

# VISION

Vision on technology for a better world

## SERVACO PRODUCT TESTING PROCEEDS WITH VITO TECHNOLOGY

WORKING TOWARDS A  
**SUSTAINABLE HEALTH SYSTEM**

**ATMOSYS** CONQUERS  
**EUROPE** (AND THE WORLD)

**CIRCULAR CONSTRUCTION**  
GETS OFF TO A SPEEDY START

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Dear reader,

With a budget of 185 million euro in 2018 VITO confirms the positive trend of the previous years. These means are the result of the efforts of the Flemish government for VITO and of the dedication of our employees and reflects the important position that VITO holds in the scientific world and the Flemish economy. On page 3 you can find an overview of the VITO results 2018 in figures.

When we think of sustainability we do not only think about our energy system or the impact of our economy and society on the environment and the climate. Also in our healthcare there is an ongoing transition towards a more sustainable model. In this model sustainable equals quality, accessible and affordable. Our business unit VITO Health is guiding this transition. You can read all about it in our extensive article about the way towards a sustainable healthcare system.

At the same time we are also evolving towards a healthier society. This is illustrated by measures taken by governments and companies to closely monitor the impact of materials and products on our health. Our cover story, where we show the close cooperation with the Flemish 'testing company' Servaco, is a good example of this. In another article our contribution to the ambition of Flanders to be 'free of asbestos' by 2040 is explained.

Who says sustainable today also - more often - says circular. In this edition we zoom in on the aspirations of Flemish companies and organisations to close their loops (raw materials, materials, products). In this transition towards a circular economy VITO is more and more taking the role of facilitator and even accelerator, a role that we wish to enforce in the next years.

Together we are moving towards a sustainable society. Enjoy reading this issue of VITO VISION!

**Dirk Fransaer**  
Managing Director of VITO



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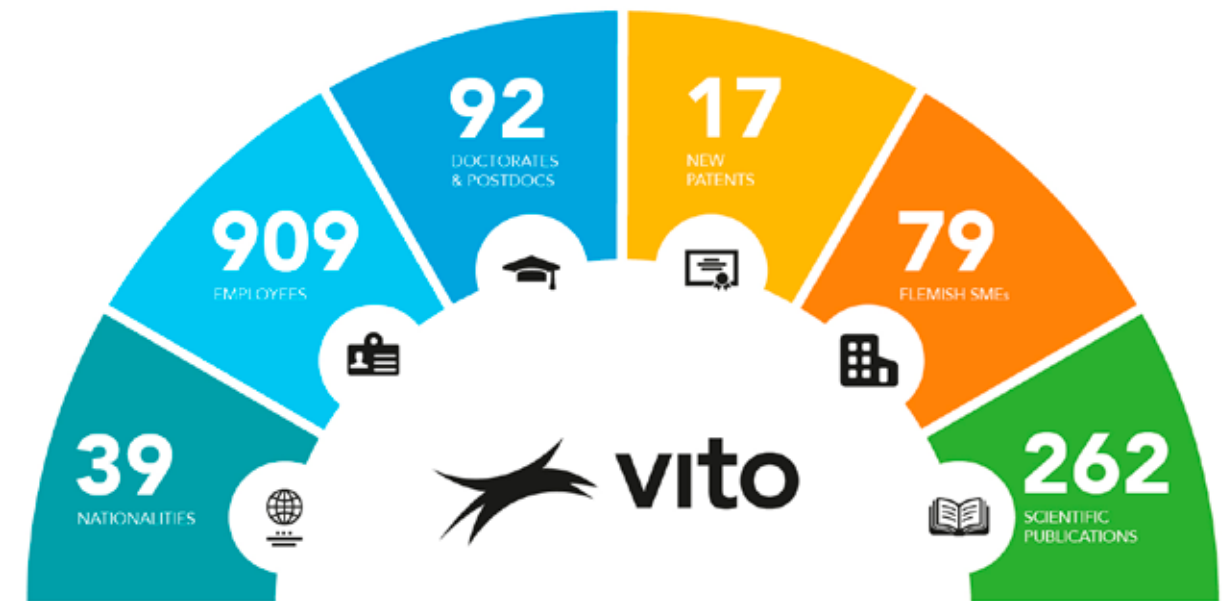
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## VITO IN FIGURES

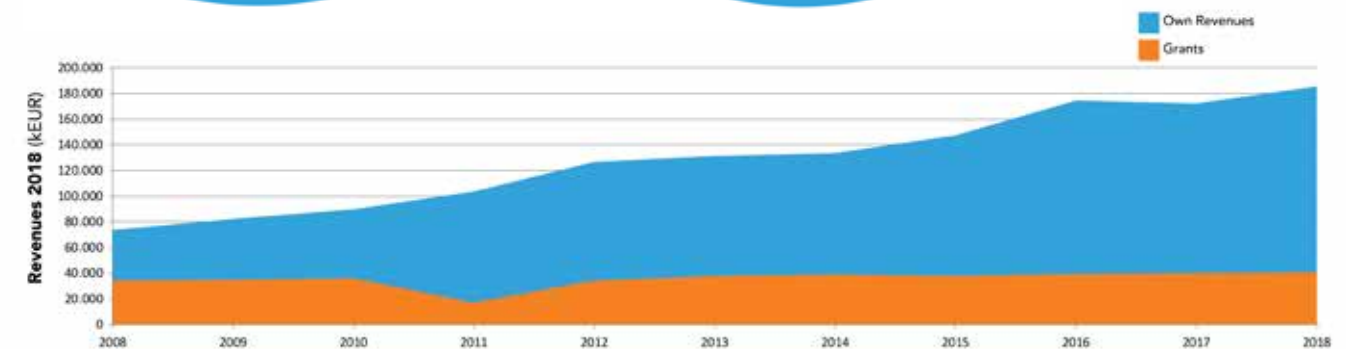


Revenues 2018 (kEUR)

Business Revenues	68.090
Research and Development	50.300
Grants	55.351
Financing Reference Tasks	11.970
<b>Total</b>	<b>185.711</b>

Expenditures 2018 (kEUR)

Salaries	73.527
Operating Means	38.191
Depreciation R&D	50.300
Normal Depreciation	22.460
<b>Total</b>	<b>184.478</b>



On Friday 5th April 2019, the Flemish government has approved the new VITO covenant. The covenant offers VITO a stable framework for its operation until the end of 2023.

