URBAN WATER QUALITY MANAGEMENT

Pharmafilter: an innovative waste and wastewater management system for hospitals, The Netherlands

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National Water Quality Context

From:

- *National Water Plan 2016-2021*
- *Summary: River basin management plans 2016-2021 of the Netherlands*

Monitoring results show that the water quality in the Netherlands has improved substantially in recent years. The number of water bodies with a healthy fish stock has increased considerably, the oxygen content of the water is up to par almost everywhere and the water has become clearer in many places. Surface water quality is adequate in most places for almost all uses, including swimming, agriculture and leisure activities.

Nevertheless, additional policy efforts are required, because water quality is almost nowhere adequate in all respects. This sets a task for realizing a better hydro morphology of water bodies and reducing harmful substances, both for familiar substances such as nutrients and plant protection products and for new substances such as medicines and (micro) plastics. For example, the Organization for Economic Co-operation and Development has stated that progress with respect to nitrogen, phosphorus and pesticides and the recovery of natural dynamics (OECD, March 2014) has been stagnating. Part of the reason for this is that the Netherlands is situated downstream and the pressure on the water quality is high on account of the intensive land use. New substances entering the water also entail risks.

<u>Controlling improvement of water quality: policy boost</u>

The Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs work together with the partners of the Steering Committee on Water, including the Delta Programme. This means that all water tasks are discussed in connection with one another. Under the direction of the Steering Committee on Water, an initial joint water quality work programme was drawn up in November 2015. This work programme is updated annually.

The measures planned by the Cabinet are expected to ensure that by the end of 2021 the Netherlands is still on course with regard to the objectives of the Water Framework Directive. In the 2016-2018 period the Cabinet will examine, together with the partners of the Steering Committee on Water, whether the Water Framework Directive objectives are still feasible in 2027 and whether any additional measures are necessary and possible (feasible and affordable) in order to achieve those.

Tackling medicines

The presence of medicines in the surface water has adverse effects on aquatic ecosystems. The chain-oriented approach is central to the Dutch policies directed at reducing the impact of medicines. The aim of this is to encourage a source-oriented approach at the beginning of the chain, supplemented by measures at the end of the chain (purification).

Care institutions, which form a major source of medicinal residue, are working to make their business operations more sustainable. Despite measures that are taken at the source, measures may also have to be taken at wastewater purification plants. In the period until 2017 it will be examined which measures will be the most effective and how they can be funded. The national government is making agreements with the water boards and drinking water companies about the national chain approach, which the aim that all parties in the pharmaceutical chain jointly subscribe to the urgency and jointly identify the tasks and potential solutions for each phase (at the source, at the prescription point, at the user end and at the disposal stage). The national approach should culminate in an implementation programme in 2018. In parallel to drawing up the national chain approach, pilot projects and no-regret measures are already being facilitated and carried out.

Pharmafilter: an innovative waste and wastewater management system for hospitals

Project/Policy Overview

Wastewater from hospitals is a source of potential health risks. This is particularly due to the pharmaceutical substances present in urine and faeces, entering the waste water. Traditional sewage treatment systems are not designed to remove all (organic) micro contamination. The consequence is contamination of surface waters.

The Netherlands encourages a source-oriented approach at the beginning of the chain, supplemented by measures at the end of the chain. The Pharmafilter is a typical source-oriented project and therefore fits perfectly in this policy.

Technically, the system basically works as follows: solid and liquid waste are collected and then separated. The waste water then is treated in a biological reactor. In this process, organic substances and a large part of the nitrogen and phosphorus compounds are removed; after which the water is further purified by means of ozonization and filtration through activated carbon.

The innovative character of the Pharmafilter systems is that it collects and cleanses waste water and other (solid) hospital waste in one system. This results first of all in a reduction of logistical waste streams and cross infections, and thereby in improved care. Furthermore, the waste water pollution as discharged by the hospital is almost completely eliminated. The on-site treatment system delivers clean water *and* biogas, the warmth and energy of which is used for the very system itself.

