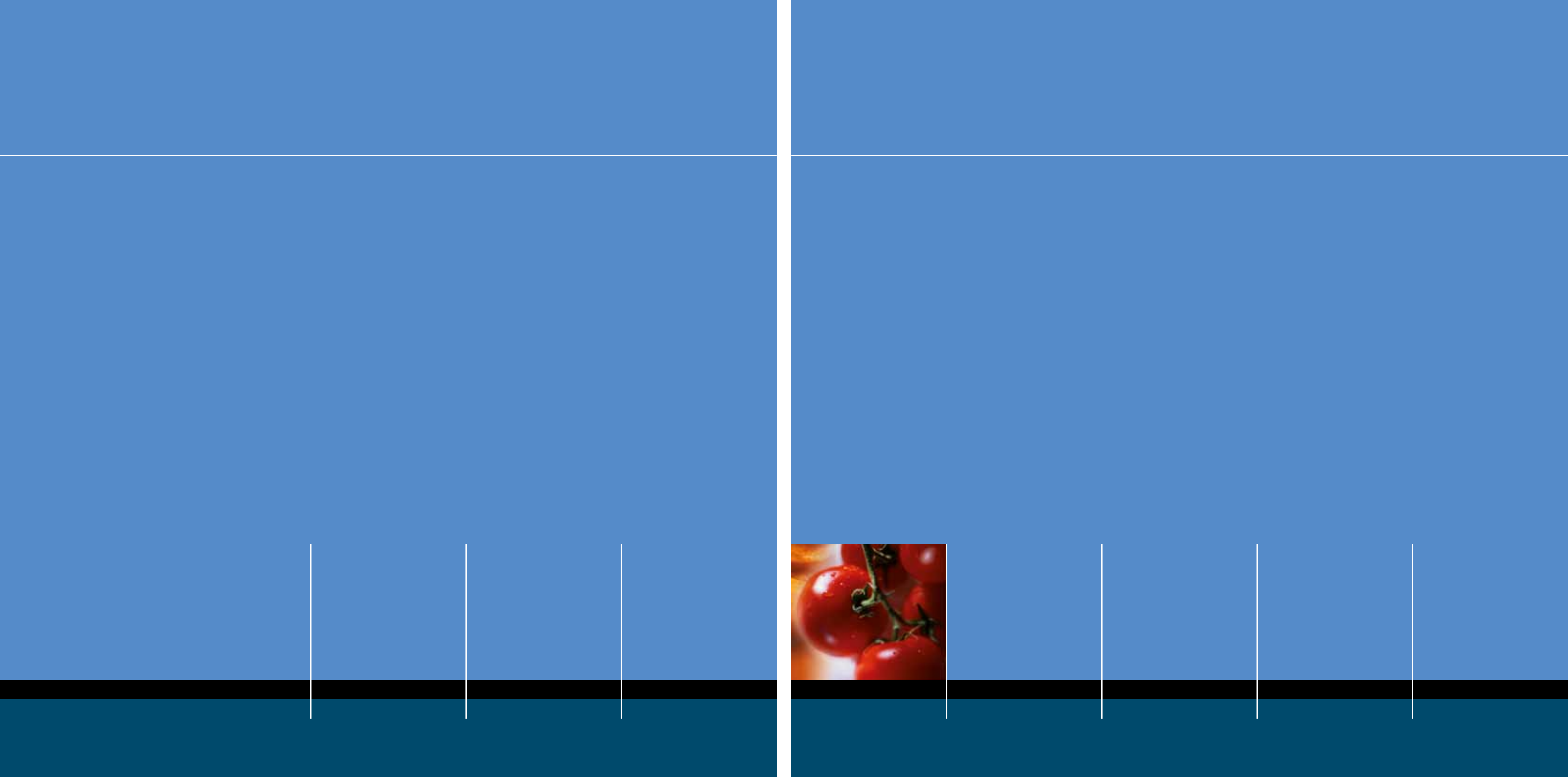


RIKILT

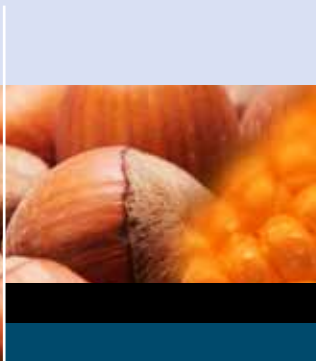
for safe food





RIKILT

for safe food





Foreword

Dear reader,

RIKILT – Institute of Food Safety aims to be an international top institute in the area of research and consultancy on food safety and food quality.

Food safety in the Netherlands is at a high level. We work together with our clients and utilise all our knowledge and expertise to maintain this level. On a global level, food safety is somewhat less self-evident, and this is an area in which we feel we can also play an important role.

RIKILT is an independent research institute with over 110 years of experience. We are part of the Wageningen University & Research centre and focus on the safety, quality and health aspects of food and animal feed

RIKILT has developed into a national and international respected laboratory dealing with incidents and crises, particularly in the area of chemical food safety. Here we support government institutions and the business community. RIKILT also identifies and carries out research into possible new risks linked to the introduction of new production technologies and global developments such as climate change. In the coming years, RIKILT will continue to take a proactive approach in dealing with new issues facing us. We can achieve this by continually developing ourselves and updating our expertise.

This brochure is intended to introduce ourselves to you and to give you an idea of the fascinating range of activities we are engaged in.

Robert van Gorcom

Director RIKILT - Institute of Food Safety, Wageningen UR





RIKILT – Institute of Food Safety is an independent research institute in the area of safe and healthy food. We carry out high-quality research into the detection, identification, functionality and effects of substances in animal feeds as well as plant-based, animal-based and composite foodstuffs. RIKILT also supports national and international government bodies within its role as a laboratory specialised in incident and crisis management and by providing consulting services in relation to defining standards and analytical methods and approving agricultural additives of plant-based and animal-based foodstuffs. Besides carrying out research and providing consultancy services, RIKILT also participates in various national and international expertise centres and committees.

Most of our work is commissioned by the Ministry of Agriculture, Nature and Food Quality (LNV), the Ministry of Health, Welfare and Sports, (VWS), the Ministry of Housing, Spatial Planning and the Environment (VROM) and the Food and Consumer Product Safety Authority (VWA). We also work for the European Union, the European Food Safety Authority (EFSA), foreign governments, social organisations and the business community.



Mission

The RIKILT carries out high-quality independent research and provides consulting services with the goal of contributing to the safety and health of foods and animal feed in the Netherlands and the rest of the world.

developing and applying **innovative** measurement methods
in a complex food/feed **matrix**
thinking and working proactively from a **forensic** and **risk-based** perspective
knowledge development and **consultancy** based on **multidisciplinary** cooperation

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- *Chemical contaminants*
- *Natural hazardous substances*
- *GMOs*
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RIKILT highlights

RIKILT contributes to safe and healthy foods and feed in the Netherlands and the rest of the world. This brochure aims to give you an idea of how we do this. Several of our rather special activities are briefly highlighted below.

Statutory research tasks

The research described in this brochure consists in large part of Statutory Research Tasks (in Dutch: WOT, Wettelijke Onderzoeks-Taken). These tasks involve activities intended to monitor and support relevant legislation and regulations. RIKILT carries out these tasks at the request of the Ministries (LNV, VWS and VROM), the VWA, the European Commission and the EFSA.

24 hours a day standby

RIKILT is a flexible organisation which can significantly increase its measurement capacity in a very short time. For example, we are an important partner for the Ministries (LNV, VWS and VROM) and VWA during crisis situations, and are available to them on a round-the-clock basis. This is a basic requirement, as we play an important role in terms of providing advice and taking action in case of calamities involving feeds and/or foods as well as environmental incidents.

Laboratory tasks

In terms of volume, the largest of RIKILT's tasks involves laboratory activities. In addition to our 19 National Reference Laboratory (NRL) tasks and our EU-RL task, we offer clients a very broad package of screening and confirmation methods for a lot of food and feed safety issues.

