



# LeAF Letter

Number 6, December 2006

**With this newsletter Lettinga Associates Foundation aims at informing the reader on its projects, courses and other activities performed in the field of implementation of environmental protection and resource conservation technologies**

Dear readers,

Finally it looks as if winter is about to start. The high temperatures of recent weeks stimulated the discussions on global warming and climate changes. Of course we know already for a long time what to do: use our resources in a sustainable way (see article on multiple water use in this LeAF Letter). And this is what brings you and LeAF together.

We wish you a peaceful Christmas and an inspiring New Year.

Marjo Lexmond  
managing director

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## LeAF back and forth

2006 has been a good year for LeAF: we have improved our testing services (see related article in this LeAF Letter), we have intensified our cooperation with the Department of Environmental Technology of Wageningen University, we have met a lot of new and interesting people from complementary organisations, we have acquired the status of knowledge centre as described in article 1, c, sub. 6 of the innovation voucher programme 2006 of SenterNovem making it more attractive for the small and medium sized Dutch enterprises (MKB) to contract us, and as a result we have been able to grow.

LeAF aims at being the worlds leading knowledge centre on anaerobic processes for a sustainable society in general and more specific for the treatment and purification of waste and wastewater, energy production and reuse of water and nutrients in order to provide an added value to the society and the companies working in this field. LeAF continuously develops new concepts and applications and seeks to disseminate this knowledge all over the world. LeAF also wants to improve the sanitation in countries in transition as laid down in the Millennium Development Goal No. 7 'sustainable access to safe drinking water and hygienic sanitation', thereby contributing to the abatement of poverty.

For 2007 we aim at increasing our activities and we will focus on the implementation of sustainable technologies wherever we can and think it is useful. We will also celebrate our tenth anniversary. In our next LeAF Letter you can read more on this topic.

In January 2007 we will say goodbye to Tony Sijm, who has been our secretary for one year. Gusta de Kaste will take over his tasks. Gusta will also continue to work as secretary at the Department of Environmental Technology.

For more information on LeAF's activities contact Marjo Lexmond (marjo.lexmond@wur.nl) or one of LeAF's project leaders as indicated at the end of each article in this LeAF Letter.

## Lettinga Award 2007

### Focus on the chemical industry

The Lettinga Award was initiated in 2001 and financed by three Dutch Environmental Engineering companies: Paques Natural Solutions B.V., Royal Haskoning and Biothane Systems International. The purpose of this award is to stimulate innovation in the field of anaerobic technology for wastewater treatment aiming at cleaner production or recycling, sustainable development and/or resource conservation. This may concern sustainable treatment concepts of industrial or domestic wastewater, and also activities that are focused on awareness, implementation, knowledge transfer and demonstration of sustainable environmental biotechnologies. The innovative projects that can be submitted may take place all over the world. This year's focus is on the chemical industry.

The chemical industry is faced with an ever-pressing need to find cost effective and sustainable solutions for wastewater treatment. Anaerobic technologies offer important potentials for removing organic pollutants from high strength industrial effluents. However, as effluents from the chemical industry may contain compounds that are recalcitrant or affect the treatment process, many challenges remain as to the application of anaerobic treatment technology.

Do you have an innovative anaerobic thought that can stimulate the implementation of anaerobic technology within the chemical industry? Then use the opportunity that the third Lettinga Award offers you. The prize of 25.000 euro might help you to get a start with your project. You have time until the 1<sup>st</sup> of April 2007 to send in a proposal. For more information on the award and the selection procedure please visit LeAF website, where you can also download the notes for applicants and the application form <http://www.leaf-water.org>.



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The contact person for all your questions on the Lettinga Award is Darja Kragic (darja.kragic@wur.nl).



## Workshop 'Predicting methane production during (co)-digestion of biomass' (date: 29 March 2007)

LeAF will organise a workshop for consultancies, constructors and operators of biogas plants on 'Predicting methane production during (co)-digestion of biomass'. The workshop is organized in the framework of the SenterNovem ROB research project 'Development of a model for predicting methane production during (co)-digestion of manure at different  $\text{NH}_4^+$ -N concentrations' executed by the Department of Environmental Technology of Wageningen University. The course will take place on 29<sup>th</sup> of March 2007 in Wageningen.