The covenant holds 5 strategic objectives:

- 1 To be an internationally renowned research organisation, to be measured by the amount of external, competitively acquired research resources.
- 2 Contribution to the training of highly skilled employees, to be measured by the number of doctoral students and postdocs. (also see article page 16-17)
- 3 Strengthening the Flemish economy, to be measured by the income from private customers and the turnover of VITO's young Flemish spin-offs.
- 4 Supporting the Flemish sustainability policy, to be measured by the revenues from government customers.
- 5 Creating an open innovation environment in Flanders. For this objective we need to work closely with the six spearhead clusters and we have annual access to 5 million euros earmarked resources for concrete projects.





COVER STORY

TRANSFER OF VITO EXPERTISE IN PRODUCT EMISSION TESTING TO SERVACO

## SERVACO PRODUCT TESTING PROCEEDS WITH VITO TECHNOLOGY

VITO's mission is to bring expertise and technological innovation to the market. The transfer of the business around emission testing for products and (building) materials is a textbook example of this valorisation. The integration within Servaco strengthens the assets that the Flemish company has, including a view towards foreign activities.

It is not something that is often mentioned, but we even inhale harmful substances, so-called VOCs or volatile organic compounds indoors, at home, in the office and in the car. And although the focus today is still primarily on air quality outdoors, attention is slowly but surely also being paid to improving air quality indoors. Manufacturers of building materials, furniture, household appliances and other interior products must comply with national and European guidelines for VOCs. In an average household, there is a vast array of VOCs floating around, approximately 180 of which are on the European LCI list and should therefore be closely monitored. These substances escape from building materials such as adhesive, processed wood and linoleum, or from interior objects such as furniture and even (scented) candles.

### Full service provision

In order to comply with government standards or commercial labels and certificates, manufacturers must, of course, first be fully aware of product emissions. In order to guarantee this, manufacturers call upon a service provider that specialises in measuring, analysing and interpreting emissions. In recent years, many of them have worked with VITO, where the expertise and technology for an operational service for product testing was developed. VITO has been conducting research into product emissions for years, on behalf of both the government and companies. It therefore saw its customer portfolio expand significantly, thanks to the full range of services it offers. After all, VITO has not only developed the most adequate measurement methodology, it also helps customers

to comply with legislation and other regulations in other countries, both within and outside Europe. "If a company wants to know the emission levels of a specific hazardous substance, it also wants to know whether it complies with the regulations in the countries to which it exports," explains Marc Lor of VITO. "We monitor this closely at VITO. Moreover, we are also well aware of all legislation and product labels that exist, both domestically and abroad. This is all too complicated for most companies, and we have noticed that this is another reason why they are keen to turn to us."

### Joint venture

Due to the success of the VITO service and the commercial and industrial focus of the activities – more routine, less innovative research – this VITO activity

was ready for transfer to the market. The decision was therefore reached to transfer the expertise and know-how to an independent company. A joint venture with an existing private company (with similar activities) was the best option here. VITO found an excellent industrial partner in Servaco. The new company Servaco Product Testing was founded on 22 March 2019. VITO employee Marc Lor immediately transferred to the new company to work as operational director. VITO itself is becoming a minority shareholder.

"This is a good example of how we at VITO support the Flemish economy with technological innovation", explains Bart Swaelens, Head of the Tech Transfer and Venture Development Department at VITO. "The maturity and routine nature of the product emission testing meant that the time was ripe to transform it into an independent company. We have approached several private operators for this. The advantage of Servaco is that the analysis of product emissions is very closely linked to the company's own activities. What is more, the CEO will personally supervise the integration of our expertise."

### European niche market

The new company will be located at the Servaco site in Wetteren, which also houses the Servaco Food Control Department (food, water and animal feed analyses). Servaco's other activities (which are more focussed on the

environment and technical building research) are spread over the sites in Wevelgem, Puurs and Hasselt. "Our activities can be very generally summarised under the headings of inspection, certification, compliance and testing", explains Nico Van Landuyt, CEO of the Servaco Group. "We therefore carry out independent and objective analyses on behalf of our customers. Within Belgium, this includes companies and authorities from virtually all sectors. With the expansion of expertise on product emissions, we are hoping to strengthen ourselves in this niche market and also play a more important role on a European level." Servaco has also been part of the Dutch Normec Group since last year, which means that the focus on Europe will definitely be stronger."

Servaco has already accrued many years of experience in emission measurements for various substances in flue gases. The VITO project to measure emissions from products immediately attracted our interest because of its compatibility with the services we currently offer. "We have seen that story grow and today it seems only logical that we should expand our activities in that direction", explains Jan Goossens, Commercial Director at the Servaco Group. "The integration not only gives us an important level of in-house expertise all at once, but also the opportunity to immediately roll out these activities on an international level." After all, many of Servaco's cus-

tomers have a cross-border business. "Take the automotive industry, for example, which is hoping to establish which substances are being released for increasing numbers of materials and products – artificial leather, dashboards, car mats."

This cooperation shows how VITO is increasingly focusing on the start of innovative industrial activities, with the intention of being able to split them in due course. "At VITO, we usually work at lab and pilot level. Scaling up and commercialising an activity is better carried out outside VITO", explains Swaelens. "This could be in a spin-off that remains strongly linked to VITO by patents, or, as in this case, a joint venture with a private Flemish company."



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# WORKING TOWARDS A SUSTAINABLE HEALTH SYSTEM

**It is the role of VITO's business unit Health to keep the flywheel of the transition to sustainable healthcare turning while maintaining the high quality of the system. Together with the many other stakeholders in this complex ecosystem, the unit is working on the healthcare of the future.**

If there is one thing on which almost everyone agrees, it is that we can enjoy a solid healthcare system in Belgium. A system that not only excels in terms of quality, but that is also easily accessible thanks to far-reaching reimbursements from consultations, treatments and medicines. A large majority of Belgians would like to keep it that way. However, this is a major challenge, because our healthcare system will no longer be affordable in the long term because of its current design.

Costs are rising faster than gross national product and healthcare revenues. Increasing life expectancy, the ageing population, the increase in the number of chronic diseases and the high cost of innovative therapies are all factors that put our model – and actually most healthcare systems in the Western world – under pressure. If we do not intervene, we risk evolving into a model that either offers less quality or is much less accessible.

## Changing medical practice

In many other economic and societal sectors, technological solutions are often intensively sought when facing problems. The irony is that technological innovation is at the heart of the greatest challenge facing healthcare, along with other factors of course, and that is driving up costs, giving us a more expensive system that is no longer sustainable.

At VITO Health, around one hundred employees reflect and work on the healthcare of the future. This needs to become a system that is inherently sustainable and therefore resistant to constantly changing medical practice. An example of such a change that is currently posing major challenges to the system is personalised medicine. Take immunocell therapy, for example; a new and promising cancer treatment. This therapy focuses on the patient's individual characteristics. The price is therefore high, and in the current context, this cannot remain affordable for society. The fact that personalised treat-

ments such as immunocell therapy are so expensive is also a consequence of the market logic in which healthcare is trapped. In any case, the sustainable health system of the future will have a different logic.