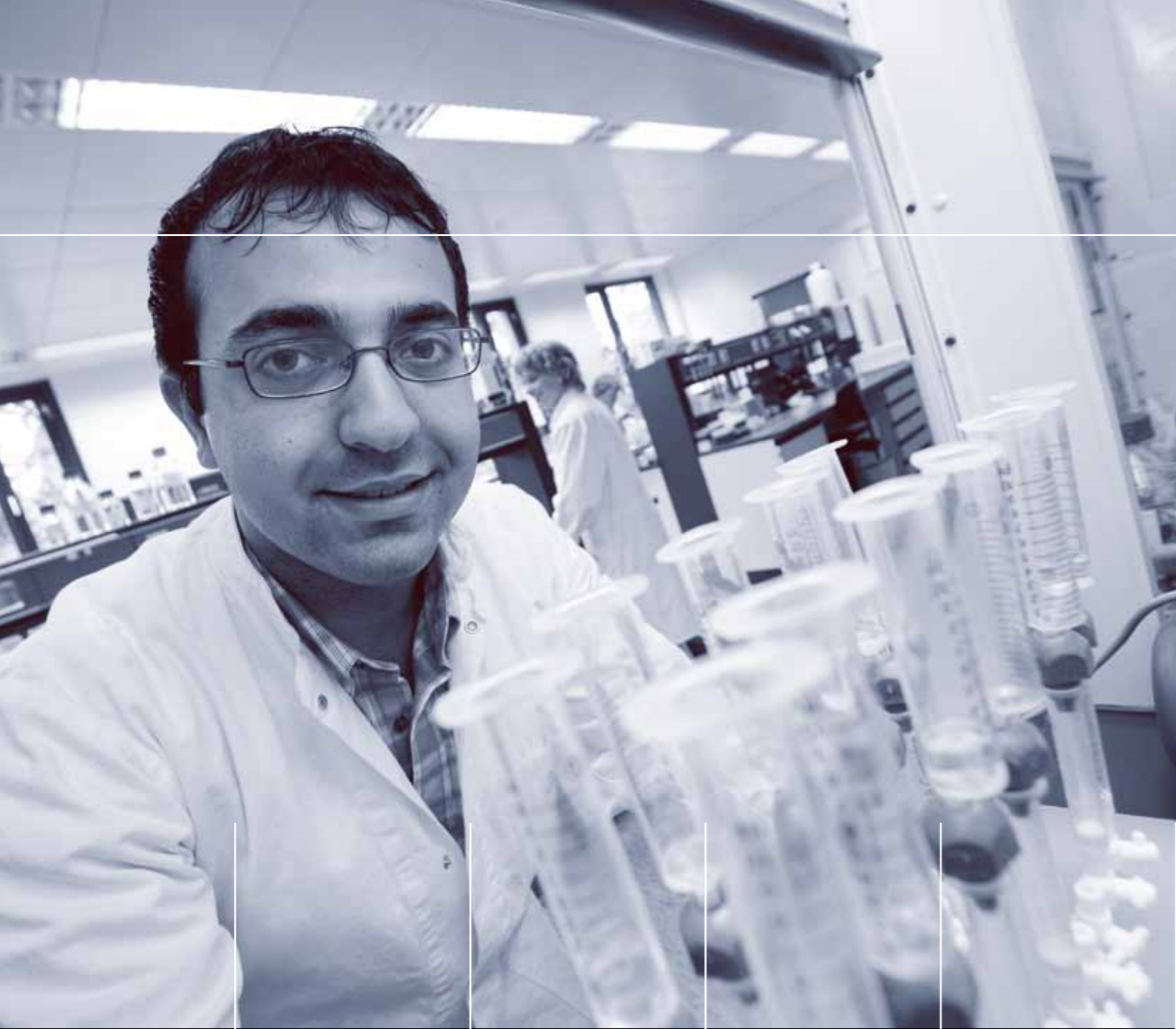
Scientific research

In addition to its analytical activities, RIKILT carries out a great deal of scientific research. Much of this research takes place within the framework of national and international cooperative networks. RIKILT also aims to be a leading player in this area and is, for example, very successful when it comes to winning commissions for coordinating and implementing EU research projects.

Research for third parties

Although the research activities carried out for third parties comprise only a small part of RIKILT's activities, they are sometimes essential for monitoring food safety. The government has implemented a policy whereby companies are increasingly being required to carry out self-monitoring activities themselves. As a result, there is an increasing demand for establishing and implementing measurement and monitoring systems. RIKILT has much expertise in this area and can be of assistance to the business sector in this regard.





Activities

- *Reference and quality assurance tasks*
- *Analyses*
- *Developing knowledge and methods*
- *Consultancy & Training*

Reference and quality assurance tasks

NRL

RIKILT is a National Reference Laboratory (NRL). NRLs are responsible for assuring the quality and reliability of the laboratories which carry out the official controls in a country within the framework of the European foodstuffs and animal feeds legislation. The tasks of an NRL include: coordinating the activities of the national laboratories, standardisation of analytical methods, developing new methods and organising comparative tests between the national laboratories (proficiency tests).

RIKILT currently has 19 NRL tasks in various areas including dioxins & PCBs, PAH compounds, heavy metals, mycotoxins, marine biotoxins, residues in animal products, animal proteins, feed additives, milk and milk products, GMOs, and water content in poultry meat.

Within the framework of its various NRL tasks, RIKILT has built up a large collection of reference materials and standard substances. In these areas, it also works closely together with colleague NRLs and the EU-RL.





EU-RL

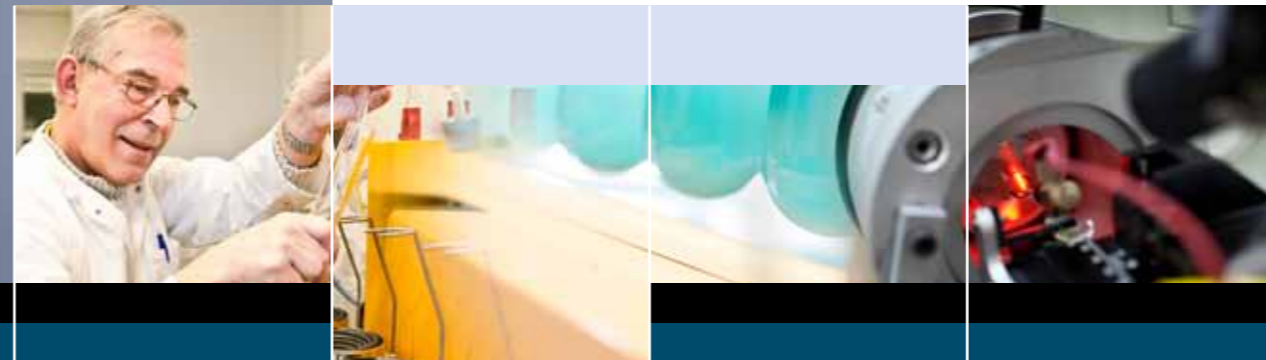
An EU-RL (formerly referred to as CRL) is the European umbrella equivalent of the NRLs: an EU-RL is primarily responsible for the overall coordination and quality assurance of the NRLs. In addition, the EU-RLs ensure that all EU member states have access to good analytical methods and that these are validated in accordance with the applicable guidelines. To accomplish this, annual workshops are organised, often in combination with specific trainings

When analytical technical matters are involved, the EU-RLs function as a link between the European Commission and the NRLs. This is particularly important in cases where arbitration is needed with regard to laboratory results. If member states do not agree on the correctness of a laboratory result, the EU-RL will present an opinion on the matter, if necessary after carrying out its own analysis.

RIKILT is the EU-RL for hormonal growth promoting substances, sedatives and mycotoxins in foods of animal origin.

Quality assurance tasks

Quality assurance is an important part of the package of tasks assigned to NRLs and EU-RLs. But quality assurance activities in relation to research and analysis is also an important RIKILT activity outside the framework of its NRL and EU-RL tasks, for example in supporting laboratories involved in self-monitoring activities for specific sectors. This involves the evaluation of the analytical methods used in relation to the applicable legislation, carrying out quality assurance analyses, and functioning as a knowledge centre when special situations arise.



Analyses

The Dutch government is responsible for ensuring that food in the Netherlands is safe. This safety is anchored in legislation and regulations. The VWA monitors compliance with relevant legislation and regulations, and within this framework, RIKILT carries out a great many analyses each day on a wide variety of agricultural products, foodstuffs and feeds.