In the morning presentations will be given on the principles of the anaerobic digestion process and the newly achieved knowledge within the ROB-project. Moreover a basic model for predicting methane production at anaerobic digestion of different substrates will be explained. In the afternoon the participants will exercise with the computer model and see the effect of using substrates with different characteristics on the biogas yield and the retention time to be applied.

For more information please contact:  
Grietje Zeeman (grietje.zeeman@wur.nl) or  
Henri Spanjers (henri.spanjers@wur.nl)

## Research and demonstration Project Anderen: Urine as a Fertilizer for Energy Crops

From January 2007 on, LeAF will be involved in an R&D project investigating the possible use of urine as a nutrient source for energy crops. Urine contributes only 1% of the total wastewater amount, but contains about 80% of the nitrogen and 45% of the phosphate present in domestic wastewater. Therefore separate collection and treatment of urine seems an attractive option. However, urine also contains a range of pharmaceuticals and hormones excreted by humans.



In this project eight urine-separating toilets will be installed at the 'Natuurwerkplaats Anderen' in the province of Drenthe. The ultimate aim is to use the harvested urine as a fertiliser for energy crops on the land around the Natuurwerkplaats. LeAF will perform laboratory tests in order to investigate the fate of selected pharmaceutical residues and hormones, prior to actual application of urine to the soil. It is

hypothesized that a large fraction of these compounds will be biologically degraded due to their long residence time in the soil.



The aim is to investigate whether there are potential consequences of urine application for the soil environment and the ground water quality. Column experiments, biodegradation experiments and sorption, desorption

experiments are going to take place. Partners in this project are Grontmij Nederland, Wageningen University, STOWA, WMD/WLN, Waterschap Hunze en Aa's and the Province of Drenthe.

For more information please contact Adriaan Mels (adriaan.mels@wur.nl)

## In-situ biodegradation of chlorinated compounds: follow-up

Anaerobic bioremediation of soil and groundwater is a proven technology to clean-up sites that are contaminated with chlorinated hydrocarbons. As published in LeAF Letter no. 4 (December 2005, the article called 'Boosting in-situ biodegradation') LeAF and P&J Milieuservices BV are cooperating on a project to apply a novel technique to improve the biodegradation of these contaminants. The technique makes use of specific bacteria growing in an anaerobic reactor, which are subsequently injected along with the reactor effluent into the soil to accelerate in-situ biodegradation.



In the previous article we reported mostly on the background of the project and we announced by means of a photograph that the reactor had been built. In December 2005 the reactor was filled with anaerobic sludge, and now we can add that after a careful start-up process the reactor has been running for some time. The first results are promising, as biodegradation capacity has developed.

Please contact Henri Spanjers for more information (henri.spanjers@wur.nl)

## Second PAO course on source separated collection, transport and treatment of household wastewater (date: 21, 22 November 2007)

The course on source separated collection, transport and treatment of household wastewater for the foundation of Post Academic Education (PAO), given by LeAF in November 2005, was very well received. PAO therefore asked LeAF to organise a second course on source separated collection, transport and treatment of household wastewater on 21 and 22 November 2007.

Different topics of concern, when introducing new sanitation concepts based on source separation, will be addressed. The topics include (bio-) technological aspects like anaerobic treatment of black water, nitrogen and phosphorus recovery and conversion technologies, fate of natural and synthetic hormones and medicine rests in biological systems, but also project management and consumer acceptance at realising new sanitation concepts and fitting these in the building environment. Special attention will be paid on the experience achieved



with different demonstrations, like the black water collection, transport and treatment system, applied for 32 houses in Sneek and several urine separation projects.



Pictures from the project in Sneek, The Netherlands (photographs by Brendo Meulman, Landustrie BV)

For more information please contact:  
Grietje Zeeman (grietje.zeeman@wur.nl) or  
Adriaan Mels (adriaan.mels@wur.nl)

### Registration for E-course on Wastewater Reclamation for Agricultural Reuse is open

This course is scheduled for the spring 2007 and deals with urban wastewater reclamation for agriculture. The course is designed as a hands-on experience. It starts as a real job may: you are contacted by the Mayor of a middle-size city in a developing country. The Mayor asks you to study the severe sanitation and sewage problems of the city and to come up with a 'sustainable' solution.

