15 ANNUAL REPORT

IVL SWEDISH ENVIRONMENTAL RESEARCH INSTITUTE

RECYCLING AND REUSE – BY HOOK OR BY CROOK

Measuring emissions – a particle level showpiece

AIR POLLUTION MONITORING – THE FOREST AS HEALTH INDICATOR

IVL – A 50-year old that never stands still

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HAMMARBY SJÖSTADSVERK DEVELOPS

STOCKHOLM'S FUTURE WASTEWATER TREATMENT

This is IVL

PURPOSE

IVL Swedish Environmental Research Institute is engaged in applied research and consulting projects aimed at promoting ecologically, economically and socially sustainable growth in the business sector and society at large.

VISION

IVL's vision is a sustainable society. We are driving the transition into a sustainable society by transforming:

- science into reality
- environmental problems into opportunities
- linear processes into a circular economy.

CORE VALUES

IVL's core values are based on credibility, a holistic and forward-looking approach, commitment and benefit.

SWEDEN'S FIRST ENVIRONMENTAL RESEARCH INSTITUTE

IVL was jointly established by the Swedish State and the business sector in 1966. IVL has been operated as a public limited company since 1982. The company is owned by the Swedish Water and Air Conservation Foundation (SIVL).

EMPLOYEES AND NATURE AND EXTENT OF EXPERTISE

IVL has just over 250 employees, of whom 95 are graduates and of these 27 per cent postgraduates. Our expertise is broadly based, extending beyond traditional environmental areas to behavioural science, economics and sociology.

ALL SECTORS COVERED

Today, IVL operates on a broad basis across the entire spectrum of sustainability. Activities span every sector, and we serve customers in all parts of Swedish society. The Company also conducts wide-ranging international operations, focusing primarily on China and India. IVL regards Europe as its domestic market.

SIX FOCUS AREAS BECOME FOUR

IVL's operations are organized into four operational units, as well as units for research, business development and marketing. In addition there are staff functions tasked with finance, human resources, IT and communications.

All units work together in focus areas that together comprise IVL's market offerings. These focus areas were previously; *Climate & Energy, Water & Soil, Air & Transport, Sustainable Building, Sustainable Production and Resource-efficient Products & Waste*. As of 2016 these were replaced with: *Natural Resources, Climate & Environment, Resource-efficient Recycling & Consumption, Sustainable Production & Environmental Technology* and *Sustainable Urban Development & Transport*.

RESEARCH AND CONSULTANCY PROJECTS

Just under half of IVL's activities consist of research commissioned directly by external customers. The remainder is made up of research that is either co-funded by the State and the business sector or grant-funded via State-owned research bodies, foundations or the EU.

PARTNERSHIPS AND NETWORKS

Part of IVL's strategy is to maintain and develop close cooperation with the business sector, international research bodies and institutes of higher education. As a result, IVL plays an active role in several international research networks and other partnerships. In Sweden, IVL cooperates closely with the Chalmers University of Technology in Gothenburg, and KTH, the Swedish Royal Institute of Technology in Stockholm.

LABORATORIES AND TEST CENTRES

IVL operates its own laboratories for advanced chemical analysis – both organic and inorganic – and an experimental facility where new technology for more resource-efficient production is developed. Together with KTH, IVL jointly operates Hammarby Sjöstadsverk, a unique testing and pilot facility in advanced water treatment technology.

ENVIRONMENT AND QUALITY

IVL is engaged in environmental and quality management, as well as in work environment issues within the scope of an integrated management system. The system has been environment and qualitycertified under ISO 14001 and ISO 9001:2000.

IVL Swedish Environmental Research Institute 50 years
Sweden's environmental history is also IVL's history. In 2016 we celebrate 50 years.

Hammarby Sjöstadsverk
Here IVL develops wastewater management together with some twenty Swedish and foreign companies.
Read more on page 34.

The COP21 Paris climate conference
In December 2015 the world's countries agreed to take action on climate change. The IVL-led Mistra Indigo research programme leaves an imprint on global climate policy.
Read more on page 40.

Cover image shows Christian Baresel

IVL Swedish Environmental Research Institute
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A 50-year old that never stands still

As I write these lines we are already more than two months into 2016, the year in which IVL Swedish Environmental Research Institute turns fifty. When we started we restricted ourselves to issues around air and water. Since then our focus has widened, and we are now an environmental institution with a lot more strings to our bow. On the occasion of our half-centennial we are able to look back and reflect on the fifty years that have passed.

My relationship with IVL doesn't quite span fifty years, but a good thirty. After graduation I started as trainee at Pharmacia, working with research, development and production in Uppsala. Even at quite an early stage the pharmaceutical industry in Sweden had a fair grasp of many of the environmental problems that were then crying out for resolution. During my first year I was involved in a number of projects aimed at developing more resource-efficient and environmentally friendly processes and products. Then, in the mid-80s, emissions of organic substances to the air took centre stage and it was then I first came in contact with IVL.

Twenty years later I was appointed to IVL's board of directors and focus areas were extended to cover climate, energy efficiency, system analysis, sustainable production and building practices. In mid-2008 I left my assignment on the board to become CEO. Today, climate and sustainability issues are no longer isolated components but have become an integral part of doing business. This is equally true for IVL.

During the years I have been CEO at IVL our workforce has increased by almost 50 per cent, and our annual turnover by 70 per cent, and this is very positive. But in addition to celebrating we must look ahead to the future. If we are to remain successful, we must continuously follow up on the added value we create for our customers, and the ways in which we contribute to a sustainable society.

That is why customer surveys are so important. The 2015 customer interviews depict a positive image of IVL as a professional and outstanding partner and contractor. But it's always possible to do a little bit better, and therefore I urge readers of our annual report, our customers and partners, to give us feedback on the work we do, on our sustainability efforts, and how successful we are in documenting these. Feel free to email us at sustainability@ivl.se.

Enjoy your reading!

Tord Svedberg
CEO

Contents

TORD SVEDBERG, CEO:

The need for IVL's services continues to grow

▲ Tord Svedberg, CEO

Both the market for and the importance of our services are on the increase. Sustainability is now a mega trend and a huge opportunity for all those active in the field.

Meanwhile competition between consulting firms in our branch sharpens. Competition for assignments out on tender and research funding from universities and other institutions has become more intense. Things are much tougher for the entire sector, and this is reflected in lower earnings for many Swedish actors and in layoffs among prominent European research institutions. Against this background, it is gratifying to see that our sales continue to grow and generate an acceptable, although unremarkable operating income 2015.

VISIBILITY STRENGTHENS BRAND IDENTITY

IVL's strategic focus on visibility in the media and in the public debate has yielded dividends. Over the past four years, our media presence, measured in the number of press clippings, has doubled, from 752 to 1484. Visibility is important if our research findings are to reach a wider audience, and vital if we are to continue to develop, clarify and promote our brand. Key decision-makers in politics and business have become increasingly aware of IVL and this reinforces our ability to attract qualified employees.

Our visual identity has also undergone change in 2015. We have introduced a new graphic profile, along with new colours and shapes, as well as a new logo. This new logo is based on the company name and is unequivocally associated with our core values – credibility, inclusiveness and foresight.

AN ATTRACTIVE WORKPLACE

A strong and positive brand is crucial if we are to keep skilled employees and attract new ones, something we must do if we are to meet our growth targets. In 2015 we have made a number of strategic hires to strengthen our expertise in key development areas such as sustainable urban development, mobility, digitalization and life cycle analysis. Our focus on leadership development, internal project management training and coaching to improve efficiency and reduce stress, has given good results and is appreciated by our employees. This strengthens us for the future and in competition for employees best able to deliver solutions for our customers' and society's needs. It is essential that IVL be an attractive workplace.

If we are to maintain our position at the forefront of research and translate opportunity into services and products, we must continuously look for and analyse changes in our business environment. Our efforts to develop systematic market monitoring techniques have continued in 2015. In addition to standard business intelligence gathering we have tried to identify trends of particularly interest to IVL in a three to five years perspective. The management team and the operational units are at present engaged in analysing the implications of these trends for IVL.

WHAT WILL HAPPEN IN 2016 AND BEYOND?

IVL will continue to encourage collaboration between business, academia and the community at large, and strive to transcend limits and traditional sector boundaries. Among other things, this means highlighting and exploiting synergies between the private and public sectors for the benefit of sustainable growth. One area where we can make a contribution is the system of environmental objectives adopted by the Swedish Parliament in 1999. To date, environmental targets have principally been relevant to the work of the authorities. In the future, it is important that we add a business perspective so that companies will be able to grasp the import of these goals and use them to achieve a competitive edge on national and international markets.

The business community also plays a key role when it comes to driving change through innovation and business development in the quest for solutions to the challenges of climate change, both in connection with emission mitigation and adaptation. Many companies are now actively implementing technological innovations and revising their entire value chain, from purchasing and production to consumption and recycling, with the aim of reducing their own carbon imprint and contributing to innovative market solutions. In addition, many companies are engaged in a wide range of innovative global initiatives. It is obvious that both IVL's vision of a sustainable society and our focus on applied research, coupled with our assignments to achieve an ecologically, economically and socially sustainable growth in business and society as a whole, are wholly in line with the new Agenda 2030 global development goals and national Swedish environmental objectives.

By focusing on the social benefits of IVL's efforts and by placing them in a broader context we will be able to expand our future endeavours. Our breadth, independence and credibility will allow us to take the initiative and ensure that we are the obvious choice when it comes to sustainable cooperation between business, academia and the community at large. //

PROFIT FOR THE YEAR

The 2015 financial result was MSEK 5.4 after financial items.

	2015	2014	2013	2012	2011
Net turnover (MSEK)	274	264	255	248	240
Earnings after financial items	5.4	12.5	10.4	7.7	12
Number of employees (person years)	228	224	215	197	186
Return on equity (%)	5.1	13	12.3	9.7	17.5
Investments (MSEK)	11.3	7.1	10.8	6.2	3.1

RESEARCH AND DEVELOPMENT AT IVL

A year with sustainability on the agenda

In 2015, R&D at IVL expanded into new fields and several new projects were launched. The number of published scientific papers has increased and in general we have successfully disseminated the results of our research through reports and seminars and in the media. Moreover, we enjoy continuing support from the funding agencies that sponsor our research, and several of the applications we have developed have been put to practical use. Having our results used and applied is of great importance for us.

THE DEVELOPMENT OF WELFARE AND SOCIAL JUSTICE

2015 also brought a series of major political events that will impact both IVL's activities and society in general. The Paris climate agreement has been prioritized in the media but the adoption of the UN's 17 new sustainability goals and the European Commission's proposals for an action plan to transform Europe into a circular economy are just as important. In Sweden, the in-depth evaluation of our national environmental goals with a number of concrete proposals was put forward, and – somewhat overshadowed – work on a national forest programme began.

The above political initiatives are designed to drive development in a more resource-efficient and fossil-free direction. The UN sustainability goals are of course broader and will hopefully ensure that the global development of welfare and social justice will be addressed in a future transition of society.

For those of us who work with applied research the above policy initiatives provide development frameworks and priorities that stake out a direction and define needs that we must relate to. Research is needed to find new solutions, both technological innovations and new policy instruments and business models that support transition. We also need methods to both monitor and evaluate ongoing change and to advise on future directions – and in some cases to raise a note of caution about changes that may lead in the wrong direction.

THE CIRCULAR ECONOMY IS THE SHAPE OF THE FUTURE

The European Commission's plan for a circular economy proposes a series of actions that require further research and development if they are to become reality. This applies primarily to areas such as product design and to new business models that reward low resource consumption and provide access to recycling services. We also need to develop methods for recovering raw materials from today's products and processes; especially regarding rare earth metals and nutrients.

THE FOREST RAISES GREAT EXPECTATIONS

We are fortunate in Sweden to have a wealth of renewable natural resources in our forests that contribute to our well-being, providing both job opportunities and access to recreational activities as well as meaningful nature experiences.

The forest raises great expectations. It is expected to provide resources for future fuel supplies, as well as a range of new materials that will replace fossil-based products. At the same time, we hope to be able to exploit the natural value of the forest and its potential for tourism and recreation.

HOW SHOULD WE EVALUATE ECOSYSTEM SERVICES?

The forest, its ecosystems and the benefits that accrue to humankind, can best be described in terms of ecosystem services. According to the government's interim target the value of ecosystem services is to be integrated into economic positions and political considerations by 2018 at the latest. For this to be possible, it is essential that we understand more, and establish a shared methodology that can be used to describe and evaluate ecosystem services and the extent to which they are interdependent – which can then be used to weigh conflicting utilities against one another. The challenge is great and will require targeted interdisciplinary research and development, as well as dialogue with forest stakeholders. //

◀ For those of us who work with applied research the above policy initiatives provide development frameworks and priorities that stake out a direction and define needs that we must relate to, says John Munthe, Vice President Research at IVL.

OPPORTUNITIES FOR CORPORATE RESEARCH FUNDING

IVL's jointly funded research opens up unique opportunities for Swedish companies to carry out research with equal funding from government and industry. A co-funded R&D project must be based on an environmental issue or have sustainability-related development potential. Research projects should be deemed of general interest to society and include the fundamentals of research and development.

The Swedish Environmental Protection Agency and The Swedish Research Council Formas administer the public funding allocated to co-funded research at IVL. In 2015, appropriations amounted to SEK 37 million. //

Sustainability – a prerequisite for all our activities

Environmental mitigation, the efficient use of resources, the improvement of working conditions – these have been at the core of IVL's activities since its inception in 1966. Over the years we have grown exponentially, and today we are concerned with all aspects of sustainability. Ecological and social sustainability is the bedrock that underlies all our internal activities, our research and consultancy as well as our relations to shareholders, employees and other stakeholders.

SUSTAINABILITY INITIATIVES

Our research and professional services focus on everything – from the mapping and monitoring of environmental issues to solutions and preventive measures, including economic and social aspects.

This means we have ample opportunity to make a constructive sustainability imprint through the advice we give our principals and by ensuring that our research is put to practical use in society.

