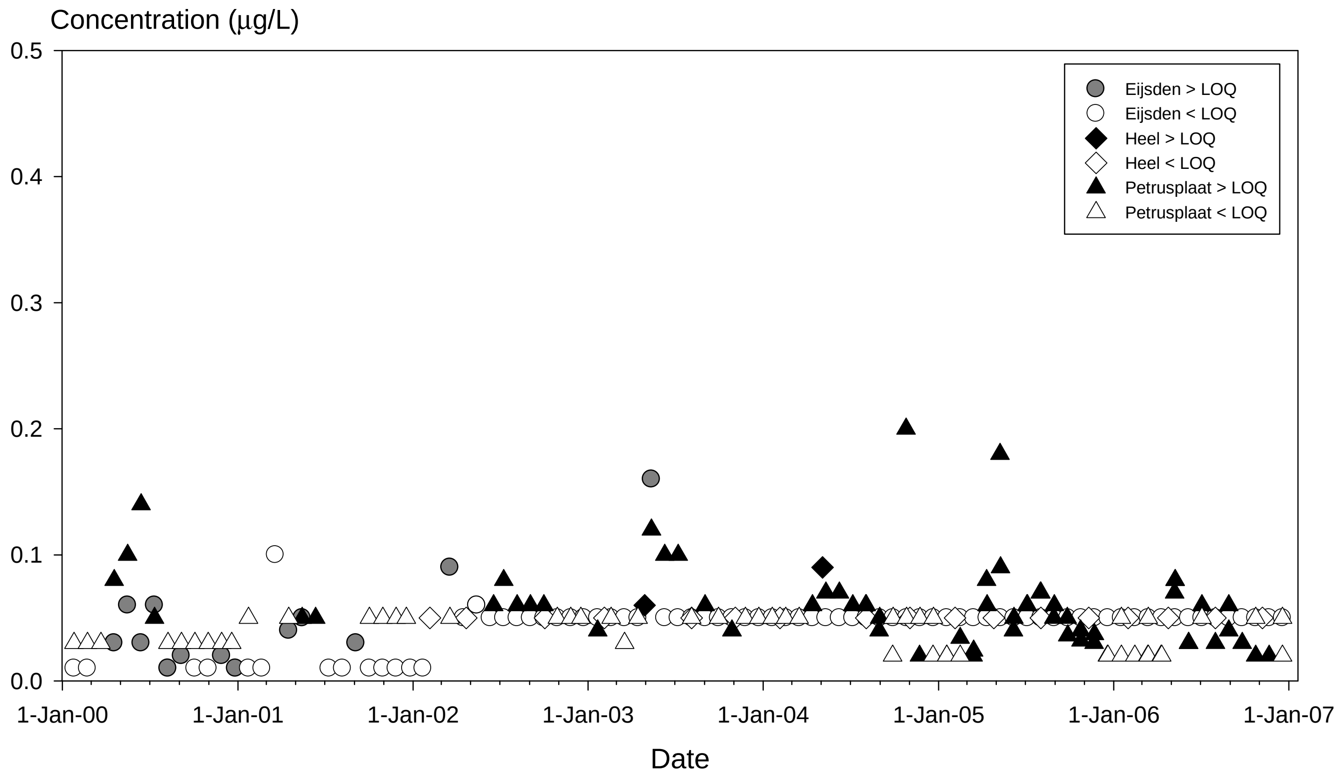
Appendix 15 MCPA in the Meuse, abstraction points Heel and Petrusplaat



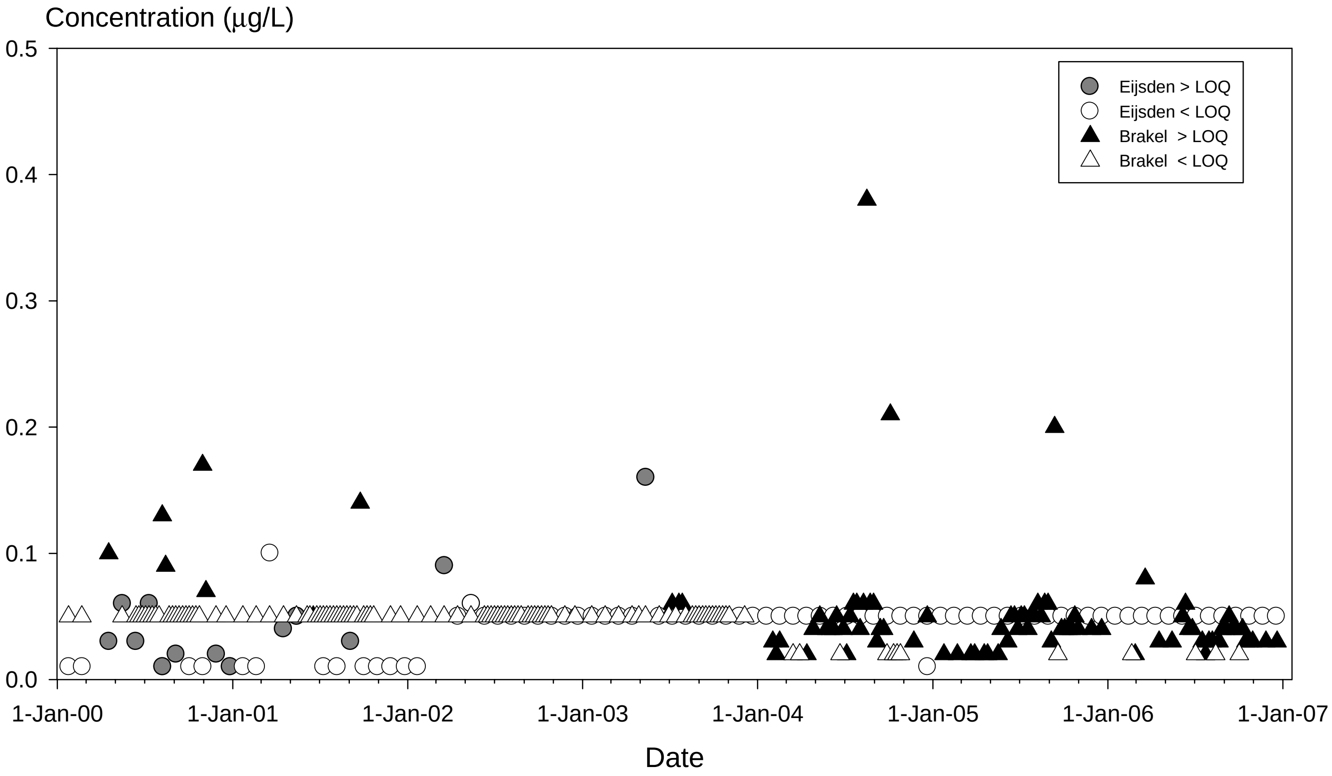
Appendix 16 MCPA in the Meuse, abstraction point Brakel



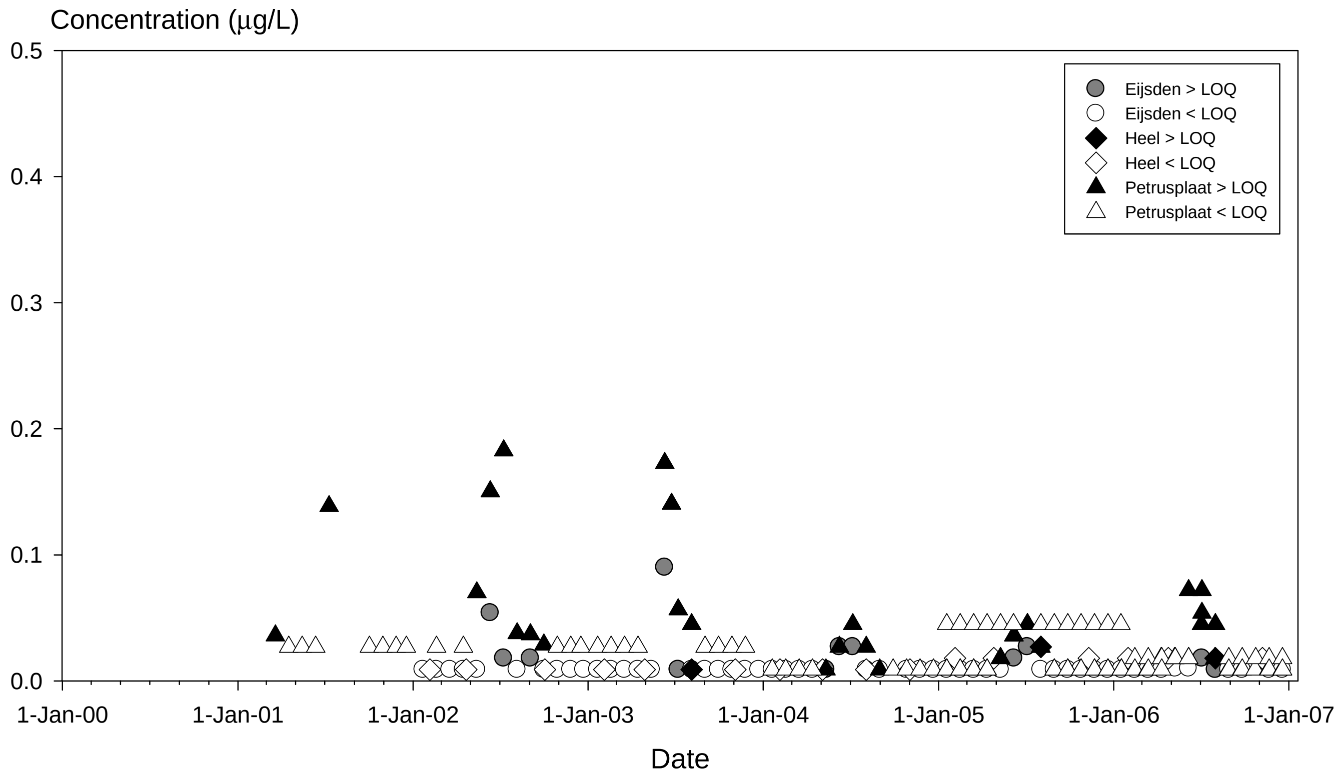
Appendix 17 Mecoprop-P in the Meuse, abstraction points Heel and Petrusplaat (0.94* measured concentration mecoprop)



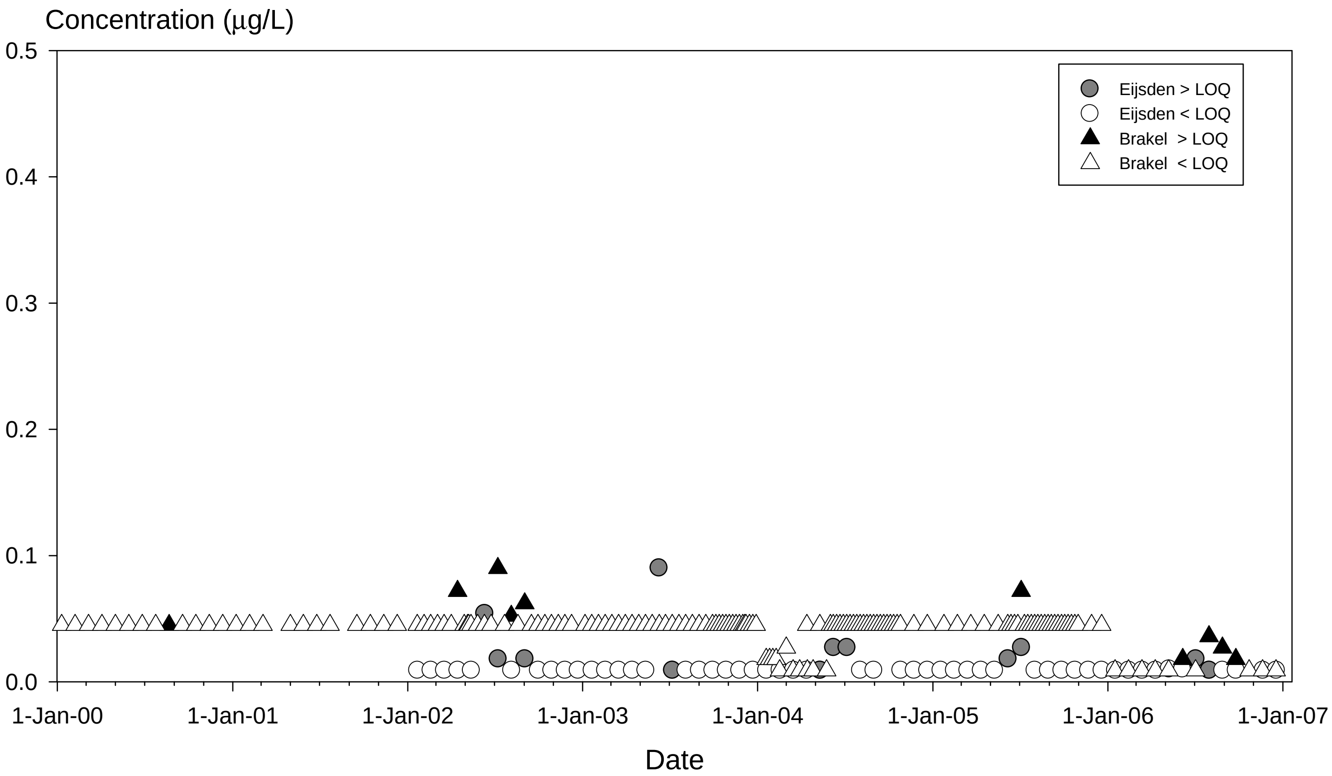
Appendix 18 Mecocrop-P in the Meuse, abstration point Brakel (0.94* measured concentration mecoprop)



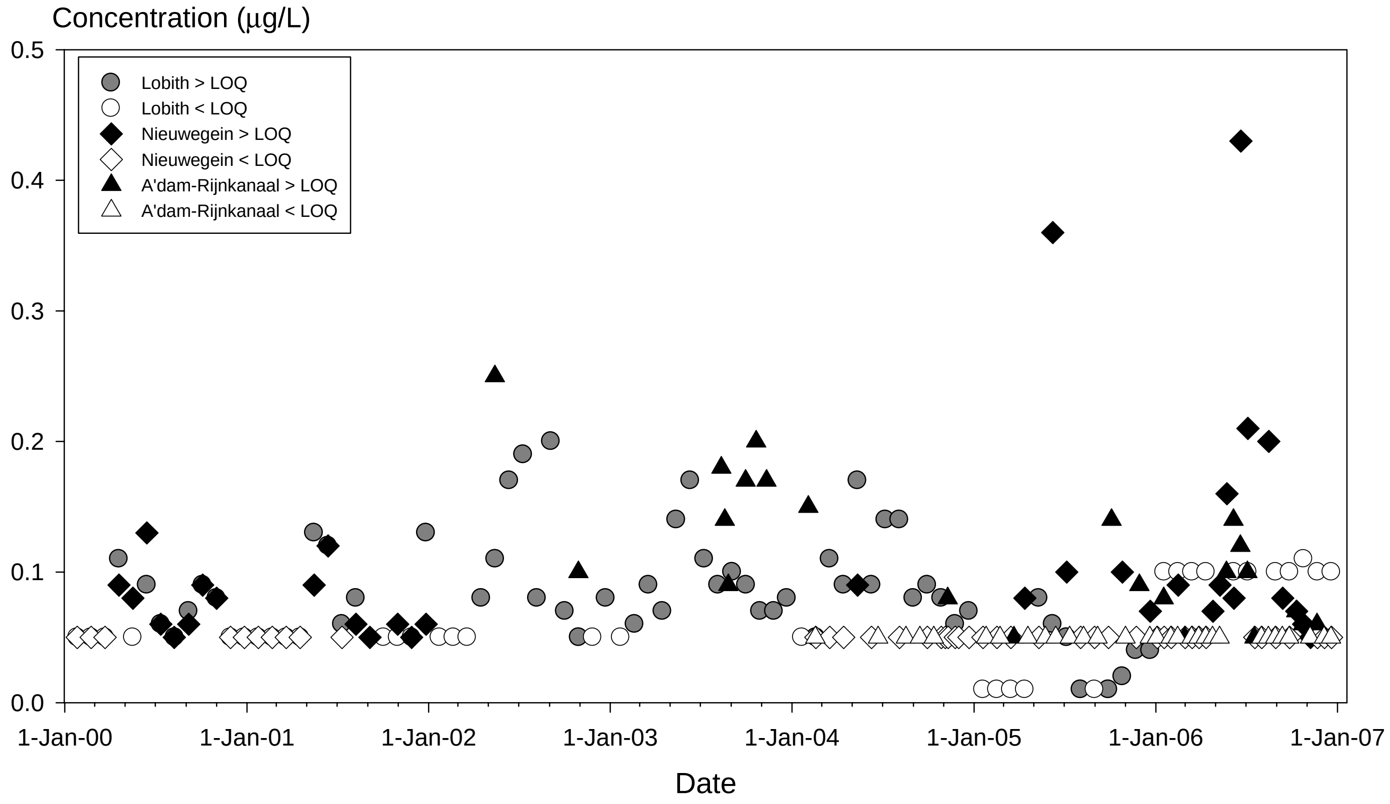
Appendix 19 S-Metolachlor in the Meuse, abstraction points Heel and Petrusplaat (0.9* measured concentration metolachlor)



