Protecting Drinking Water Quality Against Contamination by Pesticides: An Alternative Regulatory Framework

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Samenvatting

In onderstaand artikel wordt de huidige regulering van de vervuiling van drinkwater door pesticiden geanalyseerd. Deze regulering is een samenspel tussen EC- en nationale instrumenten. Aan de hand van de casus van drinkwatervervuiling in Italië door de pesticide atrazine wordt aangetoond dat de huidige regulering niet functioneert. Met name het Italiaans verbod op het gebruik van de pesticide verschuift enkel het vervulingsprobleem. De auteurs proberen middels een economische analyse te komen tot een alternatief voorstel voor regulering van het pesticidenprobleem. Aan de basis van dit voorstel liggen optimaal gedifferentieerde standaarden en een juist samenspel tussen Europese en nationale regelgeving. Het artikel geeft hiermee een voorstel voor een efficiënte en effectieve oplossing van het probleem van de vervuiling van drinkwater door pesticiden.

Introduction

This article discusses the question of what regulatory framework can be used to avoid the accumulation of pesticides in drinking water. Currently the European Community (EC) uses specific directives to set strict quality standards to protect drinking water. Once these EC standards are set, the Member States have to implement them in their national system. The interaction between the EC regulatory system and the Member State implementation does not however always function satisfactorily. In this article the authors will describe the case of pollution of drinking water by atrazine in Italy. The regulatory approach used in the atrazine case has been shown to fail in reducing toxic pesticide accumulation in drinking water. The question that will be addressed in this article is what legal rules should be developed in a combined European and National legal system for avoiding the accumulation of pesticides in drinking water.

First, the authors give a short description of the current regulation of atrazine in the EC and in Italy in the first section of this article. Secondly, the authors develop, from a law and economics point of view, an alternative regulatory framework. In order to do this, the authors try to establish the precise desired goal they want to attain with the rules and on this basis they try to identify which incentives will have to be given to whom: in other words, who will be subject to obligations under the regulation, which is elaborated in the second section of this article. Once the addressees of the regulation have been determined, the optimal differentiation of the regulation has to be examined. The question is whether a general rule suffices or whether the rule has to be differentiated according to possible location specific circumstances that play an important role in determining the regulation. Taking into account this level of optimal differentiation, the instrument of regulation has to be chosen in the third section. The conclusions drawn from the foregoing will be applied in examining how these rules should be set in a combined European and National legal approach in the final part. Obviously, the problem of accumulation of pesticides in drinking water cannot be analyzed in all its complexities within the scope of this article. The authors, therefore, will mainly focus on one instrument: zoning.
Some Problems with the Current Regulatory Approach

On 15 July 1980 the EC adopted Directive 80/778/EEC on the quality of water intended for human consumption. On the basis of this Directive the Member States have to take the necessary steps to ensure that water intended for human consumption at least meets the requirements specified in Annex I of the Directive. Annex I of the Directive allows 0.1 μ g/litre for pesticides and related products considered separately, with the total concentration not to exceed 0.5 μ g/litre. Member States had to bring into force the laws, regulations and administrative measures necessary to comply with the Directive within two years after its notification (Article 18), and had to ensure that the quality of the drinking water complied with the Directive within five years of its notification (Article 19). In reaction to the problems with atrazine in the drinking water and to facilitate compliance with the target standards of the Directive, Italy prohibited the sale and use of atrazine on 21 March 1990.

The EC Standard

The current EC standard of 0.1 μ g/l is a rather strict interpretation of toxicological knowledge. In contrast to the EC norm, the World Health Organization (WHO) uses a considerably higher limit of 2 μ g/l. It has been argued that the EC standard is too strict for various reasons. Vighi and Zanian argue that:

in terms of real risk for the exposed human population as a consequence of the consumption of water contaminated by atrazine, it is clear that the EEC limit for individual pesticides in drinking water is very conservative and, in many cases, orders of a magnitude below a demonstrable threshold value. The philosophy of this part of the EEC Directive is based on the notion that products such as pesticides, (which are biocides by definition), should not be present in drinking water because this is a fundamental resource, intended for regular daily consumption.

The EC standard, which was basically set at the lowest amount detectable at that time, now causes serious problems since the methods of analytical detection have improved, so that in many cases the 0.1 μ g/l norm is violated although not causing a serious threat to human health. One could however argue that the 'practically zero' approach of the EC takes a broader approach to the problem of drinking water pollution than the WHO approach. The philosophy of the EC is mainly based on the broader principles. First it is argued since pesticides are toxic substances by definition they should not be present in the natural environment at all. Second the EC approach is based on the view that drinking water is a too important human resource which man uses intensively for a lifelong period. The possibility of high exposures therefore in the view of the EC warrants a strict approach.