## Complex ecosystem

It is not only the people of VITO that are convinced that things need to change. All stakeholders in the sector agree that the healthcare system must be (thoroughly) redesigned. Or perhaps we should think about a complex ecosystem: a dense network in which many stakeholders each have their own specific role to play. In recent years, similar initiatives have emerged from different levels and niches of this network, as demonstrated by the 'vision paper' published earlier this year by some of these stakeholders. In this paper, a number of concrete reform measures were already proposed with the aim of making the transition towards high-quality and affordable healthcare. All in all, this strengthens our conviction that we all share the same common goal: a sustainable health system.

## 4P medicine

But how can we achieve this? The role of VITO Health is not only to identify problem areas and develop solutions, but also to identify and create opportunities and then convert them into something that works in society. It should come as no surprise that it is precisely this new technological innovation that opens the door to these new possibilities. The spectacularly improved availability of analysis and diagnostic equipment is a good example of this. After all, it enables a much better insight into how diseases occur. This ranges from sequencing of the entire DNA (the

genome) to the genetic analysis of the intestinal bacteria (the microbiome) and mapping of the proteins in the cell (the proteome).

This so-called omics revolution is also linked to a working framework that is becoming increasingly accepted in the development of a sustainable health system, namely that of the four Ps: predictive, preventive, personalized and participatory. In '4P medicine', the emphasis is shifted from healing to prevention. At VITO Health, we cherish the combination of technological developments with a data-driven approach. As a result, we are shifting the focus from disease to health.

## Predicting and anticipating

In essence, we can say that at VITO Health, we try to predict how the healthcare system will change as well as possible, in order to anticipate this as accurately as possible. On the one hand, we do this by using groundbreaking research to chase up new insights. A good example is the I AM Frontier study that we have launched (see inset). On the other hand, we launch concrete initiatives and projects based on existing insights. In both cases, we focus on studies and initiatives that are complementary and closely aligned.

One of these initiatives is the digitisation of an existing health guide of Domus Medica, a medical association with more than three thousand general practitioners. With this prevention guide, citizens can, together with their general practitioner, draw up an individual risk profile based on validated questionnaires. By transforming the paper guide into a digital, well-secured platform, we are hoping to make it more usable and, above all, more accessible to the public. This platform can also be used to integrate medical data from the GP's office. What is more, the digitised guide is linked to a personal prevention plan: a range of preven-

tive actions and tailor-made services. The latter can also be offered by the local authorities. This is important because, of all the authorities, the local level of government is closest to the citizen. The aim is for citizens to feel involved and, with the support of these authorities, to play an active role in the preventive improvement of their health.

## Keeping the flywheel turning

The concrete initiative of the digital health guide illustrates how we at VITO Health map out the way to a sustainable healthcare system. That system is up and running: it is active and constantly changing due to developments that simply cannot be avoided. It is therefore not a question of developing a new system from scratch, but of pushing the existing system in the right direction, and of ensuring that the transition doesn't falter or stall. In other words, we must keep the flywheel of the transition turning.

VITO Health does this by working closely with as many ecosystem stakeholders as possible (such as Domus Medica), by making small but significant and medically validated adjustments (such as the digitisation of the health guide), and by ensuring that the system as a whole moves forward. It is therefore a realistic approach that also puts an end to the utopian nature of a brand new sustainable health system.

## A UNIQUE STUDY

VITO Health has recently launched a groundbreaking study in which thirty employees are turned inside out, figuratively speaking: a cohort study called I AM Frontier. The health of the participants is screened for a year and a half, together with an extensive range of biological parameters. This is carried out by taking regular blood, urine, stool and even hair samples. We then use these samples to identify cells, DNA, proteins and other molecules. In short, the complete biological complexity is mapped out and, more importantly, monitored over time.

The I AM Frontier study is a first step in the I AM My Health research programme by VITO Health. In that programme, we are hoping to focus on preventive health care, based on a personalised approach. With this cohort study, VITO Health is hoping to gain new insights into the relationship between physical health, underlying biological processes, lifestyle and environment. In our cohort study we work longitudinally. This means that we search for correlations and deviations in time within individuals.

In this sense, it is a pilot study that starts with 'only' thirty participants, which of course means that it is not representative of the general population. However we do this in order to study the methodology behind it in detail now, with a view to scaling it up later.

When seeking participants, we look for 'disturbances' at different biological levels. If, for example, we find something in the gene expression, we will look to see whether it persists at other levels, such as in proteins. If that is the case, then this means that we have found a disturbance that is not coincidental. But in order to identify disturbances, we do, of course, need natural reference points. In contrast to extensive studies, we work with an individual version of 'normal'. For example, we can compare this with our body temperature which is 37 degrees Celsius on average, but can differ significantly in different individuals. In some people, the 'normal' temperature is higher or lower. The same can be said for normal glucose levels in the blood, which also vary from person



to person. The participants in our study undergo a thorough examination every month for a period of one and a half years. Whether this results in sufficient measurements to find disturbances to the 'norm' at the various screened levels remains to be seen in our evaluation research.

Our cohort study is unique, even in Europe. For the first time, we look longitudinally at the changes at protein level (the proteome) within individuals. This distribution in fluctuations has only been studied at population level to date and usually concerned a snapshot. What is more, the study may signify a breakthrough in the way in which data-driven health studies are organised. After all, it will generate a rich dataset and thus show the way to upscaling and a long-term vision on the collection of health data.

There are many challenges associated with this upscaling, not least in terms of logistics and ethics. The thirty participants provide researchers with an insight into their personal health data. That is why we have de-

liberately chosen our VITO employees, because they understand the importance of such groundbreaking research. What is more, they also receive feedback from a collaborating doctor who interprets the data together with us. The ethical aspects of the study are also scientifically researched and the study design has been approved by the Ethics Committee of Antwerp University Hospital.

Although the cohort study is unique to VITO, the design and execution of this type of research is in our DNA. VITO Health can build on more than twenty years of experience in molecular measurements, as well as in environmental and health studies among the general population that examine the effect of chemicals on health.



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# CIRCULAR BUSINESS: RECONCILING PROFITABILITY WITH SUSTAINABILITY

**More and more companies want to contribute to the transition to a sustainable, circular economy. But in order to succeed, they must be able to link the ecological added value of a circular business model to economic added value.**

Circular business operations involve much more than simply making a sustainable product – such as designer handbags made from recycled plastic waste – and then selling it on to environmentally conscious consumers. After all, most consumers have different needs other than buying a circular product. In order to prompt companies in the direction of the circular economy, it is therefore important to link sustainable innovation to business innovation.