Reasoning for reform and the introduction of the instrument

The idea for Pharmafilter started in 2008. In light of the renewal of its hospital, The Reinier de Graaf Hospital was searching for ways to reduce the long waiting times at the elevators, caused by the many people and goods that had to be moved between units. The elimination of one of the most important logistical streams – waste containers – would make a big difference. The Hospital commissioned research to Eduardo van den Berg, who is now director of Pharmafilter. He researched the possibility of flushing solid waste together with liquid waste through the existing sewerage system.

Policy Instrument Design

Selection and development of the instrument

This instrument was not selected by the government. It has been completely initiated bottom-up, thereby really providing the solutions that were at need on the ground.

As the project did fit the government's source policy to reduce medical waste in the waters, the government has taken a facilitating role, creating the conditions for the innovation to materialize. This has been mainly done by 1) providing finances to help create the Pharmafilter and helping the company to access special (inter)national funds for innovation 2) finding ways for more flexibility in the regulations on waste, thereby enabling the Pharmafilter.

How the instrument works, who benefits and who bears the costs

The core of the instrument is the collection and cleansing of waste water to which other hospital waste streams have been added, and includes the use of single use biodegradable products. This leads to various benefits for various stakeholders:

- Hospital:
  - Reduction of the annual costs of taxes to the regional water authority (Delfland) from between € 50,000 – € 100.000 to less than € 100. This is due to the fact that the Delfland Water Board pollution tax for the hospital is determined on the basis of the number of population equivalents, which has drastically reduced due to the Pharmafilter;
  - The volumes of waste that has to be transported both inside and ouside the hospital, has decreased. This decreases waiting times at elevators and increases efficiency;
  - Replacing reusable bedpans and urinals with single use products that are shredded in the filter has been found to be satisfactory in practice. There are approx. 350,000 fewer contact moments with contaminated material. This means reduced risk of cross-contamination. Furthermore, it had reduced the number of times that a nurse has to handle waste, thereby increasing efficiency. Both nurses and patients have indicated to enjoy greater comfort;
  - The on-site treatment system uses its own produced biogas for (part of) the energy needed.
- Central government and Delfland Water Board:
  - Reduced medical waste in the waters due to local treatment of these substances
  - Development of new techniques;
  - Positive exposure.

Regarding who bears which costs and disadvantages:

- Hospital:
  - Costs for biodegradable disposables; operation and maintenance; depreciation: +-290.000. This comes into addition to the costs for the on-site treatment plant (costs available at Pharmafilter). Taking into account the savings in waste water and drinking water, on waste, on personnel and on infection prevention, it is estimated (by Pharmafilter) that the return of investment is approximately 5-10 years.

- Delfland Water Board: forgone tax income and a new player in waste water treatment;
- Finance and subsidies (totaling to 4 million euros) for development of the Pharmafilter were provided by:
  - Delfland Water Board
  - Foundation for Applied Water Research (STOWA): research platform for Dutch water controllers. STOWA participants are all ground and surface water managers in rural and urban areas, managers of domestic wastewater treatment installations and dam inspectors
  - The European Environment and Nature Policy Programme Life+ (Delfland Water Board, STOWA and Reinier de Graaf hospital helped in the application for this*)
  - the innovation programme Water Framework Directive of the Ministry of Infrastructure and Environment (Delfland Water Board and STOWA helped in the application for this*)
  - R&D tax credit (WBSO) of the Netherlandse Enterprise Agency (collaboration between Ministry of Economic Affairs; Ministry of Infrastructure and Environment; Ministry of Foreign Affairs)

*For the subsidies of Life + and the innovation program of the WFD, Delfland Water Board and STOWA have been involved in the application. This meant that they had the responsibility for well-spending the funds and also were the risk bearers.

How the instrument combines with other instruments

The instrument fits very well in chain approach to reduce medical waste water policy; but also in its circular economy ambitions.