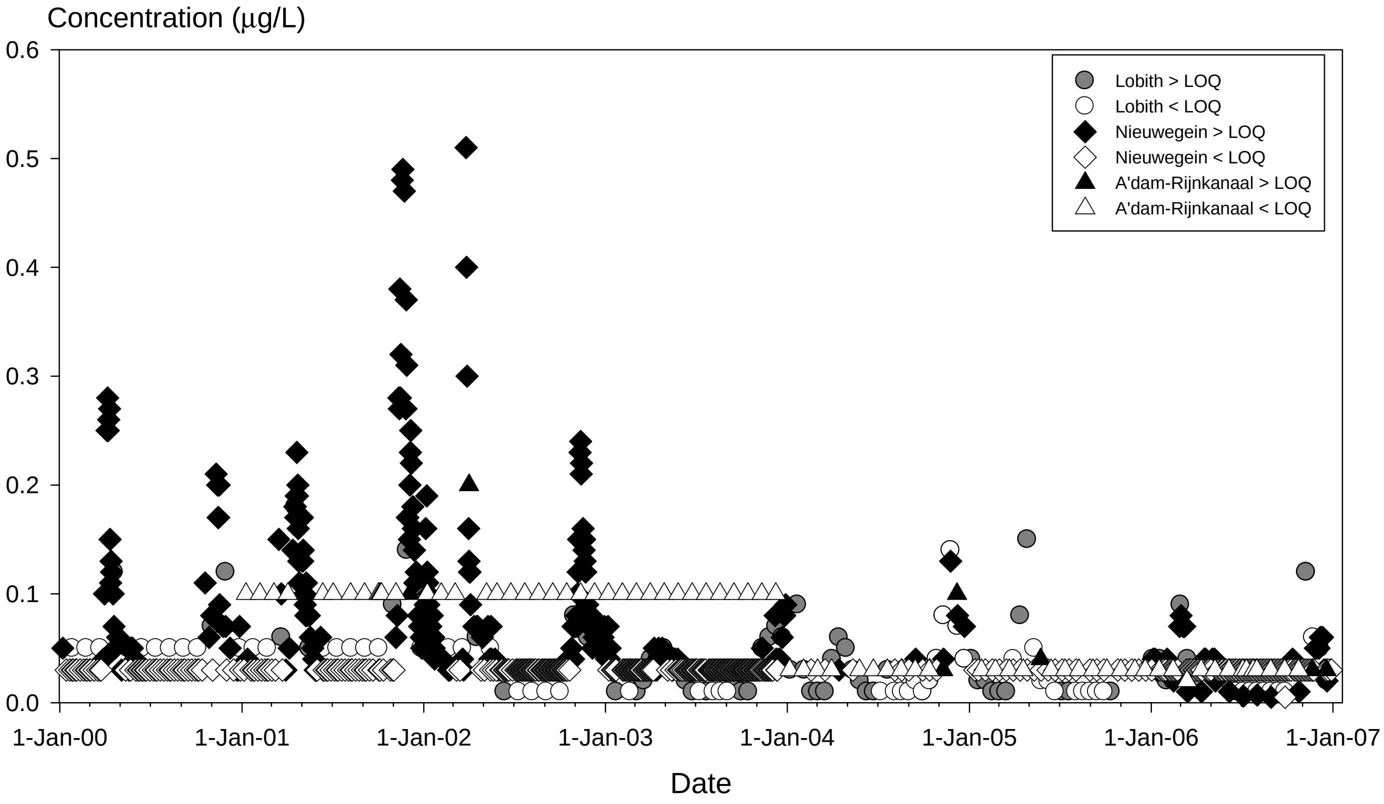
Appendix 20 S-Metolachlor in the Meuse, abstraction point Brakel (0.9* measured concentration metolachlor)



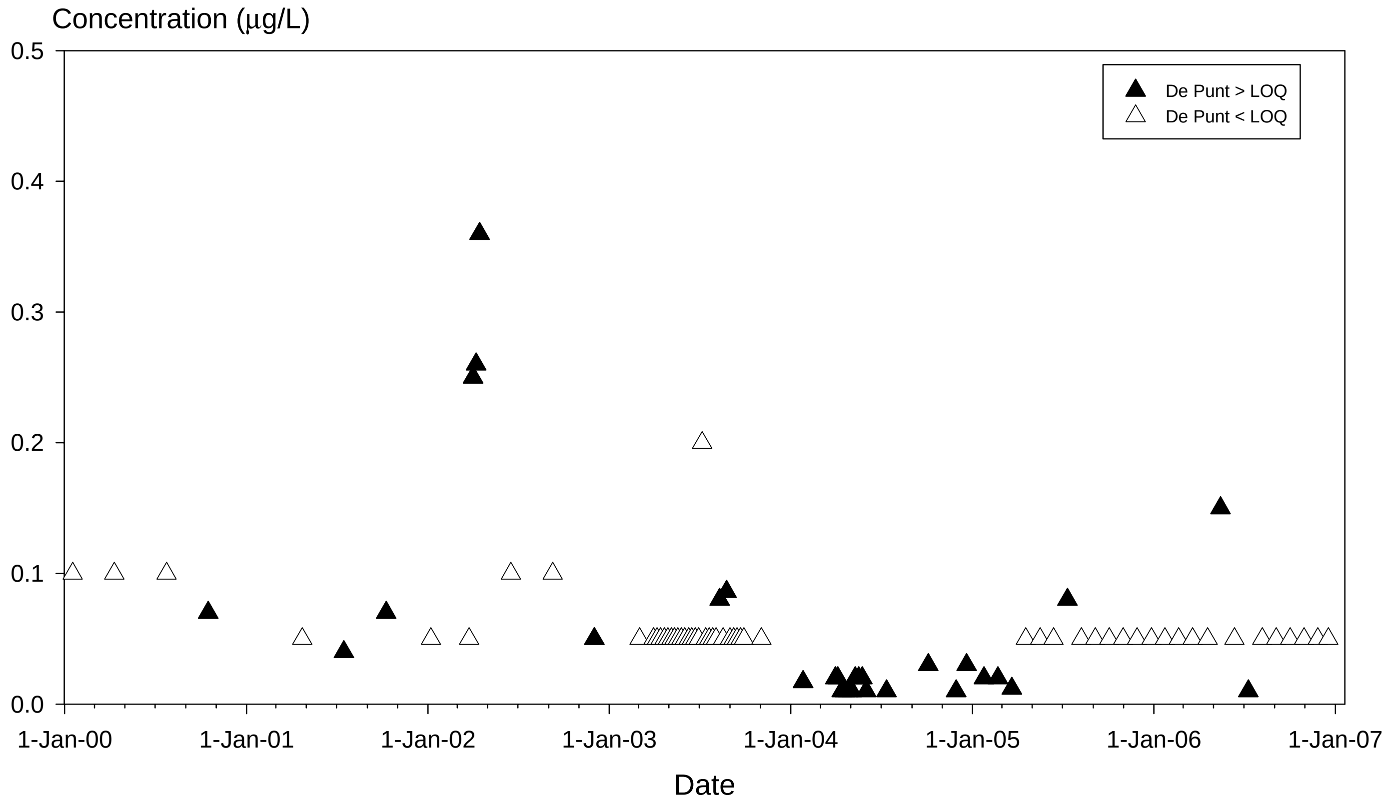
Appendix 21 Glyphosate in the Rhine, abstraction points Nieuwegein and A'dam-Rijnkanaal



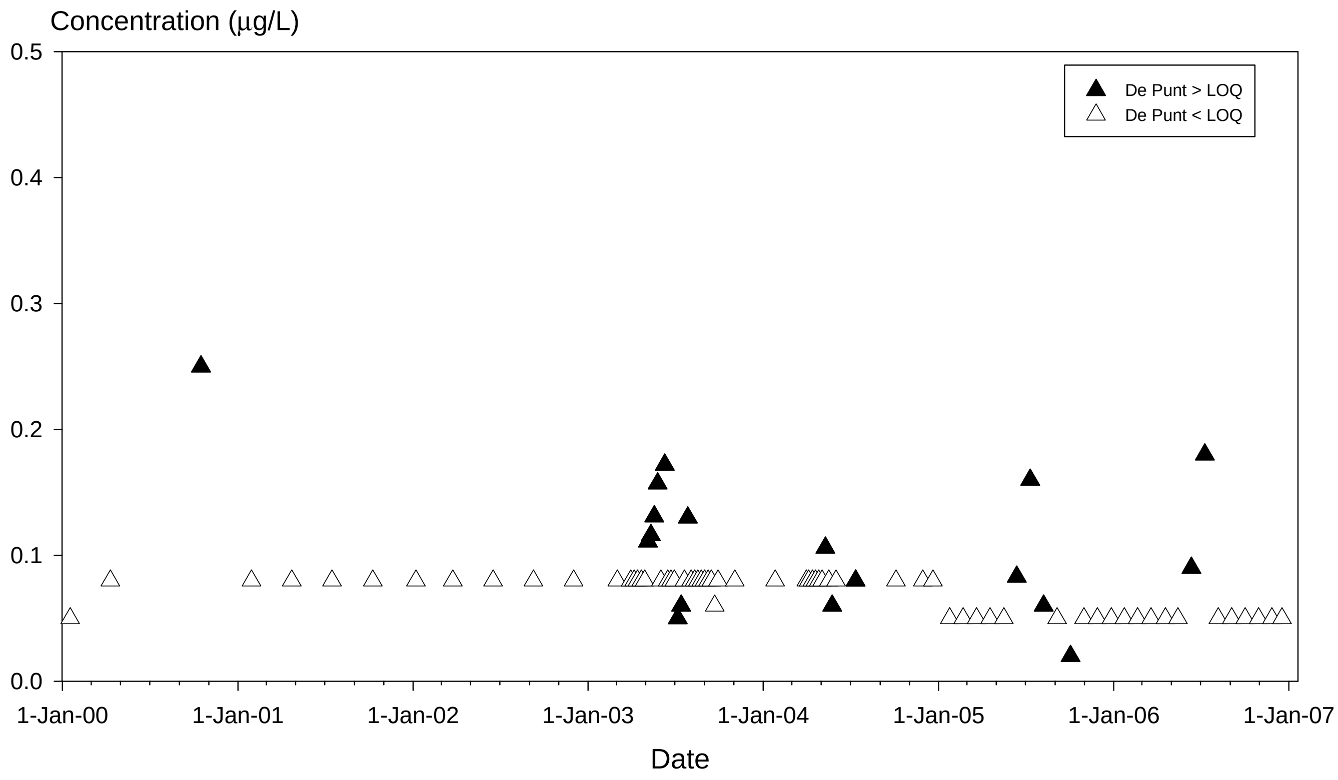
Appendix 22 Isoproturon in the Rhine, abstraction points Nieuwegein and A'dam-Rijnkanaal



Appendix 23 Glyphosate in the Drentsche Aa, abstraction point De Punt



Appendix 24 Mecoprop-P in the Drentsche Aa, abstraction point De Punt (0.94* measured concentration mecoprop)



Appendix 25 Market Share Estimation

Overview registered and recommended substances
Source: Gewasbeschermingsgids 2006 (PD) voor toegelaten middelen en Gewasbescherming in 2006 voor diverse sectoren, uitgaven van DLV Plant BV voor aanbevolen middelen

crop	**pest or disease**	**substance**	**Active ingredient**	**registered**	**advised**	
aardappel	nematoden	Monam	metam-natrium	X	X	
		Basamid	dazomet	X		
		Nemathorin	fosthiazaat	X	X	
		Temik 10 G Gypsum	aldicarb	X	X	
		Vydate 10G	oxamyl	X	X	
		Mocap	ethoprofos		X	vrijstelling
aardappel	bladluizen	Agrichem Deltamethrin	deltamethrin	X	X	
		Budget Deltamethrin	deltamethrin	X	X	
		Decis EC	deltamethrin	X	X	
		Decis micro	deltamethrin	X	X	
		Decis vloeibaar	deltamethrin	X	X	
		Deltamethrin E.C. 25	deltamethrin	X	X	
		Holland Fyto deltamethrin	deltamethrin	X	X	
		Splendid	deltamethrin	X	X	
		Asepta Dimethoaat	dimethoaat	X	X	
		Brabant Dimethoaat	dimethoaat	X	X	
		Danadim 40	dimethoaat	X	X	
		Danadim Progress	dimethoaat	X	X	

Continuation Appendix 25

crop	pest or disease	substance	Active ingredient	registered	advised	
		Dimistar Progress	dimethoaat	X	X	
		Luxan Dimethoaat	dimethoaat	X	X	
		Perfekthion	dimethoaat	X	X	
		Sumicidin Super	esfenvaleraat	X	X	
		Teppeki	flonicamid	X	X	
		Karate Zeon	lambda cyhalothrin	X	X	
		minerale olie diverse	minerale olie	X	X	
		Agrichem pirimicarb	pirimicarb	X	X	
		Pirimor	pirimicarb	X	X	
		Calypso	thiacloprid	X	X	
		Calypso vloeibaar	thiacloprid	X		
		Plenum	pymetrozine	X	X	
		Amigo	imidacloprid	X	X	
aardappel	loofvernietiging	Spotlight	carfentrazone ethyl	X	X	
		Actor	diquat dibromide	X	X	
		Agrichem diquat	diquat dibromide	X	X	
		Imex-diquat	diquat dibromide	X	X	
		Reglone	diquat dibromide	X	X	
		Budget glufosinaat ammonium 150 SL	glufosinaat ammonium	X		
		Finale SL 14	glufosinaat ammonium	X	X	
		Holland Fyto Finish	glufosinaat ammonium	X		
		Liberty	glufosinaat ammonium	X		
		Purivel	metoxuron	X	X	

Continuation Appendix 25

crop	pest or disease	substance	Active ingredient	registered	advised	crop
aardappel	phytophthora	Valbon	benthiavalicarb/mancozeb	X	X	
		Budget Chloorthalonil	chloorthalonil	X	X	
		Daconil vloeibaar	chloorthalonil	X	X	
		Tattoo C	propamocarb/chloorthalonil	X	X	
		Ranman	cyazofamid	X	X	
		Curzate 60DF	cymoxanil	X		
		Tanos	cymoxanil/ famoxadone	X	X	
		Curzate M	cymoxanil/mancozeb	X	X	
		Turbat	cymoxanil/mancozeb	X		
		Zetanil	cymoxanil/mancozeb	X	X	
		Aviso DF	cymoxanil/metiram	X	X	
		Forum	dimethomorph	X		
		Acrobat DF	dimethomorph/mancozeb	X	X	
		Sereno	fenamidone/mancozeb	X	X	
		Shirlan (5 handelsproducten)	fluazinam	X	X	
		Mancozeb (14x)	mancozeb	X	X	
		Fubol gold	mefonoxam/mancozeb	X	X	
		Maneb (8x)	maneb	X	X	
aardappel	onkruid	Challenge	aclonifen	X	X	
		Mirabo	aclonifen/linuron	X	X	
		Basagran (4x)	bentazon	X	X	
		Centium	clomazone	X	X	
		Finale (4x)	glufosinaat ammonium	X		
		Roundup (>10x)	glyfosaat	X	X	
		Linuron (6x)	linuron	X	X	
		Butisan S (3x)	metazachloor	X	X	