Management

IVL addresses environmental and quality issues within the framework of an integrated management system certified according to ISO 14001 and ISO 9001. Goals are set and monitored according to a set order in this system. The most important aspect of IVL's environmental mission is the guidance we are able to give our customers.

Significant environmental aspects

- advice to customers
- international business trips
- domestic business trips
- travel to and from work
- electricity and heating/cooling in buildings
- office equipment
- use of chemicals in laboratories
- activities affecting the environment at Hammarby Sjöstadsverk pilot facility

Environmental benefits of IVL's efforts

We have developed a tool, primarily for internal use, to help us assess the environmental benefits accruing from our counseling, contingent upon the customer following our guidelines. The idea is that all completed projects are to be evaluated using seven environmental categories as starting point, as well as a number of categories that gauge social and economic impact.

The tool has been in use for two years, ensuring dependability and robustness, as well as providing an extensive assessment base. During 2015, 146 (81) completed projects were assessed and index finished up at 7.2, where 10 indicates that the project has led to at least two impact categories being judged of major importance.

Environmental load from travel

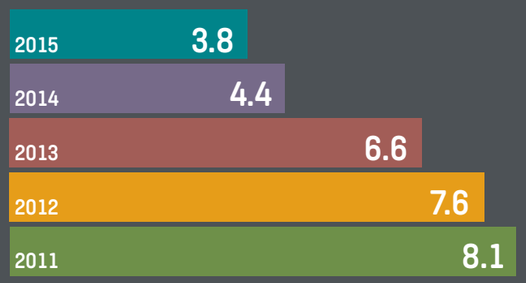
Foreign air travel is inevitable in connection with international business activities. IVL utilizes an index that measures environmental impact in the form of carbon dioxide emissions per Swedish crown earned. During the four year period 2012–2015, the index decreased by 50 per cent.

In 2015 the environmental impact of domestic flights has decreased by 7.8 (6.6) per cent, while the number of work trips by domestic trains has increased by 6.4 per cent.

Energy use

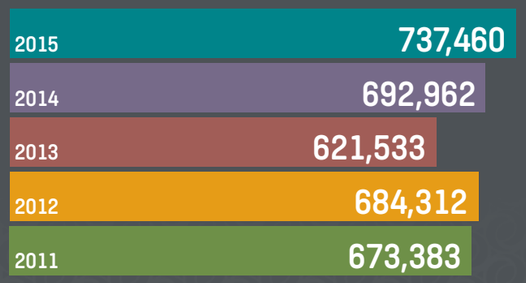
Energy consumption at the offices in Stockholm and Gothenburg has fallen by 6.3 per cent, from 2233 kWh (2013) to 2092 kWh per employee (2014), even though the number of employees has increased.

Air travel index, trips abroad



CO_2 load of foreign air travel in grams per Swedish crown earned in international business.

Business trips by train, kilometres

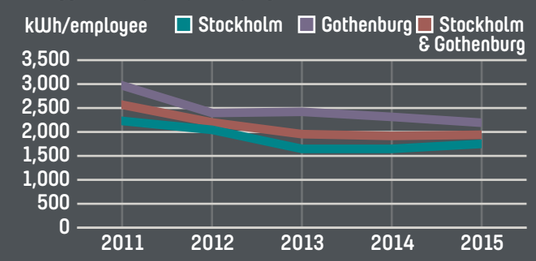


-7.8%

+6.4%

The environmental impact of domestic flights has during 2015 decreased by 7.8 percent while the number of business trips by domestic trains has increased by 6.4 per cent.

Energy consumption per employee at the office



The goal today is to maintain the level of energy consumption despite the increased number of employees.

Economic value generated, kSEK

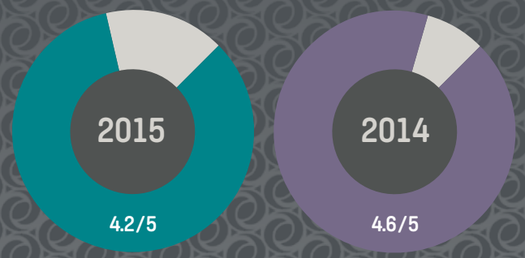
kSEK	2015	2014	2013
Net turnover	274,232	264,488	255,353
Employee wages	98,628	92,592	87,087
Payroll taxes	47,081	43,884	40,977
Tax	1,375	3,336	2,205

Venues

1,730

representatives from the environmental movement in Sweden gathered together at IVL conferences, seminars and workshops.

Customer satisfaction index



Other internal environmental work

For a number of years now we have encouraged travel-free meetings, and invested in modern video technology in most of our conference rooms, including those at the China office. Environmentally-best alternatives are given priority when procuring everything from chemicals to office supplies. Source separation is a well-established practice at all our offices and only environmentally friendly and fair-trade coffee is served.

IVL has entered into agreement with suppliers of laptops and mobile telephones to ensure that all discarded devices are reconditioned and reused on the secondary market. Equipment that cannot be reused is scrapped and all component materials recycled.

SOCIAL RESPONSIBILITY

Most of IVL's undertakings take place in Sweden and compliance with Swedish labour legislation in the form of laws and collective agreements is a minimum commitment on our part. We demand an identical commitment from our suppliers. The same applies to our operations in Beijing.

Code of conduct

IVL's code of conduct takes as its starting point the company's core values and the UN Global Compact's ten principles in the areas of human rights, labour, the environment and anti-corruption. Our values are based on credibility, vision, a holistic approach, commitment and the common good.

The code of conduct has been adopted by the IVL board and governs the company's relationship with employees, suppliers, business partners and other stakeholders. The code applies to employees as well as to members of the Board. When current and future suppliers are appraised the principles of the code of conduct, available in its entirety on both our Intranet and IVL's external website, are strictly adhered to.

Whistleblower function

We have introduced a whistleblower function on the intranet that enables employees to report confidentially and anonymously any suspected violation of rules, regulations and or the code of conduct without fear of repercussion. All employees are guaranteed this right.

Responsible investments

A certain amount of the company's liquid assets shall always be available in a checking account, but above this minimum liquidity funds can be invested in a variety of ways, and over a longer term. The Board sets the amount of the liquidity reserve annually.

Investment guidelines are set forth in a policy document and are based on sustainability criteria. For example, issuers of securities shall contribute to sustainable development, and report both the positive and negative environmental and social impact of their products and services on ecosystems and society at large.

Dialogue with stakeholders via theme committees

Since IVL's prime objective is to promote sustainable development, it is essential that we cooperate with all the key players in the environmental and sustainability field. This is carried out systematically within the framework of six so-called theme committees. Up until 2015, these were: *Water and soil, Air and transport, Resource-efficient products and waste, Sustainable urban development, Climate and energy,* and *Sustainable production*. The theme committees involved representatives from government and local authorities, as well as from various companies and business sectors.

The theme committees serve the dual purpose of identifying future research needs and disclosing noteworthy outcomes of ongoing IVL R&D projects. These meetings are also occasions for the committee members to make comments and ask questions about IVL's operations and sustainability initiatives.

Forums

Since its inception, IVL has functioned as a neutral arena for meetings between various players from the environmental community in Sweden. The physical venues have always been IVL's annual conferences, which over the years have increased in number, as well as seminars and workshops addressing issues of concern. In 2015, a total of 1730 people met together at various IVL forums.

Customer interviews

The annual customer surveys take the form of personal in-depth interviews, and are an important part of the dialogue IVL holds with its stakeholders. In 2015 interviews were conducted with 20 principals from industry, diverse municipalities and government agencies. The result of these interviews is presented as a customer satisfaction index. In 2015 the index was 4.2 (4.6), of a maximum of 5.0. //

Internal coaching reduces stress and boosts competence

What steps can a company take when it becomes apparent that employees are experiencing both growing levels of perceived stress and feelings of isolation in individual projects? IVL Swedish Environmental Research Institute has launched a pilot project where colleagues coach and support one another.

▲ Therese Zetterberg, Tina Skårman and Tomas Ekvall are three of a total of six coaches.

In recent years, levels of perceived stress have increased in society as a whole, and IVL is no exception to this trend. The relatively young are particularly vulnerable to stress, and at IVL this is especially noticeable among new recruits and graduates. Many newcomers appreciate and ask for an opportunity to brainstorm and discuss together with co-workers. In 2015 IVL's management team decided to act pro-actively to create a workplace where new employees receive the encouragement and support that they need in order to flourish.

The coaching project is now part of a concerted effort to develop IVL into a more attractive workplace. With the inception of internal coaching, the probationary periods at IVL, which to date have lasted two months, have been extended. It is during this period that new employees are expected to begin working independently, often in project form.

– At IVL, we expect a lot from our new recruits right from the very go, something most people see as positive and challenging, but as of yet we haven't had an appropriate support network in place, says HR manager Anna Westberg.

– Up until now, project leaders and managers have met the need new recruits have to ventilate ideas and ask questions, but the former are often pressed for time. The coach team is an additional resource that is always ready to lend an ear or a helping hand.

Since 2013, all IVL managers have participated in a structured leadership training programme. The coaching project launched in 2015 is an extension of this scheme and the six senior employees selected to assume this coaching and mentor role have been given professional training in coaching techniques and personal treatment. It was clear from the beginning that the coaches should not also be managers.

– This colleague-to-colleague mentor programme adds another dimension and enables us to propagate a leadership mindset throughout the organization, says Maria Kardborn, communicator and coaching group project leader.

Long experience working at IVL and a marked empathetic and helpful attitude towards colleagues were the foremost criteria used to select coaches.

– My role as coach has meant a lot for my professional and personal development, says Therese Zetterberg, who along with her Gothenburg-based colleagues Tomas Ekvall and Tina Skårman make up half of the six-man coach team.

– I really think the support coaching provides can lead to positive changes. The ultimate responsibility for problem–solving still rests on the individual, but the coach has an important role to play as counsellor and motivator, observes Therese Zetterberg.

The colleague-to-colleague mentor programme was announced internally and especially targeted new employees and new graduates. With time, everyone who felt the need for the assistance the coaches can provide has been offered a place on the programme.

The project will run until December 2016, and is a mix of indi- ▶

vidual coaching sessions and group meetings. While individual coaching meetings deal primarily with the participant's personal situation, group meetings tackle issues of a more universal nature – for example, how to balance project costs against time constraints, or the best way to go about things when many different individuals are to collaborate in a single project.

One of the positive effects the coaching project has had so far is an increased competence and experience exchange between senior and junior staff. Another is that participants are able to make a quick start building their own company-wide networks, which makes it much easier for them to find the skills they need in their work.

AN ATTRACTIVE WORKPLACE

Every two years an external organization conducts an employee survey, with smaller, follow-up appraisals in between. The various departments build on the results of these surveys, using them as springboards for activities calculated to maintain or improve the work environment.

The survey exposes a series of crucial performance indices. When it comes to leadership, employee satisfaction and commitment, the 2015 survey reveals an all-round improvement in already high performance levels. The results of the employee survey also form the basis for the annual work plans.

WORK ENVIRONMENT

IVL's Work environment management is conducted by delegation and the implementation of annual work plans coordinated by safety committees in Stockholm and Gothenburg.

All IVL employees are covered by a company healthcare scheme that offers regular health checks. Employees are able to seek care for work-related health issues via the company occupational health programme. All employees are given an annual wellness allowance.

IVL subsidizes a wide range of active employee sporting and cultural activities.

SKILLS DEVELOPMENT

If you are to deliver applied, cutting-edge applied research and carry out a wide range of demanding assignments, employee skills are of paramount importance. IVL's approach to skills development can be described as the "70-20-10" model, which means that 70 per cent of competence development takes place during everyday activities, 20 per cent is learned from experienced colleagues and 10 per cent through formal training.

IVL employees at the offfice in Bejing, China.

The goal is for all employees to undergo at least two days per year of skills training through dedicated activities. In 2015, this target was achieved.

INTERNAL PROJECT LEADER TRAINING

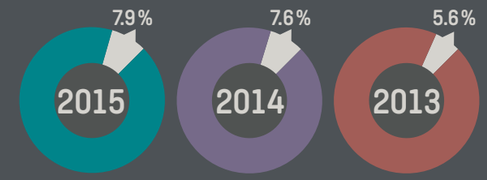
Virtually all activities at IVL are conducted in project form. In a step towards quality improvement and the professionalization of project leaders, an in-house leadership-training project in three stages was launched in collaboration with an external consultant. In 2015, a total of 50 employees underwent this training programme, which was coordinated by IVL's project management office. The project office also held a series of training sessions around the company's CRM system and planning tool, MPI. //

// When it comes to leadership, employee satisfaction and commitment, the 2015 survey reveals an all-round improvement in already high performance levels. //

Turnover/employee, kSEK

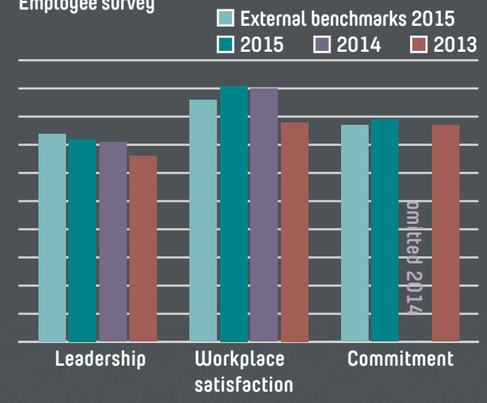
2015	2014	2013
1,098	1,010	1,002

Employee turnover

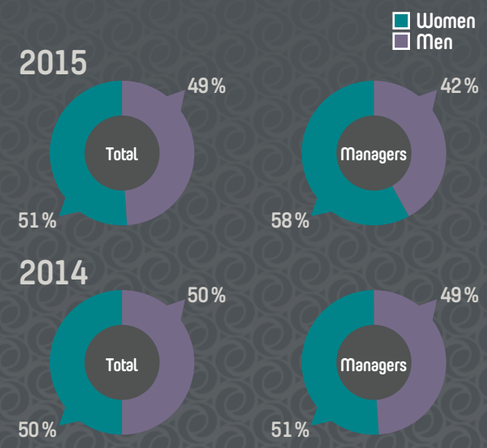


Percentage of employees who quit in relation to average number of employees.