## Expedition Circular!

“It is crucial that we convince companies of the economic added value of circular business, but that they also do not lose sight of the sustainability value”, explains Jeroen Gillabel of VITO. How exactly this should be approached was the subject of a project supported by the Flemish government (under the flag of Flanders Circular) that ran from the end of 2017 until the end of 2018. In ‘Expedition Circular!’, four Flemish companies with concrete cases were matched with four ‘supporters’ with expertise in different areas that are important in circular business: Agoria, Sirris, Start it@KBC and VITO.

“In this project, we looked at both an economic and a sustainability impact, at the level of the four companies behind the cases”, Gillabel continues. “We did this by reaching a tipping point in the acceleration of their

circular model”. The business quartet that took part in the project is diverse: two SMEs, one medium-sized company and also one start-up. This also applies to both their main activity and their circular plans (see inset). “The participants differed in size, sector and concrete case, making this a very good opportunity to look at circular business from different perspectives of the business world. What is more, this diversity allowed us to bring the companies together around the table so that they could learn from one another – after all, they are not competitors.”

## Circular business models

VITO has extensive in-house expertise in sustainability and circular economy, in terms of technology, business strategy and business models. Gillabel explains: “We can answer some of the questions from companies regarding circular business ourselves, such as what needs to be done to create the greatest added value in terms of sustainability. But that is only part of the challenge. After all, the transition to circular business involves a lot of work. Strategic and operational management need to be redefined and there are also implications at the legal and financial level, for example. Together with Agoria, Sirris and Start it@KBC, we were able to offer the four entrepreneurs a very wide range of substantive support.”

Start it@KBC, for example, supports start-ups with mentoring and coaching. “This is indispensable, especially if you have the ambition to start a circular business”, explains Dirk Lievens of Start it@KBC. “You can’t do this alone, as circular business models don’t actually exist yet in practice.” Lievens and

his colleagues primarily supervised the small company More, i.e. a start-up, in the Expedition Circular! project. They also organised a session on business pitching, and a discussion with KBC experts on financing circular business models. All four companies, as well as the other supporters, were invited to attend this.

More is hoping to collect and process plaster waste from plastering works into interior products (including designer lights). With the help of the VITO experts, this start-up quickly gained a first insight into the sustainability value of their case. “Recovering plaster waste by using it to make valuable products can result in added value in terms of sustainability”, explains Gillabel. “After all, it does not end up on the landfill or construction site together with the other site waste. On the other hand, the sustainability benefits strongly depend on the transport of the residues to the More processing plant. As a solution, we therefore proposed organising the activities locally and decentrally, for example by providing a microfactory, alongside the construction site.”

## Companies wanted

Expedition Circular! only lasted one year, and it was not the intention to make the four participating companies fully circular in that time. “The transition to a circular business model is a long and complex process that is also dependent on a large number of external factors”, explains Gillabel. “For example, just think of legislation or consumption behaviour. We wanted to have them force a breakthrough (that they had proposed themselves) and give them the insights and tools



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to allow further development. Companies can now learn lessons from the steps that they themselves have taken forward.” This also applies to the four supporters. “Thanks to this project, we have a better insight into the needs of entrepreneurs in the field of circular business, and the role that VITO and other players can play in this. We are now elaborating on this further.”

Interested companies can contact VITO for guidance in mapping out the way to a circular business model. From a first exploration of circular opportunities tailored to the company, to the development of a vision and strategy and the monitoring of added value in terms of sustainability. VITO links its sustainability expertise to its role as an integrator here. “We can draw on a great deal of knowledge regarding linking sustainability with economic added value. But we are also in a very strong network. We are therefore a point of contact for companies that want to make the transition to circular business”, explains Gillabel.

Entrepreneurs who wish to gain inspiration in advance can rely on the Circulator web tool, which was co-developed by VITO. Here they can find information regarding circular strategies and business models, and how they can be concretely applied.



## THE FOUR PARTICIPANTS IN EXPEDITION CIRCULAR!

### HaTwee

**Activity:** distributor of powder coating products.

**Case:** setting up a new value chain (and business model) to ‘rent’ surface treatment, instead of simply supplying coating powder.

**VITO’s role:** assisting in focusing on the value proposition.

### More

**Activity:** none (due to the fact it is still in the start-up phase)

**Case:** collecting plastering waste and recycling it into interior products.

**VITO’s role:** assisting in developing a business case and providing insight into the conditions for sustainability benefits.

### ETAP

**Activity:** designer, manufacturer and distributor of lighting for industrial buildings.

**Case:** operational roll-out of a circular LAAS (Light As A Service) model.  
**VITO’s role:** insight into the added value in terms of sustainability of a longer life span and repair/reuse of light fittings.

### Out of Use

**Activity:** provider of business solutions for the recycling of ICT, electrical and electronic waste.

**Case:** structurally increasing the percentage of reuse of collected ‘waste’.



# ATMOSYS CONQUERS EUROPE (AND THE WORLD)

**Mapping air quality at regional level but especially at local level – from cities to districts to individual streets – and all in real time. This is the core of the ATMOSYS air quality management system. Now that the tools of the comprehensive system have been tested and validated in Flanders, they are now making their way abroad.**

The quality of air in work, home and living environment is high on the agenda in an increasing number of industrialised countries. This is especially the case in Flanders; an example of which is the Curieuzeneuzen project, in which the concentrations of nitrogen dioxide (NO<sub>2</sub>) at street level were mapped last year (2018). But the subject is also affecting more and more people in other densely populated and highly industrialised European regions – so-called air pollution hotspots. However, before effective action can be taken, air quality must first be sufficiently mapped.

## Specific tools

This is carried out using a wide range of techniques such as remote sensing, ground-based measuring stations and complex computer models – in which all measurement data are processed. VITO has been working on this type of air quality model since the beginning of this century. In 2010, this work led to the launch of ATMOSYS, a three-year project funded by the European LIFE programme for environment-related research. “We had already completed the majority of the modelling research by that point”, explains Lisa Blyth of VITO. “In the project, we used our modelling expertise as a basis for developing specific tools.” The tools were designed based on four pillars of modern air quality management: air quality monitoring (in real time), assessment or mapping (detailed mapping and visualisation of air pollution down to street level),

forecasting (to send warnings) and, of course, improvement (through the implementation of concrete actions). “These tools were first developed, tested and then validated for Flanders within the project”, explains Blyth. “Nevertheless, we were already taking into account possible application in other hotspots in Europe at that time.”