The EC standard causes serious problems both for states and for water companies. States can be held liable for not, or incorrectly, transposing the European Directive into national law by individuals. They risk a conviction by the European Court of Justice if the water quality in their country does not meet the requirements of the Directive and they can be forced to pay a penalty payment for as long as the conditions of the Directive are not met. Since the Directive must also be implemented in national legislation, the water companies that supply water that does not meet the requirements of the Directive risk civil liability and their officials even risk criminal liability on the basis of national law. The effect will be that both the state and the water companies will have strong incentives to invest in treatment methods in order to meet the 0.1 μ g/l EC limit and so avoid liability.

Although one could argue that more resources are being spent to reach the EC standard than would be efficient, one could defend the EC approach even if the attainment of a stricter standard would be more costly. Relevant in this context is however also how much Member States are willing to pay for clean drinking water, which is of course depending on their varying preferences.

The Italian Approach

At first sight the Italian approach to the pesticide problem — the ban on one chemical, atrazine — looks effective and cheap to enforce. In practice, however, it clearly raises several problems. It is a very harsh, uniform rule that does not take local differences into account at all. A ban of atrazine might be useful in one region of the country, where products are grown that need a lot of this herbicide and where the hydrogeological situation will lead to a high accumulation of pesticides. The simulation model constructed by Zanin et al. shows that in areas with permeable soils under rainy weather conditions even small amounts of atrazine have a significant effect on the drinking water. In other, dryer regions with less permeable soils a ban on atrazine might not be necessary at all. In those regions the agronomic benefits of the use of atrazine might largely outweigh the possible disadvantages of pollution of drinking water. By introducing such a general ban on atrazine, Italian farmers are put in a disadvantageous competitive position compared to farmers in countries where a (restricted) use of atrazine is still allowed. Furthermore restrictions on the import of atrazine might cause market distortions within the European Union.

Generally, the ban on one chemical is ineffective if it can easily be replaced by substitutes that also
accumulate in drinking water. Farmers will shift to other pesticides for the protection of their crops, which will then need new legislation to ban or regulate their use. If this is not done, other pesticides will still be found in amounts exceeding the EC limit (which is indeed the case in Italy today). Hence, the total ban on atrazine does not even solve Italy's regulatory problem of compliance with the EC limit. In addition, the ban does not provide the pesticide manufacturers with incentives to produce pesticides that do not accumulate in drinking water.

A basic problem with the current regulation of the use of pesticides is that both neglect the fact that it is the ability of pesticides to accumulate in different segments of the natural environment, in the case of atrazine in drinking water that is the real problem. The accumulation of atrazine in drinking water depends on various factors, among which – obviously – the persistence of the pesticide, but also on the type of products grown (which influences the demand for pesticides), on the amount applied and on hydrogeological factors. The preliminary conclusion would therefore be that the legal system should take all these factors into account. The question we will therefore have to address now is whether a regulation should be uniform or can differentiate, taking into account these factors.

### Regulating Pesticides: Goals and Incentives

Before discussing the general principles of standard setting and some examples of regulatory instruments, the goal of the regulation of pesticides has to be identified. In other words: what is the problem that must be solved? The current problem is the presence of dangerous substances, such as atrazine, in the drinking water of the Member States. Although there is a discussion on the admissible level of atrazine in drinking water, it is generally agreed upon that the amount of atrazine in the drinking water should not exceed a certain limit. Therefore a general quality standard for the pollution of drinking water by pesticides should be established, be it a legal norm or a policy objective.

The problem with pesticides the authors are discussing in this article is their accumulation in drinking water. In order to stop the accumulation problem, the causes for this accumulation have to be found. There is no general rate of accumulation for a unit of pesticide. The accumulation rate of atrazine is dependent on several factors. Atrazine is a water soluble subst-

### Principles of Standard Setting and Optimal Legal Rules

In the previous section the authors have outlined some of the goals of the legislation and the incentives that this legislation would have to give to the farmers and the pesticide producers. The question now arises how these criteria, especially location specific features such as the hydrogeological situation, can be taken into account in the process of regulating the use of pesticides.