In addition, when requested by the VWA to do so, RIKILT investigates possible cases of fraud (within the framework of the EU subsidy schemes) or the illegal use of prohibited substances (pesticides, animal drugs etc.). Based on the results of such forensic analyses, the Public Prosecutor's Office can initiate criminal proceedings.

Each year, we receive roughly 20,000 samples from our clients. The nature of these samples varies enormously, including: urine, meat, fish, shellfish, eggs, animal feeds, milk powder, tulip bulbs, excrement, confectionery, potato crisps, bees, cattle hair, and materials confiscated by the VWA. We analyse these samples among other things for the presence of dioxins, heavy metals, pesticides, mycotoxins, prohibited growth promoters, GMOs and animal meal.

We use a wide range of analytical methods to analyse these substances. These include almost all possible types of chemical analysis, bioassays, genomics, and immunological, biochemical and cellular & molecular biological analyses as well as microscopic and histological methods.



Fast antibiotics test

The large-scale use of antibiotics, particularly in the livestock industry, poses a serious risk to consumers, not only due to the resulting increase in resistance to antibiotics but also because residues of antibiotics can end up in human foods.

Working together with the Wageningen university, RIKILT has developed a new real-time test for detecting antibiotics in the food chain. This test makes it possible to quickly and simultaneously measure various antibiotics in foodstuffs. The measurement can

be carried out in real time, and the method is automated and can quickly deal with a great many samples. It can also be adapted to detect other substances, making it possible to achieve a complete analytical picture of a foodstuff in a single measurement.





[ACTIVITIES]

Developing knowledge and methods

Knowledge development

The government sets out standards for safe food products and for safely producing foods. One of the policy goals of the Ministry of Agriculture, Nature and Food Quality is to maintain the present high level of food safety in the Netherlands. This is important from a public health perspective, for maintaining consumer confidence, and for the export position of the Dutch agricultural and foodstuffs sector. Ongoing efforts to further develop our knowledge in these areas are therefore needed. For example, RIKILT is searching for methods which can identify several new risk factors which are coming to the fore.

A contemporary and politically contentious issue in this regard is the increase in the number of authorised and non-authorised uses of GMOs in various ingredients and raw materials and the marketing of products from cloned animals. The accelerated development of nano-technological applications for the production of foodstuffs, for food products and for packaging materials is also relevant in this regard. RIKILT is expanding its knowledge base to investigate the possible risks which may be involved in these applications.

However, it is also necessary to further develop our knowledge of better-known risks such as resistance to antibiotics and the presence of natural toxins in the food chain. RIKILT also invests a great deal of energy in these areas. In particular, the acquisition of knowledge aimed at realising a better and more efficient identification and control of risks in the food chain is an important focus of attention for RIKILT.



Development of methods

The development of new analytical methods to be able to detect the large variety of relevant substances and to monitor compliance with new legislation is an important task for RIKILT. It is also necessary to be able to quickly develop measurement methods if new and potentially hazardous substances appear in the food chain.

The development of methods by RIKILT can include the following:

- methods for quickly detecting the presence of undesirable substances in large numbers of samples (screening methods);
- methods for chemically profiling samples;
- bioassays for identifying substances based on their effect;
- methods for detecting/confirming extremely low concentrations of hazardous substances in foodstuffs and feeds;
- methods for detecting and confirming specific proteins, such as undesirable additives and allergens as well as specific DNA sequences, such as those present in GMOs (genetically modified organisms), and for confirming the specific animal (species) origin of animal meal;
- new technologies such as:
 - metabolomics;
 - genomics;
 - informatics/bioinformatics;
- methods for authenticity of foods.



Toxicogenomics saves laboratory animals

At present, the possible risks posed by substances in food are primarily determined with the help of experiments using laboratory animals. As the results obtained with laboratory animals are sometimes unreliable and society wishes to drastically reduce the

use of laboratory animals, a great deal of energy is being invested in the development of alternative research methods.

RIKILT is doing this by making use of new technologies from the field of genomics, whereby thousands of variables are simultane-

ously measured with regard to the functionality/activity of genes. These new technologies can, for example, make it possible to determine how human DNA reacts to toxic substances: toxicogenomics.



Consultancy & Training

Consultancy

RIKILT plays an important role in advising the national government as well as international government bodies in the area of feed and food safety.

Our consultancy role includes the following:

- helping to determine standards and guidelines for the authorisation of new agricultural additives and foodstuffs;
- new risk factors;
- evaluating possible risks posed by GMOs;
- providing advice on food safety in the food chain;
- providing advice and recommendations, whether requested or not, during food safety incidents and crises;
- participation in national and international committees on the standardisation and introduction of new analytical methods;
- contributing to the development of policy guidelines in the area of food quality;
- participating in international committees, for example within the framework of the EU, the EFSA, Codex Alimentarius and the World Health Organization;
- evaluating specific files: providing evaluations and recommendations in response to requests, e.g. for the authorisation of GMOs and cattle feed additives; in such cases, attention is focused in particular on the health risks posed by the substances concerned.



Radioactivity

Since 1965, possible radioactive contamination has been very closely monitored in the Netherlands. RIKILT maintains a measurement network of approximately 50 radioactivity monitors, some of which are located in dairy production facilities, to monitor

radioactivity in agricultural products and food. In the event of a nuclear accident, RIKILT has an important role to play in providing technical and substantive support to the Ministries of VROM and LNV. We are part of the Radiological Information Backoffice,

(RIVM, National Institute of Public Health and the Environment). In case of a nuclear accident, we collect technical information on the scale of the accident and provide advice regarding the food safety measures which need to be taken.





Training

As we have much expertise in analysing substances in animal feeds and foodstuffs and in the field of risk assessment, we provide, often in cooperation with Wageningen International tailor made trainings all over the world, including Turkey, Bulgaria, Malaysia, Ghana, Surinam, Saudi Arabia, Thailand, Indonesia and China.



Themes

- Chemical contaminants
- Natural hazardous substances
- GMOs
- New risks
- Authenticity & nutrients





[THEMES]

Chemical contaminants

Contaminants

The research into contaminants carried out by RIKILT involves the chemical analysis of these substances in the food chain and the associated risks. The substances concerned include environmental contaminants such as dioxins and PAH compounds and radioactive substances as well as process contaminants such as acrylamide and furans and residues of certain substances used in agriculture such as pesticides.

RIKILT is a leader in the development and application of analytical methods for detecting and identifying chemical contaminants. Our ability to identify unknown contaminants is steadily improving, helped for example by the use of modern MS technology. The use of bioassays is also being developed further and offers the possibility of detecting the presence of substances on the basis of their effects.

In addition, RIKILT carries out research into the risks associated with contaminants, for example with the help of toxicogenomics and carry over studies. Toxicogenomics is also being used to develop new technologies to replace and limit the use of experimental animals. This technology shows us the effects of a substance on gene expression and gives us an indication of the possible effects and risks associated with the substance.

Over the past years, in the course of various incidents and crises, RIKILT has played an important role in identifying the source of the contamination and preventing contaminated products from being introduced into the food chain.



[CASE]

Dioxin

Dioxins are extremely toxic chemical substances which can migrate from the environment into our food. After consumption, these substances accumulate in the body and damage the person's health. RIKILT has specific investigative expertise in the

area of dioxins and monitors their possible presence in foods very closely. Occasionally, we discover concentrations in excess of the norm, in which case we make a report to the VWA and immediately take action to determine the origin of the dioxins to prevent

any further spread of the contaminants. We do so by analysing the unique chemical fingerprint of the dioxins, as this pattern is often an indication of the source of the contamination.

Animal drugs

The research into animal drugs at RIKILT focuses on the detection of prohibited growth promoters, such as substances with hormonal effects, the detection of prohibited substances such as nitrofurans and chloramphenicol, and the detection of residues of regulated and authorised animal drugs such as antibiotics. This last category is becoming increasingly important due to issues concerning the food chain and resistance to antibiotics.

We carry out sample analysis and forensic investigations for the VWA, develop screening methods for a range of uses – for identifying specific groups of substances as well as prohibited/undesirable effects (bioassays) – and we also advise national and international governments and bodies. We provide advice due to our position as a Reference Laboratory in the area of animal drugs and additives. RIKILT also advises the government in case of incidents or crises. The methods developed are used not only by RIKILT and the VWA; some of the RIKILT tests are used all over the world also in the commercial sector.





