

## Pharmaceutically burdened Wastewater - Hospitals



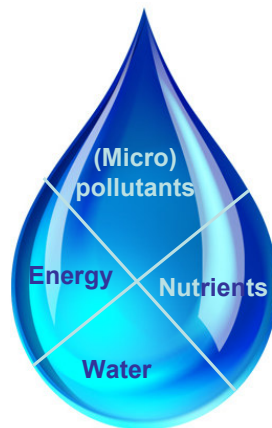
## Overview Grontmij references



# Introduction

Since the end of the 19th century wastewater has been a known risk for public health due to presence of pathogens. During the 20th century it became clear that wastewater also constituted a threat to the environment, partly because discharge of effluent leads to oxygen depletion of surface water. In search of a solution for the above mentioned problems research focused on quick and effective ways for collection and transportation of the wastewater. That is why these days the wastewater chain consists of a robust system for wastewater collection and transportation from urban areas to a central wastewater treatment plant (WWTP). At this plant pathogens, components that demand oxygen and nutrients are removed from the wastewater at a high rate. The treated water is discharged to the surface water.

In the last couple of years changes have been occurring in the wastewater chain. These changes are due to tighter regulations on one hand and the fact that wastewater infrastructure needs major repairs on the other. This created a new trend in waste water collection and treatment systems. Instead of considering waste water as *waste*, it is now more and more seen as a *raw material carrier*. The following picture depicts the composition of wastewater.



Recently the interest in so called micro pollutants is increasing. Especially wastewater originating from hospitals is a significant source of micro pollutants, in this case (remnants of) pharmaceuticals like antibiotics, x-ray contrast agents and hormones.

## Grontmij and hospital wastewaters

Grontmij has participated in several projects concerning the discharge of micro pollutants from hospitals via its wastewaters. These activities span the whole chain in which these products are of concern. Based on the intake of medicine, predictions can be made of their concentrations in wastewater, be it source separated or not. This information can be combined with information on the sewer system and the wastewater treatment plant to estimate the effect in receiving water bodies. These predicted effects can be verified by concentration measurements and toxicity measurements, throughout the chain.

This knowledge, combined with the knowledge on waste processing and disposal, also has led to the development of a concept streamlining waste management in hospitals, including their wastewater, in order to minimize both costs and the discharge of pharmaceuticals to the environment.

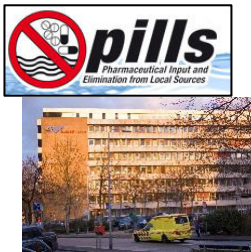
An overview of several projects highlighting these activities is given in this portfolio.

## References



### Verg(h)ulde Pillen (Hidden Pills)

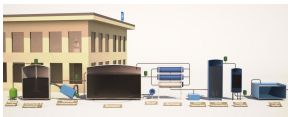
In this project Grontmij has estimated the nature and extent of pharmaceutical emissions from hospitals to Dutch water bodies. Based on interviews and literature studies estimates were made of the most important pharmaceutical groups and emission sites within hospitals and the way these travel through the wastewater chain. These estimates were then verified by measurements at three representative Dutch hospitals.



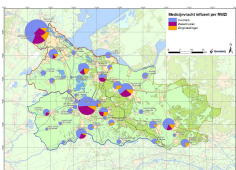
### PILLS and SLIK

PILLS (Pharmaceutical Input and eLImination from Local Sources) is an EU-project that focuses on finding solutions for pharmaceutically burdened waste water directly at the source. The project includes pilot trials at the ISALA clinic in Zwolle. Grontmij is responsible for the design of the treatment facility, both technologically and mechanically as well as research into the identification, analysis and characterization of the most important pharmaceuticals involved, both considering intake as well as discharge. SLIK (Sanitary discharges, Isala Clinic) is a subproject of PILLS for the construction of the treatment pilot. Here Grontmij supports the client in obtaining grants, contracting, design and research.

### Pharmafilter



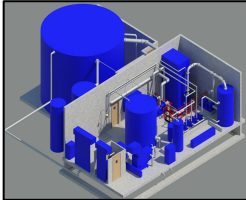
Using the knowledge gained in previous studies and combining this with the knowledge on waste processing the Pharmafilter concept was born. Combining both waste and wastewater and using biodegradable disposables (bed pans, urinals, etc.) allows for a specialized treatment system. Energy is recovered by digestion of the waste, and then treatment in a membrane bioreactor removes organics and nutrients from the wastewater. Finally pharmaceuticals are completely removed by ozonation and activated carbon filtration. This concept is currently being tested on a semi-technical scale at the "Reinier de Graaf Gasthuis" hospital in Delft (NL). Grontmij designed and build the wastewater treatment concept.



### Area Survey Utrecht-province

For the entire area of Utrecht (Dutch province) the effect of hospitals, healthcares institution and residential areas on pharmaceutical discharges is estimated for each wastewater treatment facility. This estimation was translated to a concentration of pharmaceutical compounds in receiving water bodies. Soon this estimate will be verified by measurements.

## References



### Other

Next to these projects directly dealing with hospitals Grontmij is involved in several projects dealing with reduction of discharges of organic micro pollutants, including pharmaceuticals. Techniques used to remove these micro pollutants are effectively the same as techniques used to remove pharmaceuticals, often this is ozonation and/or active carbon filtration.



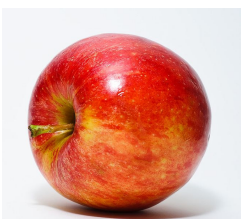
### Sleen – De Schoel (Pilot)

In 25 houses of a housing complex for seniors De Schoel in Sleen, The Netherlands, urine separation toilets have been installed. The urine is collected separately. A pilot-scale installation was designed to treat the total urine production of this elderly home to remove pharmaceuticals from the urine. Test results look very promising.



### SOURCE Simultaneous removal of human and veterinary pharmaceuticals and Nutrients (Scenario studie)

The SOURCE project (Simultaneous Reuse of nutrients and removal of human and veterinary pharmaceuticals) deals with a combination of source separated human urine and liquid manure. A pilot-scale installation was built to first remove organics and nutrients, and then remove pharmaceuticals in a post treatment. Test results for pharmaceuticals are not yet available.



### Pesticides and herbicides in fruit transport waters

This project deals with pesticides and herbicides in water used for the selection of fruit. Here the water is treated to keep concentrations of these compounds very low in order to extend the usage time of the so called transport water. Again test results are positive. However, the cost reduction by extending the usage life of potable water is very low.

[www.grontmij.nl](http://www.grontmij.nl)

**Grontmij Nederland bv**  
Water & Energy  
Afdeling Water  
De Holle Bilt 22  
3732 HM De Bilt  
Postbus 203  
3730 AE De Bilt  
T +31 30 220 78 67  
F +31 30 695 63 66  
E [marijn.kunst@grontmij.nl](mailto:marijn.kunst@grontmij.nl)  
W [www.grontmij.nl](http://www.grontmij.nl)