Continuation Appendix 25

crop	pest or disease	substance	Active ingredient	registered	advised	crop
		Sencor WG (3x)	metribuzin	X	X	
		Gramoxone (4x)	paraquat-dichloride	X	X	
		Stomp	pendimethalin	X	X	
		Budget pendimethalin	pendimethalin	X		
		Boxer	prosulfocarb	X	X	
		Titus	rimsulfuron	X	X	
aardappel	grassen	Aramo (2x)	tepraloxydim	X	X	
		Focus plus	cycloxydim	X	X	
		Fusilade	fluazifop-p-butyl	X	X	
		Galant (2x)	haloxyfop-p-methyl	X	X	
		Targa	quizalofop-p-methyl	X	X	
granen	blad en aar ziekten	Amistar	azoxystrobine	X	X	
		Priori Xtra	azoxystrobine/cyproconazool	X	X	
		Daconil 500 vlb	chloorthalonil	X	X	
		Budget Chloorthalonil	chloorthalonil	X		
		Caddy	cyproconazool	X	X	
		Sportak Delta	prochloraz/cyproconazool	X		
		Sphere	trifloxistrobin/cyproconazool	X	X	
		Delan DF	dithianon	X		
		Opus	epoxiconazool	X	X	
		Opus team	epoxiconazool/fenpropimorf	X	X	
		Allegro Plus	epoxiconazool/kresoxim-methyl/fenpropimorf	X		
		Allegro	epoxiconazool/kresoxim-methyl/fenpropimorf	X	X	
		Opera	epoxiconazool/pyraclostrobin	X		

Continuation Appendix 25

crop	pest or disease	substance	Active ingredient	registered	advised	crop
		Corbel	fenpropimorf	X	X	
		Fandango	fluoxastrobin/prothioconazool	X	X	
		Mancozeb (9x)	mancozeb	X		
		Caramba	metconazool	X	X	
		Acanto	picoxystrobin	X	X	
		Sportak (5x)	prochloraz	X	X	
		Tilt	propiconazool	X	X	
		Proline	prothioconazool	X	X	
		Comet	pyraclostrobin	X	X	
		Matador	tebuconazool/triadimenol	X	X	
		Topsin M	thiofanaat methyl	X		
		Twist	trifloxystrobin	X		
		Carbendazim (2x)	carbendazim	X		
		Mildin	ethirimol	X	X	
		Mentor	kresoxim-methyl/fenpropimorf	X		
		Flexity	metrafenone	X	X	
		Fortress	quinoxyfen	X	X	
		zwavel (4x)	zwavel	X		
mais	onkruiden	2,4 D (6x)	2,4 D	X	X	
		Challenge	aclonifen	X		
		Basagran (3x)	bentazon	X	X	
		Laddok T	bentazon/terbutylazin	X	X	
		Emblem	bromoxynil	X	X	
		Banvel 4S	dicamba	X	X	
		Frontier Optima	dimethenamid-p	X	X	
		Primus	florasulam	X		

Continuation Appendix 25

crop	pest or disease	substance	Active ingredient	registered	advised	crop
		Starane (5x)	fluroxypyr	X	X	
		Maister	foramsulforon/jodosulfuron	X	X	
		Finale (4x)	glufosinaat ammonium	X		
		Roundup (>10x)	glyfosaat	X	X	
		Callisto	mesetrione	X	X	
		Nicosulfuron (4x)	nicosulfuron	X	X	
		Gramoxone (4x)	paraquat-dichloride	X		
		Stomp 400 SC	pendimethalin	X		
		Lido SC	pyridaat/terbutylazin	X	X	
		Titus	rimsulfuron	X	X	
		Dual Gold	s-metolachloor	X	X	
		Mikado	sulcotrion	X	X	
		Gardoprim (3x)	terbutylazin	X	X	
		Merlin	isoxaflutool	X	X	
appel	schurft	Captan (12x)	captan	X	geen DLV boekje	
		Chorus 50 WG	cyprodinil	X	beschikbaar	
		Score 10 WG	difenconazool	X		
		Delan DF	dithianon	X		
		Syllit Flow 450 Sc	dodine	X		
		Stroby WG	kresoxim-methyl	X		
		Mancozeb (14x)	mancozeb	X		
		Maneb (8x)	maneb	X		
		Polyram Df	metiram	X		
		Scala	pyrimethanil	X		
		Topsin M	thiofanaat methyl	X		
		Thiram (3x)	tmtd	X		

Continuation Appendix 25

crop	pest or disease	substance	Active ingredient	registered	advised	crop
		Eupareen Multi	tolylfluanide	X		
		Flint	trifloxistrobin	X		
		zwavel (4x)	zwavel	X		
wortelen	bladziekten	Amistar	azoxystrobin	X	X	
		Ortiva	azoxystrobin	X	X	
		Signum	boscali/pyraclostrobin	X	X	
		Score	difenaconazool	X	X	
		Rovral	iprodion	X	X	
		Horizon	tebuconazool	X	X	
		Flint	trifloxistrobin	X	X	
aardbei	onkruiden	Antikiek	2,4 D/MCPA	X	X	
		Betanal (10x)	fenmedifam	X	X	
		Basamid	dazomet	X		
		Finale (4x)	glufosinaat ammonium	X	X	
		Dual Gold	s-metolachloor	X	X	
		Gramoxone (4x)	paraquat-dichloride	X	X	
		Roundup (>10x)	glyfosaat	X	X	
		Afdekfolie			X	
		Goltix	metamitron		X	vrijstelling

Samenvatting:
9 voorbeelden van gewas /aantaster combinaties over groente, fruit en akkerbouw.
Zowel grote toepassingen als kleinere opgenomen.
Voor alle toepassingen zijn minimaal 4-5 actieve stoffen toegelaten en worden aanbevolen.
Meestal is het aanbod van middelen groter.

Appendix 26 Crop areas within each of the nine intake areas for production of drinking water from surface water

The areas correspond to the GeoPEARL crop groupings and are based upon data of Kiwa Water Research for the EDG-M study (Van der Linden et al, 2006)

* Roel Kruijne, Alterra, 15 June 2006
* - Area per GeoPEARL crop [ha]
* Paulien Adriaanse, August 2006
* - Sub division Tree_nurseries (009 & 010) and Fruit_cultures (012 & 013) because of different spray drift
*
* ID# = crop ID; cropID in CompoundCropPEC-files must correspond with this ID#;
* NB: >> crops with ID# 000 may not be used in GAP definition <<
* #CBScrp = number of CBS crops in GeoPEARL group
*
* Area per GeoPEARL crop in the 9 abstraction points (according to Kiwa Water Research, used in EDG-M)
* Based on the provisional relation between CBS crops (CBS, 2004) and GeoPEARL crops (GeoPEARL 1.1.1)
*

* ID abstraction point				1	2	3	4	5	6	7	8	9
* Name abstraction point (Kiwa)				DE_PUNT	ANDIJK	N'GEIN	HEEL	A'DAM	BRAKEL	PETRUS	TWENTE	SCHEELHOEK
* Area abstraction point [ha]				56300	1185300	127900	95200	172100	565200	614700	20100	842300
* ID#	GP_name (Dutch)	#CBScrp	GP_name	[ha]	[ha]	[ha]	[ha]	[ha]	[ha]	[ha]	[ha]	[ha]
001	aardappelen	5	potatoes	5511	51010	954	2640	994	16013	16638	28	23542
002	aardbeien	1	strawberries	0	105	63	39	63	1065	1196	1	1255
003	asperges	2	asparagus	1	81	5	244	8	2018	2060	0	2065
004	bieten	4	sugar_beets	2007	24687	1488	5427	1492	16708	17478	0	23526
005	bladgroenten	3	leaf_vegetables	40	439	27	345	73	1207	1416	0	1994
006	handelsgewassen	4	plnts_com._purp 10	672	8	22	8	210	225	3	608	
007	bloemisterij	7	floriculture	23	615	153	26	173	1328	1410	15	1637
008	bol	8	flower_bulbs	0	4622	0	70	0	1370	1370	0	1384
009	_grote_bomen	7	tall_trees	16	327	1036	25	1047	1704	1798	4	2836
010	_overige_bomen	7	other_trees	35	1532	271	90	299	3165	3269	23	3628
011	braak	2	fallow	28	548	163	68	187	746	787	16	1049
012	_grote_bomen	8	tall_fruit_cult	0	1693	4014	1234	4169	2600	2711	1	8140
013	_overige_fruitteelt	8	small_fruits	4	76	115	155	115	494	505	0	643

Continuation Appendix 26

014	granen	11	cereals	3969	43231	5026	8466	5459	19201	20512	220	37109
015	gras	2	grass	14240	402609	40038	13779	51067	104909	116846	4421	178942
016	graszaad	1	grass-seed	106	2796	213	160	255	1597	1782	0	3802
017	groenbemesting	4	green-manuring	16	2695	387	189	457	1187	1322	1	2103
018	groentegewassen	12	vegetables	14	5426	111	279	118	5173	5377	3	6027
019	hennep	1	cannabis	0	1	2	0	2	0	0	0	2
020	houtteelt	0	silviculture	0	0	0	0	0	0	0	0	0
021	koolsoorten	5	cabbage	1	567	56	133	57	638	786	1	1992
022	mais	4	maize	2709	111712	7346	6828	8170	78464	86410	1700	96776
023	overige_akkerbouw	8	rem._agr._crp.	39	1640	119	220	119	2118	2303	0	2657
024	peulvruchten	9	legumes	49	3253	183	479	193	3854	4390	1	5818
025	prei	1	leek	10	102	5	214	5	2230	2334	1	2346
026	uien	3	onions	0	9985	79	153	79	668	707	0	2053
027	Total	160	_	29474	675693	62922	41862	75746	273446	298741	6558	419000
000	Total GeoPEARL	112	_	28831	670425	61859	41288	74608	268670	293631	6437	411932
000	not_in_GeoPEARL48	_		643	5269	1063	574	1138	4776	5110	121	7068
000	boomkwekerij	7	tree_nurseries	51	1859	1307	114	1346	4870	5067	27	6464
000	fruitteelt	8	fruit_culture	4	1769	4129	1390	4283	3095	3216	1	8784

Appendix 27 GAP sheet indicating the registered use of bentazone in the Netherlands (from BASF-NL)

Crop and/ or situation (a)	Member State or Country	Product name	F G or I (b)	Application: method kind (f-h)	Application: growth stage & season (j)	Application rate per treatment: g as/hL min max	Application rate per treatment: water L/ha min max	Application rate per treatment: g as/ha min max	PHI (days) (l)	Remarks: (m)	market share 2000
w-cereals	NL	Basagran	F	Spraying	13-15 15 maart-15mei	360-720	200-400	1440	NA		0.01
s-cereals	NL	Basagran	F	Spraying	13-15 1 april-15mei	360-720	200-400	1440	NA		0.01
corn	NL	Basagran	F	Spraying	14-15 15 mei-30 juni	360-720	200-400	1440	NA		0.005
potatoes	NL	Basagran	F	Spraying	33 1-30 juni	240-480	200-400	960	NA		0.05
leguminose	NL	Basagran	F	Spraying	12-30 1 april-31juli	360-720	200-400	1440	21-42		1
grassland	NL	Basagran	F	Spraying	39 in june	360-720	200-400	1440	7		0.0005
grassland	NL	Basagran	F	Spraying	39 in sept	360-720	200-400	1440	7	no application after october 1	0.0005
seedgrass	NL	Basagran	F	Spraying	39 in june	360-720	200-400	1440	NA		0.1

Continuation Appendix 27

seedgrass	NL	Basagran	F	Spraying	39 in sept	360-720	200-400	1440	NA	no application after october 1	0.1
poppy seed	NL	Basagran	F	Spraying	13-15 15 april-15 juni	90-180	200-400	360	NA		1
flax	NL	Basagran	F	Spraying	12-15 15 april-15 juni	180-360	200-400	720	NA		0.05
flax	NL	Basagran	F	Spraying	12-15 15 april-15 juni	360-720	200-400	1440	NA		0.05
onions	NL	Basagran	F	Spraying	13-15 1 april -1 juni	180-360	200-400	720	NA		0.2
chives	NL	Basagran	F	Spraying	12-15 1 april-1 juni	240-480	200-400	960	NA		1
Digitalis	NL	Basagran	F	Spraying	12-13 15 april-15 juni	60-120	200-400	240	NA	no application after July 1	1
Saponaria	NL	Basagran	F	Spraying	13-15 15 april-15 juni	120-240	400-600	480	NA		1
corn	NL	Laddok N	F	Spraying	14-15 15 mei-30 juni	133-200	400-600	800	NA		0.07

Appendix 28 GAP sheet indicating the registered use of dicamba in the Netherlands (From Syngenta-NL)

Responsible body for reporting: Syngenta Crop Protection
Pesticide(s): dicamba
EEC, CIPAC and CCPR No(s):
Trade name(s): BANVEL 4 S, Brabant 2,4-D/dicamba, Dicamix-G vloeibaar, Brabant Mixture
EU Countries
Main uses:

Date: juli 2008
Country: Netherlands

Crop and/or situation (a)	Member State or Country	Product name	F G or I (b)	Pests or Group of Pests controlled (c)	Formulation: Type (d-f)	Formulation: Conc. of as (i)	Application: method kind (f-h)	Application: growth stage & season (j)	Application: number min max (k)	Application: interval between applications (days)	Application rate per treatment: kg as/hL or L as /hL min max	Application rate per treatment: water L/ha min max	Application rate per treatment: kg as/ha or L as /ha min max	PHI (days) (l)	Crop Remarks (m)
Maize Group	Netherlands	BANVEL 4 S	Field	Dicot weed plants	SL	dicamba 480	foliar spray	May-june	1			300	.288		silage and grain
Grass seed	Netherlands	Brabant 2,4-D/dicamba	Field	Dicot weed plants	SL	Dicamba 120 2,4-D 250	foliar spray	August-september	1			200-400	.480-.600		
Amenity grasses	Netherlands	Brabant 2,4-D/dicamba	Field	Dicot weed plants	SL	Dicamba 120 2,4-D 250	foliar spray	April-may or August-september	1			200-400	.480-.960		
Grass seed	Netherlands	Dicamix-G vloeibaar	Field	Dicot weed plants	SL	Dicamba 62,5 2,4-D 293 MCPA 193	foliar spray	August-september	1			800-1000	.250-.312,5		
Amenity grasses	Netherlands	Dicamix-G vloeibaar	Field	Dicot weed plants	SL	Dicamba 62,5 2,4-D 293 MCPA 193	foliar spray	August-september	1			800-1000	.375		
Grass seed	Netherlands	Brabant Mixture	Field	Dicot weed plants	SL	Dicamba 50 2,4-D 250 MCPA 166	foliar spray	August-september	1			400-600	.300		
Amenity grasses	Netherlands	Brabant Mixture	Field	Dicot weed plants	SL	Dicamba 50 2,4-D 250 MCPA 166	foliar spray	May-september	1			400-600	.300		
Apple trees	Netherlands	Brabant Mixture	Field	Dicot weed plants	SL	Dicamba 50 2,4-D 250 MCPA 166	foliar spray	May-july	1			400-600	.250		

(a) For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (*e.g.* fumigation of a structure)
(b) Outdoor or field use (F), glasshouse application (G) or indoor application (I)
(c) *e.g.* biting and suckling insects, soil born insects, foliar fungi, weeds
(d) *e.g.* wettable powder (WP), emulsifiable concentrate (EC), granule (GR)
(e) GCPF Codes - GIFAP Technical Monograph No 2, 1989
(f) All abbreviations used must be explained
(g) Method, *e.g.* high volume spraying, low volume spraying, spreading, dusting, drench
(h) Kind, *e.g.* overall, broadcast, aerial spraying, row, individual plant, between the plant - type of equipment used must be indicated
(I) g/kg or g/l
(j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
(k) Indicate the minimum and maximum number of application possible under practical conditions of use
(l) PHI - minimum pre-harvest interval
(m) Remarks may include: Extent of use/economic importance/restrictions

Appendix 29 GAP sheet indicating the registered use of isoproturon in the Netherlands (from Bayer-NL)

Summary of the realistic uses of isoproturon in the Netherlands
July 2006

Crop and/or situation (a)	Member State or Country	Product name	F G or I (b)	Pests or Group of pests controlled (c)	Application: method kind (f-h)	Application: Growth stage & season (j)	Application: number min max (k)	Application rate per treatment: g as/ha max	Period of application (l)	Remark: (m)
Winterbarley & winterwheat	NL	Bifenix N	F	*Weeds*	broadcast spray	Voor-opkomst; vanaf 20 october	1	2331	20 october – november	
Winterwheat	NL	Bifenix N	F	*weeds*	broadcast spray	BBCH 12 – eind december	1	1998	November – December	
Winterwheat & winterbarley	NL	Bifenix N	F	*weeds*	broadcast spray	Vanaf einde winter tot uitstoeling	1	1332 (20% slib en/of 2% o.s.) 1499 (20-35% slib en/of 2-5% o.s.) 1665 (>35% slib en/of 5% o.s.)	Maart-April	
Wintercereals	NL	IP-FLO	F	*weeds*	Broadcast spray	Herfst: Voor-opkomst & vanaf BBCH 11; Voorjaar: BBCH 13-29	1	2250	Voor-opkomst: September-october; Na-opkomst: October - November ; Over vorst: December-maart Voorjaar: Maart-april	
Springwheat	NL	IP-FLO	F	*weeds*	Broadcast spray	BBCH 13-15	1	1750	Maart-april	

Isoproturon wordt 1 maal per jaar toegepast!

