

Curing our medicinal ailment

The Dutch water sector believes that pharmaceutical residues should not be found in drinking water sources. Responsibility should be taken along the chain

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Around 10-15 years ago, the first research reports were published stating that surface water in The Netherlands contained pharmaceutical residues. The concentrations of these residues were extremely low. The residues, however, included a wide range of substances. Not all these substances were medicines in the strictest sense.

The female hormone oestrogen, the active substance in the contraceptive pill, and radiographic contrast agents were, for instance, also detected in the water.

In The Netherlands, surface water (including major rivers) is used for the production of drinking water. There were indications that endocrine disruptors in particular might affect the aquatic ecosystem. These research results therefore prompted more detailed research into the problem.

The Dutch Ministry of Infrastructure and the Environment explored the issue of pharmaceutical residues in the water supply together with the

pharmaceutical industry, the healthcare sector, drinking water companies and the water authorities in order to formulate measures to improve water quality. This process was difficult.

Although we created a better picture of the concentrations of detected substances from various international research projects, we learned very little about the ecological impact. No water quality standards have been set for this category of substances and, unlike pesticides, an obvious impact on the health of the ecosystem can't be proven.

The European Commission failed to add diclofenac and estradiol to the list of priority substances, partly because there were questions about the consequences: at what level should measures be taken when standards are exceeded? The European Parliament, therefore, asked for a strategy paper on measurements to reduce pharmaceuticals in the environment.

► Oestrogen, diclofenac and estradiol can be found in sources of drinking water. The Dutch National Institute for Public Health and the Environment published a report stating that medicine finding its way into drinking water is a cause for concern.



Residues do not belong in water sources

Unie van Waterschappen (water authorities; responsible for water quality and waste water treatment) and Vewin (the association of water companies) take the view that any further purification of effluent from the waste water treatment plants can only be supported if there is a problem and if it appears that a control-at-source approach is insufficient. The drinking water companies are of the opinion that pharmaceutical residues do not belong in drinking water sources and want measures to be taken to ensure that these do not get into the ground and surface waters.

Unie van Waterschappen and Vewin sent a letter to the Dutch Secretary of State for the Environment in 2014 in which they advocated a three-track approach. This proposed the following actions:

- ~ Definition of the problem: is there a problem and if so, how big is it?
- ~ Can it be addressed at source?
- ~ Examine possible measures to remove residues of pharmaceuticals in the water chain, including additional stages in the treatment process at the waste water treatment plants or measures during the production of drinking water.

Based on the above three points, an integrated policy consideration was made that needed political support for the measures to be taken and the cost.

Chain approach to residues of pharmaceuticals in water

The Dutch Ministry of Infrastructure and the Environment has accepted the proposal of Unie van Waterschappen and Vewin and is currently working on the Chain Approach to Residues of Pharmaceuticals in Water. In the Chain Approach, all parties in the pharmaceutical and water chain will map out the challenges and possible measures.

This is done at each part of the chain: Development & Authorisation; Prescription & Use; and Waste & Treatment.



Unie van Waterschappen and Vewin have been working to improve waste water treatment. Adding activated carbon to the process removes up to 90% of medical residue.

Wherever possible, a control-at-source approach is important. It is, however, clear that all the links in the chain should accept their responsibility to resolve the pharmaceutical problem. We should have an implementation programme in 2017, to begin in 2018.

In addition to identifying measures in all the three stages of the supply chain, it is important to interpret the problem. To do this, the Ministry of Infrastructure and the Environment has commissioned the National Institute for Public Health and the Environment (RIVM) to draw up an interpretation report. The report, *Pharmaceuticals and Water Quality*, was published in 2016. It shows that there is cause for concern about the effects of medicines on water quality.



As people live longer, we are seeing greater use of medicines for the old. Urine collection bags and their separate disposal could limit the pharmaceutical problem.



The Netherlands is participating in the Transnational Action Programme on Emerging Substances, where knowledge on combating water concerns are shared.

In The Netherlands, the safe concentration in surface water is exceeded for some pharmaceuticals. Laboratory studies have shown that medicines affect aquatic organisms. The quality of drinking water is in order, but the sources of drinking water may come under pressure due to increasing residues of pharmaceuticals in water caused by an ageing population and climate change. Residuals of medicines for humans and for animals have also been measured in groundwater in lower concentrations. Veterinary medicines can leach into surface and groundwater, both sources for the production of drinking water. Once residues of medicines get into the groundwater, they continue to be present for a long period of time.