Content-wise the course provides participants with knowledge on

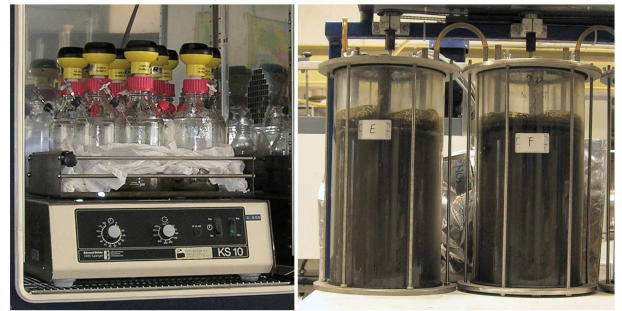
- Sewage treatment in general;
- The design of waste stabilization ponds and UASB reactors;
- The potential and technical design options for using treated wastewater for agricultural irrigation;
- A methodology for making a 'sustainability assessment' based on multi criteria analysis.

This is a tutored course. During the course you will have to submit several assignments that will be checked and discussed with you. The time investment to do the course is 1-2 weeks. The course starts in the spring of 2007 and can be followed at your own pace.

If you are interested to participate in this course, please send an e-mail to [info@leaf-water.org](mailto:info@leaf-water.org) and we will provide you with a registration form and course details. The participation fee is € 350. You will receive a certificate after finishing the course

### Testing services of LeAF

Laboratory testing is an essential tool for evaluation of waste or wastewater treatment plants and as part of the decision-making process for the selection and design of the most appropriate technologies for treatment of a specific waste or wastewater stream. LeAF offers laboratory services for a wide variety of tests, such as biogas production tests, anaerobic biodegradability tests, activity tests, toxicity tests, etc. (please visit our website for a more extensive list). No test is alike and there are many factors that should be taken into account when considering a possible test. That is why together with our clients we discuss their specific needs and come to a tailor-made test set-up. This means that your test is never treated as a routine job, and we guarantee that full attention is paid while conducting your test.



Tests always involve chemical analyses, and we have the capacity to quantify a wide range of parameters. LeAF is not a routine analytical laboratory, but of course we are happy to perform chemical analyses for you when these are complementary to a test, or when they are needed to take decisions on tests.

Our reports do not give just a number but we always provide you added value in the form of graphs, tables, interpretation and personalised advice.

Please contact Adrie Veeken ([adrie.veeken@wur.nl](mailto:adrie.veeken@wur.nl)), our project leader in charge of testing, to find out what we can do for you.

### Multiple water use: from problem to resource

The Special Chair of Professor Jules van Lier is financed via LeAF by Paques Natural Solutions B.V., Royal Haskoning, Biothane Systems International and Shell. The inaugural speech of Prof. van Lier at Wageningen University on November the 15<sup>th</sup> 2006, was titled "Multiple water use: from problem to resource".

(WUR press release)

*The Unconvenient Truth of Al Gore presents a doom scenario of our planet if we do not take immediate action. Whether or not a possible climate change can be altered is another debate, but what really matters is the depletion of worldwide resources! Fossil fuel is only one, and apparently the one that strikes our Western Societies most... Instead of focussing on the possible disasters that are awaiting us, developing all kinds of climate models, we should use our energy more efficient by taking immediate action in protecting resources and preserving them for multiple uses. Then, water becomes one of the most crucial ones says prof. Jules van Lier at the inauguration of his Special Chair "Anaerobic Wastewater Treatment for Reuse" at Wageningen University.*



Use of sewage for irrigation (Amman, Jordan)

The Western world purifies its wastewater in a costly and inefficient fashion, which also sets a poor example for developing countries. It is more sustainable – and even profitable – to reuse scarce and often costly resources such as water and fertilisers. The environmental technology required to achieve this goal is still getting insufficient attention, said Jules van Lier in his inaugural address, professor in Anaerobic Wastewater Treatment for Reuse and Irrigation at Wageningen University.