Employee survey



Gender balance



AIR POLLUTION MONITORING

The forest as health indicator

Almost 70 per cent of Sweden is covered in forest – and the trees are growing as never before. How have they been affected by acid rain and what is their state of health in general?

For thirty years, IVL has measured atmospheric deposition on Swedish forests through the Swedish Throughfall Monitoring network (SWETHRO).

Throughfall – raindrops falling from the tree canopy – contains air pollutants that adhere to needles and leaves, as well as substances bound in precipitation.

The SWETHRO Network spans from Falsterbo in the south to Palovaara in the far north. Today project leader Gunilla Pihl Karlsson pays a visit to the forest outside Alingsås. The sample plot is located in the common lands that once belonged to a 'häradsallmänning', an older administrative district. This means that the surrounding farms own the forest jointly, and all decisions that concern forestry practices are taken together and placed in a long-term perspective.

It's not only the form of ownership that has a lot of years on its back. The trees here are at least 80 years old. And they seem to be prospering. Stately, dense and silent firs. The forest floor has a thick, soft moss cover. An occasional birch sapling tries to steal light through the canopy.

– It is extremely acidic out here. The topsoil is thin and nutrient poor. To some extent the acidification has a natural explanation in the uptake of nutrients during forest growth, but the high levels are mainly due to the slow rate of recovery from the worst acidification years of the 70's, says Gunilla Pihl Karlsson.

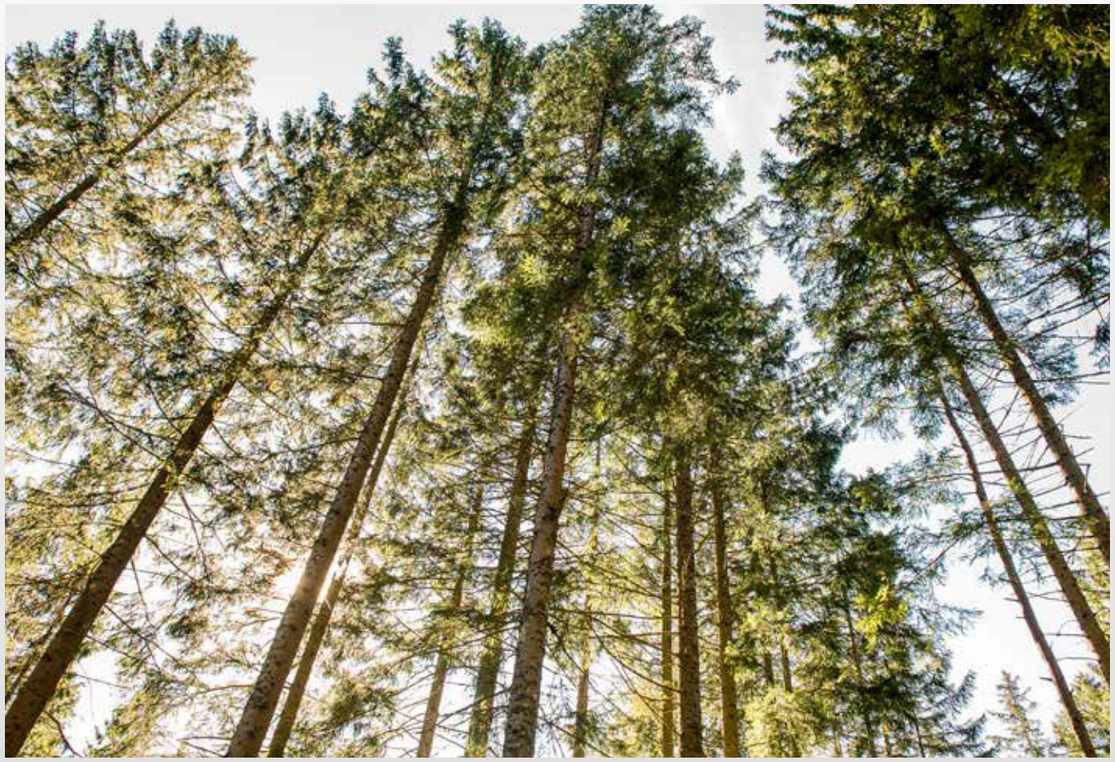
IVL established the SWETHRO Network in 1985 – initially on a modest scale in collaboration with the Air Pollution Federation in Blekinge. Monitoring activities have subsequently expanded, principally in cooperation with county boards and air quality associations, and since 2000 with the Swedish Environmental Protection Agency. In total, the network is now deployed across 70 sample plots throughout the country.

Results are reported at both county and national level. The measurements also form an important basis for the monitoring of environmental quality objectives Natural Acidification Only and Zero Eutrophication. The figures and reports are put before researchers, companies and international institutions such as the UN Convention on Long-range Transboundary Air Pollution.

But acidification no longer tops the agenda. Does this mean that it is not an issue anymore?
– Media interest fluctuates, but acidity is still a significant issue. We haven't been able to get on top of the problem. We still treat Swedish lakes and streams with lime at an annual cost of approximately SEK 200 million. Sulphur emissions have fallen sharply, but the recovery will take time. The soil chemical processes involved are just extremely slow says Gunilla Pihl Karlsson.

In 2014 there was an unexpected hump in the SWETHRO Network's monitoring series, when ambient sulphur levels in northern Sweden peaked, due to the Holuhraun volcanic eruption in Iceland. Otherwise, the sulphur emission reductions have been something of a success story. On the other hand, the more complex acidifying emissions of nitrogen, mainly from traffic, remain high.

How does nature cope with acidification?
– The forest is growing as never before. Forest death could not be more distant. Acidification is primarily an issue for lakes and rivers. The biggest problem facing forestland that we see today is the risk of nitrogen leaching. Forest soils in southwestern Sweden are approaching nitrogen saturation. This increases the risk of nitrate leaching to the groundwater and streams, which can cause acidification and eutrophication in lakes and rivers, says Gunilla Pihl Karlsson. A few hundred meters from the sample plot a



▲ The Swedish Throughfall Monitoring Network is a significant part of IVL's research into air environmental conditions and generates an annual turnover of around four million SEK.

▲The Swedish Throughfall Monitoring Network also measures soil water chemistry 50 centimetres below the tree roots.

◀ Per Erik Karlsson samples water quality, a division of the Swedish Throughfall Monitoring Network that investigates the path water takes from tree crown to watercourse and into the groundwater.

// The felling of trees has a huge impact on soil chemistry, indeed on the entire ecosystem. It is a highly topical research field that concerns the changes that are brought about by increased biomass production in the transition to a fossil-free society. //

small stream murmurs through a ravine. Here IVL has constructed a dam to sample the water. On its bank a one metre deep hole has been drilled. Per Erik Karlsson collects brook and groundwater samples, lowering a narrow tube which immediately fills with groundwater. This is part of the extended sampling carried out under the SWETHRO Network Monitoring programme.

– Broadly speaking, we follow the path water takes from precipitation over open areas, throughfall, the movement of water in the soil, groundwater and streams into lakes and watercourses. A lot happens along the way, says Per Erik Karlsson.

The SWETHRO Network is a significant part of IVL's research into air environmental conditions and generates an annual turnover in the order of SEK four million. Numerous research projects build on the data provided by the network and expand the understanding of emerging issues related to climate change and the impact of forestry practices.

The only sound in the forest is the rustling of the breeze and the bickering of some finches gently echoing among the numbered trunks. Sometime in the future, when the trees are harvested further sampling will provide important knowledge of how the forest is exploited and how this impacts the water quality of woodland brooks and streams.

– The felling of trees has a huge impact on soil chemistry, indeed on the entire ecosystem. It is a highly topical field of research that concerns changes that are brought about by increased biomass production in the transition to a fossil-free society. A greater harvest of biomass may impair the recovery of acidified areas, unless ash is recycled in the forest ecosystem. Everything is connected, there are synergies as well as conflicts on several levels, says Per Erik Karlsson.

When the trees are eventually harvested, throughfall sampling will continue in a younger tree stand a few hundred meters away. It just doesn´t feel right to stop after thirty years of monitoring. //

▲ Acidification is still a major challenge, says Gunilla Pihl Karlsson, project leader at the Swedish Throughfall Monitoring Network.

Web application charts assets and relationships between raw materials from the forest

Sweden envisions achieving an economy based on biomass by 2050. This means that raw materials, energy and chemicals must be biobased to a far greater extent than they are today. The forest will therefore play an even more important role in the future and the question is whether it will be sufficient to meet coming needs.

IVL Swedish Environmental Research Institute has developed an application that shows the flow of materials from various industrial processes that utilize forest produce. The application can be used to analyse the opportunities and potential for a future bio-based economy with an increased use of Swedish forest raw materials as a source of energy and products.

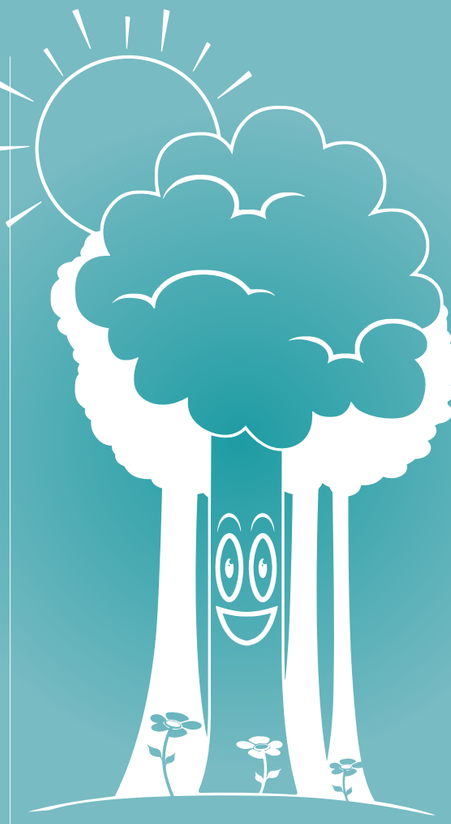
In the report, *Råvaruströmmar från skogen - tillgång och samband (Raw-material streams from the forest – resources and relationships),* IVL has profiled forest-based raw materials currently available on the market. The report explains and visualizes the extent to which commodity streams from the forest are interlocked and how future changes in the forestry industry may affect them. //

Harvesting logging residues does not aggravate soil and water acidification as feared

At whole-tree harvest it has become increasingly common that logging residues – branches, tops and needles – are utilized as biofuel. Fears that this intensive exploitation might lead to the acidification of soil and water over the long term have not been realized. Therese Zetterberg at the Swedish University of Agricultural Sciences and IVL has established this in her doctoral thesis.

The green parts of trees contain more nutrients and substances that buffer against acidification than that which are found in stem wood. If logging residues are left in the forest they replenish the supply of nutrients in the soil and neutralize acid generated during tree growth. If woody biomass is removed this is no longer possible.

In her thesis, Therese Zetterberg investigates the long-term effects of removing logging residues. Her findings suggest that it is possible to harvest logging residues in many places in Sweden without the risk of acidification. However, there may be other environmental hazards that restrict the size and scope of the harvest, for example the amount of deadwood in the forest. //



Areas adjacent to forest industries are recovering

IVL Swedish Environmental Research Institute, together with researchers from SKUTAB, Nordmiljö, the University of Gothenburg and ÅF, has compiled and evaluated environmental historical development in water areas long affected by forest industry emissions. The overall assessment is that the environmental situation has improved significantly.

– In many cases we see a huge recovery of the aquatic ecosystem. Areas that in the 60s and 70s were thought virtually wiped out and totally polluted have today recovered and now boast a flora and fauna similar to that found in adjacent reference areas, says Magnus Karlsson, project leader at IVL Swedish Environmental Research Institute.

The report shows that it is possible to reverse negative environmental trends in exposed areas. In recent decades the forest industry has taken radical steps to reduce emissions and has retired older production lines that rely on out-dated technology, an environmental cleanup that has yielded good results. //

RECYCLING AND REUSE:

By hook or by crook

The production and trading of clothes, is one of the world's largest industries and its ecological footprint is huge. And there seems to be no end to how much we consume. In Sweden we buy on average 13 kilos of clothing per person per year.

The fashion industry has a huge impact on the environment. The cultivation of cotton requires large amounts of pesticide and water. The manufacture of a single T-shirt requires 1800 litres of water and generates greenhouse gas emissions equivalent to 3 kg of CO2. Over half of all synthetic fabrics are spun from fossil fuels — these carry commonly recognized generic names, such as acrylic, polyester and nylon.

– The Swedes consume around 13 kilo textiles per person per year, almost 30 per cent more than in 2000. Only a small part of these textiles are collected for reuse or recycling and as much as eight kilos are thrown into the household trash. This is acerbated by the fact that there are still no effective processes for the sorting and recycling of textile products. Most clothes discarded in Sweden end up in an incinerator, says Maria Elander at IVL Swedish Environmental Research Institute.

Interest in creating circular and more sustainable value chains for textiles is growing. Several large fashion houses have introduced clothing collection in their stores and the second-hand market for clothing and home textiles is steadily on the increase. Moreover, technologies for recycling textile fibres are becoming more advanced, and here a range of initiatives are developing and evaluating processes for recycling textile fibres so that they can be utilized for new production.

– A particular hurdle for increased recycling is that currently far too few textiles are collected. Consequently, one of the major challenges we face is to return more used textiles to continual circulation. That so little is collected is partly because consumers do not always know how and where to donate discarded clothing and textiles, but perhaps primarily because many think the process is too much bother. It must be easy to do the right thing, emphasizes Maria Elander, who coordinates IVL's activities in the textile field.

In 2015 IVL participated in three textile projects: the *Nordic textile reuse and Recycling commitment* on behalf of the Nordic Council, Vinnova-funded *Swedish Innovation Platform for the Textile Sorting (SIPTex)* and *Mistra Future Fashion*.