[THEMES]

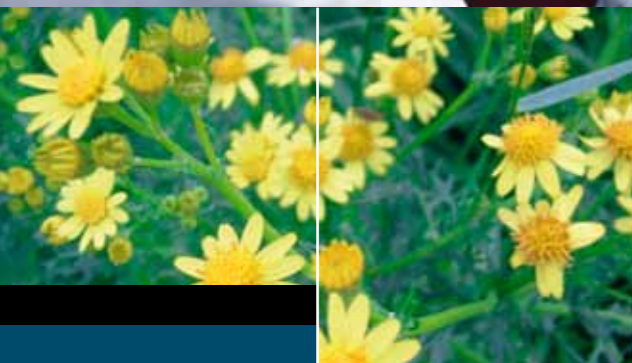
Natural hazardous substances

In the area of natural hazardous substances, RIKILT has specialised in natural toxins in particular. These toxins are harmful organic compounds which originate from nature. The presence of naturally occurring toxins in foodstuffs and feeds poses one of the most important chemical risks to the consumer.

RIKILT carries out research in the areas of mycotoxins (toxins produced by fungi), fycotoxins (toxins produced by algae) and phytotoxins (toxins produced by plants). Often working together with international partners, the institute develops modern analytical methods (also as alternatives to the present laboratory animal-based methods), which are then validated and harmonised. Some of these methods are incorporated into EU regulations.

In addition, RIKILT develop models which can be used to predict the regional presence of toxins in crops and fishery products. These models also make it possible to estimate the effect of climate change on the amounts of toxins.

RIKILT is also closely involved in the preparation of "scientific opinions" regarding natural toxins for the EFSA. These opinions provide the scientific basis for defining norms within the EU.



[CASE]

Common ragwort

Common ragwort and related groundsel species are known to cause serious health problems in productive livestock. To help solve such problems, RIKILT has worked together with Alterra to develop a computer program which makes it possible to distinguish between

common ragwort and a range of other yellow-flowering plants. The goal of this system is to optimise the choices made in terms of mowing policy and usage when it comes to managing and maintaining road shoulders, pastureland, nature parks etc. The

different species of yellow-flowering plants can be identified by answering a few questions. Plants can be compared to each other with the program, and it is also possible to look over various descriptions and photographs.

GMOs

Research into genetically modified organisms (GMOs) at RIKILT focuses primarily on the safety assessment of foodstuffs and feeds derived from GMOs and the detection of GMOs in the food chain. The latter is important to ensure proper labelling of GMO products and for tracking down prohibited GMOs.

The government inspects animal feeds for the presence of authorised and non-authorised GMOs. RIKILT analyses all the samples taken by the VWA for that purpose. Our responsibilities include the development of methods for assessing the safety of GMOs as well as methods for enabling the detection of unknown GMOs. With regard to safety assessment research, we are working on new methods which can be used to supplement present methods for investigating the safety of complex foodstuffs. To do so, we also make use of transcriptomics and metabolomics. To measure GMOs in products, we use molecular biological techniques including microarray technology.

In addition to the above GMO research, RIKILT also advises various national and international government bodies regarding the safety and detection of GMOs. RIKILT also plays a leading role in this regard within the EFSA. We are responsible for providing recommendations when it comes to evaluating the safety of GMOs within the framework of market authorisation.



GMO in livestock

The use of gene technology in livestock can have various goals, such as improving and increasing production, protecting animal health, and the production of human drugs in animal milk. Genetically modified animals for consumption are not yet on the

market. But from outside the EU they are expected to be introduced into the market for application in food like transgenic fish which grows more quickly. Requests for authorising such fish have already been submitted in the USA. RIKILT is pleading for further

development of detection methods which can be used to identify genetically modified animals and related products. RIKILT also carries out research into the possible consequences for animal health and welfare, the safety of animal products and relevant regulations.



New risks

Large-scale innovations are taking place in the agricultural and food sectors involving the primary production processes as well as the transport, storage, processing and preparation of animal feeds and food products. The use of new technologies such as new conservation methods and nanotechnologies is very promising, but the focus is often more on the opportunities and possible applications and less on the possible risks and/or disadvantages. RIKILT does research into the possible food safety risks associated with new technologies.

Technological developments are not the only potential threat to food safety. The complex logistics surrounding raw materials for animal feeds and food products and global differences in regulations and enforcement can also impact upon food safety. This is another area which RIKILT focuses on and in which it also advises the government in matters of policy development and regulations.



Early detection system

Present systems for detecting contaminants in food products are reactive in nature. Typically, a research laboratory discovers a new substance that poses a threat and is present in excessive concentrations and reports it to the responsible authority, which

then issues a warning and requests the producer to remove the product from the market. A much more efficient approach would be to predict new risks beforehand. RIKILT has worked together with European partners to investigate whether indicators are

available, inside and outside the food production chain, which can provide a direct or indirect warning for possible new risks (Emerging Risks Detection Support System, ERDSS).





Nanotechnology

Nanoparticles have different chemical and physical characteristics and behave differently in humans and animals than larger particles and normal chemical substances. These new characteristics are what make them potentially interesting for various applications. However, they also carry potential risks with them. A lot of research is being done into these potential risks.

RIKILT does research into the safety of nanotechnology in foods by:

- investigating and establishing detection methods for nanoparticles in the complex feed and food matrix;
- investigating the behaviour of nanoparticles in humans and animals;
- investigating the effect of nano-encapsulation on toxicity.

The research carried out by RIKILT differentiates itself due to the unique and integrated application of analytical chemical and toxicological expertise and an excellent instrumental infrastructure.



Authenticity & nutrients

The composition of many food products and animal feeds is regulated by legislation. An important task of RIKILT in the area of control and supervision is to monitor the authenticity and identity of food products and animal feeds. For example, such monitoring activities can detect undesirable ingredients (e.g. the presence of allergens) or undesirable admixtures, from the perspective of safety as well as possible fraud involving subsidies. In this area, there is an increasing demand for new analytical techniques, which is also being driven by the increasing use of products with additional production claims (biological, regional, authentic etc.).

The greatly increased complexity of food ingredients and products is also fuelling demand for expanding and improving the analytical methods available. RIKILT is developing methods, for example with the help of modern MS technology, which make it possible to determine very precisely the composition of proteins, fats and oils. By combining these techniques with other spectroscopic, microscopic, histological and immunological techniques as well as DNA analysis, it becomes possible to determine the authenticity and identity of food products and animal feeds.



Recognition of regional products

Regional products are becoming increasingly popular in Europe. Aroma and taste are important quality characteristics in this regard, and these are also determined by the volatile substances in the products which are released upon con-

sumption and which are detected by the nose. RIKILT has developed a method for measuring the fingerprint of these volatile substances, thereby making it possible to determine whether a product is really the authentic regional product that it

is claimed to be. This is important from the perspective of transparency in business practices as well as maintaining consumer trust in the product.





International

Partners

Research facilities

International

As a result of growing globalisation, raw materials, foodstuffs and consumer products are increasingly being sourced from all over the world. The number of food products and ingredients as well as the number of countries serving as sources of origin is therefore increasing very rapidly. In this area, RIKILT works together with other national and international research institutes to set up and maintain networks for sharing information about acute safety issues and other “early warning” information.

We are also developing new measurement methods and analytical systems to ensure the safety of food within an international framework, and these are being implemented globally. Within this framework, we also produce simple and inexpensive analytical tools for the market so that developing countries can also make use of them. We participate in a great many EU committees and are represented in various international panels and advisory groups for various bodies including the EC, EFSA, WHO, FAO, CEN, ISO, etc.





Partners

Many food safety issues require a broad and often international approach. Accordingly, RIKILT works together with many research centres inside and outside the Netherlands. Within these networks, we work together on and/or coordinate a great many international research projects.

The following is a list of our most important partners.