Appendix 30 GAP sheet indicating the registered use of MCPA in the Netherlands (from Nupharm-NL)

Crop and/or situation	Country	Product name	F,G or I	Pests	Formulation		Application			Application rate per treatment				PHI (days)	% of the crop treated	Remarks:
					Type	Conc.	application method	growth stage & season	number of treatments min max	interval between applications (min)	g as/hL min max	water L/ha min max	g as/ha min max			
cereals (spring + winter cereals)	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-15 mai	0 1	NA	165-400	250-600	1000	NA	40 %	
Pastures	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-30 sept	0 2	56	200-600	250-600	1000 - 2000	7 days before grazing	20 %	20% of the acreage is treated once; 2% is treated twice
Potatoes	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	1 june-31 jul	0 1	NA	50-200	500-1000	500 - 1000	4 weeks	4%	MCPA is concsidered as an emergency measure: most of the years, MCPA is nearly not used
Flax	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	1 mai-31 mai	0 1	NA	85-200	250-600	250 - 500	NA	75 %	average of used dose rate is <250 gr ai/ha
Grasses for seed production	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-15 mai	0 1	NA	165-400	250-600	1000	NA	50 %	
Greens and sportfields	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-30 sept	0 1	NA	165-600	250-600	1000 - 1500	NA	75 %	
Temporary uncultivated land	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 jul-15 sept	0 1	NA	330-800	250-600	2000 - 3000	NA	5%	
Permanent uncultivated land	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-30 sept	0 2	56	330-800	250-600	2000 - 3000	NA	5%	
Around fields and pastures	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-30 sept	0 2	56	330-600	250-600	1000-1500	NA	<5 %	
Orchards + Berries	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 april-31 jul	0 2	56	165-600	250-600	1000 - 2000	NA	50 %	
Bulbs	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 jul-31 aug	0 1	NA	330-800	250-600	2000 - 3000	NA	20 %	
Roadsides	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	15 march-30 sept	0 1	NA	165-600	250-600	1000-1500	NA	<5 %	
Asperangus	NL	U 46 M	F	dicots weeds	SL	500 gr/l	Spraying	1 april-15 jun	0 1	NA	150-300	250-600	750	NA	10 %	

Continuation Appendix 30

Taluds and dry ditches	NL	U 46 M	F	*dicots weeds*	SL	500 gr/l	Spraying	1 march-15 oct	0 1	NA	165-400	250-600	1000	NA	<5 %	
Grasses for green manuring	NL	U 46 M	F	*dicots weeds*	SL	500 gr/l	Spraying	15 jul-15 oct	0 1	NA	165-600	250-600	1000-1500	NA	10 %	
Others	NL	U 46 M	F	*dicots weeds*	SL	500 gr/l	Spraying	1 march-15 oct	0 1	NA	165-600	250-600	1000 - 1500	NA		the other uses are very small

Appendix 31 GAP sheets indicating the registered use of mecoprop (MCPP) in the Netherlands (from Ctgb and Nupharm-NL)

First sheet originating from Ctgb:

Teelten waarin Mecoprop-P is toegelaten:

Toelatings-nummer	Middel	Startjaar	Werkzame stof	Gehalte g/l	Teelt	Dosering middel l/ha	Dosering w.s. kg/ha	Frequentie	Interval dagen	Periode	Datum WGGA	
12157	AA Mix Junior	2000	bifenox	250	Gazons en sportvelden	4.5	1.13	1	-	maart-augustus	13-10-2000	
			mecoprop-p	308			1.39					
9806	Basagran P Duplo	1987	bentazon	333	wintertarwe en wintergerst	3	1.00	1	-	Niet na 1 oktober	14-03-2003	
			mecoprop-p	250			0.75					
			bentazon	333	zomertarwe, zomergerst en winterrogge	2.25	0.75	1	-			
			mecoprop-p	250			0.56					
			bentazon	333	Graszaad	3	1.00	1	-			
			mecoprop-p	250			0.75					
			bentazon	333	Weiland	3	1.00	1	-			
			mecoprop-p	250			0.75					
10545	Certrol Combin D	1990	MCPA	150	wintertarwe, wintergerst, zomertarwe, zomergerst, haver, graszaad, gazons en sportvelden	4	0.6	1	-	Najaarstoepassing	30-07-1999	
			mecoprop-p	150			0.6			verboden		
			bromoxynil	100			0.4					
			MCPA	150	winterrogge en triticale	3	0.45	1	-			
			mecoprop-p	150			0.45					
			bromoxynil	100			0.3					
12454	Compitone Plus	2003	mecoprop-p	59%	Rogge en triticale	2.25	1.33	1	-	Najaarstoepassing	20-06-2003	
			mecoprop-p	59%	Zomergranen, graszaad, grassland	3	1.77	1	-	verboden		
			mecoprop-p	59%	wintertarwe en wintergerst	3.5	2.07	1	-			
			mecoprop-p	59%	Gazons en sportvelden	4.5	2.66	1	-			
9531	Duplosan MCPP	1987	mecoprop-p	600	Zomer- en wintergranen, gazons en sportvelden, graszaadteelt	2	1.20	1	-	Najaarstoepassing	10-01-2003	verspuiten met een grove druppel en onder lage druk
			mecoprop-p	600	Weilanden	3	1.80	1	-	verboden		
			mecoprop-p	600	akkerranden en randen van weilanden, onder appel- en perenbomen, onder windschermen en op erven (pleksgewijs m.b.v. rugspuit 0,5% (50 ml in 10 l water, genoeg voor 100m²))	3	1.80	1	-			

Continuation Appendix 31

Toelatings- nummer	Middel	Startjaar	Werkzame stof	Gehalte g/l	Teelt	Dosering middel l/ha	Dosering w.s. kg/ha	Frequentie	Interval dagen	Periode	Datum WGGA	
10827	Luxan Dicamix-D Vloeibaar	1991	2,4-D	292	onder appel-, pere- en pruimebomen.	6	1.752	1	-	Najaarstoepassing	30-07-1999	
			mecoprop-P	125	Evt. Pleksgewijze toepassing met 1 liter per 100 l water		0.75			verboden		
			dicamba	25			0.15					
12678	Mecop PP-2	2005	mecoprop-p	600	Zomer- en wintergranen, gazons en sportvelden, graszaadteelt	2	1.20	1	-	Najaarstoepassing		
			mecoprop-p	600	Weilanden	3	1.80	1	-	verboden		
			mecoprop-p	600	akkerranden en randen van weilanden, onder appel- en perenbomen, onder windschermen en op erven (pleksgewijs m.b.v. rugspuit 0,5% (50 ml in 10 l water, genoeg voor 100m²))	3	1.80	1	-			
10834	Optica	1991	mecoprop-p	600	Zomer- en wintergranen, gazons en sportvelden, graszaadteelt	2	1.20	1	-	Najaarstoepassing	30-07-1999	verspuiten met een grove druppel en onder lage druk
			mecoprop-p	600	Weilanden	3	1.80	1	-	verboden		
			mecoprop-p	600	akkerranden en randen van weilanden, onder appel- en perenbomen, onder windschermen en op erven (pleksgewijs m.b.v. rugspuit 0,5% (50 ml in 10 l water, genoeg voor 100m²))	3	1.80	1	-			
10194	Verigal D	1989	mecoprop-p	308	Rogge en triticale	2.5	0.77	1	-	Najaarstoepassing	30-07-1999	
			bifenox	250			0.63			verboden		
			mecoprop-p	308	Zomergranen, graszaad, grassland	3	0.92	1	-			
			bifenox	250			0.75					
			mecoprop-p	308	wintertarwe en wintergerst	3.5	1.08	1	-			
			bifenox	250			0.88					
			mecoprop-p	308	Gazons en sportvelden	4.5	1.39	1	-			
			bifenox	250			1.13					
10191	Verigal Kleinverpakking		mecoprop-p	308	Gazons en sportvelden	4.5	1.39	1	-	Najaarstoepassing	13-08-1999	
			bifenox	250	(pleksgewijs m.b.v. rugspuit 0,5% (50 ml in 10 l water, genoeg voor 100m²))		1.13			verboden		

Second sheet originating from Nupharm-NL:

Crop and/or situation	Country	Product name	F, G or I	Pests or	Formulation		Application			Application rate per treatment				PHI (days)	% of the crop treated	Remarks:
					Type	Conc.	application method	growth stage & season	number of treatments min max	interval between applications (min)	g as/hL min max	water L/ha min max	g as/ha min max			
cereals (spring + winter cereals)	NL	Duplosan MCPP	F	*dicots weeds*	SL	600 gr/l	Spraying	15 march-30 april	0 1	NA	240-480	250-500	1200	NA	40%	Duplosan MCPP cannot be used before 1 march and after 30 sept
Pastures	NL	Duplosan MCPP	F	*dicots weeds*	SL	600 gr/l	Spraying	1 march-30aug	0 2	56	120-720	250-500	600-1800	NA	10%	
Grasses for seed production	NL	Duplosan MCPP	F	*dicots weeds*	SL	600 gr/l	Spraying	1 march-15 mai	0 1	NA	240-480	250-500	1200	NA	10%	
Greens and sportfields	NL	Duplosan MCPP	F	*dicots weeds*	SL	600 gr/l	Spraying	1 march-30aug	0 1	NA	240-480	250-500	1200	NA	75%	
Orchards + Berries	NL	Duplosan MCPP	F	*dicots weeds*	SL	600 gr/l	Spraying	1 mai-31 jul	0 2	56	360-720	250-500	1800	NA	50%	
Borders of fields	NL	Duplosan MCPP	F	*dicots weeds*	SL	600 gr/l	Spraying	1 april-15 oct	0 1	NA	360-720	250-500	1800	NA	5%	

Appendix 32 GAP sheet indicating the registered use of metolachlor in the Netherlands (from Syngenta-NL)

Responsible body for reporting: **Syngenta Crop Protection B.V.**
Pesticide(s): **S-metolachlor**
EEC, CIPAC and CCPR No(s):
Trade name(s): **DUAL GOLD 960 EC**
EU Countries
Main uses:

Date: **juli 2008**
Country: **Netherlands**

Crop and/or situation	Member State or Country	Product name	F G or I	Pests or Group of Pests controlled	Formulation		Application				Application rate per treatment			PHI (days)	Crop Remarks
					Type	Conc. of as	method kind	growth stage & season	number min max	interval between applications (days)	kg as/hL or L as /hL min max	water L/ha min max	kg as/ha or L as /ha min max		
(a)			(b)	(c)	(d-f)	(i)	(f-h)	(j)	(k)					(l)	(m)
Beet, fodder	Netherlands	DUAL GOLD 960 EC	Field	Dicot weeds, annual	EC	S-metolachlor 960	foliar spray	April-may	1-2			400	.48-.96		
Chicory, witloof	Netherlands	DUAL GOLD 960 EC	Field	Gramineae, annual grasses Weed plants	EC	S-metolachlor 960	foliar spray	April-may	3-6	7		400	.096-.288		
Maize Group	Netherlands	DUAL GOLD 960 EC	Field	Gramineae, annual grasses	EC	S-metolachlor 960	foliar spray	Pre-emergence April	1			400	1.536		silage and grain
Maize Group	Netherlands	DUAL GOLD 960 EC	Field	Gramineae, annual grasses	EC	S-metolachlor 960	foliar spray	Post-emergence May-june	1			400	1.536		silage and grain
Maize Group	Netherlands	DUAL GOLD 960 EC	Field	Dicot weeds, annual Gramineae, annual grasses	EC	S-metolachlor 960	foliar spray	Post-emergence May-june	1			400	.864		Silage,grain; in mixture with other products
Strawberry	Netherlands	DUAL GOLD 960 EC	Field	Gramineae, annual grasses Gramineae, annual grasses Weed plants	EC	S-metolachlor 960	foliar spray	April-may or august	1-2	7-14		400	.672	28	
Sugarbeet	Netherlands	DUAL GOLD 960 EC	Field	Dicot weeds, annual	EC	S-metolachlor 960	foliar spray	April-may	1-2			400	.48-.96		

(a) For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (*e.g.* fumigation of a structure)
(b) Outdoor or field use (F), glasshouse application (G) or indoor application (I)
(c) *e.g.* biting and suckling insects, soil born insects, foliar fungi, weeds
(d) *e.g.* wettable powder (WP), emulsifiable concentrate (EC), granule (GR)
(e) GCPF Codes - GIFAP Technical Monograph No 2, 1989
(f) All abbreviations used must be explained
(g) Method, *e.g.* high volume spraying, low volume spraying, spreading, dusting, drench
(h) Kind, *e.g.* overall, broadcast, aerial spraying, row, individual plant, between the plant - type of equipment used must be indicated
(I) g/kg or g/l
(j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
(k) Indicate the minimum and maximum number of application possible under practical conditions of use
(l) PHI - minimum pre-harvest interval
(m) Remarks may include: Extent of use/economic importance/restrictions

Appendix 33 GAP sheet indicating the registered use of metazachlor in the Netherlands (from BASF-NL)

Crop and/ or situation (a)	Member State or Country	Product name	F G or I (b)	Application: method kind (f-h)	Application: growth stage & season (j)	Application rate per treatment: g as/hL min max	Application rate per treatment: water L/ha min max	Application rate per treatment: g as/ha min max	PHI (days) (l)	Remarks: (m)	market share (aandeel) 2000
ware and starch potatoes	NL	Butisan	F	Spraying	1 april-15 mei	188-375	200-400	750	NA	not in drinkingwater protection area´s	0.05
winterrape	NL	Butisan	F	Spraying	15 sept-1 nov	375-750	200-400	1500	NA	not in drinkingwater protection area´s	1
apple and pear	NL	Butisan	F	Spraying	15 april-15 mei	375-750	200-400	1500	NA	not in drinkingwater protection area´s	0.001
cabbage	NL	Butisan	F	Spraying	1 mei-31 juli	375-750	200-400	1500	NA	not in drinkingwater protection area´s	0.6
transplanted leek	NL	Butisan	F	Spraying	15 juni-15 aug	375-750	200-400	1500	NA	not in drinkingwater protection area´s	1
nursery stock	NL	Butisan	F	Spraying	1 april-15 mei	375-750	200-400	1500	NA	not in drinkingwater protection area´s	0.2
nursery stock	NL	Butisan	F	Spraying	1 juni-1 aug	375-750	200-400	1500	NA	not in drinkingwater protection area´s	0.2

Appendix 34 GAP sheet indicating the registered use of metoxuron in the Netherlands (from BASF-NL)

Crop and/ or situation (a)	Member State or Country	Product name	F G Or I (b)	Application method kind (f-h)	growth stage & season (j)	Application rate per treatment g as/hL min max	water L/ha min max	g as/ha min max	PHI (days) (l)	Remarks: (m)	market share (aandeel) 2000
ware and starch potatoes	NL	Purivel	F	Spraying	1-30 sept	320	500	1600	NA	driftpercentage 0.5%	0.1
seed potatoes	NL	Purivel	F	Spraying	1-31 juli	320	500	1600	NA	driftpercentage 0.5%	0.05
carrots	NL	Dosanex	F	Spraying	1-mei-15 juni	400-800	300-600	2400	NA	driftpercentage 0.5%	0.01
carrots	NL	Dosanex	F	Spraying	15 mei-31 juli	535-1070	300-600	3200	NA	driftpercentage 0.5%	0.9
gladiolus	NL	Dosanex	F	Spraying	15 maart- 30 april	535-1070	300-600	3200	NA	driftpercentage 0.5%	0.01
gladiolus	NL	Dosanex	F	Spraying	15 mei-30 juni	400-800	300-600	2400	NA	driftpercentage 0.5%	1
iris	NL	Dosanex	F	Spraying	1-31 mei	133-267	300-600	800	NA	driftpercentage 1.0%	2

Appendix 35 GAP sheet indicating the registered use of metribuzin in the Netherlands (from Bayer-NL)

Summary of the realistic uses of Sencor (metribuzin 70 WG) in the Netherlands
July 2006