It is often argued that efficient environmental standards should be set at the level where the marginal costs of pollution abatement are equal to the marginal benefits in reduction of environmental damage. This can in principle also be applied with respect to the use of pesticides. The optimal level of care or the appropriate efficient standard would then be the type of pesticide to be applied or the amount or mix of various pesticides under specific hydrogeological
conditions. To determine the optimal standard (the pesticides to be applied) one would have to take into account on the one hand the benefits of the use of agronomically sophisticated pesticides with a high kill rate of specific weeds and high persistence in the environment, and on the other hand the marginal costs of the additional use of the pesticide for the environment.

Obviously the marginal costs of the additional use of pesticides will depend upon the extent to which the pesticides accumulate in drinking water. As the authors have just indicated, the propensity to accumulate is not only dependent upon the type of compound used and the amount applied, but also upon local and hydrogeological conditions. The marginal costs of the use of some pesticides might therefore be relatively low in some regions where the accumulation risk is low as a consequence of the specific hydrogeological condition.

Hence, the question arises whether a standard for the use of pesticides should be uniform or differentiated. Generally economists argue that in a public interest view, standards should be differentiated according to not only region, local needs and industry branch, but also public preferences.\(^{21}\) Indeed, the social costs arising from an activity will differ according to location specific circumstances. Uniform standards that do not take into account these differences will therefore lead to welfare losses.

A regulatory solution that would help to take into account the local conditions that influence the possibilities of accumulation of pesticides is zoning. Zoning is a legal instrument used in urbanization law.\(^{22}\) It is an instrument that basically indicates in what part of a city or region specific activities can be undertaken or what type of constructions can be built. If the hydrogeological conditions which lead to accumulation can easily be recognized by an administrative agency (the 'zoning board'), the agency could indicate in what area certain pesticides could be applied. In any event, the information costs for an individual farmer to examine the hydrogeological situation of the soil on which he is growing his products are of course much higher than the costs of an agency doing the same research for a whole area. The administrative costs of zoning are still relatively low once the relevant geological conditions are known. In that case the zoning board would issue a regulation indicating that certain types of pesticides are banned in areas with a sensitive hydrogeological condition. A decree of the zoning board can be made self-executive and enforced by criminal sanctions. It will be costly to enforce such a decree; but the same enforcement problems arise now with the general ban on atrazine.

The difference with the current Italian ban on one compound would be that, with zoning, a more sophisticated analysis of the influence of several compounds under specific hydrogeological conditions can be made, with a board of technical experts deciding, for example, that the use of several compounds in a specific area should be prohibited. This would have the advantage that the substitution problem is solved, since the exclusion would not apply just to one pesticide, but to all pesticides capable of accumulating in drinking water (provided of course that this is not true for all pesticides and that the accumulation properties of the pesticides can be easily recognized). Another advantage is that the inefficiency of excluding agronomically useful pesticides is not extended to regions where the use of these pesticides would be relatively harmless. Thus the costs of an exclusion can be limited through zoning and there should be some efficiency gain compared to the current situation in Italy.

Of course zoning creates political and economic problems. The discriminatory nature of zoning in particular will mean that farmers in less sensitive hydrogeological areas receive a benefit since they can continue the use of the agronomically sophisticated pesticides. One could, for political reasons, consider some kind of compensation to the 'losing farmers'. However, one could argue that a farmer should always take into account local conditions such as weather and soil properties when deciding which crop he is going to grow. It could be argued therefore, that zoning which takes into account the accumulation problem will in the end lead to the correct incentives for farmers either to change their production to a type of crop that needs less or other pesticides, or to relocate to areas that are less sensitive to the accumulation problem.

Proposal for Pesticide Regulation in a European National Context

The question that will be analyzed now is how the use of pesticides should be regulated in a specific European Community context, taking into account the optimal differentiation of standards.

The European Community Standards

In the previous section, the authors described some of the economic principles of standard setting and indicated that, as far as possible, an optimal specificity of standards should be achieved i.e. differentiated standards, taking into account location specific criteria, should be applied where possible. This poses some serious questions with respect to environmental policy within the EC. Economic arguments for stan-
standard setting suggest that location specific criteria should be taken into account and that therefore environmental standards should not be the same across the European Community.

The question therefore is which instrument can be best used to take into account regional differences. As said before, the philosophy of the EC is that products such as pesticides should not be present in drinking water, as this is a fundamental resource intended for regular daily consumption. It is therefore generally agreed that there should not be more than a specific concentration of pesticides in drinking water. The logical solution therefore seems to be to impose a general quality standard for drinking water on Member States. Location specific circumstances could, however, be taken into account in setting national standards.