- Wageningen University & Research Centre
- RIVM
- Consumer Product Safety Authority (VWA)
- Netherlands Toxicogenomics Centre (8 partners)
- FERA: The Food and Environment Research Agency (United Kingdom)
- JRC/IRMM, Institute for Reference Materials (Belgium)
- JRC/IHCP, Institute for Health and Consumer Protection (Italy)
- CAAS, Institute of Plant Protection (China)
- Jiao Tong University, Shanghai (China)
- LABERCA, Ecole National Veterinaires de Nantes (France)
- Chemisches und Veterinäruntersuchungsamt Freiburg (Germany)
- EU network projects



Research facilities

We have facilities available of the very highest level to enable us to carry out high-quality research in the area of food safety. In addition to the instruments normally used for such purposes, RIKILT has very specialised research equipment available. Our integrated use of analytical chemical, biological and biochemical instruments and technologies contributes to our unique position in the research world.

Analytical chemical facilities

- GC-MS/MS, LVI-GC-MS, HR-GC-MS/MS, GCxGC-ToF/MS, GC-MS
- UP(LC)-MS/MS, (UP)LC-QTRAP/MS, UPLC-(Q)-ToF/MS, nano-UPLC-Q-ToF/MS
- PTR-MS
- DESI-MS
- NMR
- AAS, HPLC-ICP-MS
- Automated (online) sample preparation equipment
- Isotope and toxin laboratory





Quality

RIKILT uses a wide range of accredited methods in its research and we have ISO 17025 and ILAC G13 certification. The accredited tests can be found on www.rva.nl under number L014 and R013.

Colophon

Contact details

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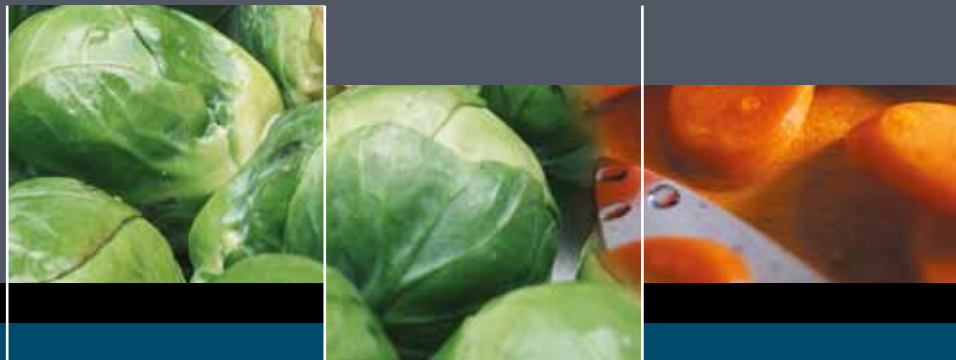
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Foreword

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This brochure is intended to introduce ourselves to you and to give you an idea of the fascinating range of activities we are engaged in.

Robert van Gorcom

Director RIKILT - Institute of Food Safety, Wageningen UR





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Most of our work is commissioned by the Ministry of Agriculture, Nature and Food Quality (LNV), the Ministry of Health, Welfare and Sports, (VWS), the Ministry of Housing, Spatial Planning and the Environment (VROM) and the Food and Consumer Product Safety Authority (VWA). We also work for the European Union, the European Food Safety Authority (EFSA), foreign governments, social organisations and the business community.



Mission

The RIKILT carries out high-quality independent research and provides consulting services with the goal of contributing to the safety and health of foods and animal feed in the Netherlands and the rest of the world.

developing and applying **innovative** measurement methods
in a complex food/feed **matrix**
thinking and working proactively from a **forensic** and **risk-based** perspective
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RIKILT highlights

RIKILT contributes to safe and healthy foods and feed in the Netherlands and the rest of the world. This brochure aims to give you an idea of how we do this. Several of our rather special activities are briefly highlighted below.

Statutory research tasks

The research described in this brochure consists in large part of Statutory Research Tasks (in Dutch: WOT, Wettelijke Onderzoeks-Taken). These tasks involve activities intended to monitor and support relevant legislation and regulations. RIKILT carries out these tasks at the request of the Ministries (LNV, VWS and VROM), the VWA, the European Commission and the EFSA.

24 hours a day standby

RIKILT is a flexible organisation which can significantly increase its measurement capacity in a very short time. For example, we are an important partner for the Ministries (LNV, VWS and VROM) and VWA during crisis situations, and are available to them on a round-the-clock basis. This is a basic requirement, as we play an important role in terms of providing advice and taking action in case of calamities involving feeds and/or foods as well as environmental incidents.

Laboratory tasks

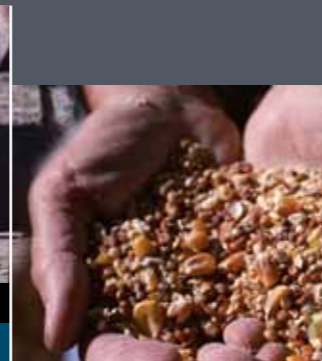
In terms of volume, the largest of RIKILT's tasks involves laboratory activities. In addition to our 19 National Reference Laboratory (NRL) tasks and our EU-RL task, we offer clients a very broad package of screening and confirmation methods for a lot of food and feed safety issues.

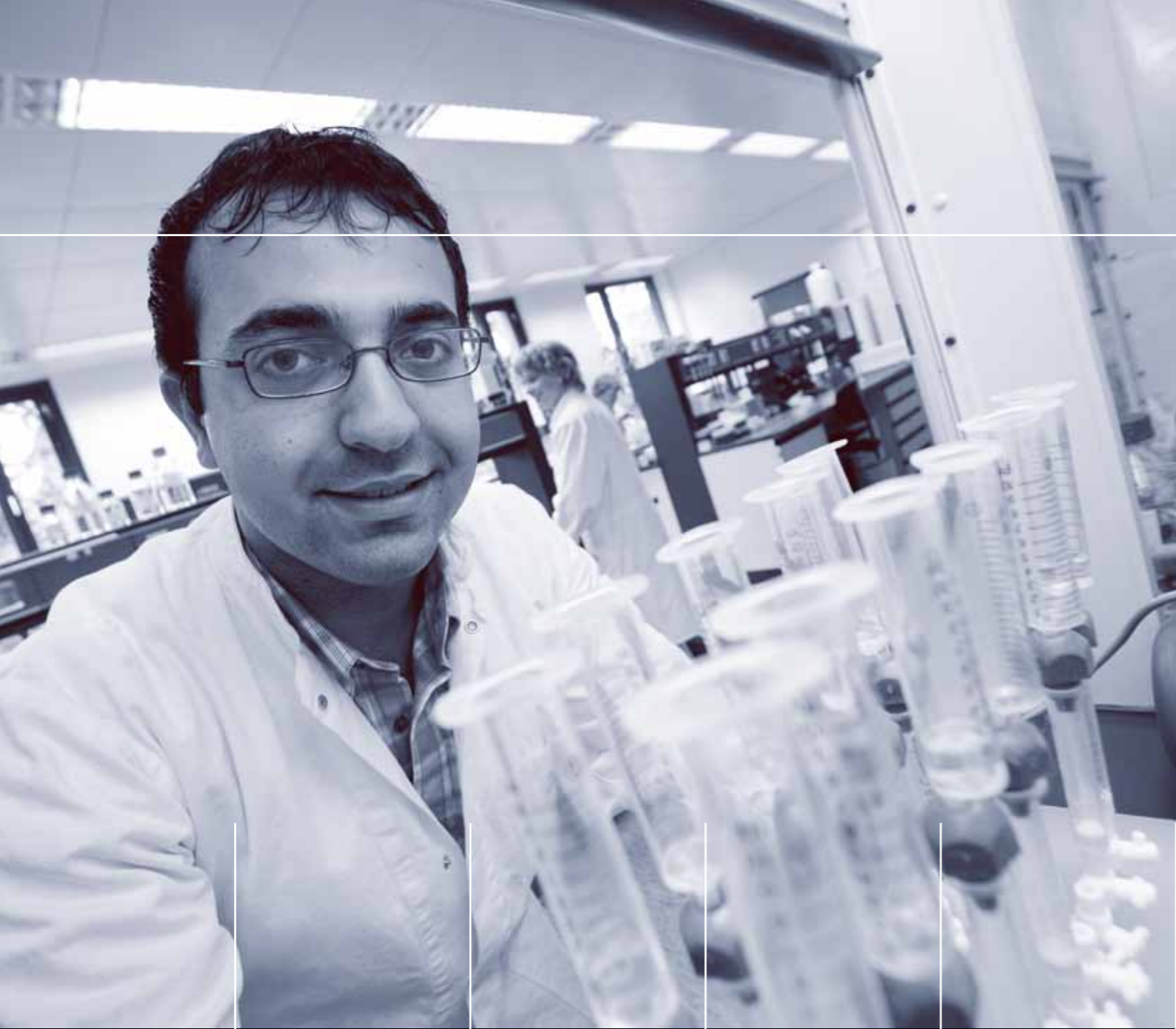
Scientific research

In addition to its analytical activities, RIKILT carries out a great deal of scientific research. Much of this research takes place within the framework of national and international cooperative networks. RIKILT also aims to be a leading player in this area and is, for example, very successful when it comes to winning commissions for coordinating and implementing EU research projects.