Development & Authorisation

The following arrangements have been made with specific parties. Regarding the Development & Authorisation stage, the openness and accessibility of environmental data pertaining to

medicines is critical, preferably regulated at European level. However, we are also developing a Dutch system in anticipation of a European system. The pharmaceutical industry is committed wherever possible to develop more 'green' medicines that reduce the environmental impact through, for example, better degradability in the environment and/or different forms of administration. Water and healthcare providers will better quantify the concentrations of residues of veterinary medicines in surface and groundwater and are committed to better understanding the effects of this.

Prescription & Use

In the Prescription & Use stage, raising awareness in the healthcare sector and among consumers about the effects of medicines on water quality is key. First and foremost, the commitment to disease prevention and encouraging proper use of medicines is important.

For medicines that are a problem for ecology and the production of drinking water, the healthcare sector, in cooperation with the water sector, is being proactive using urine collection bags, local collection and separate disposal of highly harmful agents or prescribing a less-polluting agent having equivalent effect. The Ministry of Infrastructure and the Environment is having research done into whether pairs of medicines can be produced having the same effect but whereby one has less environmental impact than the other.

Unie van Waterschappen and Vewin are encouraging measures to control at source. For example, research into the treatment of waste water from hospitals, but also discussing with doctors about the introduction of urine collection bags after the use of radiological contrast agents or about the choice of which medicine to prescribe. In the Dutch city of Meppel, doctors have decided to no longer prescribe diclofenac as there are alternative drugs available.

Waste & Treatment

In the last step of the chain, Waste & Treatment, municipalities and pharmacists are seeking the best way of collecting unused medicines locally. Unie van Waterschappen and drinking water companies monitor pharmaceuticals in the water, and some drinking water companies have intensified their water purification process or are conducting research into this. The Dutch research institutes STOWA and KWR Watercycle Research Institute have conducted investigations in recent



More environmentally friendly medicines, for example, those that better degrade or have less-polluting agents, are increasingly prescribed by doctors in the EU.

years regarding the occurrence and effects of medicines in water. The water authorities have started a hot spot analysis, which, among other things, examines where the impact of pharmaceutical residues and endocrine disruptors is the greatest, based on the size of the waste water treatment plant in relation to the receiving surface water.

Water authorities, the drinking water sector and other relevant parties are exploring cost-effective ways to largely remove medicine residues at waste water treatment plants, for example in pilot projects.

A good example is the Schone Maas Waterketen project (Clean Meuse Water Chain). The water quality of the Meuse is seriously impacted by effluent discharge. Particularly in the summer, about two thirds of the Meuse water originates from waste water treatment plants. Unie van Waterschappen and Vewin have joined forces with the Ministry of Infrastructure and the Environment to improve waste water treatment.

This is done by adding active carbon to the treatment process. So far, this looks promising (removing more than 90% of medical residues) and is a lot cheaper than existing techniques.

The organisations would never have succeeded in this on their own. A practical pilot project is currently ongoing. Effectiveness, feedback from treatment of other problematic substances, cost and funding are important for decisions on expanding treatment at waste water treatment plants.

This knowledge is applied in decisions on the hot spot approach. Treatment at specific major sources such as hospitals could be part of this. We can also learn from other countries that already apply additional treatment at their waste water treatment plants.

International research

The Dutch water sector is also active in international research projects, such as the Transnational Action Programme on Emerging Substances project. Emerging substances include, among others, pharmaceuticals, plant protection products, personal care products and industrial pollutants.

The project helped participants exchange experiences and develop knowledge on how to combat emerging substances in the water cycle. Both cooperation between different organisations – ranging from universities to water utilities – and knowledge sharing are important in relation to the project's topic, since emerging substances are a transnational problem which transcends national borders. International cooperation is essential to developing strategies and to solving the problem.

Another interesting project in which the Dutch water sector is collaborating is Solutions. This searches for new and improved tools, models and methods to support decisions in environmental and water policies. The project aims to provide solutions for emerging pollutants, among them pharmaceuticals, in European water resources in close dialogue with relevant organisations at the decision-making level. Solutions is formed by a multi and interdisciplinary consortium composed of 39 renowned scientific institutions and enterprises from Europe, Brazil, China and Australia.

The Chain Approach to Pharmaceutical Residues in Water in The Netherlands is part of the Delta Approach to water quality and freshwater. This programme, under the direction of the Ministry of Infrastructure and the Environment, seeks to accelerate the improvement in water quality.