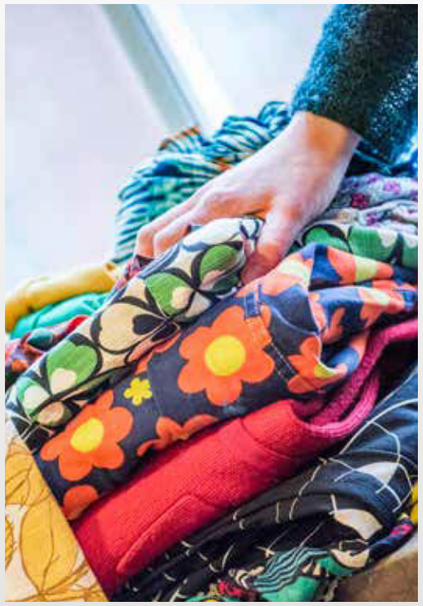
The Nordic textile reuse and recycling commitment examines how the certification of textile collection contributes to greater transparency and a more sustainable management of textile waste. A certification system that ensures that only serious actors able to meet relevant quality criteria are permitted to collect textiles increases the credibility and acceptance of the collection service. If all goes according to plan such a system can be launched in late 2016.

Today some of the clothing and textiles collected in Sweden are sorted locally, partly for reuse and sold at thrift stores, while others are exported abroad. There they are sorted both for reuse and recycling. Textiles that are recycled are today primarily repurposed for the upholstery of car door panels, and fibres are compressed for the production of mattresses and insulation.

– Today collected textiles are sorted manually. But it is difficult to repurpose clothes and other textiles, partly because a growing proportion consists of mixed materials. Textiles may be printed or contain chemicals that make them unsuitable or difficult to recycle. Those carrying out the sorting are skilled and work quickly, but industrial and automated sorting processes are required if large volumes of fabrics suitable for fibre-to-fibre recycling are to be processed, says Maria Elander.

For this reason, in the first phase of an IVL-led project, SIPtex was in 2015 charged with evaluating the potential for automated textile sorting. The project carried out a series of small-scale tests of techniques in which optical sensors were used to detect different types of materials. This is similar to the technology used for sorting packages, here deployed in a new context. SIPTex has shown that automated textile sorting has the potential to achieve both a high sorting rate and a high purity of sorted textile fractions.

– We want to preserve textile fibres for as long as is feasible, and as high up in the cycle as possible. Only when they can no longer be used to create new textiles, only then should they be repurposed as stuffing for car doors etc., says Maria Elander. The results so far have been promising and the prospects for scaling up are encouraging. But if a circular economy is to be achieved the chain must function along its entire length. An active dialogue with both fashion companies and materials recyclers is crucial in this respect.



▲ In the best of worlds recycling starts at the design stage with the selection of materials that can be kept within the cycle on the road towards a closed textile loop.

In the second phase of Mistra Future Fashion Hanna Ljugkvist works alongside Maria Elander with the IVL contributions to the second phase of Mistra Future Fashion. Here the emphasis is on policy issues and new business models to encourage textile re-use and recycling. The biggest challenges for efficient textile recycling, she says, lie in the recycling technology itself, the treatment of chemicals in textiles and the handling of mixed materials.

– Today there are almost no unadulterated textiles since fashion companies are not content with designing garments of a single fibre type, and it is difficult to ascertain the chemical content. For environmental and health reasons certain chemicals should be excluded from the loop, especially as these also impact the recycling process adversely, says Hanna Ljungkvist.

In the best of worlds recycling starts already at the design stage with the selection of materials that can be kept within the cycle on the road towards a closed textile loop.

– There are many obstacles and bottlenecks on the road to sustainable textile consumption. Right now it's cheaper to grow new cotton than to use recycled textile fibres. The branch is complex and a transition will take time. But it is an exciting field and a lot is happening, both at grassroots level and in the industry as a whole. //

The manufacture of a single mobile phone generates 86 kg waste

The ecological footprint of creating a mobile phone is 86 kilos – mainly in the form of mining waste and slag products. The cost of climate emissions is in the region of 140 Swedish crowns. The finished cell phone weighs 169 grams and is priced at about SEK 6,000. Avfall Sverige, the Swedish Waste Management Association, and IVL Swedish Environmental Research Institute have estimated the ecological footprint of eleven everyday consumer products, primarily in the food, textile and electronic industries, and the climate costs of the waste generated during production.

Some other examples of waste footprints expressed in kilograms of CO2 equivalents: a laptop 1,200 kg, a pair of cotton trousers 25 kg, gym clothes 17 kg and a pair of leather shoes 12 kg. //

Re:source – national forum for resource and waste research

IVL Swedish Environmental Research Institute is part of the research and innovation programme Re:source, whose focus is economic and environmental sustainability in the resource and waste management sectors.

– IVL is tasked with investigating the parameters of a resource-efficient society. The general thrust of the programme is to facilitate interdisciplinary collaboration and projects, says Åsa Stenmarck at IVL.

Re:source will act as a national arena for cross-industry innovation and as a forum for players from Swedish industry, the waste management sector, the research community, and other stakeholders concerned with issues around minimizing and utilizing waste.

The programme is led by the SP Technical Research Institute, and in addition to IVL, the working group consists of Chalmers Industriteknik, Luleå University of Technology and the Swerea research institute. //

MEASURING EMISSIONS:

A particle level showpiece

At the entrance to Gothenburg harbour heavy petrochemical industries rub shoulders with a sensitive Natura 2000 area. Rows of refineries, pipelines and hydrocarbon haze. Red-listed species. Fresh sea breezes.

PHOTO: HELENA DAVIDSSON

// The instruments respond directly when a ships approaches. They show background, background and then a ship passes and the levels peak, and then background, background again. //

– HÅKAN SALBERG

In the opening of Gothenburg harbour, ”Big Glenn, Sweden’s largest onshore wind turbine, soars into the air. Under the constant swish of rotor blades IVL’s Hakan Salberg captures exhaust plumes from passing ships and ferries. A three-meter-long ventilation shaft points out to sea and sucks in the volatile gas clouds that sweep in over land.

– It all looks much more advanced than it really is. Inside are filters that absorb the emissions. The tube retains the exhaust plume, which increases the absorption of the various air pollutants. The hardest thing is to capture the emissions; the weather gods have to be on your side.

The tiny monitoring station next to it is crammed with sophisticated measuring instruments, air intakes, vents, and computers. It takes just seconds to reveal some of our most common air pollutants: nitrogen oxide, sulphur oxide and particulate matter. During the eight-week monitoring campaign there is a lot of data to process. But now the instruments are on the blink. Håkan re-calibrates.

– The instruments are really sensitive. They respond directly when a ship approaches. They show background, background and then a ship passes and the levels peak, and then background, background again.

Marine emissions monitoring is an area in which IVL excels, both on-board and real-world monitoring, as here on Risholmen. Through the years, IVL monitoring campaigns have led to substantial cost savings for shipping companies and their customers, since vessels with low nitrogen oxide emissions qualify for reduced fairway and port dues.

International shipping is still characterized by weak environmental legislation in comparison with road traffic or stationary sources such as industries and power plants. But the opportunities for improvement are many and there is no shortage of technical solutions to reduce emissions from shipping.

For example, as of January 1, 2015 the sulphur content limit of fuel oil used on board ships was reduced from 1 per cent to 0.1 per cent. The new sulphur directive applies to shipping plying the Baltic Sea, the North Sea and the English Channel, inter alia. Already in the first year, this restriction has had the effect of lowering ambient levels of sulphur dioxide along the coasts. It is hoped that cleaner fuel will also lead to a reduction in particle emissions.

Åsa Hallquist is project leader in charge of the measurements at Big Glenn. She studies the physical and chemical properties of air pollution and how these age in the atmosphere. What happens when factors such as fuel, engine load and combustion are modified? Is air quality improved or climate change aggravated? Or vice versa?

– Our method is based on the measurement of individual vehicles and vessels. We currently have emissions data from some 700 ship passages. For each passage, we also log the ship’s ID number, the type of vessel, course and speed. This allows us to us to analyse on an individual level and to compare emissions between both different vessels and those taking place under a wide range of conditions, observes Åsa Hallquist.

In addition to real-time measurement of particle mass, number, size distribution, volatility, carbon black and organic content in gas and particle phases, certain emissions are passed through a UV chamber that accelerates the atmospheric chemical transformation from three days to about thirty seconds. This simulated process provides a simplified picture of the potential to form so-called secondary particulates.

– We need more knowledge about the chemical transformation if we are to understand and predict how measures designed to reduce emissions of carbon dioxide will affect the emission of particles and gases. Only when we are able to assess the potential of forming secondary particulates will we be able to evaluate the total contribution of an emission source, i.e., the actual spill and its effects, says Åsa Hallquist.

The measurements on Risholmen are based on a multi-year research collaboration with the University of Gothenburg. Ultimately, scientists want to establish how secondary particulates are formed. What key agents are important to the process?

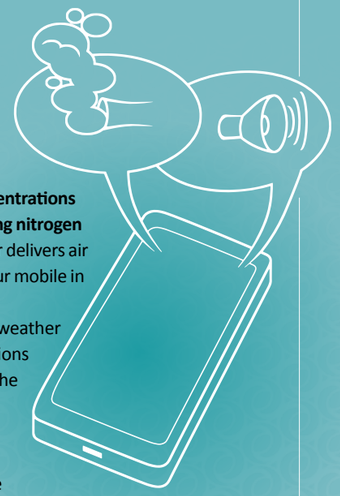
– If it is possible to identify any of these agents we may be able to determine the fuels and conditions that perform better or worse. In the longer term, we may have enough evidence to influence legislation. //

PHOTO: HELENA DAVIDSSON

▲ In studies of the physical and chemical properties of air pollution numerous sources must be taken into consideration, says Åsa Hallquist.

◀ What happens when factors such as fuel, engine load and combustion change? Is air quality improved or climate change aggravated? Or vice versa?

What is the environmental weather forecast?



”A low pressure system is approaching from the west. Increased particle concentrations in the southwest followed by decreasing nitrogen dioxide levels.” Environmental Weather delivers air and noise pollution levels directly to your mobile in real time.

The Vinnova-funded environmental weather project develops sensors and visualizations for the weather reports of the future. The project will deploy 50 sensors that will measure air pollution and noise in the Gothenburg area. The sensors will display the levels of air pollution we are exposed to, allowing, for example, the rescheduling of itineraries.

IVL Swedish Environmental Research Institute stands behind the project in collaboration with, among others, the environmental administration of the City of Gothenburg. The environmental weather project is based on the Internet of Things (IoT) – a generic term for the network of physical objects: machinery, vehicles, household appliances, wearables, etc., that are equipped with sensors and processors. //

Breakthrough for traffic emissions monitoring

One fifth of Sweden’s municipalities govern cities that exceed the ambient air quality standard for nitrogen dioxide. But measuring the long-term value of nitrogen oxide concentrations at street level is costly and demanding. Now, after many years of research and development, IVL is able to carry out air monitoring using a new type of diffusion sampler. The sampler does not require electricity or peripheral equipment and can be placed in a variety of locations to map traffic emissions.

– Our samplers are an excellent complement to conventional measuring instruments. A hundred of them can be deployed across a large area and measure emissions over an extended period, which delivers a comprehensive geographical image of contamination levels, says Martin Ferm, the inventor of the sampler. //

Great opportunity to ramp up car recycling

Every year nearly 200,000 cars are turned in for recycling in Sweden. The recovery rate is high, but plastics, textiles and precious and rare metals often disappear out of circulation. The Realize research project has shown that it is possible to recycle more, but that current EU directive does not provide incentives to recycle other than heavyweight materials.

Along with dismantlers and recycling operators, researchers from Chalmers, Chalmers Industriteknik and IVL have picked apart and analyzed 220 cars for new ways to recycle parts.

– We extracted a total of 200 kg of recyclable material from the car, which reduced the carbon bill per car by a similar amount, says Carl Jensen at IVL. //

Steps to reduce black carbon emissions

Black carbon refers to small soot particles formed during the incomplete combustion of fossil fuels and biomass. In recent years more and more attention has been paid to environmental issues arising in connection with emissions, not only has black carbon a considerable negative health impact, but it also contributes to global warming. The Finnish Transport Agency has commissioned IVL to investigate the current state of knowledge regards air pollution and to propose measures to cut back emissions from road traffic.

2000–2007 Sweden's emissions of black carbon in exhaust fumes was relatively constant at around 1,500 tonnes per year, and then almost halved to reach the present level (approximately 800 tonnes per year) as a result of stricter emission legislation and changes in the vehicle fleet.

Measures aimed at reducing the number of kilometres driven, such as congestion charges, carpooling, reduced speed limits and increased fill rate in road freight, are estimated to reduce emissions of black carbon by approximately 30–40 per cent by 2030. //

Great potential for green building

An IVL study carried out together with Basta, Skanska and the Swedish Transport Administration shows there is great potential to be found in building with materials and products with a minimized content of hazardous substances. Basta, run by the IVL subsidiary BASTAonline AB, has assembled one of Sweden's largest databases over non-toxic building products.

Three pilot projects have been at the core of the project known as "Bygga med Basta" – National Road 49, an operations area in North Värmland, and a garage building at the Nya Karolinska in Solna. The aim was to find out to what extent it is currently possible to build without using hazardous substances.

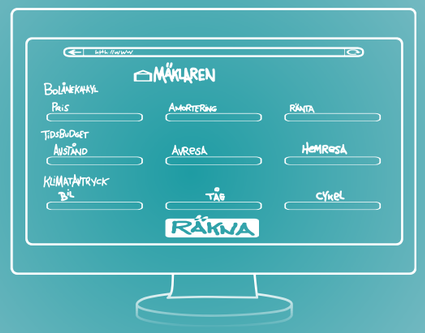
The results show that over 85 per cent of the products used in the three pilot projects were able to meet BASTA criteria and 60 per cent of the chemical products used satisfied BASTA criteria. Product groups that in general passed the criteria were often made up of simple, non-complex products, such as geotextiles, asphalt, road signs and reinforcing steel, and chemical products such as road salt and concrete. The groups that found it difficult to meet requirements included relining-products, electronics and technically specialized chemical products. //

New findings about flame retardents in indoor environments

Flame retardants in computers, textiles and plastics can easily spread to our indoor environment. Several of these substances have been shown to be harmful to humans and animals. IVL has participated in the EU Inflame programme that studies how flame retardants used in common consumer products and building materials spread and to what extent exposure to them leads to health risks.