Research for third parties

Although the research activities carried out for third parties comprise only a small part of RIKILT's activities, they are sometimes essential for monitoring food safety. The government has implemented a policy whereby companies are increasingly being required to carry out self-monitoring activities themselves. As a result, there is an increasing demand for establishing and implementing measurement and monitoring systems. RIKILT has much expertise in this area and can be of assistance to the business sector in this regard.





Activities

- *Reference and quality assurance tasks*
- *Analyses*
- *Developing knowledge and methods*
- *Consultancy & Training*

Reference and quality assurance tasks

NRL

RIKILT is a National Reference Laboratory (NRL). NRLs are responsible for assuring the quality and reliability of the laboratories which carry out the official controls in a country within the framework of the European foodstuffs and animal feeds legislation. The tasks of an NRL include: coordinating the activities of the national laboratories, standardisation of analytical methods, developing new methods and organising comparative tests between the national laboratories (proficiency tests).

RIKILT currently has 19 NRL tasks in various areas including dioxins & PCBs, PAH compounds, heavy metals, mycotoxins, marine biotoxins, residues in animal products, animal proteins, feed additives, milk and milk products, GMOs, and water content in poultry meat.

Within the framework of its various NRL tasks, RIKILT has built up a large collection of reference materials and standard substances. In these areas, it also works closely together with colleague NRLs and the EU-RL.





EU-RL

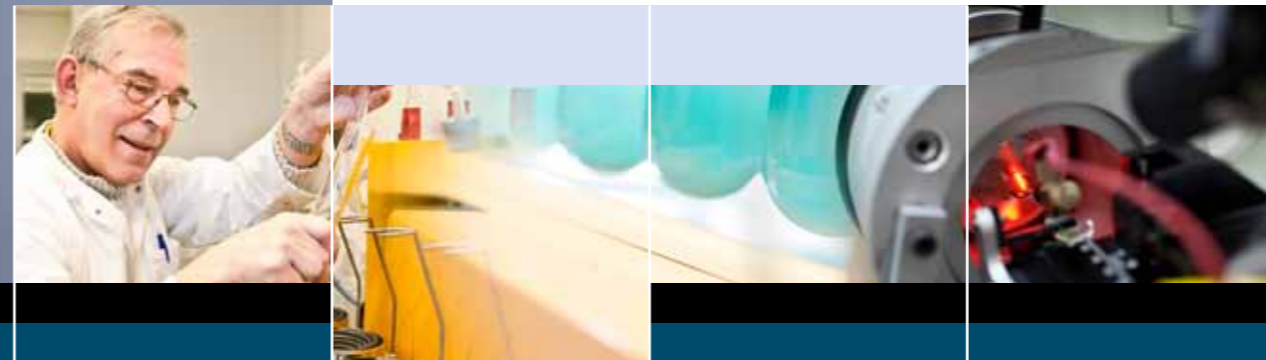
An EU-RL (formerly referred to as CRL) is the European umbrella equivalent of the NRLs: an EU-RL is primarily responsible for the overall coordination and quality assurance of the NRLs. In addition, the EU-RLs ensure that all EU member states have access to good analytical methods and that these are validated in accordance with the applicable guidelines. To accomplish this, annual workshops are organised, often in combination with specific trainings

When analytical technical matters are involved, the EU-RLs function as a link between the European Commission and the NRLs. This is particularly important in cases where arbitration is needed with regard to laboratory results. If member states do not agree on the correctness of a laboratory result, the EU-RL will present an opinion on the matter, if necessary after carrying out its own analysis.

RIKILT is the EU-RL for hormonal growth promoting substances, sedatives and mycotoxins in foods of animal origin.

Quality assurance tasks

Quality assurance is an important part of the package of tasks assigned to NRLs and EU-RLs. But quality assurance activities in relation to research and analysis is also an important RIKILT activity outside the framework of its NRL and EU-RL tasks, for example in supporting laboratories involved in self-monitoring activities for specific sectors. This involves the evaluation of the analytical methods used in relation to the applicable legislation, carrying out quality assurance analyses, and functioning as a knowledge centre when special situations arise.



Analyses

The Dutch government is responsible for ensuring that food in the Netherlands is safe. This safety is anchored in legislation and regulations. The VWA monitors compliance with relevant legislation and regulations, and within this framework, RIKILT carries out a great many analyses each day on a wide variety of agricultural products, foodstuffs and feeds.

In addition, when requested by the VWA to do so, RIKILT investigates possible cases of fraud (within the framework of the EU subsidy schemes) or the illegal use of prohibited substances (pesticides, animal drugs etc.). Based on the results of such forensic analyses, the Public Prosecutor's Office can initiate criminal proceedings.

Each year, we receive roughly 20,000 samples from our clients. The nature of these samples varies enormously, including: urine, meat, fish, shellfish, eggs, animal feeds, milk powder, tulip bulbs, excrement, confectionery, potato crisps, bees, cattle hair, and materials confiscated by the VWA. We analyse these samples among other things for the presence of dioxins, heavy metals, pesticides, mycotoxins, prohibited growth promoters, GMOs and animal meal.

We use a wide range of analytical methods to analyse these substances. These include almost all possible types of chemical analysis, bioassays, genomics, and immunological, biochemical and cellular & molecular biological analyses as well as microscopic and histological methods.



Fast antibiotics test

The large-scale use of antibiotics, particularly in the livestock industry, poses a serious risk to consumers, not only due to the resulting increase in resistance to antibiotics but also because residues of antibiotics can end up in human foods.

Working together with the Wageningen university, RIKILT has developed a new real-time test for detecting antibiotics in the food chain. This test makes it possible to quickly and simultaneously measure various antibiotics in foodstuffs. The measurement can

be carried out in real time, and the method is automated and can quickly deal with a great many samples. It can also be adapted to detect other substances, making it possible to achieve a complete analytical picture of a foodstuff in a single measurement.





[ACTIVITIES]

Developing knowledge and methods

Knowledge development

The government sets out standards for safe food products and for safely producing foods. One of the policy goals of the Ministry of Agriculture, Nature and Food Quality is to maintain the present high level of food safety in the Netherlands. This is important from a public health perspective, for maintaining consumer confidence, and for the export position of the Dutch agricultural and foodstuffs sector. Ongoing efforts to further develop our knowledge in these areas are therefore needed. For example, RIKILT is searching for methods which can identify several new risk factors which are coming to the fore.

A contemporary and politically contentious issue in this regard is the increase in the number of authorised and non-authorised uses of GMOs in various ingredients and raw materials and the marketing of products from cloned animals. The accelerated development of nano-technological applications for the production of foodstuffs, for food products and for packaging materials is also relevant in this regard. RIKILT is expanding its knowledge base to investigate the possible risks which may be involved in these applications.

However, it is also necessary to further develop our knowledge of better-known risks such as resistance to antibiotics and the presence of natural toxins in the food chain. RIKILT also invests a great deal of energy in these areas. In particular, the acquisition of knowledge aimed at realising a better and more efficient identification and control of risks in the food chain is an important focus of attention for RIKILT.



Development of methods

The development of new analytical methods to be able to detect the large variety of relevant substances and to monitor compliance with new legislation is an important task for RIKILT. It is also necessary to be able to quickly develop measurement methods if new and potentially hazardous substances appear in the food chain.