And the latter has proven to be effective. Almost ten years after the project was launched, ATMOSYS has developed into a ‘strong brand’ within the world of air quality management – especially in Europe. Blyth explains: “We have therefore chosen to continue to fully operate under the ATMOSYS flag. As a result, VITO, which has consciously followed a more commercial path over the past two decades, now plays the role of a company that has put a strong brand on the market.”

## Lesser Poland

There is a high level of interest in ATMOSYS (and its tools) in Europe today. Especially in some traditional industrial areas in Eastern Europe, such as Lesser Poland (the region around Krakow), Hungary, Slovakia and Croatia. “It also helps that the European Commission, which was one of the founders of ATMOSYS due to its LIFE programme funding, has endorsed and promoted our tools”, adds Blyth. “We have therefore managed to penetrate the highly industrialised region of Lesser Poland, where the government is making great efforts to persuade citizens to replace their old-fashioned, polluting (steam) boilers, again with the support of the LIFE programme. With our expertise and ATMOSYS tools, we help to monitor air quality in real time. And in the urban area in and around Krakow, we are simulating the impact of the construction of new bypasses and a low-emission zone on air quality. We already previously used this tool to evaluate the impact of a number of traffic measures in Flanders, such as the Oosterweel scenarios.”

One of the most important factors in the success story of ATMOSYS is capacity building, according to Blyth: improving and expanding our own expertise and technology in order to achieve a significant impact on a larger or different scale. “In a country like Poland, there is no shortage of small companies manufacturing measuring equipment and sensors. But all sensors are different, and you also need to know exactly what you are measuring. What is more, measurements

often contain errors and uncertainties. We have already seen that same complex problem in Flanders. This enables us to propose a well founded approach, combined with our tools, of course.”

## Good business relations

The ball has really started rolling for the ATMOSYS team at VITO since the project was launched in Poland in 2016. So much so, that Hungary has also asked for advice and expertise in the field of air quality modelling and monitoring. Countries such as Croatia and Slovakia are now busy setting up their own air quality management services. VITO has won public tenders in both countries.

Blyth believes that the recipe for the success of ATMOSYS lies in a number of vital ingredients. “First of all, VITO holds a solid reputation in Europe, thanks to our scientific expertise, but also thanks to our extensive business network. However, it is important to remember that these strong relationships are not formed overnight. We have invested a great deal of time and effort in the case of Croatia and Slovakia.”

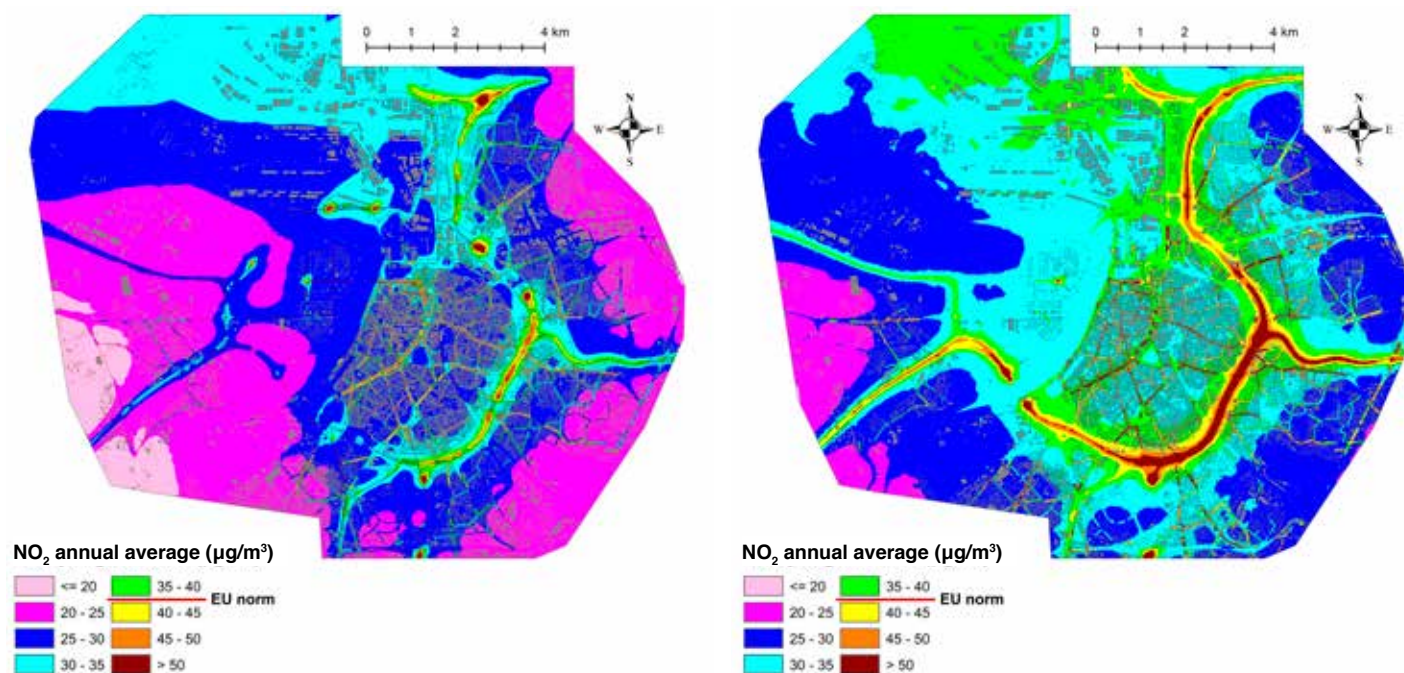
And the ball keeps on rolling. VITO’s expertise in air quality management has now also become known in China and India, two emerging economic countries that have made improving air quality a top priority. Until recently, VITO’s contribution to China was limited to providing forecasting models so that authorities can warn their citizens in time about smog peaks – via LIBO-VITO, VITO’s department in China.

“But we’ve also recently become involved in assessment and mapping campaigns, for example to identify sources of pollution and then tackle them”, explains Blyth.

Last but not least, VITO has two pilot projects in India: one on predicting air pollution in Delhi. “We are carrying this out for the national environmental agency, the Central Pollution Control Board. We hope that this will be a stepping stone for similar work in other cities. Another project focuses on mapping the air quality in Bengaluru. The latter is being carried out in collaboration with the European Earth Observation Programme, Copernicus”, explains Blyth.



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In the framework of ‘Over De Ring’ 6 design teams have drawn up strategic quality of life projects for the Antwerp ring road zone. Map 1 shows the expected air quality situation in 2030 with regards to the annual average of nitrogen dioxide concentrations when all these projects will be executed. This includes among other things partial covering and wildlife crossings, shoulders and screens next to the development of station environments and actions to realize the modal shift. This map clearly shows an improvement of the air quality compared to the situation in 2016 (Map 2).