Researchers have studied how indoor environments influence the outdoor environment in urban areas. Samples show that levels vary geographically and that concentrations of flame retardants in the air and soil increase the closer you are to a city centre. A distinct "urban pulse" has been identified in Stockholm.

– Research clearly shows that the products we have in our homes are a source of flame retardants in the outdoor environment as well. Increasing population density also leads to an increased number of consumer products that emit flame retardants which are then transported to the outdoor air through the ventilation system, says researcher Anna Palm Cousins, Inflame project manager at IVL. //



Major investment in mobility and sustainable travel

Many people who live in communities outside major urban areas are today dependent on cars. The environs of suburban commuter stations are often dominated by car parks. The Sustainable and attractive commuter community project challenges the idea of the car as the only viable transport solution.

Vinnova has invested seven million Swedish crowns in the project, which seeks to develop solutions for a car-free lifestyle in communities outside major cities.

The project aims to encourage the growth of commuter communities by developing and demonstrating products and services for efficient land use and sustainable local mobility.

IVL Swedish Environmental Research Institute, Chalmers, SP and Viktoria Swedish ICT, together with a large group of representatives from municipalities, regional authorities and industry is to study the western Swedish urban population centres, Lerum and Nödinge, that are to serve as pilot districts. The project will start at the local level but can be scaled up nationally.

Mobility services will take inspiration from transport systems that reward sustainable travel habits. Banks and realtors will provide living cost calculations with time budgets and projected carbon footprint. The researchers will also develop a new climate calculation tool that shows the climate impact of various development options. //

Balancing act when climate change impacts environmental goals

Climate change makes working for the environment a balancing act. Several environmental goals risk being weighed against one another – on the other hand some control measures will benefit multiple goals simultaneously. This is the conclusion reached by the CLEO project that after six years of deliberation delivers its synthesis report to the Swedish Environmental Protection Agency.

Researchers at CLEO have worked out different scenarios for future climate, air pollution and forest management change, and based on these assessed the potential impact on the environment.

CLEO's models show that half of the hitherto measured temperature rise of 1.3 degrees in the Arctic may be due to reduced sulphur emissions in Europe in recent decades, as sulphur particles have a cooling effect. At the same time it should be noted that today Europe has much lower emissions of sulphur than in the 70s and continued reductions will probably only result in small changes of the climate impact. //

IVL combines policy instruments to maximize resource efficiency

The raw materials used in the metal industry are finite and costly. The production chain must become more resource efficient and dependencies on newly produced metals must be moderated – both if we are to become less vulnerable today and to ensure that there will be enough resources left to meet the needs of future generations.

This is the conclusion reached by the EU Dynamix project that has analyzed how a combination of policy instruments can increase resource efficiency. IVL has coordinated the development of a proposal for a policy mix that combines enhanced producer recycling responsibility, a tax on materials used in the EU for materials efficiency and technical specifications for the substitution of materials.

– There is a lot of low-hanging fruit out there that we can pick using these instruments. But it is above all in combination that they give effect, says IVL's Tomas Ekvall who is behind the study.
The policy instrument mix is further enhanced by including green tax-switching, where payroll taxes are lowered, environmental taxes are raised and environmentally harmful subsidies phased out. //

Technology shift more important than car size

Rewards for those driving a car with low carbon emissions and penalties for those running a particularly fuel-guzzling one – IVL has calculated the impact of the so-called bonus-malus system in a lifecycle perspective.

The results show that a higher proportion of small and energy-efficient vehicles will reduce emissions, but that the greatest reduction will be brought about by the new electric and hybrid technologies. The impact of the bonus-malus system will partly be due to the values that most influence future car buyers and on how successful technical innovations will turn out to be.

– The climate benefit of a shift to electric cars depends a lot on the development of the electric power industry in Europe. What surprised me most was that electric cars proved to be better for the climate even though the amount of fossil fuels used to produce electricity increases, says IVL's Tomas Ekvall. //

HAMMARBY SJÖSTADSVERK DEVELOPS

Stockholm's future wastewater treatment

In a few years Stockholm will boast the world's largest wastewater treatment facility with membrane technology. The plant will improve wastewater treatment in this fast growing city and lessen emissions of eutrophic substances into Lake Mälaren and the Baltic Sea. The technique is one of several being tested at IVL's research facility Hammarby Sjöstadsverk.

Perched on a hill above the Henriksdal wastewater treatment plant and overlooking the whole of Stockholm lies Hammarby Sjöstadsverk – a unique water treatment research facility:

Here scientists and experts from different institutes and universities work alongside a score of Swedish and foreign water companies. The facility attracts visitors from all over the world and hosts multiple tours every week.

– The model of using a common test bed, where the academic community, research institutes and companies work collectively to evaluate and develop water treatment technologies, has proven very successful. From almost zero activity at start-up, today we have a large number of projects in progress, says Christian Baresel who manages the facility and coordinates ongoing activities.

Water treatment engineers, equipment and expertise all gathered together under the same roof. This creates opportunities for new types of solutions.

– The best thing about working here is that we are adding to knowledge all the time. For me personally this a real incentive. Many new solutions may look good on paper, but here we test them in real life, says Christian Barasel.

The expertise built up at Hammarby Sjöstadsverk has attracted a number of major global players. The sustainable water solution company Xylem has located part of its development effort here. Another substantial environmental project now underway is Stockholm's Future Wastewater Treatment, run by Stockholm Water, the company that operates the Henriksdal plant. Stockholm Water has decided to invest in membrane technology – a technology that separates sludge from wastewater by filtering it through a physical barrier, a membrane with very small pores. After a rebuild the Henriksdal plant will be the largest wastewater treatment plant in the world that utilizes membrane technology.

Tests are underway at Hammarby Sjöstadsverk to establish how this technology can cope with higher water purification requirements and the increased load expected as a consequence of Stockholm's rapid expansion.

▲ The Hammarby Sjöstadsverk research facility overlooks the whole of Stockholm.

◀ Christian Baresel and Jesper Karlsson supervising some instruments.

// It's time to rethink and see wastewater as a resource. //

Tests show that membrane filtration allows for more effective purification of nitrogen and phosphorous. A further advantage is that membranes inhibit the passage of particles and particle-bound contaminants, which may in the future allow after treatments to be applied to wastewater to further purify it from, for example, drug residues.

– An improved treatment of drug residues is another requirement we can expect in the near future. There may also be demands for a better purification of micro plastics and other undesirable substances. This means that we need technologies flexible enough to meet both current treatment requirements and those that will come in the future, and unless we accomplish this treatment plants will be saddled with recurring costs for rebuilding or retrofitting waste management processes, says Christian Baresel.

A holistic system approach is key to everything that is done at the Hammarby Sjöstadsverk facility. A particular goal of the research is to turn today's energy-consuming treatment plants into net producers of energy. As a step in this direction a biogas digester has been installed that allows for further investigation into the the possibilities of ramping up the production of biogas in present-day wastewater treatment plants.

Another essential focus of the research is the recycling of wastewater. In the ReUse project, IVL and Xylem have shown that with the right technology, waste water recycling can be both cost effective and the outflow so clean that it can be returned to the groundwater or reused in agriculture and industry. To succeed with this several existing treatment systems have been combined, among these ozone disinfection.

Reusing treated wastewater – instead of as today discharging it into lakes and seas and then pumping it up again – is still regarded in many countries as a solution somewhere way off in the distant future. But Christian Baresel sees great benefits to be had here, and believes that water scarcity is both a more serious and a more immanent threat to those of us who live in Sweden than we realize.

– It is time to rethink and see wastewater as a resource. With water shortages due to environmental degradation, combined with lower groundwater levels, higher costs of clean fresh water and increased competition with other sectors such as agriculture and industry, the reuse of treated wastewater has never been more relevant than now. //

▲ The IVL laboratories conduct numerous analyses and tests of water quality. Over the years Hammarby Sjöstadsverk has been enhanced with a variety of processes and technologies that make it possible to carry out cutting-edge research and development.

HAMMARBY SJÖSTADSVERK

Originally the facility was built to test technology for incorporation into a full-scale wastewater treatment plant intended to serve the environmentally profiled Hammarby Sjöstad residential district. In late 2007, the city of Stockholm ceded the plant to a joint consortium comprised of IVL Swedish Environmental Research Institute and KTH Royal Institute of Technology.

In the beginning the pilot facility was in principle four separate municipal water lines. Since then it has been augmented by the addition of sludge treatment processes, a membrane bioreactor (MBR), a SBR reactor and a number of other processes and technologies designed to promote cutting-edge research and development. Add to this energy-efficient technologies for the purification of nitrogen in wastewater (Anammox), equipment for ozonation, UV light, hydrogen peroxide, activated carbon, bio-filters, reverse osmosis and ultrafiltration. The pilot facility can be utilized for longer and shorter trials targeting the development and optimization of new systems or components. The facility is also used to demonstrate processes and equipment.

In 2015, IVL was given financial support by Vinnova to extend operations at Hammarby Sjöstadsverk to include industrial water treatment. The testbed that will be built for this purpose will be open to other interested parties and companies, making it unique in its kind.

Sjöstadsverket can also look forward to new office premises, bigger laboratories, an increased number of workplaces and demonstration and teaching facilities. //

Testbed for industrial wastewater treatment

Together with, among others, AB Volvo, IVL Swedish Environmental Research Institute has received SEK 4.7 million from Vinnova to extend operations at Hammarby Sjöstadsverk to include industrial wastewater treatment. The projected testbed will be open to other stakeholders and businesses, making it unique in its kind.

– This is very positive. We are convinced that this will greatly strengthen Swedish innovation power and the export of industrial wastewater treatment technologies. It will also induce foreign companies to locate their R&D in this field to Sweden, says Staffan Filipsson at IVL.

There is great demand for testbeds on which companies and industries can develop and demonstrate their products and processes. A testbed enables more efficient and faster development of individual technologies, but above all, of increasingly demanding system solutions. Better procedures mean that both water and chemicals can be recycled, while at the same time volumes of waste are reduced. //

Cultured ascidians to biogas

Fast growing ascidians cultivated in the sea can be used to generate biogas. The concept, developed by IVL researcher Fredrik Norén, is currently undergoing tests in a research project that has received SEK 23 million in support from the Swedish Energy Agency and the EU.

The concept is based on established techniques for growing mussels. Managed properly, naturally occurring and fast growing ascidians are grown on cultivation strips in the sea. Just as mussels, ascidians are filter feeders living on plankton and bacteria extracted from large volumes of water, which means that when they are harvested nitrogen and phosphorus are removed from the sea. With a growth rate of approximately two centimetres per month, a significant biomass is quickly created. After anaerobic digestion the biomass can be used as organic fertilizer.

The project is led by Marin Biogas and implemented by, among others, Scanfjord in Mollösund. Under a period of three years Scanfjord will grow and harvest ascidians for the Eon digestion plant at Falkenberg. IVL Swedish Environmental Research Institute is responsible for research and evaluation. One of the project goals is to establish whether the technique is viable in the Baltic Sea. //

Knowledge report on drug residues in wastewater treatment plants

IVL Swedish Environmental Research Institute, together with KTH, Stockholm Water and Syvab, has produced a knowledge report that shows how drug residues can be removed from wastewater.

Many drug residues pass straight through today's wastewater treatment plants and end up in the environment, sometimes at harmful levels. The report aims to provide a solid knowledge base, recommendations for priority substances, treatment techniques and to highlight knowledge gaps and development needs. The report will help treatment plants implement supplementary purification techniques and choose the solution best suited to local conditions and future goals.

The project has received support from the Marine and Water Authority through the Measures for Marine and Aquatic appropriation, included in the government's four-year commitment to a better and more advanced treatment of wastewater. //

PFAS compounds widespread in the environment

PFAS is a generic term for a large group of highly fluorinated chemicals that have been used since the 50s in products such as fire foam, impregnating agents for textiles and ski wax, etc. The most well known compounds in this group are PFOS and PFOA, both of which are extremely persistent and toxic.

In the Re-Path research project, IVL and Swedavia have studied the consequences of the spread of highly fluorinated substances from the Arlanda and Landvetter airports where a florinated chemical was previously used in fire fighting foam.

Results indicate that fire drill sites are critical point sources of highly fluorinated compounds in Sweden. From fire drill sites at Arlanda airport 1.3 kilograms of toxic PFOS leak into Lake Mälaren every year. Fish and watercourses in the vicinity of fire drill sites can contain up to 100 times higher concentrations of PFOS compared with reference areas.

– There are still large concentrations of PFOS in the ground, retained by the soil. If nothing is done it will be a 100 years before levels in the environs of airports return to normal, says Karin Norström, researcher at IVL Swedish Research Institute. //

Research that impacts global climate policy

For four years, the IVL-led research program Mistra Indigo has investigated the way in which global climate policy instruments are best designed and made to complement each other. The results have had an impact on UN climate negotiations, Swedish industry climate transition, US and EU emission reduction commitments, and restructuring work underway in Swedish industry.