The development of methods by RIKILT can include the following:

- methods for quickly detecting the presence of undesirable substances in large numbers of samples (screening methods);
- methods for chemically profiling samples;
- bioassays for identifying substances based on their effect;
- methods for detecting/confirming extremely low concentrations of hazardous substances in foodstuffs and feeds;
- methods for detecting and confirming specific proteins, such as undesirable additives and allergens as well as specific DNA sequences, such as those present in GMOs (genetically modified organisms), and for confirming the specific animal (species) origin of animal meal;
- new technologies such as:
 - metabolomics;
 - genomics;
 - informatics/bioinformatics;
- methods for authenticity of foods.



Toxicogenomics saves laboratory animals

At present, the possible risks posed by substances in food are primarily determined with the help of experiments using laboratory animals. As the results obtained with laboratory animals are sometimes unreliable and society wishes to drastically reduce the

use of laboratory animals, a great deal of energy is being invested in the development of alternative research methods.

RIKILT is doing this by making use of new technologies from the field of genomics, whereby thousands of variables are simultane-

ously measured with regard to the functionality/activity of genes. These new technologies can, for example, make it possible to determine how human DNA reacts to toxic substances: toxicogenomics.



Consultancy & Training

Consultancy

RIKILT plays an important role in advising the national government as well as international government bodies in the area of feed and food safety.

Our consultancy role includes the following:

- helping to determine standards and guidelines for the authorisation of new agricultural additives and foodstuffs;
- new risk factors;
- evaluating possible risks posed by GMOs;
- providing advice on food safety in the food chain;
- providing advice and recommendations, whether requested or not, during food safety incidents and crises;
- participation in national and international committees on the standardisation and introduction of new analytical methods;
- contributing to the development of policy guidelines in the area of food quality;
- participating in international committees, for example within the framework of the EU, the EFSA, Codex Alimentarius and the World Health Organization;
- evaluating specific files: providing evaluations and recommendations in response to requests, e.g. for the authorisation of GMOs and cattle feed additives; in such cases, attention is focused in particular on the health risks posed by the substances concerned.



Radioactivity

Since 1965, possible radioactive contamination has been very closely monitored in the Netherlands. RIKILT maintains a measurement network of approximately 50 radioactivity monitors, some of which are located in dairy production facilities, to monitor

radioactivity in agricultural products and food. In the event of a nuclear accident, RIKILT has an important role to play in providing technical and substantive support to the Ministries of VROM and LNV. We are part of the Radiological Information Backoffice,

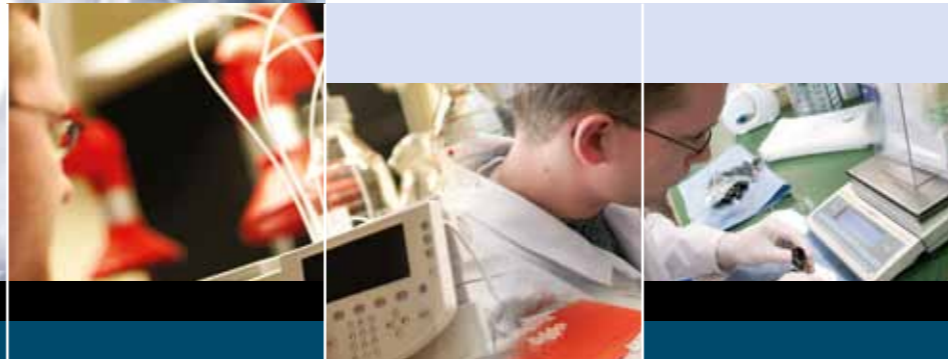
(RIVM, National Institute of Public Health and the Environment). In case of a nuclear accident, we collect technical information on the scale of the accident and provide advice regarding the food safety measures which need to be taken.





Training

As we have much expertise in analysing substances in animal feeds and foodstuffs and in the field of risk assessment, we provide, often in cooperation with Wageningen International tailor made trainings all over the world, including Turkey, Bulgaria, Malaysia, Ghana, Surinam, Saudi Arabia, Thailand, Indonesia and China.



Themes

- Chemical contaminants
- Natural hazardous substances
- GMOs
- New risks
- Authenticity & nutrients





[THEMES]

Chemical contaminants

Contaminants

The research into contaminants carried out by RIKILT involves the chemical analysis of these substances in the food chain and the associated risks. The substances concerned include environmental contaminants such as dioxins and PAH compounds and radioactive substances as well as process contaminants such as acrylamide and furans and residues of certain substances used in agriculture such as pesticides.

RIKILT is a leader in the development and application of analytical methods for detecting and identifying chemical contaminants. Our ability to identify unknown contaminants is steadily improving, helped for example by the use of modern MS technology. The use of bioassays is also being developed further and offers the possibility of detecting the presence of substances on the basis of their effects.

In addition, RIKILT carries out research into the risks associated with contaminants, for example with the help of toxicogenomics and carry over studies. Toxicogenomics is also being used to develop new technologies to replace and limit the use of experimental animals. This technology shows us the effects of a substance on gene expression and gives us an indication of the possible effects and risks associated with the substance.

Over the past years, in the course of various incidents and crises, RIKILT has played an important role in identifying the source of the contamination and preventing contaminated products from being introduced into the food chain.



[CASE]

Dioxin

Dioxins are extremely toxic chemical substances which can migrate from the environment into our food. After consumption, these substances accumulate in the body and damage the person's health. RIKILT has specific investigative expertise in the

area of dioxins and monitors their possible presence in foods very closely. Occasionally, we discover concentrations in excess of the norm, in which case we make a report to the VWA and immediately take action to determine the origin of the dioxins to prevent

any further spread of the contaminants. We do so by analysing the unique chemical fingerprint of the dioxins, as this pattern is often an indication of the source of the contamination.

Animal drugs

The research into animal drugs at RIKILT focuses on the detection of prohibited growth promoters, such as substances with hormonal effects, the detection of prohibited substances such as nitrofurans and chloramphenicol, and the detection of residues of regulated and authorised animal drugs such as antibiotics. This last category is becoming increasingly important due to issues concerning the food chain and resistance to antibiotics.

We carry out sample analysis and forensic investigations for the VWA, develop screening methods for a range of uses – for identifying specific groups of substances as well as prohibited/undesirable effects (bioassays) – and we also advise national and international governments and bodies. We provide advice due to our position as a Reference Laboratory in the area of animal drugs and additives. RIKILT also advises the government in case of incidents or crises. The methods developed are used not only by RIKILT and the VWA; some of the RIKILT tests are used all over the world also in the commercial sector.





[THEMES]

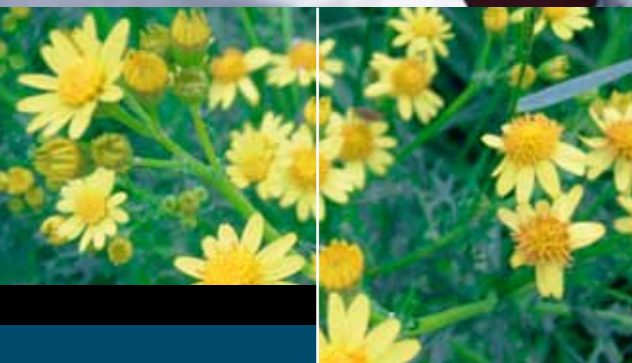
Natural hazardous substances

In the area of natural hazardous substances, RIKILT has specialised in natural toxins in particular. These toxins are harmful organic compounds which originate from nature. The presence of naturally occurring toxins in foodstuffs and feeds poses one of the most important chemical risks to the consumer.

RIKILT carries out research in the areas of mycotoxins (toxins produced by fungi), fycotoxins (toxins produced by algae) and phytotoxins (toxins produced by plants). Often working together with international partners, the institute develops modern analytical methods (also as alternatives to the present laboratory animal-based methods), which are then validated and harmonised. Some of these methods are incorporated into EU regulations.

In addition, RIKILT develop models which can be used to predict the regional presence of toxins in crops and fishery products. These models also make it possible to estimate the effect of climate change on the amounts of toxins.

RIKILT is also closely involved in the preparation of "scientific opinions" regarding natural toxins for the EFSA. These opinions provide the scientific basis for defining norms within the EU.