# GROWING EXPERTISE IN THE FIELD OF BATTERY TECHNOLOGY

**The R&D on battery technology – and everything related to it – is running at full speed and requires qualified employees, not only in research centres and knowledge institutions, but also in the growing industry. That is why VITO/EnergyVille is developing and organising specially tailored courses and training sessions (in collaboration with EIT InnoEnergy), which are freely accessible via an online platform and also physically accessible in the VITO/EnergyVille battery labs.**

The courses will be offered on the learning platform of InnoEnergy, part of the European Institute of Innovation & Technology. The online training on offer forms part of the assignment of the European Battery Alliance (EBA), an initiative of the European Commission to boost the development and research of storage technologies in Europe.

## Very complementary

VITO/EnergyVille closely follows the activities within the EBA (which has existed since autumn 2017). In addition to stimulating industrial development, the initiative also has an educational mission. "From VITO/EnergyVille, we are perfectly placed to help shape and further develop this assignment", explains Jeroen Büscher of VITO/EnergyVille. "Due to our organisational structure, we are very complementary – especially with regard to electrical storage: whilst the University of Hasselt and imec primarily focus on new battery materials, VITO works from cell to package level (testing, modelling and management systems of batteries) and the Catholic University of Leuven [KU Leuven] works on the integration of the various components into a storage system. We are therefore able to provide both introductory know-how and technical depth from various angles."

Who is the target audience? Büscher explains: "The target audience is diverse. On the one hand, there are

the Master's students and PhD students who specifically work around energy-related subjects and electrical storage. They are therefore the researchers of tomorrow, who can (most importantly) start working for us. On the other hand, we are seeing that the industry is in the process of making the switch to sustainable energy systems and electrification. Current employees can also benefit from our training courses. This allows people to develop an advantage that will benefit them in their future careers. In short, you could say that our main aim is to build up expertise."

## Hands-on training sessions

The online courses will cover all aspects of battery technology, divided into separate modules, each consisting of up to five lessons. One lesson would last no longer than seven minutes. When a student is ready, he/she can opt to undertake a practice-based follow-up course. "This then includes intensive hands-on training sessions, which make working with battery tests or management systems (VITO's speciality) very tangible", explains Büscher.

This therefore concerns very specific knowledge and skills, especially in the follow-up course. "We think it is important that we can offer this for the industry, and on European level. Not only will it benefit people, but also companies in the battery sector. After all, they do not have to invest as much in their own training", explains Büscher.



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# VITO EMPLOYEE IN THE SPOTLIGHT

**Inge Genné, Programme manager at VITO, together with a group of (internal) water technologists, made the internal switch from the Sustainable Chemistry Department to the Water Management & Technology Department (WMT) at the beginning of 2016. At the same time, the Flemish Knowledge Centre Water (Vlaqua) was also incorporated in VITO. "We monitor the Flemish water system under the VITO umbrella. We do this by listening to the needs of stakeholders and by accelerating innovation in the water domain based on an integrated approach. We are now seeing that our water experts have a strong reputation."**

**The start of your career in December 1991 is closely linked to the birth of VITO. In fact, you might have been the very first newly hired VITO employee!**

(laughs) I'm not sure whether I really was the first one – perhaps HR could look into that. But it is true that when I applied in the Summer of 1991, VITO did not yet officially exist. I was recruited by the HR Director of SCK, after which I had to wait until VITO was officially established before I could get to work.

**You also combined two roles in your first position: that of VITO researcher and that of PhD student.**

That's right. After completing my studies in chemistry (University of Hasselt and the Catholic University of Leuven), I wanted to start an application-oriented PhD in polymer chemistry. At VITO, I was given the opportunity to combine the PhD research with a role as a researcher

(these temporary contracts have now been replaced by the scholarship system). My PhD was therefore one of the very first VITO PhDs.

**You started researching membrane technology and you are now the Water Programme Manager today. How have you seen your working environment change over the last 28 years?**

In the early nineties, the focus was on membrane development, both for electrochemical and filtration applications. At that time, there was no mention of water purification or contract research for membrane filtration. However, pressure on groundwater reserves led to growing industrial interest in water saving and reuse. I then began focusing on the field of process optimisation, ranging from water audits to the implementation of reuse scenarios.

In the last almost three decades, VITO has also changed a lot as an organisation. What initially started as a rather academic research organisation, quickly evolved into a customer-oriented innovation organisation that was more readily responsive. We then began to organise ourselves more strictly as a modern company, with a focus on targeted training for commercial and management positions. In the third and final wave, the focus was firmly placed on the social impact. As far as the availability of sufficient water is concerned, this impact is, of course, evident.



**And as a Programme manager, you ensure that VITO takes on the role of 'accelerator' in the management and transition of the Flemish water system.**

There is a lot of movement in the field of Flemish water, not just at VITO but also in (drinking water) companies, cities and innovation policy. Cooperation is obviously very important. During the recent periods of water stress (for example the extreme drought in the summer of 2018), we have seen how important it is to look at the bigger picture and work from this.

The reorganisation of VITO in 2016 came at just the right time. VITO resolutely opted for the development of a multidisciplinary water team and united hydrology, data and IT specialists with experts in the field of technology, economy and policy. This cross-pollination has had a stimulating effect. A colleague recently described it as follows: "Looking beyond the boundaries of your own expertise forces you to be more focussed." And that's exactly what we need!

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# A PHD AT VITO

**One of VITO's strategic objectives is to train young people in applied scientific research so that they can add value to the Flemish economy and industry. Around 80 PhD students are currently working as researchers at VITO. Half of them come from abroad.**

One of VITO's main tasks is to accelerate the transition from scientific research to genuinely applicable technologies that can be incorporated into the Flemish economy and thus offer added value to it. "This is our response to an urgent demand from the industry", explains Walter Eevers, R&D Director at VITO. "Among other things, we are very adept at carrying out techno-economic analyses, including when studying their application in an economic sense. Does it make sense to continue with a technology? When can we expect a breakthrough? With this approach, we quickly familiarise young researchers who often still have an academic mentality from when they were at university. By doing so, we help bridge the gap between basic research and industrial needs."

## More research efficiency

VITO is collaborating with all Flemish universities (umbrella organisations) on its PhD programme. In its collaboration with the Leuven association, the focus is primarily on energy-related subjects, whilst in the collaboration with the University of Antwerp, chemistry and the environment form the focus. The terms and conditions of a PhD at VITO are also comparable to those of 'conventional' PhDs: a mandate lasts four years and the remuneration is also (almost) the same. Not all PhD students work full-time at VITO. Some have their office at the university and come to Mol for specific training courses or infrastructure.