// Unlike many other traditional research programmes, Mistra Indigo's results are clearly linked to ongoing climate negotiations and the international political agenda, as well as to efforts to mitigate climate change in both the public and private sector. //

– ÅKE IVERFELDT, CEO MISTRA

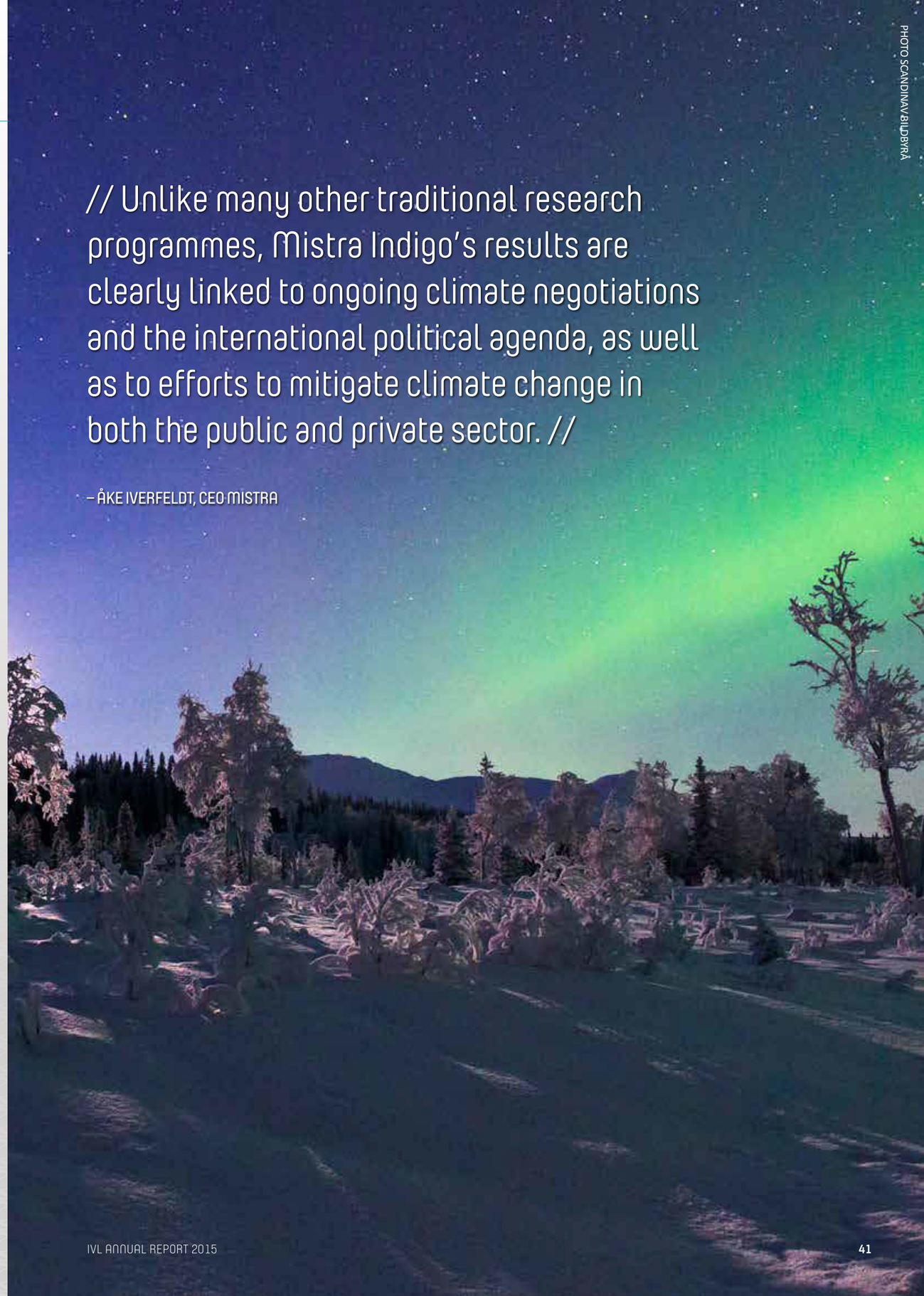


PHOTO SCANDINAV BILDBYRÅ

Research undertaken by Mistra Indigo and its predecessor Clipore adds up to twelve years of climate policy research at IVL.

– We have been involved in shaping the agenda for the industry's work on climate change and we have influenced political decision-makers, but above all, we have ramped up the quality of Swedish climate policy research, says Peringe Grennfelt, Mistra Indigo programme director, at the project's concluding conference.

Through the years, international climate negotiations have been central to the research at Mistra Indigo and Clipore. Just like the climate agreement eventually signed in Paris, Mistra Indigo early on adopted a bottom-up strategy – a strategy that insists that international frameworks must be based on and supported by national and regional efforts emanating from below.

When Sweden's Climate Ambassador Anna Lindstedt took seat on the Mistra board, the programme was able to open a direct channel to the negotiation efforts and decision-making processes at the UN. Insights into the EU and US climate policy agenda and a strong link to Swedish and European industry have ensured that the research was up-to-date and progressive. Insights into the EU and US climate policy agenda and strong links to Swedish and European industry and interests in the UNFCCC ensures that the research is up-to-date and progressive.

– Mistra Indigo's results have, unlike those of many other traditional research programmes, clear links to both the climate negotiations and the international political agenda, as well as to climate work in progress in industry and government bodies, says Åke Iverfeldt, Mistra CEO.

In addition to a strengthening of the programme board with stakeholders such as, Volvo, Fortum and the World Bank, the deep and long-term collaboration between the program's research partners, IVL Swedish Environmental Research Institute, the Stockholm School of Economics and the US research institute Resources for the Future, plays a major role.

– This enables us to deliver credibility. The effect is difficult to measure, but I think it is one of the success factors. It is about trust and confidence, which is especially important in interdisciplinary programmes like this, says Peringe Grennfelt.

Over four years the research team produced more than 50 publications and participated in nearly 140 communications activities, targeting issues such as emissions trading, climate policy implications for industry and renewable energy subsidies.

There are numerous climate and energy issues, and they have become increasingly complex. The Mistra Indigo research also suggests that a variety of flexible instruments are required, both sticks and carrots. Thomas Sterner, Professor of Environmental Economics at the University of Gothenburg, believes that the one mechanism that would have the greatest impact is a global carbon price, which could be achieved through a global emissions trading scheme or tax on carbon.

– Why is a global carbon price so difficult to implement? One explanation is that governments and ministries of finance guard the national sovereignty, and tend to react negatively to supranational proposals. But, above all, there is resistance among powerful global fossil-exploiting companies who also enjoy a great deal of political influence. Putting a tax on oil instead of subsidies is still far too contentious in many countries.

– A price on carbon is imperative because it offers substantial efficiency benefits. To date many advocates for carbon pricing have unfortunately framed pricing as an exclusive policy alternative. Progress lies in understanding how price and non-price approaches can be integrated rather than framing one or the other as an exclusive alternative, says Dallas Burtraw from Resources for the Future, one of the programme's most prominent scientists.

But then the price cannot be set too low.

– Mistra Indigo has argued that a price floor in the EU ETS would preserve the integrity and credibility of the system. This is particularly important as we have recently seen a weakened EU with some member countries opposing climate-mitigation measures, says Lars Zetterberg, who for many years has studied the development of EU ETS.

For although we are in the midst of a solar-cell revolution – there are now more solar energy jobs in California than there are coal-industry jobs in the entire United States – we still haven't put outmoded and dirty energy and transport systems behind us.

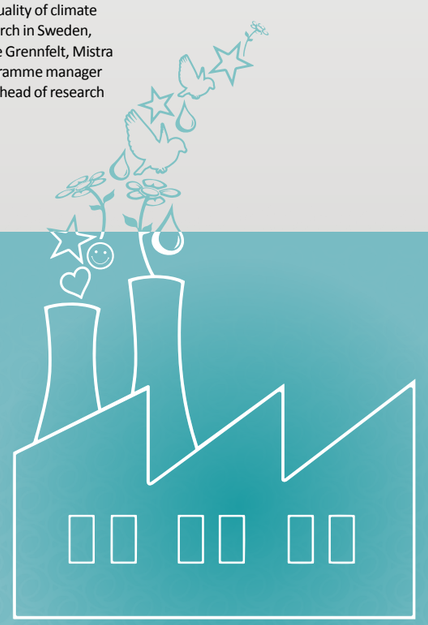
// The Paris agreement will be no better than what governments, businesses and citizens actually do to reduce emissions. //

Some revolutions seem to progress rather slowly, but do we really have the time to wait? Markus Wråke studies global energy systems – one of IVL's biggest areas of strength.

– The biggest challenge lies in the transport sector. By 2030, at least one in three cars should be powered by electricity, and with the right incentives, this is quite feasible. Simultaneously, the construction industry must be twice as energy efficient. What worries me most are the doubts about the pace of change and the lack of interest in carbon capture and sequestration. CCS is absolutely necessary if we are to meet the two-degree target. Now it is time to deliver. The agreement reached in Paris is no better than what governments, businesses and citizens actually do to reduce emissions. //

▲ Christian Egenhofer, Centre for European Policy Studies, Dallas Burtraw, Resources For the Future and Anna Lindstedt, Sweden's Climate Ambassador, at Mistra Indigo's concluding session.

◀ We have been instrumental in shaping the agenda for the industry's work on climate change, and in particular in lifting the quality of climate policy research in Sweden, says Peringe Grennfelt, Mistra Indigo programme manager and former head of research at IVL.



Flagship research on climate-smart transport systems

The transport sector is a long way from achieving climate goals. Emission trends point sharply upward while the necessary emission reductions curve points just as sharply downward. How can we speed up the shift to a climate-smart transport system?

The Nordic flagship project Shift – Sustainable Horizons in Future Transport, attempts to identify the technical solutions and instruments needed to transform the transport system, with an emphasis on long-distance transports and urban transit systems.

Researchers will examine the cultural, political and behavioural aspects of new habits and transport solutions. IVL is host organization for the programme that also includes the Technical University of Denmark, the Norwegian Centre for Transport Research and the research institute, Viktoria Swedish ICT. //

Bio-coal to reduce emissions from steel industry

SSAB, The Swedish steel conglomerate, together with an IVL-led consortium is to investigate the possibility of replacing fossil fuels with bio-coal.

Sweden burns about 3 million tonnes of fossil carbon per year, about 70 per cent of which is consumed in the iron and steel industry. SSAB has set up ambitious targets for the reduction of greenhouse gas emissions and is evaluating a number of different solutions, including replacing fossil fuels with renewable ones. The project focuses on replacing fossil coal and other fossil fuels with bio-coal. Not only will bio-coal reduce greenhouse gases, it also will deliver ecological and social added value.

– It's all about putting together a functioning chain that goes from cultivation, through end-use in different industrial and energy facilities to competitive industrial products and services that benefit Swedish industry says Jenny Gode, Head of the Climate and Energy Unit at IVL. The project is a collaborative undertaking between SSAB, Scandinavian Bioheat, the Swedish University of Agriculture and Carbon Wealth. //

Director’s Report

The Board of Directors and CEO of IVL Swedish Environmental Research Institute hereby submit their annual report for the operating year 1 January 2015 – 31 December 2015, the company’s thirty-fourth fiscal year.

Consolidated Operations

IVL Swedish Environmental Research Institute undertakes applied research and consultancy assignments across the entire environment and sustainability area. Our customers are to be found in all sectors of industry, government agencies and organisations. Operations are based in Sweden and Europe, but our customers are located throughout the world, particularly in China, where IVL has been active for more than 25 years.

IVL was founded in 1966 and is owned by the Foundation of the Institute for Water and Air Research (SIVL). The Swedish government and the Swedish business sector appoint directors to serve on IVL and SIVL boards. IVL has operated as a limited company since 1982.

In addition to the parent company the group consists of the subsidiary BASTAonline AB, EPD International AB, IVL Environmental Technologies (Beijing) Company Ltd and the joint venture company SEC in China. Operations are predominantly carried under the auspices of the parent company.

PARENT COMPANY

The purpose of IVL's operations is to promote ecological, economic and socially sustainable growth in business and society at large. Activities are structured into four operational units, together with research, business development and marketing units that operate laterally across the organization. IVL's working methodology is characterized by an interdisciplinary and holistic approach. The company is active across the entire area of sustainability, and for this reason, in addition to its traditional expertise in the environmental field, IVL employs behavioural and social scientists, financial and communications experts.

Our activities range across the entire industrial spectrum, and our customers represent Swedish society in its entirety; from small and medium enterprises to large multinationals, industrial and trade organizations, public agencies – of which the Swedish EPA is the biggest single principal – as well as local authorities and other organizations.

International operations

IVL conducts extensive international operations. Europe is the company's home market; otherwise the focus is mainly on China and India, and to some extent South America, particularly Brazil and Chile. The previous collaborative ventures and project activities in Russia and the ECCA countries have in recent years come to a halt.

Communication, training and seminars

Communication, and the organization of courses and seminars, falls under Business Development & Marketing. This means that communication is an integral part of the company's business development.

Communication has become increasingly important, both as a component in research programmes and in general terms as a means of spreading information about IVL's activities. In this regard courses and seminars are essential, particularly as a means of consolidating IVL's role as an arena where stakeholders from the research community, industry, public and political spheres can meet. This was especially the case with the following: The *State of the Environment*, *Towards Non-toxic Building Practices*, the annual *Baltic Sea Seminar* and *Sustainable Transport*.

COLLABORATION WITH UNIVERSITIES AND COLLEGES

A core component in IVL's strategic approach is the establishment and development of close collaborative undertakings alongside the business sector, international research bodies and tertiary institutions. As part of this endeavour, IVL has formalized collaboration with the Royal Institute of Technology, Stockholm (KTH) and Chalmers University of Technology. Together with Chalmers, IVL has initiated a dedicated programme aimed at developing infrastructures for long-term competence development and research in the transport and logistics field.

For almost 20 years, in partnership with Chalmers and industrial companies across the globe, IVL has been a driving force at the Swedish Life Cycle Center, SLC (formerly CPM), whose aim is to improve the environmental performance of products and services. Now, KTH and SP are also members of SLC.

Within f3 (Fossil Fuel Free) IVL cooperates with other research institutes, academia, and vehicle and fuel manufacturers.

Currently, IVL has three adjunct professors at KTH and the University of Gothenburg, and two staffers affiliated to KTH. In addition, an IVL employee has received the Vinnmer Scholarship Award linked with the Chalmers Energy Initiative.

Hammarby Sjöstadsverk

IVL and KTH are joint owners of the Hammarby Sjöstadsverk R&D facility, a national resource for the development of water purification technology. The facility is used by IVL and KTH for their own research, but also by external stakeholders for testing of new purification technology on different types of wastewater.

Hammarby Sjöstadsverk is member of a collaborative partnership with KTH, Uppsala University, the Swedish University of Agricultural Sciences (SLU) and Mälardalen University, a centre for municipal wastewater treatment with funding from the Swedish Water & Wastewater Association (SWWA), and municipal authorities in the Mälardalen region.