[CASE]

Common ragwort

Common ragwort and related groundsel species are known to cause serious health problems in productive livestock. To help solve such problems, RIKILT has worked together with Alterra to develop a computer program which makes it possible to distinguish between

common ragwort and a range of other yellow-flowering plants. The goal of this system is to optimise the choices made in terms of mowing policy and usage when it comes to managing and maintaining road shoulders, pastureland, nature parks etc. The

different species of yellow-flowering plants can be identified by answering a few questions. Plants can be compared to each other with the program, and it is also possible to look over various descriptions and photographs.

GMOs

Research into genetically modified organisms (GMOs) at RIKILT focuses primarily on the safety assessment of foodstuffs and feeds derived from GMOs and the detection of GMOs in the food chain. The latter is important to ensure proper labelling of GMO products and for tracking down prohibited GMOs.

The government inspects animal feeds for the presence of authorised and non-authorised GMOs. RIKILT analyses all the samples taken by the VWA for that purpose. Our responsibilities include the development of methods for assessing the safety of GMOs as well as methods for enabling the detection of unknown GMOs. With regard to safety assessment research, we are working on new methods which can be used to supplement present methods for investigating the safety of complex foodstuffs. To do so, we also make use of transcriptomics and metabolomics. To measure GMOs in products, we use molecular biological techniques including microarray technology.

In addition to the above GMO research, RIKILT also advises various national and international government bodies regarding the safety and detection of GMOs. RIKILT also plays a leading role in this regard within the EFSA. We are responsible for providing recommendations when it comes to evaluating the safety of GMOs within the framework of market authorisation.



GMO in livestock

The use of gene technology in livestock can have various goals, such as improving and increasing production, protecting animal health, and the production of human drugs in animal milk. Genetically modified animals for consumption are not yet on the

market. But from outside the EU they are expected to be introduced into the market for application in food like transgenic fish which grows more quickly. Requests for authorising such fish have already been submitted in the USA. RIKILT is pleading for further

development of detection methods which can be used to identify genetically modified animals and related products. RIKILT also carries out research into the possible consequences for animal health and welfare, the safety of animal products and relevant regulations.



New risks

Large-scale innovations are taking place in the agricultural and food sectors involving the primary production processes as well as the transport, storage, processing and preparation of animal feeds and food products. The use of new technologies such as new conservation methods and nanotechnologies is very promising, but the focus is often more on the opportunities and possible applications and less on the possible risks and/or disadvantages. RIKILT does research into the possible food safety risks associated with new technologies.

Technological developments are not the only potential threat to food safety. The complex logistics surrounding raw materials for animal feeds and food products and global differences in regulations and enforcement can also impact upon food safety. This is another area which RIKILT focuses on and in which it also advises the government in matters of policy development and regulations.



Early detection system

Present systems for detecting contaminants in food products are reactive in nature. Typically, a research laboratory discovers a new substance that poses a threat and is present in excessive concentrations and reports it to the responsible authority, which

then issues a warning and requests the producer to remove the product from the market. A much more efficient approach would be to predict new risks beforehand. RIKILT has worked together with European partners to investigate whether indicators are

available, inside and outside the food production chain, which can provide a direct or indirect warning for possible new risks (Emerging Risks Detection Support System, ERDSS).





Nanotechnology

Nanoparticles have different chemical and physical characteristics and behave differently in humans and animals than larger particles and normal chemical substances. These new characteristics are what make them potentially interesting for various applications. However, they also carry potential risks with them. A lot of research is being done into these potential risks.

RIKILT does research into the safety of nanotechnology in foods by:

- investigating and establishing detection methods for nanoparticles in the complex feed and food matrix;
- investigating the behaviour of nanoparticles in humans and animals;
- investigating the effect of nano-encapsulation on toxicity.

The research carried out by RIKILT differentiates itself due to the unique and integrated application of analytical chemical and toxicological expertise and an excellent instrumental infrastructure.



Authenticity & nutrients

The composition of many food products and animal feeds is regulated by legislation. An important task of RIKILT in the area of control and supervision is to monitor the authenticity and identity of food products and animal feeds. For example, such monitoring activities can detect undesirable ingredients (e.g. the presence of allergens) or undesirable admixtures, from the perspective of safety as well as possible fraud involving subsidies. In this area, there is an increasing demand for new analytical techniques, which is also being driven by the increasing use of products with additional production claims (biological, regional, authentic etc.).

The greatly increased complexity of food ingredients and products is also fuelling demand for expanding and improving the analytical methods available. RIKILT is developing methods, for example with the help of modern MS technology, which make it possible to determine very precisely the composition of proteins, fats and oils. By combining these techniques with other spectroscopic, microscopic, histological and immunological techniques as well as DNA analysis, it becomes possible to determine the authenticity and identity of food products and animal feeds.



Recognition of regional products

Regional products are becoming increasingly popular in Europe. Aroma and taste are important quality characteristics in this regard, and these are also determined by the volatile substances in the products which are released upon con-

sumption and which are detected by the nose. RIKILT has developed a method for measuring the fingerprint of these volatile substances, thereby making it possible to determine whether a product is really the authentic regional product that it

is claimed to be. This is important from the perspective of transparency in business practices as well as maintaining consumer trust in the product.





International

Partners

Research facilities

International

As a result of growing globalisation, raw materials, foodstuffs and consumer products are increasingly being sourced from all over the world. The number of food products and ingredients as well as the number of countries serving as sources of origin is therefore increasing very rapidly. In this area, RIKILT works together with other national and international research institutes to set up and maintain networks for sharing information about acute safety issues and other “early warning” information.

We are also developing new measurement methods and analytical systems to ensure the safety of food within an international framework, and these are being implemented globally. Within this framework, we also produce simple and inexpensive analytical tools for the market so that developing countries can also make use of them. We participate in a great many EU committees and are represented in various international panels and advisory groups for various bodies including the EC, EFSA, WHO, FAO, CEN, ISO, etc.



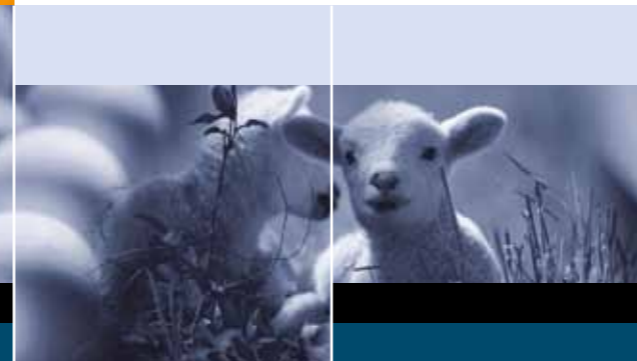


Partners

Many food safety issues require a broad and often international approach. Accordingly, RIKILT works together with many research centres inside and outside the Netherlands. Within these networks, we work together on and/or coordinate a great many international research projects.

The following is a list of our most important partners.

- Wageningen University & Research Centre
- RIVM
- Consumer Product Safety Authority (VWA)
- Netherlands Toxicogenomics Centre (8 partners)
- FERA: The Food and Environment Research Agency (United Kingdom)
- JRC/IRMM, Institute for Reference Materials (Belgium)
- JRC/IHCP, Institute for Health and Consumer Protection (Italy)
- CAAS, Institute of Plant Protection (China)
- Jiao Tong University, Shanghai (China)
- LABERCA, Ecole National Veterinaires de Nantes (France)
- Chemisches und Veterinäruntersuchungsamt Freiburg (Germany)
- EU network projects



Research facilities

We have facilities available of the very highest level to enable us to carry out high-quality research in the area of food safety. In addition to the instruments normally used for such purposes, RIKILT has very specialised research equipment available. Our integrated use of analytical chemical, biological and biochemical instruments and technologies contributes to our unique position in the research world.

Analytical chemical facilities

- GC-MS/MS, LVI-GC-MS, HR-GC-MS/MS, GCxGC-ToF/MS, GC-MS
- UP(LC)-MS/MS, (UP)LC-QTRAP/MS, UPLC-(Q)-ToF/MS, nano-UPLC-Q-ToF/MS
- PTR-MS
- DESI-MS
- NMR
- AAS, HPLC-ICP-MS
- Automated (online) sample preparation equipment
- Isotope and toxin laboratory





Quality

RIKILT uses a wide range of accredited methods in its research and we have ISO 17025 and ILAC G13 certification. The accredited tests can be found on www.rva.nl under number L014 and R013.

Colophon

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