Groundwater protection in France

Laurent Pavard
Agence de l'eau Artois Picardie
(Artois Picardie Water agency)

Please note : This paper is the result of a personal work. It expresses neither the position of the French government on the Framework directive project, nor that of the Artois Picardie water agency.

1-Groundwater : a major resource for drinking water supply

In France groundwater accounts for 65% of the total abstraction for drinking water supply. Whereas big cities rely on groundwater and surface water for drinking water supply, smaller towns often depend on groundwater.
The number of abstraction points in groundwater is very high. 34,852 abstraction points produce 4.2 billion m3 yearly, whereas 1,529 surface water abstraction points yield 2.3 billion m3 yearly.
The sheer number of groundwater wells is in fact approximately the same as the number of municipalities in France. This is an indication of the relatively small size of many distribution networks in France.

2-Drinking water quality concerns

A 1991 survey carried out by the Ministry of Health on distribution units with more than 10, 000 inhabitants shows that most quality problems are linked to microbiological pollution, turbidity comes second, followed by iron and aluminium pollution. Pollution from nitrates is far behind with only 0.5 % of distribution units concerned by this problem. However nitrate pollution, along with pesticide pollution, is the major concern in extended parts of Brittany where intensive farming and cattle breeding has caused serious water pollution. In the former coal district of the north of France, historical groundwater pollution due to industry and poorly designed sewage systems has also strongly contaminated the water resource and in some large cities the water supply does not meet the minimum standards especially for nitrate.

3-The French protection scheme: the protection areas

In France the quality of each abstraction point should be protected in accordance with government regulations. This regulation is enforced by the Ministry of Health.
The protection area consists of three different zones:
-An "immediate" proximity protection area. This area encompasses the well itself; it is generally small (less than 1 hectare, usually a couple of ares). It is bought by the municipality or the utility, and is fenced. Its purpose it to protect the well itself from direct pollution.
-A proximity area. The purpose of this area is to protect the well from nearby point source pollution, allowing a sufficient reaction time in case of pollution. The limit of 50 days water transit is generally used to fix the limits of this area. The size varies according to the hydrogeological characteristics of the area (hydraulic conductivity) and the abstraction, but is usually a couple of hectares.
In this area the use of the soil is subject to limitations, such as banning of manure, pesticides, road construction, etc. These constraints are proposed by a hydrogeologist according to preliminary studies.
-The distant area is studied case by case and its purpose is to protect the catchment area. In this area soil use is only subject to recommendations. This area can be very large.

4-Defining the protection areas: a complex procedure

The procedure consists of six phases. Since it infringes on private property legal considerations are of primary importance throughout the procedure.

The first stage is the decision of the municipality or the utility to undertake the protection of the abstraction points. This may seem surprising since the protection is a legal obligation. However municipalities in France have total decision making power and without formal decision the public enquiry could not be organised. In fact, for more than 30% of the abstraction points, this decision is still to be made.
The second stage is mainly technical. Geological studies are carried out in order to assess the overall vulnerability, the hydrogeological characteristics, etc.
The third stage consists of a public enquiry organised under the supervision of a public commissioner , where soil use limitation, size and limits of the protection areas are communicated for information to the public. The public has the opportunity to ask questions or to make observations on the project. Questions and observations are answered, and the commissioner eventually gives his advice. If this advice is positive, public utility of the protection is registered by the government local authorities (fourth stage). For the other cases further studies are carried out and a new enquiry is organised.
The fifth stage is the recording of soil use limitations in the propriety registers, and if necessary the expropriation of the land for the immediate proximity area.
The last stage is the realisation of the vulnerability reduction works.
It is only then that the protection can be considered complete.
As a whole the procedure is long and difficult, and can raise local opposition. Conflict frequently occurs about soil use limitations especially when water is abstracted for a distant city. In small towns the mayor is frequently reluctant to impose constraints on the farmers who are his electors and sometimes his colleagues. These problems can slow down or indeed jeopardise the procedure itself. This may be an explanation for the fact that 11% only of the groundwater abstraction points are today fully protected whereas for 30% of them the decision to carry out the protection procedure is still to be made.
Despite it's difficulty this procedure offers quite good protection from point source pollution for a limited cost. In France 90% of the procedures have cost less than 23,000 € for the administrative and technical parts, and 70% of the protection works have cost less than 38,000 €.
This procedure is adapted to today's main concern about non-conformity of drinking water: microbiological contamination.
The Protection areas however do not protect abstraction points from diffuse pollution: nitrates and pesticides. Different protection policies must be designed and set up in order to reduce diffuse pollution.