Crop and/or situation	Member State or Country	Product name	F G or I	Pests or Group of pests controlled	Formulation		Application				Application rate per treatment			PHI (days)	Remark:
(a)			(b)	(c)	Type (d-f)	Conc. of as (i)	method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (min)	kg as/hL min max	water L/ha min max	g as/ha min max	(l)	(m)
Potatoes-consumption	NL	Sencor WG	F	*Weeds*	WG	70	broadcast spray	1. Pre-emergence; 2. pre-flowering 3. post flowering	1-3	7		200-400	1: 0-20% slib: 525 20-35% slib: 700 35-50% slib: 875 2&3: 175	28	1. Apr-May 2. May-Jun 3. August
Potatoes-industrial	NL	Sencor WG	F	*weeds*	WG	70	broadcast spray	1) BBCH 00-14 (maximum 50% of the plants at stage 09-14; none plants >BBCH 14) 2. pre-flowering 3. post flowering	1-3	7		200 - 400	1: 350 – 700 2&3: 175	28	1. May 2. May-Jun 3. Aug
Asparagus - production	NL	Sencor WG	F	*weeds*	WG	70	broadcast spray	Pre-harvest; on aspargus-beds, before aspargus are visible	1	-		200 - 400	525	NA	Mar-Apr
Asparagus - production	NL	Sencor WG	F	*weeds*	WG	70	broadcast spray	Post-harvest; shortly after destroy of beds, before regrowth	1	-		200 - 400	700	NA	Apr-Jul
Aspargus – nursery	NL	Sencor WG	F	*weeds*	WG	70	Broadcast spray	1) post-emergence, crop height>5cm	1-3	7-10		200-400	1) 70 2) 140 3) 210	NA	Mar-May

Appendix 36 GAP sheet indicating the registered use of terbutylazin in the Netherlands, 2000-2004 (from Syngenta-NL)

Responsible body for reporting: Syngenta Crop Protection B.V.
Pesticide(s): terbuthylazine
EEC, CIPAC and CCPR No(s):
Trade name(s): GARDOPRIM 500 SC , Lido 410 SC, Laddok N
EU Countries
Main uses:

Date: juli 2008
Country: Netherlands

Crop and/or situation	Member State or Country	Product name	F G or I	Pests or Group of Pests controlled	Formulation		Application				Application rate per treatment			PHI (days)	Crop Remarks
(a)			(b)	(c)	Type (d-f)	Conc. of as (i)	method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (days)	kg as/hL or L as /hL min max	water L/ha min max	kg as/ha or L as /ha min max	(l)	(m)
Maize Group	Netherlands	GARDOPRIM 500 SC	Field	Annual broad-leaved plants Poa supina	SC	terbuthylazine 500	foliar spray	May-june	1			400	.75 – 1.0		silage and grain
Maize Group	Netherlands	LIDO SC	Field	Dicot weed plants Echinochloa crus-galli Poa supina	SC	terbuthylazine 250 pyridate 160	foliar spray	May-june	1			200-400	.75 – 1.0		silage and grain
Maize Group	Netherlands	LIDO SC	Field	Dicot weed plants Echinochloa crus-galli Poa supina	SC	terbuthylazine 250 pyridate 160	foliar spray	May-june	2	7-14		200-400	.5		silage and grain
Maize Group	Netherlands	Laddok N	Field	Annual broad-leaved plants Annual grasses	SC	terbuthylazine 200 bentazon 200	foliar spray	May-june	1			400-600	.8		silage and grain

(a) For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (*e.g.* fumigation of a structure)
(b) Outdoor or field use (F), glasshouse application (G) or indoor application (I)
(c) *e.g.* biting and suckling insects, soil born insects, foliar fungi, weeds
(d) *e.g.* wettable powder (WP), emulsifiable concentrate (EC), granule (GR)
(e) GCPF Codes - GIFAP Technical Monograph No 2, 1989
(f) All abbreviations used must be explained
(g) Method, e.g. high volume spraying, low volume spraying, spreading, dusting, drench
(h) Kind, *e.g.* overall, broadcast, aerial spraying, row, individual plant, between the plant - type of equipment used must be indicated
(I) g/kg or g/l
(j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
(k) Indicate the minimum and maximum number of application possible under practical conditions of use
(l) PHI - minimum pre-harvest interval
(m) Remarks may include: Extent of use/economic importance/restrictions

Appendix 37 Overview of the representative crop grouping for the Ctgb crops for which registration can be applied

The mentioned crop groupings (GeoPEARL, FOCUS Surface water scenario D1 and D3 crop groupings) are needed in the proposed Tier I calculation method.

The D1 and D3 FOCUS surface water scenarios contain only a limited number of crop groupings, so all crops mentioned in the GAP sheets must be categorized into these FOCUS surface water crops groupings in order to be able to calculate concentrations for the crops mentioned in the GAP sheets. Furthermore the crops of the GAP sheets must be categorized into the geoPEARL crop groupings to be able to calculate their relative crop areas with the geographical information on crop areas presented in appendix 60.

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
<u>Volgorde van gewassen</u>				
1. Akkerbouwgewassen				
1.1. Aardappelen				
1.1.1.	Pootaardappelen	potatoes	oil seed rape, spring	potatoes
1.1.2.	Consumptie-aardappelen		idem	idem
1.1.3.	Fabrieksaardappelen		idem	idem
1.1.4.	Overige aardappelen		idem	idem
1.2. Bieten				
1.2.1.	Suikerbieten	Sugar beets	oil seed rape, spring	Sugar beets
1.2.2.	Voederbieten	idem	idem	idem
1.2.3.	Overige bieten	idem	idem	idem
1.3. Granen				
1.3.1.	Wintertarwe	cereals	cereals, winter	cereals, winter
1.3.2.	Zomertarwe	idem	cereals, spring	cereals, spring
1.3.3.	Wintergerst	idem	cereals, winter	cereals, winter
1.3.4.	Zomergerst	idem	cereals, spring	cereals, spring
1.3.5.	Winterrogge	idem	cereals, winter	cereals, winter
1.3.6.	Zomerrogge	idem	cereals, spring	cereals, spring
1.3.7.	Haver	idem	cereals, spring	cereals, spring
1.3.8.	Triticale	idem	?	?
1.3.9.	Overige granen	idem	?	?
1.4. Maïs				
1.4.1.	Snijmaïs	maize	cereals, spring	maize
1.4.2.	Korrelmaïs	idem	idem	idem
1.4.3.	Suikermaïs	idem	idem	idem
1.4.4.	Overig maïs	idem	idem	idem
1.5. Landbouwerwten				
1.5.1.	Kapucijner	legumes	oil seed rape, spring	legumes
1.5.2.	Gele erwt	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
1.5.3.	Grauwe erwt	idem	idem	idem
1.5.4.	Groene erwt	idem	idem	idem
1.5.5.	Linze	idem	idem	idem
1.5.6.	Rozijnenerwt	idem	idem	idem
1.5.7.	Schokker	idem	idem	idem
1.5.8.	Suikererwt	idem	idem	idem
1.5.9.	Overige landbouwerwten	idem	idem	idem
1.6. Landbouwstambonen				
1.6.1.	Bruine boon	legumes	oil seed rape, spring	legumes
1.6.2.	Gele boon	idem	idem	idem
1.6.3.	Kievitsboon	idem	idem	idem
1.6.4.	Witte boon	idem	idem	idem
1.6.5.	Overige landbouwstambonen	idem	idem	idem
1.7. Veldbonen				
1.7.1.	Veldbonen voor ernstige doeleinden	legumes	oil seed rape, spring	field beans
1.7.2.	Overige veldbonen	idem	idem	idem
1.8. Graszaadteelt				
1.9. Oliehoudende zaden, vezelgewassen				
1.9.1.	Blauwmaanzaad	leaf vegetables	oil seed rape, spring	oil seed rape, spring
1.9.2.	Karwij (= Kummel)	idem	idem	idem
1.9.3.	Lijnzaad	idem	idem	idem
1.9.4.	Mosterd (gele- en bruine-)	idem	idem	idem
1.9.5.	Raapzaad	idem	idem	idem
1.9.6.	Winterkoolzaad	idem	?	oil seed rape, winter
1.9.7.	Zomerkoolzaad	idem	idem	idem
1.9.8.	Teunisbloem	idem	idem	idem
1.9.9.	Zonnebloem	idem	idem	idem
1.9.10.	Hennep	idem	idem	idem
1.9.11.	Vezelvlas	idem	idem	idem
1.9.12.	Overige oliehoudende zaden en vezelgewassen	idem	idem	idem
1.10. Voeder- en groenbemestingsgewassen, stuifdekgewassen				
1.10.1.	Alexandrijnse en Perzische klaver (rode- en witte-)	green manuring	grass/alfalfa	cereals, winter
1.10.2.	Lupine	idem	idem	idem
1.10.3.	Serradelle	idem	idem	idem
1.10.4.	Luzerne	idem	idem	idem
1.10.5.	Voederwikke	idem	idem	idem
1.10.6.	Bladkool	idem	idem	idem
1.10.7.	Bladrammenas	idem	idem	idem
1.10.8.	Gele mosterd	idem	idem	idem
1.10.9.	Phacelia	idem	idem	idem
1.10.10 .	Spurrie	idem	idem	idem
1.10.11.	Mergkool	idem	idem	idem
1.10.12.	Winterrogge	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0	Representatief GEOPEARL gewas	Representatief D1	Representatief D3
1.10.13. Grasgroenbemester	idem	idem	idem
1.10.14. Stoppelknol	idem	idem	idem
1.10.15. Overige voeder- en groenbemestingsgewassen, stuifdekgewassen	idem	idem	idem
1.11. Overige akkerbouwgewassen			
1.11.1. Boekweit	remaining arable crops	cereals, spring	cereals, spring
1.11.2. Aardpeer (= Topinamboer)	idem	idem	idem
1.11.3. Hop	idem	idem	idem
2. Cultuurgrasland	grass	grass/alfalfa	grass/alfalfa
3. Fruitgewassen			
3.1. Pitvruchten			
3.1.1. Appel	fruit culture	appl, aerial	Pome/stone fruit, early or late applns
3.1.2. Peer	idem	idem	idem
3.1.3. Kweepeer	idem	idem	idem
3.1.4. Mispel	idem	idem	idem
3.1.5. Overige pitvruchten	idem	idem	idem
3.2. Steenvruchten			
3.2.1. Kers	fruit culture	appl, aerial	Pome/stone fruit, early or late applns
3.2.2. Pruim	idem	idem	idem
3.2.3. Abrikoos	idem	idem	idem
3.2.4. Nectarine	idem	idem	idem
3.2.5. Perzik	idem	idem	idem
3.2.6. Overige steenvruchten	idem	idem	idem
3.3. Bessen			
3.3.1. Rode bes	fruit culture	appl (hand, crop >50 cm)	appl (hand, crop >50 cm)
3.3.2. Witte bes	idem	idem	idem
3.3.3. Zwarte bes	idem	idem	idem
3.3.4. Kruisbes	idem	idem	idem
3.3.5. Blauwe bes	idem	idem	idem
3.3.6. Bosbes (incl. vossebes en veenbes)	idem	idem	idem
3.3.7. Cranberry	idem	idem	idem
3.3.8. Vlierbes	idem	idem	idem
3.3.9. Druif	idem	idem	idem
3.3.10. Overige bessen	idem	idem	idem
3.4. Aardbei	strawberries	oil seed rape, spring	vegetables, leafy
3.5. Houtig klein fruit			
3.5.1. Braam	fruit culture	appl (hand, crop >50 cm)	appl (hand, crop >50 cm)
3.5.2. Framboos	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
3.5.3.	Logan bes	idem	idem	idem
3.5.4.	Moerbei	idem	idem	idem
3.5.5.	Rozenbottel	idem	idem	idem
3.5.6.	Overig houtig kleinfruit	idem	idem	idem
3.6. Noten				
3.6.1.	Hazelnoot	fruit culture	appl, aerial	Pome/stone fruit, early or late applns
3.6.2.	Kastanje	idem	idem	idem
3.6.3.	Walnoot (= okkernoot, incl. hickorynoot)	idem	idem	idem
3.6.4.	Overige noten	idem	idem	idem
				idem
3.7. Overige fruitgewassen		fruit culture	appl, aerial	idem
4. Groenteteelt				
4.1. Bladgroenten				
4.1.1.	Bladmosterd (= amsoi)	leaf vegetable	oil seed rape, spring	vegetables, leafy
4.1.2.	Boerenkool (incl. maaiboerenkool)	idem	idem	idem
4.1.3.	Choisum	idem	idem	idem
4.1.4.	Losbladige Chinese kool (paksoi)	idem	idem	idem
4.1.5.	Comatsuna	idem	idem	idem
4.1.6.	Raapstelen (incl. rucola)	idem	idem	idem
4.1.7.	Chinese broccoli	idem	idem	idem
4.1.8.	Krulsla	idem	idem	idem
4.1.9.	Snijsla	idem	idem	idem
4.1.10.	Pluksla	idem	idem	idem
4.1.11.	Eikebladsla	idem	idem	idem
4.1.12.	Lollo rossa	idem	idem	idem
4.1.13.	Kropsla (incl. rode kropsla)	idem	idem	idem
4.1.14.	IJs(berg)sla	idem	idem	idem
4.1.15.	Bindsla	idem	idem	idem
4.1.16.	Kropandijvie	idem	idem	idem
4.1.17.	Krulandijvie	idem	idem	idem
4.1.18.	Witloftrekteelt	idem	idem	idem
4.1.19.	Roodlof (Radicchio Rosso)	idem	idem	idem
4.1.20.	Maaiandijvie	idem	idem	idem
4.1.21.	Groenlof	idem	idem	idem
4.1.22.	Spinazie	idem	idem	idem
4.1.23.	Nieuw-Zeelandse spinazie	idem	idem	idem
4.1.24.	Snijbiet	idem	idem	idem
4.1.25.	Tuinmelde	idem	idem	idem
4.1.26.	Tuinkers	idem	idem	idem
4.1.27.	Postelein (incl. winterpostelein)	idem	idem	idem
4.1.28.	Veldsla	idem	idem	idem
4.1.29.	Zuring	idem	idem	idem
4.1.30.	Overige bladgroenten	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
4.2. Peulvruchten				
4.2.1.	Stamslaboon (= sperzieboon)	legumes	cereals, spring?	field beans
4.2.2.	Stamsnijboon	idem	idem	idem
4.2.3.	Boterboon (= wasboon)	idem	idem	idem
4.2.4.	Flageolet	idem	idem	idem
4.2.5.	Stokslaboon (= sperzieboon)	idem	idem	idem
4.2.6.	Stoksnijboon	idem	idem	idem
4.2.7.	Spekboon	idem	idem	idem
4.2.8.	Pronkboon	idem	idem	idem
4.2.9.	Asperge-erwt	idem	idem	idem
4.2.10.	Peul (stam- en rijs-)	idem	idem	legumes
4.2.11.	Doperwt (= conservenerwt)	idem	idem	idem
4.2.12.	Kapucijner (= blauwschokker)	idem	idem	idem
4.2.13.	Suikererwt	idem	idem	idem
4.2.14.	Kouseband	idem	idem	idem
4.2.15.	Tuinboon	idem	idem	idem
4.2.16.	Sojaboon	idem	idem	idem
4.2.17.	Limaboon	idem	idem	idem
4.2.18.	Cowpea (= korte kouseband)	idem	idem	idem
4.2.19.	Overige peulvruchten	idem	idem	idem
			idem	idem
4.3. Vruchtgroenten				
4.3.1.	Aubergine	remaining arable crops	appl (hand, crop >50 cm)	appl (hand, crop >50 cm)
4.3.2.	Augurk	idem	idem	idem
4.3.3.	Courgette	idem	idem	idem
4.3.4.	Komkommer	idem	idem	idem
4.3.5.	Tomaat	idem	idem	idem
4.3.6.	Paprika (incl. scherpe = Spaanse peper)	idem	idem	idem
4.3.7.	Meloen	idem	idem	idem
4.3.8.	Okra	idem	idem	idem
4.3.9.	Pattison	idem	idem	idem
4.3.10.	Pompoen	idem	idem	idem
4.3.11.	Spaghettigroenten	idem	idem	idem
4.3.12.	Overige vruchtgroentegewassen	idem	idem	idem
4.4. Koolgewassen				
4.4.1.	Rode kool	cabbage	oil seed rape, spring	vegetables, leafy
4.4.2.	Savooien kool (gele- en groene-)	idem	idem	idem
4.4.3.	Spitskool	idem	idem	idem
4.4.4.	Witte kool	idem	idem	idem
4.4.5.	Chinese kool	idem	idem	idem
4.4.6.	Bloemkool (witte, groene, paarse en Romanesco)	idem	idem	idem
4.4.7.	Broccoli	idem	idem	idem
4.4.8.	Spruitkool	idem	idem	idem
4.4.9.	Koolrabi	idem	idem	idem
4.4.10.	Overige koolgewassen	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
4.5. Knol- en wortelgroenten				
4.5.1.	Knolraap (= consumptieknol = consumptieraap)	leaf vegetables	oil seed rape, spring	vegetables, root
4.5.2.	Koolraap	idem	idem	idem
4.5.3.	Radijs	idem	idem	idem
4.5.4.	Rammenas	idem	idem	idem
4.5.5.	Knolselderij	idem	idem	idem
4.5.6.	Wortelpeterselie	idem	idem	idem
4.5.7.	Bospeen	idem	idem	idem
4.5.8.	Waspeen	idem	idem	idem
4.5.9.	Winterwortel	idem	idem	idem
4.5.10.	Rode biet (= kroot)	idem	idem	idem
4.5.11.	Pastinaak	idem	idem	idem
4.5.12.	Schorseneer (incl. haverwortel = salsifis)	idem	idem	idem
4.5.13.	Witlof pennenteelt	idem	idem	idem
4.5.14.	Cichorei pennenteelt	idem	idem	idem
4.5.15.	Overige knol- en wortelgroenten	idem	idem	idem
4.6. Alliums				
4.6.1.	Zaaiui (incl. picklers)	onions	cereals, spring	vegetables, bulb
4.6.2.	Eerstejaars plantui	idem	idem	idem
4.6.3.	Tweedejaars plantui	idem	idem	idem
4.6.4.	Bosui	idem	idem	idem
4.6.5.	Stengelui	idem	idem	idem
4.6.6.	Prei	leek	idem	idem
4.6.7.	Bieslook	onions	idem	idem
4.6.8.	Zilverui	idem	idem	idem
4.6.9.	Tweedejaars plantui	idem	idem	idem
4.6.10.	Picklers	idem	idem	idem
4.6.11.	Knoflook	idem	idem	idem
4.6.12.	Zaaisjalot	idem	idem	idem
4.6.13.	Plantsjalot	idem	idem	idem
4.6.14.	Overige alliums	idem	idem	idem
4.7. Steel- en stengelgroenten				
4.7.1.	Asperge (witte- / groene-)	asparagus	cereals, winter	vegetables, leafy
4.7.2.	Bleek/groenselderij	leaf vegetables	idem	idem
4.7.3.	Snij- en bladselderij	idem	idem	idem
4.7.4.	Kardoen	idem	idem	idem
4.7.5.	Rabarber	idem	idem	idem
4.7.6.	Stengelsla	idem	idem	idem
4.7.7.	Overige steel- en stengelgroenten	idem	idem	idem
4.8. Overige groententeelt				
4.8.1.	Knolvenkel	remaining arable crops	cereals, winter	vegetables, leafy
4.8.2.	Artisjok	idem	idem	idem
4.8.3.	Peterselie	idem	idem	idem
4.8.4.	Maggi	idem	idem	idem
4.8.5.	Overige	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
5. Kruidenteelt				
5.1. Tuinkruidenteelt				
5.1.1.	Alsem	remaining arable crops	cereals, spring?	cereals, spring?
5.1.2.	Basilicum	idem	idem	idem
5.1.3.	Bazielkruid	idem	idem	idem
5.1.4.	Bernagie	idem	idem	idem
5.1.5.	Bonenkruid	idem	idem	idem
5.1.6.	Citroenkruid	idem	idem	idem
5.1.7.	Citroenmelisse	idem	idem	idem
5.1.8.	Dille	idem	idem	idem
5.1.9.	Dragon	idem	idem	idem
5.1.10.	Engelwortel	idem	idem	idem
5.1.11.	Husop	idem	idem	idem
5.1.12.	Kervel	idem	idem	idem
5.1.13.	Knoflookbieslook	idem	idem	idem
5.1.14.	Koreander	idem	idem	idem
5.1.15.	Krulpeterselie	idem	idem	idem
5.1.16.	Lavendel	idem	idem	idem
5.1.17.	Maggikruid (= lavas)	idem	idem	idem
5.1.18.	Majoraan (= marjolein)	idem	idem	idem
5.1.19.	Mierikswortel	idem	idem	idem
5.1.20.	Munt	idem	idem	idem
5.1.21.	Oregano	idem	idem	idem
5.1.22.	Peterselie	idem	idem	idem
5.1.23.	Pimpernel	idem	idem	idem
5.1.24.	Rozemarijn	idem	idem	idem
5.1.25.	Salie	idem	idem	idem
5.1.26.	Tijm	idem	idem	idem
5.1.27.	Venkel	idem	idem	idem
5.1.28.	Overige tuinkruiden	idem	idem	idem
5.2. Medicinale tuinkruiden		remaining arable crops	cereals, spring?	cereals, spring?
5.2.1.	Aartsengelwortel	idem	idem	idem
5.2.2.	Gifsla	idem	idem	idem
5.2.3.	Mariadistel	idem	idem	idem
5.2.4.	Opgeblazen Lobelia	idem	idem	idem
5.2.5.	Valeriaan	idem	idem	idem
5.2.6.	Wollig vingerhoedskruid	idem	idem	idem
5.2.7.	Overige medicinale kruiden			
5.3. Overige kruidenteelt				
5.3.1.	Driekleurig viooltje	remaining arable crops	cereals, spring?	cereals, spring?
6. Paddestoelenteelt				
6.1.	Champignon	not relevant	no drift	no drift
6.2.	Cantharel	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
6.3.	Oesterzwam	idem	idem	idem
6.4.	Truffel	idem	idem	idem
6.5.	Overige paddestoelen	idem	idem	idem
7. Sierteeltgewassen				
7.1. Bloembollen- bolbloementeelt				
7.1.1.	Amaryllis	flower bulbs	cereals, winter	vegetables, bulb
7.1.2.	Gladiool	idem	idem	idem
7.1.3.	Hyacint	idem	idem	idem
7.1.4.	Lelie	idem	idem	idem
7.1.5.	Narcis	idem	idem	idem
7.1.6.	Tulp	idem	idem	idem
7.1.7.	Iris	idem	idem	idem
7.1.8.	Krokus	idem	idem	idem
7.1.9.	Bijgoed	idem	idem	idem
7.1.10.	Overige bloembollen en bolbloemen	idem	idem	idem
7.2. Bloemisterijgewassen				
7.2.1.	Potplanten	floriculture	oil seed rape, spring	vegetables, leafy
7.2.2.	Snijbloemen onder glas	idem	idem	idem
7.2.3.	Buitenbloemen (incl. zomerbloemen en droogbloemen)	idem	idem	idem
7.2.4.	Perkplanten	idem	idem	idem
7.2.5.	Trekheesters	idem	idem	idem
7.2.6.	Snijgroen	idem	idem	idem
7.2.7.	Overige bloemisterijgewassen	idem	idem	idem
7.3. Boomkwekerijgewassen				
7.3.1.	Laanbomen	tree nurseries	appl, aerial	Pome/stone fruit, early or late applns
7.3.2.	Klimplanten	idem	idem	idem
7.3.3.	Rozeonderstammen- en buitenrozen	idem	idem	idem
7.3.4.	Coniferen	idem	idem	idem
7.3.5.	Sierheesters	idem	idem	idem
7.3.6.	Kerstsparren	idem	idem	idem
7.3.7.	Heide soorten	idem	idem	idem
7.3.8.	Vruchtboomonderstammen	idem	idem	idem
7.3.9.	Vruchtbomen en -struiken	idem	idem	idem
7.1.1.	Overige boomkwekerijgewassen	idem	idem	idem
7.4. Vaste planten		floriculture	cereals, winter	cereals, winter
7.5. Overige sierteelt				
7.5.1.	Bloemenzaadteelt/pootgoedteelt	floriculture	oil seed rape, spring	vegetables, leafy
7.5.2.	Potgrond voorbehandeling	idem	idem	idem
7.5.3.	Particuliere tuinen	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
7.5.4.	Kamerplanten	idem	idem	idem
7.5.5.	Balkonplanten	idem	idem	idem
7.5.6.	Borders	idem	idem	idem
7.5.7.	Moestuinen	idem	idem	idem
7.5.8.	Snijteen (vochtig)	idem	idem	idem
7.5.9.	Snijteen (droog)	idem	idem	idem
7.5.10.	Rietteelt	idem	idem	idem
7.5.11.	Stekmateriaal	idem	idem	idem
7.5.12.	Moeras- en waterplanten	idem	appl, aerial	appl, aerial
7.5.13.	Overige sierteelt	idem	oil seed rape, spring	vegetables, leafy
8.	**Openbaar groen**			
8.1. Openbare grasvegetatie				
8.1.1.	Gazon	grass	grass/alfalfa	grass/alfalfa
8.1.2.	Speelweide	idem	idem	idem
8.1.3.	Sportveld, golfgreens	idem	idem	idem
8.1.4.	Grasbermen	idem	idem	idem
8.1.5.	Overige openbare grasvegetatie	idem	idem	idem
8.2. Openbare aanplant				
8.2.1.	Laan- en perkbomen	tree nurseries	appl, aerial	appl, aerial
8.2.2.	Windsingels			
8.2.3.	Wegbeplanting (bosplantsoen)	silviculture	appl, aerial	appl, aerial
8.2.4.	Plantsoenbeplanting			
8.2.5.	Rozenperken	floriculture		
8.2.6.	Perkplanten	floriculture		
8.2.7.	Vaste planten	floriculture		
8.2.8.	Overige openbare aanplant			
8.3. Bosbouw				
8.3.1.	Kaalslagterrein	silviculture	appl, aerial	appl, aerial
8.3.2.	Loofhout	idem	idem	idem
8.3.3.	Naaldhout	idem	idem	idem
8.3.4.	Gemengd bos	idem	idem	idem
8.3.5.	Stobben	idem	idem	idem
8.3.6.	Houtige opslag	idem	idem	idem
8.3.7.	Overige bosbouw	idem	idem	idem
8.4. Overig openbaar groen				
9.	**Onbeteeld terrein**			
9.1. Tijdelijk onbeteeld terrein				
9.1.1.	Land dat voor zaaien of planten geschikt wordt gemaakt	fallow	cereals, winter	cereals, winter
9.1.2.	Leeg bloembollenland	idem	idem	idem
9.1.3.	Op wintervoor geploegd land	idem	idem	idem