Project/Policy Outcomes

Outcomes (social, economic and environmental)

- Economic:
  - reduced annual costs for pollution tax from Reinier de Graaf hospital to Delfland Water Board
  - Reduction of logistical streams in the hospital, more efficiency
  - decrease in the number of hospital acquired infections
- Social:
  - Better nurses and patient satisfactory (more comfy bedpans), better health care (less cross-contaminations between patients and nurses)
  - Less waiting time at elevators
- Environmental:
  - Reduced medical waste and classical waste (such as nutrients) in the waters
  - Re-use of waste water and organic waste for biogas

Challenges with implementation

The big challenge was to move from innovation towards implementation. It had been quite doable to get the starting (developing) phase of the innovation funded. However, in the Netherlands, as soon as the project develops towards the demonstrational phase, it normally is designated as a "showroom" fase and hence, of a more commercial character. This is were funding usually ends; even though for the projects, there is very often no other source of funding available (private funding normally does not fund in this phase as it is not yet a demonstrated succes). Both the funding of Delfland Water Board and the LIFE+ financing helped in this case, as they also secured funding for the demonstration phase.

Another challenge was the regulation. The idea to integrate hospital *solid* waste with its waste *water*, was so new that it did not fit in the consisting regulation. Difficulties started already in the definitions. Was the waste to be clustered under the solid waste regulations or under the waste water regulations? Furthermore, the legislation dictated *how* to dispose hospital waste, which made the innovation impossible, as it excluded the possibility to dispose solid waste together with the waste water through the sewarage system. Eventually, the regulation had been adapted, *setting minimum standards* for waste disposal, instead of dictating the process. This gave the needed space to move from innovation to implementation.

There is, however, still a challenge in how to move forward in acquiering the needed permits for other hospitals, in other regions. This is due to the grey area of regulation under which this innovation falls (see above). It implies that local governments are doing their own interpretation and assessments for permits, which is time-consuming and not always in line with how it has worked out in Delft.

Finally, acquiring the needed funding took a long time and gave uncertainty, as the funding partners could not always give clarity on when they would transfer the money.

Lessons learned from the process

1) Integrate the interests of various sectors. Sectors can have varying reasons for working on the same issue: a cost reduction for one sector, may help the other sector increase its efficieny. It leads to mutual gains. For this to materialise, cooperation between various Ministeries (as well as between various levels of government) is key. In this case, the water sector had a gain in reducing the pollutants in the water at the start of the chain; the waste sector had a reduction in contamitated waste at view and the re-use in form of biogas; and the health sector had effinciency and better health care to gain.

2) Governments at all levels should inform themselves continuously on what is at issue and at stake in the various sectors; but also how they can facilitate innovative companies in implementing their ideas. Listening to what is happening "on the ground" is absolutely key in achieving innovation whatsoever, so also in the field of waterquality.

3) Regulations should leave as much as possible flexibility to allow innovations to materialise. True innovations do not always fit in the existing laws. In this case, the Landelijk Afvalplan 2 (National Waste Plan 2) at first prescribed exactly *how* waste should be disposed of; but after intensive talks with the company with the innovative idea, it had been changed to prescribe to *which minimim standards* waste disposal should apply. This made it possible to actually collect the solid hospital waste in the waste water system – whilst this was not possible at first.

4) Challenge: how to move innovations from pilot to implementation phase, especially when they are in a grey area of regulations. Possibly, a more centralised view (instead of decentralised) might help in avoiding the variety in how municipalities assess the innovation to the legislation.

Requisites to make the instrument work

Support from central and regional authorities. In this case, regional water authority Delfland Water Board has been most intensely involved, with knowledge, expertise and finances, from starting phase until full scale phase. It does not have any shares in the business; but does support it by showcasing it.
See also lessons-learnt.

Sources:

Reinier de Graaf, https://reinierdegraaf.nl/algemeen/over-reinier-de-graaf/duurzaam-ziekenhuis/ (accessed march 2016).

Evaluation Report Pharmafilter (2012), STOWA et all. Accessible through www.reinierdegraaf.nl/rdgg/cache/file/507BD2BF-CC1D-42DA-A8577060EA03636E.pdf.