5-Reducing diffuse pollution: a long-term project

Groundwater may have very strong inertia. A study carried out in the Artois Picardie basin concludes that the progression of the pollution in the unsaturated zone of the chalk aquifer is very slow: about 0.5 meter per year. The delay of groundwater pollution may reach several decades depending on the depth of the water table. Nitrate concentrations of up to 300 mg/l have been measured in interstitial water in the unsaturated zone keeping the record of former agricultural practices. The stock of pollutants within the unsaturated zone is a matter of tons of nitrogen per hectare.
No matter how efficient our policies may be, this stock continues to contaminate groundwater for years or decades.
This is our greatest challenge for the future, particularly if we take into account the framework directive on water management. This directive stipulates to achieve good status within the next 15 years unless specific conditions are met, and to inverse upward pollution trends …
Diffuse pollution reduction policies have been enforced over the past years, some of them according to European regulation. However their efficiency still needs to be proven.

In order to achieve efficiency , a pollution control policy must cope with numerous difficulties :
-its effects are long term, and proof of it's efficiency may be likely to come late : such a policy requires tenacity especially in the field of politics where the farmer's lobby is powerful.
-it has to cope with numerous farmers, each of them being an economic decision maker, and cultivating various plots of land with various agronomic conditions.

-It is very difficult and costly to assess the pollution due to land farming.
-It has to overcome the powerful incentives of the common European agricultural policy. Although if it has recently been redefined in a less productivity-minded way, it still encourages high yield and intensive use of fertilisers. To set up the comparison, the funds of the agricultural policy on the sole arable crops in France were 5.1 billion €, that is three times more than the total budget of the six water agencies in France. This is today a major obstacle.
Four different policies have been tested by now, none of which has proven totally satisfactory.
Regulation has been enforced, in particular through the "nitrate" directive, with questionable effects.
First, the focus has mainly been set on manure although chemical fertilisers are also in the scope of the directive. The fact that only manure has a quantified target : 170 kg nitrogen/ha may be a reason.
Secondly, its administrative costs are not negligible, although they are usually neglected. The controls, which are difficult to achieve, are of course a major part of this cost.
Finally, the French adaptation of the nitrate directive deals only with water resources already polluted by nitrate over 40 mg NO3 /l. It is likely to be to late in most cases.
This discrepancy will by no doubt be settled thanks to the framework directive, which requests to avoid any further degradation of the quality of the water.
Concerning pesticides the regulation may be the solution when it comes to ban a harmful compound.
Economic incentives are widely used. It's not a surprise that farmers' trade unions have a strong preference for these kinds of policies. Good or reasonable practices in agriculture are financially compensated. European funds have been employed in the past in such deals. However they should be carried on for long periods in order to achieve tangible results. And again controls are very difficult to carry out.
In France a pollution control program specifically aimed at breeding farms has been carried out since 1994. But the main part of the money has been put into building modernisation and the fertilisation has been one more time neglected. Today it's efficiency is considered as very low.
Soil appropriation is another possible policy. Despite it's cost it is of course the ultimate solution but the idea of phasing out agriculture may arise some opposition.
Thus priority areas where soil appropriation could be considered must be designated according to objective criteria such as vulnerability or pressure.
This technique has already been implemented in France. The famous "Vittel" brand of bottled water has bought the whole catchment area of the spring.
The size of protection areas is increasing. Municipalities are buying farms in water production areas.
The pollution taxes, or "polluters pays" principle.
Economic regulation generally gives good results for a moderate cost.
The polluter pays principle has been applied to industrial pollution by the French water agencies for more that 30 years with very good results.
Thus we may think that taking into account the cost of water pollution would give good results with farming.
The main problem is however to assess correctly the pollution discharge under the crops. There is no easy answer to this problem, but techniques based on farm accounting have been developed. They allow a reliable assessment of the nitrogen balance for a given farm.
A new water bill under study plans to implement a nitrate pollution tax. This text plans however several reductions (25 kg N/Ha on average plus 50 kg/ha for meadows, plus 50 kg/ha for intermediate nitrate traps crops). The planned rate is quite low (0,20 €/kg to 0,23 €/kg) compared to the cost of chemical fertilisers (0,54 €/ kg of nitrogen) and to the price of cereals (wheat: 250 Kg nitrogen are necessary for a 100-quintal yield. The price of wheat being 11,50 € the margin value of nitrogen is approximately 4,57 € per Kg).
These shortcomings are likely to jeopardise the efficiency of the tax. Nevertheless this will be a first step towards a real ecological taxation of agricultural pollution.
Pesticides are already subject to ecological taxation in France. The rates are within a range from zero to 1 524 € per ton of active matter depending of the toxicity of the compound.

Conclusion

No single solution will definitely settle the problem of diffuse pollution. A carefully designed combination of available tools may give a more satisfactory answer.

This is a real economic and social challenge. Today the average French family drinks 264 litres of bottled water (1999 figure) for a total turnover of 2,2 billion €. This figure is about half of the turnover of the water supply industry. Besides massive advertising campaigns, the lack of confidence in the quality of the drinking water supply is the main reason for the high level of bottled water consumption in France.

Further degradation of water quality would force the stakeholders to build costly treatment plants. A dramatic increase of the price of tap water could result in social and political consequences in may places where tap water prices have already become an issue.