The collaboration with universities offers advantages in terms of research efficiency. "By joining forces with us, not only is more funding available for academic departments, but they can also make use of our research infrastructure, and vice versa", explains Eevers. "It also prevents us from investing in the same thing in different locations in Flanders."

## Knowledge and innovation from abroad

Some 80 researchers are currently working on a PhD at VITO. And one interesting finding is that approximately half of them come from abroad. "Some technological innovations are already much more developed abroad", explains Karen Vercammen of VITO. "In that case, it would be silly to keep searching within your own biotope. Our PhD programme therefore also brings knowledge and innovation to Flanders in the interest of the future of the Flemish economic fabric."

A good example here is the expertise in fourth-generation heating networks. "These are very well developed in the Scandinavian countries", explains Eevers. "That is why we have a number of collaboration projects running with knowledge institutions there (DTU in Denmark and the University of Lund in Sweden). It is therefore possible for a Flemish PhD student to carry out research under our umbrella with a supervisor in Sweden."

## Continuous innovation

Can foreign researchers easily find their way to Mol? Vercammen explains: "We strongly promote the available positions on an international level as well, for example through Euraxess (a European platform for research mobility). We also find that researchers often come to us specifically because they want to work on a particular subject, such as sustainable technology. They then come to us with the conviction to work towards a better world. And they are right to do so, as sustainability is the core of our mission."

Finally, the PhD programme also contributes to the rejuvenation of VITO. After all, PhD students make up ten percent of the entire workforce. "PhD students are among our youngest researchers. They are able to cast a fresh eye over a discipline, and this helps our permanent employees to stay focused. Moreover, there is continuous innovation as a result of their comings and goings", explains Eevers.



Photo 2018

## "CONCRETE APPLICATION IN THE NEAR FUTURE"

The applications for a PhD at VITO are assessed by an independent jury consisting of about ten academics, which convenes a few times a year, depending on the number of applications and the needs of VITO. It is chaired by Luc Sterckx, guest professor of Chemical Engineering at the Catholic University of Leuven and ex-top executive of various industrial players, such as Indaver, Olean and EDF/Luminus.

"Our jury includes people with purely an industrial and technological background, as well as academics from the Flemish universities", explains Sterckx. "As a guest professor and industrialist, I am somewhere in between." Every application is thoroughly assessed by the jury on the basis of ten criteria that show the different aspects of the PhD candidate and his/her research. "With regard to the latter, we look, for example, at the originality and feasibility of the research, as well as at its strategic importance for our economy. What is more, we also check whether the candidate has sufficient scientific knowledge, is able to work independently and whether good supervision is available (both at the collaborating university and at VITO)."

According to Sterckx, one of the major differences between this and a PhD at a university is the concrete applicability of the research in the near future. "It is therefore not purely scientific research, the application of which is not immediately evident. I am personally seriously concerned about the applicability in our own industry. Does the research meet an industrial need and is there an economic basis? Nowadays, I supervise and coach a large number of start-ups and I see the problems that arise when translating new technology into an industrial reality there. I try to communicate this experience."



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## "CLOSE TO INDUSTRIAL REALITY"

Lies Eykens obtained her PhD on research into membrane technology at VITO in 2017. Membrane distillation allows aqueous solutions with high salt concentrations to be purified. In her research, she primarily studied how the technology can be brought closer to the market. After her PhD, she worked as a researcher at VITO with the Chem<sup>2</sup> team for two more years. She has now been working at Umicore in Olen for a few months.

"At Umicore, I work on environmental technology, with a strong focus on water treatment", says Eykens. "Not specifically for the Olen site, but for all sites worldwide." How did she find the transition to industry? "The major advantage of carrying out a PhD at VITO is that the research ties in closely with the industrial reality – although this ofcourse depends on the specific subject area. The transition from lab to pilot scale was of particular added value."

The two years at VITO after her PhD were of extra added value. "During that period, I worked on a wide variety of projects instead of one specific topic, in which a few large companies were also involved. That was very informative", explains Eykens.



# CIRCULAR CONSTRUCTION GETS OFF TO A SPEEDY START

**The importance of a circular economy should not be underestimated when making the transition to a low-carbon society. More than half of our CO<sub>2</sub> emissions come (directly or indirectly) from the materials we use. The production of building materials is particularly notorious for the major impact it has on the climate. Earlier this year, VITO signed the Green Deal on Circular Construction, a commitment to support the transition to a world of circular construction in Flanders.**

Circular construction means much more than simply reusing and recycling building materials. By focussing on change-oriented construction, architects and product developers can allow the buildings and their components to evolve along with usage requirements. And new business models can encourage contractors and product and service providers to fulfil the planned life cycle of a building project differently: performance-oriented, adaptable in accordance with the needs and/or the recovery of valuable materials.

Together with the Public Waste Agency of Flanders (OVAM), including the Flanders Circular team, VITO is strongly committed to encouraging circular construction in Flanders. Both organisations are involving as many partners as possible from the extensive construction sector: from small and large construction companies to consultants and facilitating organisations to research and even educational institutions. "We have noticed that there is a great deal of interest in circular construction", explains Brigitte Mouligneau, Circular Economy Transition Manager at OVAM. "Of the more than 130 current projects in the field of circular economy, over 40 are construction related. That speaks for itself."

## Experimental and learning environment

The Green Deal on Circular Construction is a new initiative of the Flemish Ministry of Environment, Nature and Agriculture, OVAM and the Flemish Construction Confederation. "The plastics federation essenscia is also involved via the latter (as a member of the public-private Flanders Circu-

lar partnership). This is important because construction waste also contains a considerable amount of plastics", explains Mouligneau.

Based on the Green Deal, OVAM and VITO have initiated a partnership around an experimental and learning environment, in which experiences are exchanged. "The aim is for partners to implement concrete innovative circular projects", explains Mouligneau. "This can range from the use of new sustainable materials to eco-design and change-oriented construction. We work with an open mind here: everything that can further help us close the construction loop is taken into consideration."

The end of February 2019 marked the official starting point for this. Since then, more than 290 participants have signed up. By doing so, they enter into a commitment to realise at least one project that they can choose and devise themselves. Participants will then be able to exchange their experiences with one another during so-called inspiration sessions. Mouligneau explains: "We are hoping to organise these sessions four times a year. What is more, we are developing an online platform to share knowledge and experiences even more easily."

## Beyond the low hanging fruit

In addition to this initiative, OVAM and VITO/EnergyVille, in collaboration with the Scientific Technical Centre for the Construction Industry (WTCB), the University of Hasselt and the Vrije Universiteit Brussel, have launched an additional (research) project, in the form of a living lab. This looks beyond the low hanging fruit – call it circular construction for advanced users. "This project deals with obstacles in circular construction, such as regulations, legal matters relating to contracts or labour taxation", explains Wim Debacker of VITO/EnergyVille. "Our researchers provide their expertise in this living lab."