Ctgb-gewassenlijst HTB 1.0	Representatief GEOPEARL gewas	Representatief D1	Representatief D3
9.1.4. Stoppelland	idem	idem	idem
9.1.5. Braak	idem	idem	idem
9.1.6. Akkerrand	idem	idem	idem
9.1.7. Overig tijdelijk onbeteeld terrein	idem	idem	idem
9.2. Permanent onbeteeld terrein			
9.2.1. Verharde wegen en paden	not relevant	aminity use (USES 2.0)	aminity use (USES 2.0)
9.2.2. Onverharde wegen en paden	idem	idem	idem
9.2.3. Trottoirs, straatgoten	idem	idem	idem
9.2.4. Spoor- en trambanen	idem	idem	idem
9.2.5. Parkeerterreinen, (bij) benzinestations	idem	idem	idem
9.2.6. Grensstrook van wegen en paden met de bermen			
9.2.7. Fabrieksterreinen			
9.2.8. Opslagterreinen			
9.2.9. Laad- en losplaatsen			
9.2.10. Onder hekwerken en afrasteringen			
9.2.11. Onder vangrails			
9.2.12. Rondom wegmeubilair (verkeersborden, bermpalen)			
9.2.13. Op (rieten) daken en muren			
9.2.14. Op terrassen	idem	idem	idem
9.2.15. Op flagstones, grafzerken	idem	idem	idem
9.2.16. Op tennisbanen (niet gras) en atletiekbanen	idem	idem	idem
9.2.17. Kunststof buitenbanen, kunststof sportvelden	idem	idem	idem
9.2.18. Overig permanent onbeteeld terrein	idem	idem	idem
9.3. Overig onbeteeld terrein			
10. Watergangen			
10.1. (droog) Talud	remaining arable crops	appl. aerial	appl. aerial
10.2. Droge slootbodems	idem	idem	idem
10.3. Waterhoudende watergangen	idem	idem	idem
10.4. Onderhoudspaden van watergangen	idem	idem	idem
10.5. Vijvers	idem	idem	idem
10.6. Overige watergangen	idem	idem	idem
11. Afvalhopen			
12. Bewaarplaatsen, fust, gereedschap			
12.1. Bloembollenschuren			
12.2. Pootgoed bewaarplaatsen			
12.3. Stenen en plastic potten			
12.4. Teelttafels			

Ctgb-gewassenlijst HTB 1.0		Representatief GEOPEARL gewas	Representatief D1	Representatief D3
12.5.	Kassen, glas			
12.6.	Gereedschappen			
12.7.	Overig			

13. Bijenteelt

14. Overige

Appendix 38 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for bentazone

Bentazone	total no. applns.	appln. window first	daynr	last	daynr	selected appln. appln.	daynr	min interval (d)	nr of applns.	appln. rate (kg/ha)
Winter cereals										
D1 ditch	1	7-May	127	7-Jun	158	14-May	134	1	1	1.440
D3 ditch	1	15-Mar	74	15-Apr	105	16-Mar	75	1	1	1.440
Maize		*Spring cereals used for D1 scenario*								
D1 ditch	1	1-Jun	152	1-Jul	182	17-Jun	168	1	1	1.440
D3 ditch	1	15-May	135	30-Jun	181	15-Jan	135	1	1	1.440
Potatoes		*Spring cereals used for D1 scenario*								
D1 ditch	1	15-Jun	166	15-Jul	196	17-Jun	168	1	1	0.960
D3 ditch	1	1-Jun	152	1-Jul	182	14-Jun	165	1	1	0.960
Grass/alfalfa										
D1 ditch	2	1-Jun	152	30-Sep	273	17-Jun	168	65	1	1.440
						28-Aug	240		2	1.440
D3 ditch	2	1-Jun	152	30-Sep	273	14-Jun	165	80	1	1.440
						12-Sep	255		2	1.440

Appendix 39 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for dicamba

Dicamba	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Grass/alfalfa										
D1 ditch	1	1-Aug	213	30-Sep	273	4-Aug	216	1	1	0.600
D3 ditch	1	1-Aug	213	30-Sep	273	1-Aug	213	1	1	0.600
Pome/stone fruit, early applns		*Spring cereals used for D1 scenario*								
D1 ditch	1	15-Apr	105	15-May	135	25-Apr	115	1	1	0.250
D3 ditch	1	1-May	121	1-Jun	151	5-May	125	1	1	0.250

Appendix 40 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for isoproturon

Isoproturon	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Winter cereals		*Spring cereals used for D1 scenario*								
D1 ditch	1	11-Sep	254	11-Oct	284	11-Sep	254	1	1	2.331
D3 ditch	1	7-Nov	311	7-Dec	341	6-Nov	310	1	1	2.331

Appendix 41 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for MCPA

MCPA	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Winter cereals										
D1 ditch	1	15-Mar	74	15-May	135	29-Mar	88	1	1	1.000
D3 ditch	1	15-Apr	105	15-Jun	166	21-Apr	111	1	1	1.000
Grass/alfalfa										
D1 ditch	1	15-Mar	74	30-Sep	273	29-Mar	88	1	1	3.000
D3 ditch	1	15-Apr	105	30-Oct	303	20-Apr	110	1	1	3.000
Potatoes		*Spring cereals used for D1 scenario*								
D1 ditch	1	15-Jun	166	15-Aug	227	17-Jun	168	1	1	1.000
D3 ditch	1	1-Jun	152	31-Jul	212	15-Jun	166	1	1	1.000
Pome/stone fruit, early applns		*Spring cereals used for D1 scenario*								
D1 ditch	2	1-May	121	15-Aug	227	14-May	134	30	1	2.000
						17-Jun	168		2	2.000
D3 ditch	2	15-Apr	105	31-Jul	212	21-Apr	111	30	1	2.000
						21-May	141		2	2.000
Vegetables, bulb		*Spring cereals used for D1 scenario*								
D1 ditch	1	30-Jul	211	15-Sep	258	4-Aug	216	1	1	3.000
D3 ditch	1	15-Jul	196	31-Aug	243	25-Jul	206	1	1	3.000
Vegetables, root		*Spring cereals used for D1 scenario*								
D1 ditch	1	15-Apr	105	30-Jun	181	25-Apr	115	1	1	0.750
D3 ditch	1	1-Apr	91	15-Jun	166	5-Apr	95	1	1	0.750