Prof. Van Lier contends that the greatest concern for ourselves and our progeny is the exhaustion and unequal distribution of resources that are essential for maintaining our society. Greater pressure on these resources leads to even greater social inequality. And this in turn can lead to worldwide social unrest with a fundamental struggle for resources. In contrast, he believes that the concerns about the greenhouse effect and the attempts to limit climate change are futile because there is little that can be done about these problems and they draw attention away from the real issue: the exhaustion of the Earth's resources.



Use of sewage for irrigation (Sana'a, Yemen)

Dealing responsibly with the limited amount of water is one of the greatest challenges for the coming decades, states Van Lier. Only 0.01 - 0.02 percent of all the water on Earth is suitable for human consumption and use ("many times less than the standard measurement error"). Freshwater is a renewable resource; the water that is consumed by a resident of Amsterdam has already passed through a German's body. Van Lier believes it is worthwhile to include the reuse of water and the recovery of resources as part of the basic design of the water chain, where the final user of the water partly determines its quality, and therefore the cost of purification. Extensive purification of water at high cost is pointless if this is not strictly necessary. For example, using a great deal of energy to initially remove fertilisers from wastewater that will be used later in agricultural production cannot be justified. This is especially the case if the land has to be fertilised anyway. Van Lier advocates a much more realistic approach – which could be a breakthrough for developing countries – by implementing wastewater purification on a large scale. He believes this is essential because long periods of pollution are creating a time bomb underneath society.

At this time, 1.8 million people die annually by drinking contaminated water, of which 90% are children younger than five, while 2.4 billion people do not even have access to adequate sanitary facilities.

### **Inefficient**

The Western world processes its wastewater inefficiently. In our households, we dilute human waste by a factor of 100 or even more. As a result, we have created an immense wastewater problem, says Van Lier. The removal of pathogens from wastewater can also result in extremely high costs, while its necessity is disputable. For every potential case of hepatitis A infection, the United States spends between 3 and 30 million dollars per year on purification to eliminate the risk. This amount is completely disproportional to the costs of treating one patient with this disease.

### **Anaerobic Treatment**

Traditional purification technology is based on adding air to the wastewater, which allows aerobic bacteria to do their purifying work. According to Van Lier, this method is completely obsolete; it requires a relatively large amount of energy and does not contribute to sustainable solutions. Within Wageningen University and Research Centre, far-reaching expertise has been developed in the area of anaerobic (oxygen-free) wastewater treatment. This method does not use any energy from fossil fuels. In fact, it produces energy because it generates methane. For developing countries, this consideration is extremely important for the choice of an applicable environmental technology. Much more complex, but equally essential, is that the water chain becomes much better organised, states Van Lier.

Examples include the deliberate reuse of urban wastewater for irrigation in agriculture within and around large cities in developing countries. This is an effective alternative for discharging wastewater to surface waters. It prevents environmental and health problems downstream from the city and provides income for the farmers. However, it also means that the relevant organisations and users need to communicate with each other, so that they can prevent situations such as that in the Jordan Valley. Farmers there use wastewater for irrigation, but have little knowledge of its composition, so they also apply fertilisers. As a result, dangerously high concentrations of nitrate occur in the groundwater.

Jules van Lier is a scientific advisor of LeAF. You can contact him for more information ([jules.vanlier@wur.nl](mailto:jules.vanlier@wur.nl)).

### **This year's LeAF publications**

In 2006 LeAF co-workers have published a number of reports and articles on a variety of subjects.

A publication list for this year can be found in the appendix to this LeAF-letter and on our website, <http://www.leaf-water.org>

### **Colophon**

Lettinga Associates Foundation is a non-governmental, not for profit organisation that does not receive donor funding. The foundation earns its income from projects related to applied research, consultancy tasks, organisation of courses, biological tests, etc.

Twice a year Lettinga Associates Foundation will distribute this LeAF Letter amongst its clients, relations, and others interested in environmental technologies for waste and wastewater treatment.

If you would like to receive this newsletter on a different e-mail account, or if you wish to subscribe someone else for this service, please send an e-mail to [leaf@leaf-water.org](mailto:leaf@leaf-water.org). If you wish to be removed from this mailing list, you can send an e-mail to the above mentioned address with the subject 'remove from LeAF Letter list'.