**National Standards**

As we have seen before a simple ban on the use of a pesticide does not suffice to reach the aim of giving farmers the correct incentive to use pesticides under the right conditions. The regulation of pesticides therefore needs to be differentiated according to the circumstances under which these pesticides can be used best. The properties of atrazine require regulation that takes into account the hydrological and geological conditions of the area.

As Vighi and Zanin have shown, areas can be separated into four types in term of the vulnerability of their aquifers:

a. areas where herbicides could be used without particular restrictions;
b. areas where leaching herbicides could only be used in exceptional cases, and with a restriction on the amount used;
c. areas where only non-leaching herbicides can be used and with some control of the amount used;
d. areas where the use of herbicides (and perhaps all pesticides) should be completely forbidden because of the vulnerability of the aquifers and their strategic value as drinking water supplies.

In order to make such a classification of agricultural areas, Vighi and Zanin have composed a list of necessary information, which includes, *inter alia*, the permeability of surface soils, the hydrogeological structure of the area, the herbicides used and their characteristics, and the distribution of the crop types. Although the information is not yet complete for all areas, *ad hoc* studies can fill the gaps.

Using this classification of four types of vulnerability, zones can be established in which different rules for the use of pesticides will be imposed. A general regulation will be enough to set standards for the use of specific pesticides in each type of zone. The administrative and enforcement costs of such a system will be minimal. Every time a new pesticide is put on the market, research has to be done on the polluting, accumulative properties of this pesticide. Once the pesticide is included in the regulation, enforcement authorities will have to take regular soil and drinking water samples in order to determine compliance. High penalties for non-compliance will be required for effective enforcement.

One of the advantages of a zoning system is that it can be used in combination with other types of regulatory instruments. Instead of imposing detailed standards on the use of the pesticides in the specific zones, the national authorities might choose economic instruments for giving the farmers the right incentives. An example might be putting a higher tax on the use of, under the specific circumstances, more polluting pesticides.

**Conclusion**

In this article, the authors have presented a proposal for an optimal regulation of the use of pesticides, specifically atrazine, concentrating on the property of accumulation in drinking water. The authors conclude on the basis of previous research that the current regulatory approach of the accumulation of pesticides in drinking water is not working properly, in that it only moves the environmental problems to other areas or other types of pesticides. The aim of the regulation of pesticides should be twofold. First and most importantly incentives should be given to producers of pesticides to produce 'less polluting' alternatives for atrazine. Secondly, farmers should be given incentives to use pesticides under the right conditions.

The law and economics of standard setting and optimal differentiation was discussed in order to point out that the current system is inefficient and to find criteria for efficient regulatory methods. With a view to the current institutional framework of regulation and enforcement in a European and National context, the authors have endeavoured to take the advantages of this framework into account in proposing an alternative regulation of pesticides.

The most efficient way of regulating the use of pesticides in order to protect drinking water quality is the use of differentiated rules on two levels. First of all reasonable quality standards have to be set at the European level. These quality standards should be enforceable upon the Member States by both the Commission and Individuals who suffer damage from the fact that the Member States do not reach the Community standards. Member States can most efficiently
reach these goals by using a system of zoning of regions where pesticides are frequently used. In each type of zone, rules should be set that ensure the correct use of pesticides with regard to the characteristics of the zone. The system of zoning allows for an optimal use of pesticides, ensuring an acceptable accumulation in drinking water. Of course these zoning rules have to be enforced upon the farmers by State or regional authorities. This system could be supplemented by European legislation giving the producers of pesticide incentives to produce 'cleaner' pesticides, possibly using a tax system, making the framework of optimal regulation of the market and the use of pesticides complete.

Designing and implementing a regulatory framework as described above will lead to an efficient, optimally differentiated regulation of the use of pesticides, taking into account the goal of preventing the accumulation of pesticides in drinking water.

Notes

2. L. Bergman and D.M. Pugh (eds.), Environmental Toxicology, Economics and Institutions, The Atrazine Case Study (Dordrecht, Kluwer, 1994) [hereafter, Bergman and Pugh].
5. See further, M.G. Faure, id.
7. See M.G. Faure, n.4 above, at 57–58.
14. This point concerning market distortions is further developed in M. Faure, n.4 above, at 77–80.
15. This has indeed happened in Italy: see Vighi and Zanin, n.6 above.
17. Vighi and Zanin, n.6 above, at 125.
18. Vighi and Zanin, n.6 above.
19. A third alternative would be to consider the possibility of cleaning the polluted ground water if it is used e.g. as drinking water. Within the scope of this article we do not further examine this third possibility.
24. Vighi and Zanin, n.6 above.

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