Appendix 42 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for mecoprop-p (MCPP-P)

MCPP-P	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Spring cereals										
D1 ditch	1	21-Apr	111	21-May	141	25-Apr	115	1	1	1.770
D3 ditch	1	18-Mar	77	17-Apr	107	18-Mar	77	1	1	1.770
Grass/alfalfa										
D1 ditch	1	1-May	121	31-May	151	14-May	134	1	1	1.800
D3 ditch	1	1-Apr	91	1-May	121	5-Apr	95	1	1	1.800
Pome/stone fruit, early applns		*Spring cereals used for D1 scenario*								
D1 ditch	2	1-May	121	31-Jul	212	14-May	134	56	1	1.800
						9-Jul	190		2	1.800
D3 ditch	2	1-May	121	31-Jul	182	5-May	125	56	1	1.800
						1-Jul	182		2	1.800

Appendix 43 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for S-metolachlor

S-metolachlor	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Strawberries		*Spring cereals used for D1 & D3 scenario*								
D1 ditch	2	1-May	121	30-Jun	181	14-May	134	7	1	0.672
						17-Jun	168		2	0.672
D3 ditch	2	1-Apr	91	30-May	150	5-Apr	95	7	1	0.672
						21-Apr	111		2	0.672
Maize		*Spring cereals used for D1 scenario*								
D1 ditch	2	21-Apr	111	21-Jun	172	25-Apr	115	30	1	1.536
						17-Jun	168		2	1.536
D3 ditch	2	1-Apr	91	30-Jun	181	5-Apr	95	30	1	1.536
						22-Jun	173		2	1.536
Sugar beets		*Spring cereals used for D1 scenario*								
D1 ditch	2	21-Apr	111	21-Jun	172	25-Apr	115	30	1	0.960
						17-Jun	168		2	0.960
D3 ditch	2	1-Apr	91	30-May	150	5-Apr	95	7	1	0.960
						21-Apr	111		2	0.960
Vegetables, leafy		*Spring cereals used for D1 scenario*								
D1 ditch	6	21-Apr	111	28-Jun	179	25-Apr	115	7	1	0.288
						14-May	134		2	0.288
						7-Jun	158		3	0.288
						14-Jun	165		4	0.288
						21-Jun	172		5	0.288
						28-Jun	179		6	0.288
D3 ditch	6	1-Apr	91	5-Jun	156	5-Apr	95	7	1	0.288
						21-Apr	111		2	0.288
						5-May	125		3	0.288
						15-May	135		4	0.288
						23-May	143		5	0.288
						30-May	150		6	0.288

Appendix 44 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for metazachlor

Metazachlor	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Oil seed rape, winter		*Spring cereals used for D1 scenario*								
D1 ditch	1	15-Sep	258	1-Nov	305	15-Sep	258	1	1	1.500
D3 ditch	1	1-Sep	244	15-Oct	288	27-Sep	270	1	1	1.500
Pome/stone fruit, early applns		*Spring cereals used for D1 scenario*								
D1 ditch	1	15-Apr	105	15-May	135	25-Apr	115	1	1	1.500
D3 ditch	1	1-Apr	91	1-May	121	5-Apr	95	1	1	1.500
Potatoes		*Spring cereals used for D1 scenario*								
D1 ditch	1	1-Apr	91	15-May	135	1-Apr	91	1	1	0.750
D3 ditch	1	15-Mar	74	1-May	121	17-Mar	76	1	1	0.750
Vegetables, leafy		*Spring cereals used for D1 scenario*								
D1 ditch	1	1-May	121	31-Jul	212	14-May	134	1	1	1.500
D3 ditch	1	1-May	121	30-Jun	181	5-May	125	1	1	1.500

Appendix 45 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for metoxuron

Metoxuron	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Potatoes		*Spring cereals used for D1 scenario*								
D1 ditch	1	1-Jul	182	30-Sep	273	2-Jul	183	1	1	1.600
D3 ditch	1	1-Jul	182	30-Sep	273	9-Jul	190	1	1	1.600
Vegetables, root		*Spring cereals used for D1 scenario*								
D1 ditch	2	1-May	121	31-Jul	212	14-May	134	60	1	2.400
						13-Jul	194		2	3.200
D3 ditch	2	1-May	121	31-Jul	212	5-May	125	60	1	2.400
						9-Jul	190		2	3.200
Vegetables, bulb		*Spring cereals used for D1 scenario*								
D1 ditch	2	7-Apr		21-Jul		25-Apr	115	70	1	3.200
						4-Jul	185		2	2.400
D3 ditch	2	15-Mar	74	30-Jun	181	17-Mar	76	60	1	3.200
						16-Jun	136		2	2.400

Appendix 46 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for metribuzin

Metribuzin	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Potatoes										
D1 ditch	1	21-Apr	111	29-Jul	210	25-Apr	115	7	1	0.875
						14-May	134		2	0.175
						17-Jun	168		3	0.175
D3 ditch	1	29-Apr	116	31-Aug	243	4-May	125	7	1	0.875
						14-May	135		2	0.175
						24-May	145		3	0.175
Asparagus (veg. root)										
D1 ditch	1	21-Apr	111	21-May	141	10-Apr	101	1	1	0.700
D3 ditch	1	11-Apr	101	11-May	131	25-Apr	115	1	1	0.700

Appendix 47 Application pattern as defined in SWASH used to calculate $PEC_{FOCUS\_NL,D3}$ for terbutylazine

Terbutylazin	total no. applns.	appln. window				selected appln.		min interval	nr of applns.	appln. rate
		first	daynr	last	daynr	appln.	daynr	(d)		(kg/ha)
Maize		*Spring cereals used for D1 scenario*								
D1 ditch	1	1-May	121	30-Jun	181	14-May	134	1	1	1.000
D3 ditch	1	21-Apr	111	21-Jun	172	21-Apr	111	1	1	1.000

Appendix 48 Input file for the calculation of the $PEC_{Tier\ 1}$ for bentazone

```
* Relevant crops and PEC values for Bentazone (#id 09)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
4       crops for Bentazone
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop         D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     88.780  2       85.708  2       7.674   1       3.600   1       014     cereals         cereals_spring cereals_spring
0.4     15.789  2       15.285  2       8.135   1       4.120   1       022     maize           cereals_spring maize
0.4     10.650  2       10.305  2       5.439   1       2.704   1       001     potatoes        cereals_spring potatoes
0.4     41.163  2       40.125  2       13.006  1       9.257   1       015     grass           grass/alfalfa  grass/alfalfa
```

Appendix 49 Input file for the calculation of the $PEC_{Tier 1}$ for dicamba

```
* Relevant crops and PEC values for Dicamba (#id 07)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
2       crops for Dicamba
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop         D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     3.500   2       3.417   2       1.992   1       0.799   1       015     grass           grass/alfalfa  grass/alfalfa
0.4     9.696   2       9.268   2       0.823   1       0.137   1       012     tall_fruit_cul  cereals_spring pome_early_appln
```

Appendix 50 Input file for the calculation of the $PEC_{Tier\ 1}$ for isoproturon

```
* Relevant crops and PEC values for Isoproturon (#id 01)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
1      crops for Isoproturon
*
*       |-----------D1---------------||------------D3--------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop        D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     58.5    2       54.4    2       7.6     1       0.8     1       014     cereals        cereals_winter cereals_winter
```

Appendix 51 Input file for the calculation of the $PEC_{Tier\ 1}$ for MCPA

```
* Relevant crops and PEC values for MCPA (#id 03)
* (version 27/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
6       crops for MCPA
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop        D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     42.935  2       40.191  2       3.322   1       0.522   1       014     cereals        cereals_winter cereals_winter
0.4     158.844 2       148.570 2       9.970   1       2.131   1       015     grass          grass/alfalfa  grass/alfalfa
0.4     43.892  2       40.367  2       6.722   1       1.417   1       012     tall_fruit_cul cereals_spring pome_early_appln
0.4     11.185  2       10.116  2       3.337   1       0.476   1       001     potatoes       cereals_spring potatoes
0.4     72.919  2       65.899  2       10.162  1       1.762   1       008     flower_bulbs   cereals_spring veg._bulb
0.4     9.612   2       9.508   2       2.486   1       0.356   1       003     asparagus      cereals_spring veg._root
```

Appendix 52 Input file for the calculation of the $PEC_{Tier\ 1}$ for mecoprop (MCPP)

```
* Relevant crops and PEC values for MCPP-P (#id 05)
* (version 27/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak        = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd     = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7        = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd     = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket     = market share of the pesticide [-]; DEFAULT = 0.4
* codeID      = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*               NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop     = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
3       crops for MCPP-P
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop         D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     62.931  2       60.975  2       5.814   1       0.811   1       014     cereals         cereals_spring cereals_spring
0.4     6.825   1       6.477   2       5.925   1       1.000   1       015     grass           grass/alfalfa  grass/alfalfa
0.4     22.030  2       21.705  2       5.939   1       1.401   1       012     tall_fruit_cultcereals_spring pome_early_appln
```

Appendix 53 Input file for the calculation of the $PEC_{Tier\ 1}$ for metolachlor

```
* Relevant crops and PEC values for Metolachlor (#id 06)
* (version 27/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak          = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd       = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7          = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd       = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket       = market share of the pesticide [-]; DEFAULT = 0.4
* codeID        = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                 NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop       = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
4       crops for Metolachlor
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop        D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     2.803   1       1.261   1       2.207   1       0.300   1       002     strawberries   cereals_spring cereals_spring
0.4     6.030   1       3.081   1       5.043   1       0.653   1       022     maize          cereals_spring maize
0.4     1.575   1       1.193   2       0.948   1       0.128   1       005     leaf_vegetablescereals_spring veg._leafy
0.4     3.756   1       1.910   1       3.153   1       0.437   1       004     sugar_beets    cereals_spring sugar_beets
```

Appendix 54 Input file for the calculation of the $PEC_{Tier\ 1}$ for metazachlor

```
* Relevant crops and PEC values for Metazachlor (#id 11)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak          = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd       = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7          = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd       = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket       = market share of the pesticide [-]; DEFAULT = 0.4
* codeID        = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                 NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop       = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
4       crops for Metazachlor
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop        D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     61.630  2       58.614  2       4.959   1       1.120   1       014     cereals        cereals_spring oil_seed_winter
0.4     9.851   1       9.702   1       4.933   1       0.693   1       012     tall_fruit_cul cereals_spring pome_early_appln
0.4     6.507   1       4.045   2       4.934   1       0.690   1       021     cabbage        cereals_spring veg._leafy
0.4     26.691  2       25.498  2       2.464   1       0.335   1       001     potatoes       cereals_spring potatoes
```

Appendix 55 Input file for the calculation of the $PEC_{Tier 1}$ for metoxuron

```
* Relevant crops and PEC values for Metoxuron (#id 10)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
3       crops for Metoxuron
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop         D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     5.325   1       2.975   1       5.261   1       0.603   1       001     potatoes        cereals_spring potatoes
0.4     10.928  1       4.715   1       10.521  1       1.350   1       008     flower_bulbs    cereals_spring veg._bulb
0.4     10.652  1       4.206   1       10.515  1       1.262   1       023     rem._agr._crp.  cereals_spring veg._root
```

Appendix 56 Input file for the calculation of the $PEC_{Tier\ 1}$ for metribuzin

```
* Relevant crops and PEC values for Metribuzin (#id 02)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
2      crops for Metribuzin
*
*      |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop        D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     34.2    2       33.1    2       2.9     1       0.43    1       001     potatoes       cereals_spring potatoes
0.4     26.2    2       25.4    2       2.3     1       0.33    1       003     asparagus      cereals_spring vegetables_root
```

Appendix 57 Input file for the calculation of the $PEC_{Tier\ 1}$ for terbutylazine

```
* Relevant crops and PEC values for Terbutylazin (#id 08)
* (version 24/11/2006)
*
* This file contains crop & PEC data for the specified compound for FOCUS D1 and D3 SW scenarios
* Peak         = Global maximum concentration [ug/L] (TOXSWA output)
* Peak_cd      = Global maximum code indicating main contributer to peak concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* TWA7         = Time Weighed Average (7 day) concentration [ug/L] (TOXSWA output)
* TWA7_cd      = TWA (7 day) code indicating main contributer to TWA concentration; (SPRAY DRIFT = 1; DRAINAGE = 2)
* fmarket      = market share of the pesticide [-]; DEFAULT = 0.4
* codeID       = GeoPEARL code for crop; values must correspond with codes in CropArea.inp file;
*                NB: >> GeoPEARL crops may not be used more than once in a simulation <<
* GP_crop      = name of GeoPEARL crop
* D1_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D1 scenario
* D3_FOCUS_crop = name of FOCUS SW crop corresponding with used GeoPEARL crop in D3 scenario
*
1       crops for Terbutylazin
*
*       |-----------D1---------------||-------------D3-------------||--GeoPEARL-crops----|       |---------FOCUS-SW-crops-------|
fmarket Peak    Peak_cd TWA7    TWA7_cd Peak    Peak_cd TWA7    TWA7_cd codeID  GP_crop        D1_FOCUS_crop  D3_FOCUS_crop
[-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [ug/L]  [-]     [-]
0.4     28.163  2       27.000  2       3.326   1       0.486   1       022     maize          cereals_spring maize
```

Appendix 58 Dilution factors, correcting the edge-of-field concentration for effects of intensity of use of the pesticide within the intake area

The first table dilution factors refers to situations in which the peak concentration is mainly caused by spray drift entries, the second table refers to situations in which the peak concentration is mainly caused by drainage entries (for details, see chapter 4).

$f_{use\ intensity}$
spray drift

	cereals	*tall_fruit_cult*	*cabbage*	*potatoes*
De Punt	0.026932	0.000000	0.000007	0.037396
Andijk	0.012796	0.000501	0.000168	0.015099
Nieuwegein	0.015975	0.012759	0.000178	0.003032
Heel	0.040447	0.005896	0.000635	0.012613
A'dam-Rijnkanaal	0.014414	0.011008	0.000151	0.002625
Brakel	0.014044	0.001902	0.000467	0.011712
Petrusplaat	0.013732	0.001815	0.000526	0.011139
Twentekanaal	0.006709	0.000030	0.000030	0.000854
Scheelhoek	0.017713	0.003885	0.000951	0.011237
	maize	*grass*	*strawberries*	*leaf_vegetables*
De Punt	0.018382	0.096628	0.000000	0.000271
Andijk	0.033066	0.119169	0.000031	0.000130
Nieuwegein	0.023350	0.127262	0.000200	0.000086
Heel	0.032621	0.065831	0.000186	0.001648
A'dam-Rijnkanaal	0.021572	0.134837	0.000166	0.000193
Brakel	0.057389	0.076731	0.000779	0.000883
Petrusplaat	0.057849	0.078226	0.000801	0.000948
Twentekanaal	0.051845	0.134828	0.000030	0.000000
Scheelhoek	0.046194	0.085414	0.000599	0.000952
	flower_bulbs	*rem._agr._crp.*	*sugar_beets*	*asparagus*
De Punt	0.000000	0.000265	0.013619	0.000007
Andijk	0.001368	0.000485	0.007307	0.000024
Nieuwegein	0.000000	0.000378	0.004730	0.000016
Heel	0.000334	0.001051	0.025928	0.001166
A'dam-Rijnkanaal	0.000000	0.000314	0.003939	0.000021
Brakel	0.001002	0.001549	0.012220	0.001476
Petrusplaat	0.000917	0.001542	0.011701	0.001379
Twentekanaal	0.000000	0.000000	0.000000	0.000000
Scheelhoek	0.000661	0.001268	0.011230	0.000986

$f_{use\ intensity}$
drainage

	cereals	*tall_fruit_cult*	*cabbage*	*potatoes*
De Punt	0.161593	0.000000	0.000041	0.224374
Andijk	0.076776	0.003007	0.001007	0.090591
Nieuwegein	0.095852	0.076552	0.001068	0.018194
Heel	0.242683	0.035373	0.003813	0.075677
A'dam-Rijnkanaal	0.086484	0.066047	0.000903	0.015747
Brakel	0.084262	0.011410	0.002800	0.070272
Petrusplaat	0.082394	0.010890	0.003157	0.066832
Twentekanaal	0.040256	0.000183	0.000183	0.005124
Scheelhoek	0.106279	0.023313	0.005705	0.067423
	maize	***grass***	***strawberries***	***leaf_vegetables***
De Punt	0.110294	0.579765	0.000000	0.001629
Andijk	0.198395	0.715015	0.000186	0.000780
Nieuwegein	0.140097	0.763574	0.001201	0.000515
Heel	0.195729	0.394984	0.001118	0.009890
A'dam-Rijnkanaal	0.129433	0.809025	0.000998	0.001156
Brakel	0.344334	0.460386	0.004674	0.005297
Petrusplaat	0.347097	0.469354	0.004804	0.005688
Twentekanaal	0.311070	0.808966	0.000183	0.000000
Scheelhoek	0.277163	0.512483	0.003594	0.005711
	flower_bulbs	***rem._agr._crp.***	***sugar_beets***	***asparagus***
De Punt	0.000000	0.001588	0.081713	0.000041
Andijk	0.008208	0.002913	0.043843	0.000144
Nieuwegein	0.000000	0.002269	0.028378	0.000095
Heel	0.002007	0.006306	0.155568	0.006994
A'dam-Rijnkanaal	0.000000	0.001885	0.023637	0.000127
Brakel	0.006012	0.009295	0.073322	0.008856
Petrusplaat	0.005503	0.009251	0.070207	0.008275
Twentekanaal	0.000000	0.000000	0.000000	0.000000
Scheelhoek	0.003964	0.007610	0.067378	0.005914

Appendix 59 Relative Cropped Area, RCA factor, specifying the ratio of the area occupied by the specified crop grouping and the total intake area

The crop groupings correspond to those defined for GeoPEARL.
(Note that a value of 0.000000 may indicate that the factor is smaller than 0.0000005 or that the factor is truly zero.)