Other cooperative ventures and important networks

IVL's role is to act as bridge builder between the research and business communities, and to create arenas of interaction between different social actors. This is one of the reasons why IVL leads or participates in networks and cooperative ventures of various kinds, some of which are featured above. IVL is also involved in a long line of European technology platforms, such as, WSST (water), ESTEP (steel), FBST (forest) and ECTP (construction).

Other examples:

- **Spire** – a network working to increase resource efficiency in the process industry.
- **Enero** – European Network of Environmental Research Organisations, a group of European research institutes operating under the umbrella of the European Research Area (ERA). IVL is an active member.
- **EurAqua** – the European Network of Freshwater Research Organisations. IVL is the Swedish representative.
- **Norman** – a network of reference laboratories and research organisations involved in the screening of new, environmentally hazardous chemicals.
- **Lighthouse** – Nordic centre for maritime expertise and a collaboration between Chalmers, Gothenburg School of Business, Economics and Law and the Swedish Shipowners' Association.
- **NTM** – the Swedish Network for Transport and environment. As member of the network, IVL has worked in formal collaboration with NTM since 2009. The aim is to strengthen cooperation by placing IVL's expertise at the disposal of NTM members and working groups.
- **SMED** – the Swedish Environmental Emissions Database, a consortium formed in 2001 by IVL, Statistics Sweden (SCB), the Swedish Meteorological and Hydrological Institute (SMHI) and the Swedish University of Agricultural Sciences (SLU) to compile and develop Swedish competence in emission statistics relating to action programmes in the fields of air and water pollution, waste, and hazardous substances and chemicals. Since 2006 SMED has supplied all data required for Sweden's international reporting in these areas, the present framework agreement expires 2022.
- **Stockholm Cleantech** – a spinoff of the Stockholm Environmental Technology Centre, initiated and administrated by IVL. Stockholm Cleantech connects visitors, stakeholders, projects, technologies, companies and researchers active in the field of environmental technology in the Stockholm/Mälardalen region.

Group Companies

BASTAONLINE AB

Bastaonline AB (CIN 556719-5697) is since 2007 owned by IVL (60%) and the Swedish Construction Federation (40 %). Bastaonline AB has its seat in Stockholm and its operations are located at IVL's head office.

The company manages and develops the BASTA system for evaluating and phasing out particularly hazardous substances in building materials. Totalling 58 initially, the number of suppliers joining the system had increased to 366 by the end of 2015, at which time 22,500 products, corresponding to over 95,000 individual items, were registered.

Six substantial programs have been completed and in March Bastaonline organized the annual seminar, The Road to Non-toxic Construction, in collaboration with IVL. The strategic collaborative project Building with Basta, with IVL, Skanska and the Swedish Transport Administration, was concluded in 2015. A further development project is projected as an offshoot of this, this time with focus on the rail network, and is a cooperation between Bastaonline, the Swedish Transport Administration and Infranord; the project is expected to continue until 2017.

Net turnover for the fiscal year increased by 9% and amounted to SEK 5,604 (5,102) thousand, with a profit after financial items of SEK 204 (503) thousand.

EPD INTERNATIONAL AB

Since 1 July 2014, EPD International AB (CIN 556975-8286) is a wholly owned subsidiary of IVL. The company has its headquarters in Stockholm and operations are located at IVL's head office. The company operates and manages the EPD system, which is a programme for the verification and registration of Environmental Product Declarations, EPDs.

EPD is an information system that objectively describes the impact of products and services on the environment. Among other things, the programme is tasked with providing information about its activities, organizing international collaborations, managing the work of an international technical committee, recording approved environmental and climate declarations as well as maintaining records of these. In total over 500 EPDs have been published at www.environdec.com, and in 2015 139 new EPDs from companies in 17 different countries were registered, an increase of 21% compared to the year before. Valid product category rules (PCRs) for over 100 product groups are available.

During the year, a number of events were organized, including the third EPD International Stakeholder Conference in Bordeaux, France, and smaller seminars in Stockholm and Tianjin in China. A new board was elected

and held its inauguration meeting December 2015. License EPD registration agreements were entered into with organizations in Chile and Mexico, and similar agreements were made with organisations in Turkey, Australia and New Zealand.

Net turnover for the fiscal year amounted to SEK 2,894 (1,575) thousand and profit after financial items to SEK -7 (133) thousand.

SINO-SWEDISH ENVIRONMENTAL TECHNOLOGY DEVELOPMENT CENTER LTD (SEC)

For more than ten years, IVL and the Tianjin Academy of Environmental Sciences (TAES) have been joint owners of the Sino-Swedish Environmental Technology Development Centre (SEC), based in Tianjin. SEC has helped a large number of Swedish environmental technology companies to enter the Chinese market.

IVL ENVIRONMENTAL TECHNOLOGIES (BEIJING) COMPANY LTD

Since 2014, IVL has a wholly owned subsidiary in China. The company is primarily dedicated to the provision of environmental consulting services and technology transfer for the Chinese market. During its first year, the company mainly engaged in marketing activities, which to date have resulted in contracts on behalf of two Swedish customers. Net sales for the fiscal year were SEK 834 (174) thousand and net profit SEK 248 (-183) thousand. At the end of the year, the company employed three people.

Financial performance

THE GROUP

Consolidated revenues for the fiscal year increased by 4% and amounted to SEK 274,232 (264,488) thousand and a profit after financial items of SEK 5,392 (12,543) thousand. Net profit after tax amounted to SEK 4,017 (9,207) thousand. Return on equity was 5.1 (13.0)% and return on assets (7,1)%. Average return on equity over the last five years is 11,5%.

The group's total assets increased to SEK 196,794 (172,754) thousand and equity increased to SEK 83,900 (79,865) thousand. Cash flow was positive at SEK 15,005 (-23,933) thousand. Investments in tangible and intangible fixed assets amounted to SEK 11,285 (7,074) thousand. The equity ratio is somewhat lower 42.6 (46.2)%.

For a more detailed financial overview and key figures, please refer to Note 2.

THE PARENT COMPANY

IVL's net turnover for the fiscal year increased by 4% (4) and amounted to SEK 272,812 (263,272) thousand, with a profit after financial items of SEK 7,173 (11,972). Profit after tax amounted to SEK 3,067 (6,300) thousand.

Total assets amounted to SEK 190,880 (167,070) thousand, and equity to SEK 57,006 (53,939) thousand. Adjusted equity is estimated at SEK 68,935 (63,584) thousand. Cash flow during the year was SEK 16,008 (-25,299) thousand.

Adjusted return on equity was 8.4 (15.8)%, and return on assets 4.1 (7.0)%. Average return on equity over the last five years was 13.6 (11.1)%.

Investment in tangible and intangible fixed assets amounted to SEK 10,669 (6,736) thousand. The equity ratio fell to 36.1 (38.1)%.

For a more detailed financial overview and key ratios, please refer to Note 2.

Organization and Corporate Governance

OWNERSHIP

Since 2004 IVL is a wholly owned by the Foundation Institute for Water and Air Research (SIVL) CIN 802006-2611, with head office in Stockholm. The aim of the foundation is to promote the long-term conditions required for environmental research and, through ownership, guarantee the independent status of IVL.

SIVL is governed by a representative board of directors, of whom the chair and six members are appointed by the Swedish state, and seven members by the Swedish business community. SIVL is the sole owner of IVL and proposes members to the board of IVL, partly by inviting nominations from industry representatives, and partly by inviting nominations from government.

BOARD ACTIVITIES

During the 2015 fiscal year the board held four ordinary meetings, in addition to an inaugural meeting in May and a strategy meeting, which was held in September. Board activities focus primarily on strategic issues, financial statements, major investments and acquisitions. The board receives regular reports on the performance of the Company's operations and finances. Selections of the Company's operations are presented at ordinary meetings. The CEO acts as rapporteur at board meetings.

The board appoints a remuneration committee from its members, tasked with the submission of compensation guidelines, and other terms of employment for the CEO and other members of executive management. The committee shall consist of at least two members, appointed for a term of two years.

GROUP MANAGEMENT

The Company's management group consists of the CEO, the Executive Vice President, the CFO, the Vice President Business Development and Market and the Director of Research. The Company's management group also includes the four heads of unit, the Director of Human Resources and the Director of Communications; the Director of Quality and Environmental Issues is co-opted member.

ORGANIZATION

IVL's operations are organized into four operational units, which are in turn divided into a number of groups with group managers tasked with managing personnel and capacity planning. Other units focus on business development and market and research, which operate laterally across the entire organization.

All units interact in a matrix organization covering six thematic areas: *Climate & Energy, Water & Soil, Air & Transport, Sustainable Building, Sustainable Production* and *Resource-efficient Products & Waste*. At the same time, the thematic areas make up IVL's customer offering and reflect the remit of the "Theme Committees" with external stakeholder representation, established by the owner SIVL.

In 2015, IVL's organization was revised, as of 2016 four focus areas replace the six thematic areas. These focus areas are: *Natural Resources, Climate & Environment, Resource-efficient Recycling & Consumption, Sustainable Production & Environmental Technology and Sustainable Urban Development & Transport*.

IT

IVL works actively with information security issues to ensure that customers can rely on the data provided by the company and that all data is guaranteed adequate protection. IT systems are an indispensable and entirely critical resource in the handling of digital material, data, communication and information. IT systems are used in accordance with current policies and IVL's Code of conduct. IVL restricts access to data and software from unauthorized users via login routines.

Backups are taken on a regular basis to ensure that data can be restored with as little loss as possible. Some critical systems are built so that business can continue to function in the event of damage to the system and in addition support the Company's crisis management.

In 2013, IVL strategic investment in a new laboratory data system. Since then, analytical techniques have been successively phased in, the project is on track and should be completed 2017 as projected.

Environmental and quality management

IVL is engaged in environmental and quality issues within the scope of an integrated management system. The system and its implementation at IVL is ISO-certified for environmental and quality management in accordance with SS-EN ISO 14001 and SS-EN ISO 9001. The certifications are maintained annually and renewed periodically by accredited certification agencies. The major part of operations comprising sampling, field measurements and analyses are accredited and audited regularly by SWEDAC in accordance with SS-EN ISO/IEC 17025:2005.

QUALITY

IVL's work on quality focuses on customer relations and for that reason activities are regularly followed up to ensure that customers are satisfied with the Company's work. This is done in the form of telephone interviews with at least two customers per operational unit. The customers are representative of the business sector, municipalities and government agencies. In 2015, the Customer Satisfaction Index (CSI) ranking was 4.2 (4.6) on a scale of 1 to 5. In addition to several suggested improvements, the internal report on the interviews revealed a positive image of IVL as a professional and important partner and supplier. IVL's long-term focus on project manager training made a positive impression on customers.

Significant events during the year and after year-end

GROWTH AND STRATEGIC RECRUITMENT

To meet the growth target of approximately 10% per year set by The Board, IVL has made a number of strategic hires in 2015. These involved senior and post doctoral individuals with front-line abilities in key development areas such as mobility, digitalization, industrial symbiosis and life cycle analysis.

The regional expansion in southern Sweden has continued in 2015. IVL's Malmö office has been strengthened with several employees, especially in the energy and sustainable building sectors.

NEW VISUAL IDENTITY

Our visual identity has undergone change in 2015. We have introduced a new graphic profile, along with new colours and shapes, as well as a new logo. The new logo is based on the company name and is unequivocally associated with our core values – credibility, inclusiveness and foresight.

VISIBILITY

IVL's strategic focus on visibility in the media and in the public debate has yielded dividends. Over the past four years, our media presence, measured in the number of press clippings, has doubled, from 752 to 1484. This is an advertising value equivalent to approximately SEK37 million – this is what Retriever, the Nordic region's leading supplier of media monitoring, has estimated an equal coverage in paid advertisements would cost.

STRATEGIC PROJECTS

Among major projects IVL managed to secure in 2015 can be named Sheba, a three-year EU-funded research project to evaluate the effects of shipping on the Baltic Sea, and Shift financed by Nordic Energy Research, under the Nordic Council of Ministers. Over a period of four years, Shift, which stands for Sustainable Horizons in Future Transport, will explore the possibilities for creating an energy efficient Nordic transport system. Both projects are led by IVL, and have a budget of approximately 30 million respectively.

LEADERSHIP AND QUALITY

The leadership training programme that was launched in 2013 continued in 2015, but now with a sharper focus on business. During the year, a special initiative was launched with the aim of increasing the volume and quality of consultancy assignment sales.

Anticipated future developments, material risks and uncertainties

LONG-TERM EXPANSION

IVL's long-term goals, adopted by the Board of Directors, include a specific target for expansion. The target set is a doubling of turnover by 2020 and represents annual growth of 10 per cent. This growth is to be achieved both organically and via acquisitions, although without any compromise to the quality of research and consultancy work. Expansion is necessary if IVL is to be able to continue contributing to sustainable development in the business sector, as well as in the international market.

THE MARKET

Europe, and in particular the Nordic region, is IVL's biggest market. Customers are served in a number of industries including the energy, public and industrial sectors, plus the construction and property sectors. As a result, the Company is dependent on stable growth in these areas if it is to achieve its targets and manage the risks arising from economic and structural change, as well as evolving market trends. At the same time, because IVL is active in multiple markets and in sectors and industries susceptible to different business cycles, this lessens the Company's vulnerability to short-term fluctuations.

Systematic and periodic assessments of the IVL's situation relative to external factors create a high degree of readiness to cope with change.

All in all, IVL has therefore been able to face faltering economic growth in Europe without suffering any significant setbacks. Now that the economic situation is slowly beginning to stabilize in several of the crisis-ridden countries of Europe, IVL is in a relatively strong position. It should be noted, however, that many large European research institutions, several of which are IVL partners, been forced to cut back on their activities due to economic constraints.

COMPETITORS

IVL contends with both major international competitors and small local ones in every market. This poses a risk, as there is fierce competition for the most attractive projects and the most highly-skilled employees. Against this background, continuous assessment of these risks is vital.