The living lab consists of two subtasks: during the first eighteen months, the focus will be on urban mining, whilst over the next 24 months, the emphasis will be on change-oriented building. Debacker explains: "With urban mining, we are

hoping to create a solution for the legacy of the existing building heritage. We can reduce the large amount of construction and demolition waste by consciously finding useful applications for this waste."

## Building As Material Banks

In the meantime, the European Building As Material Banks (BAMB) project came to an end at the end of February 2019, when the Green Deal on Circular Construction was launched. This project studied bottlenecks – 'systemic barriers' – that stand in the way of the development of a circular construction model. Within the project, which involved fifteen other European organisations in addition to VITO/EnergyVille, the focus was on three system changes. "First of all, the focus was on a different way of designing buildings, materials and products", explains Debacker. "Today, buildings are primarily designed for one set function. This is problematic, as needs change faster than buildings. In the BAMB project, we studied how we can already integrate several functions into the building plans during the design phase and ensure that buildings can be purposefully and easily dismantled. After all, when the function of a building changes, we do not only want to recover materials, but also, and more importantly, entire components."

The second system change involves the entire value network of a build-

ing, from contractors, architects and builders to building managers and demolishers (or 'dismantlers'). Debacker explains: "Now we are seeing that although small clusters of architects, contractors and consultancy agencies are working together more, little account is taken of other players who are active in the later stages of the building's life cycle. A circular model requires cooperation throughout the entire chain, for example by sharing data and information regarding products, components and buildings. The development of material passports plays an important role here. This digital tool can be used to bring all information about a specific product in a specific building together and share it. The passport not only contains traditional parameters such as density or technical performance, but also information regarding assembly or disassembly. This instrument can help builders and contractors to carry out construction work in a reversible and change-oriented manner."

Thirdly, there is still the challenge of creating different value for buildings than is the case today. "It is no longer a matter of simply carrying out building work as cheaply as possible. "We need to evolve towards business models that take into account the costs and benefits over the entire life cycle – and these models must also be social and environmental", explains Debacker.

The BAMB project was action-driven, just like much of VITO's research. Work was thus carried out on a number of pilot projects, such as the design of a transformable building based on a steel skeleton or a renovation strategy for prefabricated student accommodation.



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# SPOTTING ASBESTOS FROM THE AIR

**Flanders is hoping to put an end to the historical asbestos pollution in its building heritage and is therefore calling on remote sensing expertise of VITO and the Flanders Information Agency (AIV) for the inventarisation process.**

Belgium was once a country that was highly contaminated by asbestos, and we still carry this historical legacy with us in our building heritage. According to estimates by the Public Waste Agency of Flanders (OVAM), there are still about 2.3 million tonnes of asbestos in homes, schools, businesses and other buildings today. A large part of that asbestos can be found in corrugated roofs and slates. This not only poses a risk during demolition work, but there is also a threat to the local environment (as well as health) as a result of weathering of the roofing due to exposure to natural elements and the ability of the released asbestos fibres to spread easily.

## Asbestos plan

The Flemish government has asked OVAM to devise an ambitious 'asbestos plan', with the aim of making our region asbestos-safe in the long term – which means that during normal use of a building there should be no more risks from the present asbestos materials. One of the key actions of the plan is the gradual removal of asbestos cement roofs, facades and cable insulation by 2034. By 2040 all other hazardous asbestos materials should be removed.

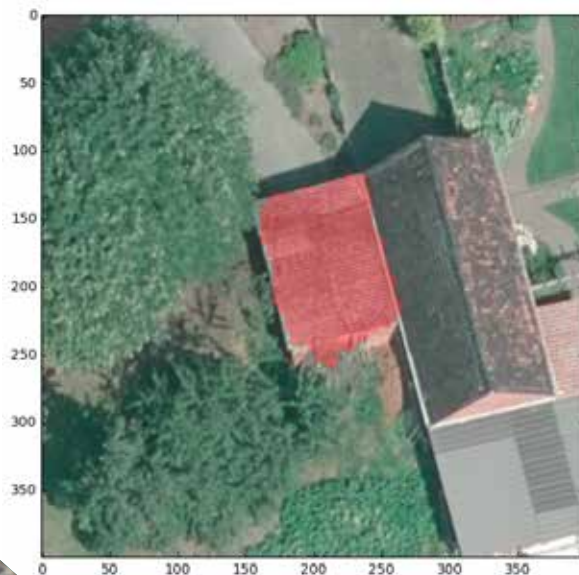
Unfortunately, there is hardly any geographic information available on the spread of asbestos in the construction industry in recent decades. That is why OVAM has called upon VITO and the Information Agency to use its remote sensing techniques to support the asbestos inventory for Flanders.

## Archive images

"We began by looking at which data is available and to what extent we can use this data to identify asbestos roofs from the air", explains Jan Biesemans of VITO. "During that exercise, we learned that multispectral aerial images (RGB) with a resolution of ten centimetres or more are sufficient for recognising corrugated sheets and slates to an acceptable level of accuracy. The major benefit here is that, thanks to the Information Agency we already have these images for the whole of Flanders, the result of an intensive measurement campaign that ran from 2013 to 2015 within the framework of the Flanders II Digital Altitude Model."

VITO and the Information Agency are now compiling the first aerial map based on these images. Biesemans explains: "Just to be clear, this is a map of potential occurrence. It therefore indicates where asbestos roofs could be located." VITO researchers, together with AIV and Passwerk are also responsible for processing the images and thus detecting roofing containing asbestos. They are using new technology from the field of artificial intelligence in order to achieve this. Together with the AIV, VITO developed a number of deep learning models that were then specifically trained for this task.

How can the researchers use their images to establish when a building was erected or a roof was laid or renewed? "The year of construction



*Detection (transparent red) of old slates by the AI-algorithm*

cannot be deduced from an image, but in a later phase, combined with historical photographs, the year of construction can be determined more accurately and by doing so, we can better assess whether the roofing contains asbestos or not. If there is still any doubt in a specific case, an expert will need to visit the site", explains Biesemans.

According to Astrid Verheyen of the OVAM asbestos phase out team, the remote sensing approach also provides a useful tool for raising citizens' awareness and informing them about actions that support asbestos removal. "With a possible combination of the solar map and the information on asbestos removal we could give more targeted advice about the locations where asbestos removal followed by the installation of solar panels is profitable and for which locations the (target) milestone of 2034 is applicable."



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