	1	2	3	4	5	6	7	8	9
	DE_PUNT	ANDIJK	N'GEIN	HEEL	A'DAM	BRAKEL	PETRUS	TWENTE	SCHEELHOEK
GP_name	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]
potatoes	0.097886	0.043036	0.007459	0.027731	0.005776	0.028332	0.027067	0.001393	0.027950
strawberries	0.000000	0.000089	0.000493	0.000410	0.000366	0.001884	0.001946	0.000050	0.001490
asparagus	0.000018	0.000068	0.000039	0.002563	0.000046	0.003570	0.003351	0.000000	0.002452
sugar_beets	0.035648	0.020828	0.011634	0.057006	0.008669	0.029561	0.028433	0.000000	0.027931
leaf_vegetables	0.000710	0.000370	0.000211	0.003624	0.000424	0.002136	0.002304	0.000000	0.002367
plnts_com._purp	0.000178	0.000567	0.000063	0.000231	0.000046	0.000372	0.000366	0.000149	0.000722
floriculture	0.000409	0.000519	0.001196	0.000273	0.001005	0.002350	0.002294	0.000746	0.001943
flower_bulbs	0.000000	0.003899	0.000000	0.000735	0.000000	0.002424	0.002229	0.000000	0.001643
tall_trees	0.000284	0.000276	0.008100	0.000263	0.006084	0.003015	0.002925	0.000199	0.003367
other_trees	0.000622	0.001292	0.002119	0.000945	0.001737	0.005600	0.005318	0.001144	0.004307
fallow	0.000497	0.000462	0.001274	0.000714	0.001087	0.001320	0.001280	0.000796	0.001245
tall_fruit_cult	0.000000	0.001428	0.031384	0.012962	0.024224	0.004600	0.004410	0.000050	0.009664
small_fruits	0.000071	0.000064	0.000899	0.001628	0.000668	0.000874	0.000822	0.000000	0.000763
cereals	0.070497	0.036473	0.039296	0.088929	0.031720	0.033972	0.033369	0.010945	0.044057
grass	0.252931	0.339668	0.313041	0.144737	0.296729	0.185614	0.190086	0.219950	0.212444
grass-seed	0.001883	0.002359	0.001665	0.001681	0.001482	0.002826	0.002899	0.000000	0.004514
green-manuring	0.000284	0.002274	0.003026	0.001985	0.002655	0.002100	0.002151	0.000050	0.002497
vegetables	0.000249	0.004578	0.000868	0.002931	0.000686	0.009153	0.008747	0.000149	0.007155
cannabis	0.000000	0.000001	0.000016	0.000000	0.000012	0.000000	0.000000	0.000000	0.000002
silviculture	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
cabbage	0.000018	0.000478	0.000438	0.001397	0.000331	0.001129	0.001279	0.000050	0.002365
maize	0.048117	0.094248	0.057435	0.071723	0.047472	0.138825	0.140573	0.084577	0.114895
rem._agr._crp.	0.000693	0.001384	0.000930	0.002311	0.000691	0.003747	0.003747	0.000000	0.003154
legumes	0.000870	0.002744	0.001431	0.005032	0.001121	0.006819	0.007142	0.000050	0.006907
leek	0.000178	0.000086	0.000039	0.002248	0.000029	0.003946	0.003797	0.000050	0.002785
onions	0.000000	0.008424	0.000618	0.001607	0.000459	0.001182	0.001150	0.000000	0.002437

Appendix 60 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for bentazone

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Bentazone $f_{dissipation}$ =	0.995968											
	D1						**D3**					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Spring cereals	88.780	25-May	dr	85.708	31-May	dr	7.674	4-Apr	sp	3.600	11-Apr	sp
Maize	15.789	2-Nov	dr	15.285	8-Nov	dr	8.135	14-May	sp	4.120	21-May	sp
Potatoes	10.650	2-Nov	dr	10.305	8-Nov	dr	5.439	14-Jun	sp	2.704	21-Jun	sp
Grass	41.163	3-Mar	dr	40.125	20-Feb	dr	13.006	12-Sep	sp	9.257	19-Sep	sp
$PEC_{Tier\ 1}$												
De Punt	11.039			10.718			0.474			0.305		
Andijk	11.453			11.138			0.568			0.377		
Nieuwegein	10.374			10.089			0.486			0.328		
Heel	9.131			8.851			0.329			0.202		
A'dam-Rijnkanaal	9.467			9.209			0.450			0.306		
Brakel	7.858			7.633			0.394			0.248		
Petrusplaat	7.945			7.718			0.400			0.252		
Twentekanaal	6.798			6.616			0.363			0.242		
Scheelhoek	8.825			8.572			0.417			0.266		

Appendix 61 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for dicamba

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Dicamba

$f_{dissipation}$ = 0.938911

	D1						D3					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Grass	3.500	15-Feb	dra	3.417	20-Feb	dra	1.992	31-Jul	sd	0.799	7-Aug	sd
Tall fruit cultures	9.696	11-May	dra	9.268	16-May	dra	0.823	4-May	sd	0.137	11-May	sd
$PEC_{Tier\ 1}$												
De Punt	0.499			0.487			0.047			0.019		
Andijk	0.678			0.661			0.064			0.025		
Nieuwegein	0.789			0.766			0.061			0.024		
Heel	0.356			0.346			0.028			0.011		
A'dam-Rijnkanaal	0.717			0.698			0.057			0.023		
Brakel	0.391			0.381			0.035			0.014		
Petrusplaat	0.399			0.389			0.036			0.014		
Twentekanaal	0.434			0.424			0.041			0.017		
Scheelhoek	0.472			0.459			0.040			0.016		

Appendix 62 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for isoproturon

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Isoproturon

$f_{dissipation}$ = 0.978932

	D1						D3					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Winter cereals	58.5	19-Nov	dra	54.4	23-Nov	dra	7.6	6-Nov	sd	0.8	13-Nov	sd
$PEC_{Tier 1}$												
De Punt	2.422			2.253			0.052			0.006		
Andijk	1.253			1.165			0.027			0.003		
Nieuwegein	1.350			1.256			0.029			0.003		
Heel	3.056			2.841			0.066			0.007		
A'dam-Rijnkanaal	1.090			1.014			0.024			0.002		
Brakel	1.167			1.085			0.025			0.003		
Petrusplaat	1.147			1.066			0.025			0.003		
Twentekanaal	0.376			0.350			0.008			0.001		
Scheelhoek	1.514			1.408			0.033			0.003		

Appendix 63 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for MCPA

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

MCPA												
$f_{dissipation}$ =	0.845735											
	D1						**D3**					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Winter cereals	42.935	11-Apr	dra	40.191	11-Apr	dra	3.322	20-Apr	sd	0.522	27-Apr	sd
Grass	158.844	11-Apr	dra	148.570	16-Apr	dra	9.970	20-Apr	sd	2.131	27-Apr	sd
Tall fruit cultures	43.892	24-Sep	dra	40.367	8-Nov	dra	6.722	20-May	sd	1.417	27-May	sd
Potatoes	11.185	24-Sep	dra	10.116	8-Nov	dra	3.337	14-Jun	sd	0.476	21-Jun	sd
Flower bulbs	72.919	24-Sep	dra	65.899	29-Sep	dra	10.162	24-Jul	sd	1.762	31-Jul	sd
Asparagus	9.612	27-May	dra	9.508	1-Jun	dra	2.486	4-Apr	sd	0.356	8-Apr	sd
$PEC_{Tier\ 1}$												
De Punt	22.479			21.009			0.261			0.053		
Andijk	28.594			26.733			0.313			0.065		
Nieuwegein	26.830			25.083			0.295			0.062		
Heel	14.090			13.170			0.163			0.033		
A'dam-Rijnkanaal	25.181			23.544			0.275			0.058		
Brakel	16.072			15.024			0.179			0.037		
Petrusplaat	16.399			15.331			0.182			0.038		
Twentekanaal	17.976			16.814			0.189			0.040		
Scheelhoek	18.530			17.323			0.207			0.043		

Appendix 64 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for mecoprop (MCPP)

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

MCPP-P

$f_{dissipation}$ = 0.938970

	D1						D3					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Cereals	62.931	25-May	dra	60.975	28-May	dra	5.814	17-Mar	sd	0.811	24-Mar	sd
Grass	6.825	14-May	sd	6.477	20-Feb	dra	5.925	4-Apr	sd	1.000	11-Apr	sd
Tall fruit cultures	22.030	28-May	dra	21.705	1-Jun	dra	5.939	30-Jun	sd	1.401	7-Jul	sd
$PEC_{Tier 1}$												
De Punt	2.662			3.345			0.179			0.029		
Andijk	1.529			2.510			0.210			0.035		
Nieuwegein	1.983			2.876			0.213			0.037		
Heel	3.407			3.742			0.136			0.022		
A'dam-Rijnkanaal	1.615			2.469			0.196			0.033		
Brakel	1.380			1.901			0.124			0.021		
Petrusplaat	1.360			1.894			0.126			0.021		
Twentekanaal	0.530			1.179			0.128			0.021		
Scheelhoek	1.818			2.407			0.148			0.025		

Appendix 65 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for metolachlor

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Metolachlor												
$f_{dissipation}$ =	0.941294											
	D1						**D3**					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Strawberries	2.803	14-May	sd	1.261	24-Jun	sd	2.207	20-Apr	sd	0.300	27-Apr	sd
Maize	6.030	25-Apr	sd	3.081	2-May	sd	5.043	21-Jun	sd	0.653	11-Apr	sd
Leaf vegetables	1.575	25-Apr	sd	1.193	20-Nov	dra	0.948	29-May	sd	0.128	27-Apr	sd
Sugar beets	3.759	25-Apr	sd	1.910	2-May	sd	3.153	20-Apr	sd	0.437	27-Apr	sd
$PEC_{Tier\ 1}$												
De Punt	0.040			0.021			0.033			0.004		
Andijk	0.061			0.031			0.051			0.007		
Nieuwegein	0.037			0.019			0.031			0.004		
Heel	0.062			0.034			0.051			0.007		
A'dam-Rijnkanaal	0.030			0.016			0.025			0.003		
Brakel	0.090			0.047			0.075			0.010		
Petrusplaat	0.091			0.048			0.076			0.010		
Twentekanaal	0.048			0.025			0.040			0.005		
Scheelhoek	0.076			0.040			0.063			0.008		

Appendix 66 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for metazachlor

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Metazachlor												
$f_{dissipation}$ =	0.917354											
	D1						**D3**					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Cereals	61.630	3-Nov	dra	58.614	8-Nov	dra	4.959	26-Sep	sd	1.120	3-Oct	sd
Tall fruit culture	9.851	27-May	sd	9.702	1-Jun	sd	4.933	4-Apr	sd	0.693	11-Apr	sd
Cabage	6.507	14-May	sd	4.045	8-Nov	dra	4.934	4-May	sd	0.690	11-May	sd
Potatoes	26.691	25-May	dra	25.498	28-May	dra	2.464	16-Mar	sd	0.335	23-Mar	sd
$PEC_{Tier 1}$												
De Punt	3.829			3.648			0.054			0.010		
Andijk	1.871			1.783			0.027			0.005		
Nieuwegein	1.471			1.401			0.034			0.006		
Heel	3.437			3.273			0.053			0.011		
A'dam-Rijnkanaal	1.183			1.127			0.027			0.005		
Brakel	1.573			1.500			0.024			0.005		
Petrusplaat	1.534			1.463			0.024			0.005		
Twentekanaal	0.392			0.373			0.005			0.001		
Scheelhoek	1.915			1.827			0.032			0.006		

Appendix 67 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for metoxuron

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Metoxuron												
$f_{dissipation}$ =	0.960231											
	D1						**D3**					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Potatoes	5.325	4-Aug	sd	2.975	8-Nov	sd	5.261	8-Jul	sd	0.603	15-Jul	sd
Flower bulbs	10.928	25-Apr	sd	4.715	2-May	sd	10.582	16-Mar	sd	1.350	23-Mar	sd
Rem. agr. crops	10.652	13-Jul	sd	4.206	20-Jul	sd	10.515	8-Jul	sd	1.262	15-Jul	sd
$PEC_{Tier\ 1}$												
De Punt	0.051			0.028			0.050			0.006		
Andijk	0.028			0.015			0.027			0.003		
Nieuwegein	0.005			0.003			0.005			0.001		
Heel	0.017			0.009			0.017			0.002		
A'dam-Rijnkanaal	0.004			0.002			0.004			0.000		
Brakel	0.021			0.011			0.021			0.002		
Petrusplaat	0.020			0.010			0.020			0.002		
Twentekanaal	0.001			0.000			0.001			0.000		
Scheelhoek	0.019			0.010			0.019			0.002		

Appendix 68 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for metribuzin

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Metribuzin

$f_{dissipation}$ = 0.943282

	D1						D3					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Potatoes	34.2	26-May	dra	33.1	31-May	dra	2.9	17-Mar	sd	0.43	24-Mar	sd
Asparagus	26.2	26-May	dra	25.4	31-May	dra	2.3	10-Apr	sd	0.33	17-Apr	sd
$PEC_{Tier 1}$												
De Punt	1.895			1.834			0.027			0.004		
Andijk	0.834			0.807			0.012			0.002		
Nieuwegein	0.145			0.140			0.002			0.000		
Heel	0.575			0.556			0.008			0.001		
A'dam-Rijnkanaal	0.112			0.109			0.002			0.000		
Brakel	0.601			0.582			0.009			0.001		
Petrusplaat	0.574			0.555			0.008			0.001		
Twentekanaal	0.027			0.026			0.000			0.000		
Scheelhoek	0.577			0.559			0.008			0.001		

Appendix 69 Overview of calculated peak concentrations in D1 and D3 FOCUS ditch scenarios with Dutch drift deposition, corresponding date and main contributor (drift or drainage entries) for each for the relevant crops for terbutylazin

The lower part of the table presents the calculated Tier I concentration in the nine abstraction points on the basis of the edge-of-field concentrations listed in the upper part of the table.

Terbutylazin

$f_{dissipation}$ = 0.949643

	D1						D3					
Crops	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*	*PEC_{max}* (µg/L)	*date*	*type*	*TWA_{7d}* (µg/L)	*date*	*type*
Maize	28.163	13-Nov	dra	27.000	20-Nov	dra	3.326	20-Apr	sd	0.486	27-Apr	sd
$PEC_{Tier\ 1}$												
De Punt	0.772			0.740			0.015			0.002		
Andijk	1.512			1.450			0.030			0.004		
Nieuwegein	0.922			0.884			0.018			0.003		
Heel	1.151			1.103			0.023			0.003		
A'dam-Rijnkanaal	0.762			0.730			0.015			0.002		
Brakel	2.228			2.136			0.044			0.006		
Petrusplaat	2.256			2.163			0.044			0.006		
Twentekanaal	1.357			1.301			0.027			0.004		
Scheelhoek	1.844			1.768			0.036			0.005		