## Appendix – LeAF publication list 2006

### Reports

- van Nieuwenhuijzen A.F., Mels A.R., Brandt C.E., Piekema P., Ottenhoff E.C. (2006) Geavanceerde voorzuivering van afvalwater; praktijktoepassing op de RWZI Amstelveen, STOWA-rapport 2006-13, Utrecht.  
→ See <http://www.stowa.nl/> for downloading or ordering of the report.
- Mels A., Swart B., Zeeman G. (2006) Quicksan knelpunten bij praktische toepassing van DESAH initiatieven, In: Anders omgaan met huishoudelijk afvalwater, STOWA-rapport 2006-18, Utrecht, p. 45-63.  
→ See <http://www.stowa.nl/> for downloading or ordering of the report.

### Articles

- Bisschops I., Spanjers H., Keesman K. (2006) Automatic detection of exogenous respiration end-point using artificial neural network, *Water Science and Technology*, 53 (4-5), 273-281  
→ Also published last year in conference proceedings of 2<sup>nd</sup> IWA ICA Conference, Busan, Korea, 2005
- Huibers F.P., Seghezzo L., Mels A. (2006) Wastewater and irrigated agriculture, lessons learnt and possible applications in Africa, African Technology Policy Studies Network, Nairobi, Kenya. ATPS Special Paper Series 23.  
→ See <http://www.atpsnet.org/> for downloading or ordering of the article.
- Mels, A., van Andel N., Kristinsson J., Wortmann E., Oei P., de Wilt J., Lettinga G., Zeeman G. (2006) Zonneterp voorziet decentraal in alle nutsfuncties, *Spil* 229-230, 2006 no. 5, 12-18  
→ See <http://www.platteland-in-perspectief.nl/> for downloading or ordering of the article.
- Mels A., Zeeman G., Kujawa-Roeleveld K., Palsma B., Swart B. (2006) De keten verandert, langzaam maar zeker!, *Afvalwaterwetenschap* 5, 43-47
- Spanjers H., Bouvier J.-C., Steenweg P., Bisschops I., van Gils W. and Versprille B. (2006) Implementation of in-line infrared monitor in full-scale anaerobic digestion process, *Water Science and Technology*, 53 (4-5), 55-61  
→ Also published last year in conference proceedings of 2<sup>nd</sup> IWA ICA Conference, Busan, Korea, 2005
- Spanjers H., van Lier J.B. (2006) Instrumentation in anaerobic treatment - research and practice, *Water Science and Technology*, 53 (4-5), 63-76  
→ Also published last year in conference proceedings of 2<sup>nd</sup> IWA ICA Conference, Busan, Korea, 2005

### Conference contributions

- Seghezzo L., Mels A., van Buuren J., van Lier J. (2006) Internet course on urban wastewater treatment and agricultural reuse, In: Proceedings of Euro-Arab Environment Conference & Exhibition 2006, 27-29 November, p. 2006. 803-810.
- Van Lier J.B. (2006) Anaerobic industrial wastewater treatment; perspectives for closing water and resource cycles. In: Proceedings of IChemE 2006, 28th Int. Exhibition Conference on Chemical Technology, Environmental Protection and Biotechnology. May 15-19, 2006, Frankfurt, Germany, Invited Key-note speaker.
- Van Lier J.B. (2006) Anaerobic treatment for resource recovery. In: Proceedings of Workshop on Produktionintegrierte Wasser/Abwasser Technik. Sept. 13-14, 2006, Bremen, Germany. Invited speaker

### Other publication types

- Dos Santos A.B., Bisschops I.A.E. (2006) Closing process water cycles and product recovery in textile industry: perspective for biological treatment, In: Advanced Biological Treatment Processes for Industrial Wastewaters – Principles and Applications, Integrated Environmental Technology Series, IWA Publishing, London, UK
- Lettinga Associates Foundation, Aqua For All, Wageningen University (2006) Internet Course on Urban Wastewater Treatment and Agricultural Reuse  
→ Visit our website <http://www.leaf-water.org> for more information