EMPLOYEES

To attract and retain highly skilled employees, the Company invests in continuous training, as well as and skills and leadership development. IVL can also offer large, complex international projects, which is attractive to prospective employees.

SUSTAINABILITY

IVL operates in a global market, which increases risks related to sustainability factors such as human rights, working conditions, the environment and corruption. These risks are reduced by a transparent and established environmental policy, and environmental work that is followed up under a certified environmental management system and that adheres to a strict code of conduct. A whistleblower function gives every employee the opportunity to report any code of conduct violation without reprisal or retaliation.

FINANCIAL RISK

By the nature of its business IVL is exposed to financial risks, consisting of fluctuations in income and cash flow resulting from changes in exchange and interest rates, and credit risk. However, on the whole, the financial risks to the Company are relatively minor. Nevertheless, currency risks arising from fluctuations in anticipated and contracted payment flows in EU projects total EUR 4,8 (7,3) million. A change of SEK 0.10 in the exchange rate for the SEK will impact income to the extent of SEK 0.7 million, taking project matching into account. The Company continually assesses the need for hedging of payment flows but during 2015 elected not to engage in hedging. During the year, exchange rate gains totalled MSEK 0.2.

The Company's credit risks comprise outstanding, not-yet invoiced consultancy projects. IVL's 30 largest customers, accounting for approximately 75 per cent of turnover, consist exclusively of major international corporations, the European Commission and major international corporations, the European Commission and Swedish and foreign government institutions.

SENSITIVITY ANALYSIS

IMPACT ON	CHANGE, % (ALL ELSE EQUAL)	IMPACT ON INCOME, KSEK 2015	2014	2013
Chargeability ratio	1	3,227	3,130	2,959
Hourly rate	1	2,141	2,076	1,965
Payroll costs	1	1,487	1,399	1,314
Overheads	1	566	540	529
Number of full-year employees	1	870	850	844

Research and Development

RESPECTIVE SHARES OF RESEARCH AND CONSULTANCY WORK

During the year, the shares of fees earned and expenditure incurred in IVL's research and consultancy activities accounted for 53% (55) and 47% (45), respectively.

In this context, "research activities" refers partly to research co-funded by central government and the business sector via SIVL, and partly to activities that are grant-funded via central government research bodies, research foundations, the EU and the equivalent. Co-funded operations accounted for 18% (22) of fees earned and expenditure incurred, while grant-funded operations represented 33% (33) of the total.

IVL's research is an integral part of the Company's operations and an essential factor in IVL's ability to conduct a consultancy business with front-line expertise.

IVL's consultancy activities comprise not only short-term consultancies and analysis projects, but also more substantial research and development projects nationally and internationally.

Consultancy

In addition to consultancy projects for industry, municipalities and other organizations, IVL also conducts major projects on behalf of the Swedish EPA, including responsibility for data compiled within the national and regional environmental monitoring programme in air and precipitation chemistry, air quality in built-up regions and levels of environmental toxins and metals in biological materials. IVL also operates a screening database for environmental toxins and metals.

Current EU projects

During the year, several projects with partial funding from various EU bodies were approved and started, among them Horizon 2020 and Bonus. In addition IVL disposed over outstanding funds from the EU's Seventh Framework Programme for Research. In total, IVL participated in 37 EU-funded research projects in 2015, of which eight were new.

Other current research projects

For four years, IVL has led work with the Mistra Indigo climate policy research programme. The programme, which focused on policy instruments, was completed in 2015 and had a budget of SEK 25 million. Additionally, IVL participated in the Mistra programmes Closing the Loop and Mistra Future Fashion. IVL is also one of the partners in the consortium behind the Mistra Urban Futures programme, which is based in Gothenburg.

Parallel with this, IVL leads a number of research programmes funded by the Swedish Environmental Protection Agency, for example, the *Swedish Clean Air and Climate Research Programme* (SCAC).

In 2015, IVL won approval for six projects under Vinnova's *Challenge-driven Innovation* programme. The Vinnova call for proposals *Innovations for a Sustainable Society* resulted in a research grant of SEK 4.9 million to the MagBeW project. MagBeW – functionalized magnetic microspheres for water – is a cooperation between IVL, Chalmers, Acreo Swedish ICT and SP Technical Research Institute of Sweden.

AFA Insurance funds several IVL research projects targeting safety issues. In 2015 a total of over SEK 8 million was granted to, among others, a project that will help SMEs assess chemical risks.

CO-FUNDED RESEARCH

SIVL is the owner of the Company and acts as principal in IVL's co-funded activities. In 2015 research was conducted in six thematic areas: *Climate & Energy, Air & Transport, Water & Soil, Resource-efficient Products & Waste, Sustainable Building* and *Sustainable Production.*

In 2015, a research review was conducted to enable us to follow emerging developments and needs in the environmental and sustainability fields; this led to the six thematic areas being replaced by four better able to respond to society's sustainability challenges. These are: *Natural Resources, Climate & Environment, Resource-efficient Recycling & Consumption, Sustainable Production & Environmental Technology* and *Sustainable Urban Development & Transport*.

Watchwords for IVL's research are high quality and relevance.

During 2015, a total of SEK 37 (37) million was available to SIVL for co-funded research via government appropriations of SEK 17 (17) million to the EPA and SEK 20 (20) million to Formas. The aggregate volume – SEK 80.4 (86.4) million – for co-funded research is made up of that amount, plus SEK 20.2 (23.5) million from industry and SEK 23.2 (25.9) million from the EU.

Formas supports in-depth scientific research via an extra funding facility (>50 per cent) for scientific publishing. In addition to the finance for co-funded research, SEK 5 million was received in 2015 for core funding of operations.

In 2016, SIVL will have SEK 42 million at its disposal for co-funded research, of which SEK 5 million will be available for core funding.

EXAMPLES OF CO-FUNDED RESEARCH

Examples of co-funded research projects approved and/or commenced in 2015 within the respective thematic areas:

- **Climate & Energy:** *Ranking of Swedish municipalities work on climate adaptation.*
- **Air & Transport:** *Sheba (Sustainable shipping and Environment of the Baltic Sea region).*
- **Air & Transport:** *Guide values for PFAS in soil.*
- **Resource-effective Products & Waste:** *Total product waste.*
- **Sustainable Building:** *Environmental benefits of Lindholm harbour as sustainable district.*
- **Sustainable Production:** *Optimization of process chemicals.*

Foreign Affiliates

IVL's operations in China continue to expand. At year-end 2015, the Beijing office had seven employees.

Collaboration with the Chinese research institute CRAES, one of the most prominent advisors to China's government, continues in the environmental field. IVL and CREAS work together on the measuring of emissions into the air, and in September agreement on a joint laboratory – the Sino-Swedish Air Joint Lab – was reached. Additionally, IVL's employees at the Beijing office, together with IVL's air quality experts, developed and implemented an air protection training programme targeting representatives of the environmental authorities in the city of Tianjin and, an established IVL partner for many years, TAES, the Tianjin Academy of Environmental Sciences.

In 2015, the EU-funded project EGP-Guizhou terminated; the project was designed to facilitate public access to justice in matters of environmental crime. Simultaneously, the EU Refresh project, which aims to cut down on food waste was launched; the project is led from IVL's headquarters and involves several partners in Europe and China.

Environmental Impact

The Company's most significant environmental effects have been identified as advice to customers, travel and energy use. Goals have been set for these effects and they are monitored annually. At project completion IVL carries out a sustainability assessment, which to date has generated a positive index, provided that IVL's advice is followed.

TRAVEL

To encourage travel-free meetings, video conferencing equipment has been installed in all conference rooms on IVL premises. In 2015, the environmental impact of domestic travel by train and plane decreased by 4.2 (6.5)%. Distributed across all employees the environmental load diminished by 4.9 (10.2)%.

Foreign air travel is inevitable in connection with international business activities. Despite this, in 2015 the total environmental impact decreased by 2.9 (12.2)% compared with the previous year. The environmental load, calculated as grams of carbon dioxide per kilometre, has fallen steadily. During the period from 2010 (2009–2014), on average 120 g / km was generated. The air travel index calculated in grams CO_2 per SEK earned in foreign-related activities has simultaneously fallen to 3.8 (4.4).

ENVIRONMENTAL PERMIT

The company's operations are not subject to licensing under the Swedish Environmental Code Act. Nevertheless, IVL has a license to handle asbestos issued by the Swedish Work Environment Authority. Since neither of the two Company laboratories in Stockholm and Gothenburg exceed 5,000 square metres of premises, obligation to notify mandated under environmental impact assessment regulations does not apply.

Personnel

STRUCTURE AND PERSONNEL TURNOVER

The number of employees during the financial year averaged 228 (224), of whom 49 (50)% were men and 51 (50)% were women. The operating units are divided into teams with appointed team managers. Of the total of eight unit managers in 2015, five were women and three men. IVL has 18 team managers, of whom ten are women and eight men.

During the year, 18 (13) permanent employees left the Company to take up other positions. New recruitment totalled 21 (21) employees.

EQUAL OPPORTUNITY AND EQUAL TREATMENT

IVL has an overall policy and plan for equal opportunity and equal treatment. The plan was developed by a representative group. Executives, managers and personnel shall all strive to ensure that IVL's activities and corporate culture are characterized by a diversity perspective and equal treatment, and thus help promote IVL's credibility as an advisor on sustainability issues.

CHARGEABILITY RATIO

During the period, the chargeability ratio was 66.3 per cent (66.3). The chargeability ratio is defined as the proportion of attendance time that is charged to the customer. The remaining – in-house – time is made up of time spent on marketing, training, technical maintenance, management and administration.

ABSENCES AND HOLIDAYS

During the year, total absences including holidays accounted for 22.7 (25.4)% of working hours. Sick leave represented 2.62 (2.61)% and holiday time taken accounted for 7.5 (8.5)%. Leave of absence totalled 10.3 (11.5)%, including 7.0 (9.1)% parental leave. Working hours are defined as the number of hours worked, including holidays and overtime worked, less absence owing to illness, child's illness, holiday, parental leave or other leave of absence and compensatory leave taken. The same calculation method is used for the figures on the average number of salaried full year positions quoted in Note 7, Personnel expenses.

SKILLS DEVELOPMENT

IVL's ambition is to provide its employees with at least two days of skills development per year, and to follow up such activities continuously. In 2015, the average time spent on skills development was two days/employee.

IVL's project department conducts the Company's internal project management programme. In all, the programme provided training for 50 members of personnel on eight occasions in 2015. Practically all work at IVL takes place in project form, and training is designed to further professionalize project management. The project department also conducted training courses in the Company's CRM system for 41 members of personnel, and courses in the MPI planning tool for 97 members of personnel.

During 2015 the project department planned and conducted sales training for 19 members of personnel.

IVL's leadership programme, which was launched in 2013, continued in the form of development and coaching of IVL's management group, teams and managers. This programme, which involves all managers, builds on IVL's critical success factors for leadership.

ATTRACTIVE WORKPLACE

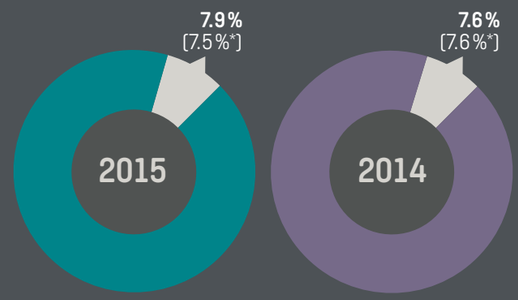
In 2015, the biannual employee survey was conducted. A smaller employee survey takes place in the year in between these. This year the employee survey showed improved results that reflect a commitment to the workplace and work-tasks across the board. The groups work internally to follow up on these results and to use them as springboards for activities to maintain or improve the workplace. At the organizational level, we work with the results of the employee survey in the work environment committee using the work environment plan. Additionally, at the end of 2015, we launched a coaching project where six senior employees were trained to act as coaches, and subsequently entered into a mentoring relationship with a number of employees. The aim here is to exploit and increase an exchange of expertise and experience in order to leverage the progress of individual projects, and also to provide support and encourage development when facing challenging work-tasks.

WORK ENVIRONMENT

IVL's systematic focus on the work environment is conducted via delegated responsibilities and annual work environment plans approved by the Company's management group. The work environment plan is based on safety inspections carried out twice yearly at the company's facilities. Ergonomic safety inspections are also conducted annually in the presence of an ergonomist from the Company health service. The Company's work environment committees, one for Gothenburg and Lysekil and one for Stockholm and Malmö, meet quarterly.

OTHER PERSONNEL PER 31 DECEMBER

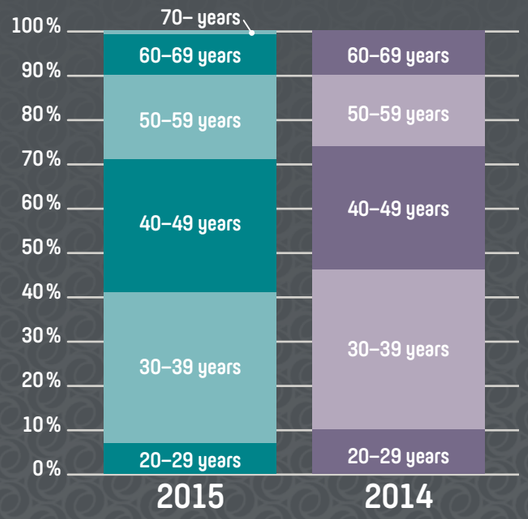
Employee turnover



Percentage of employees who quit in relation to average number employed during the year.

* Pension excluded

Distribution by age

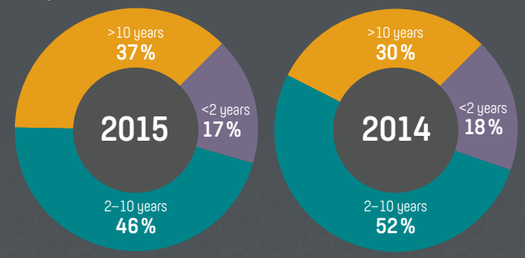


Average 43.5 (42) years

Key figures per employee

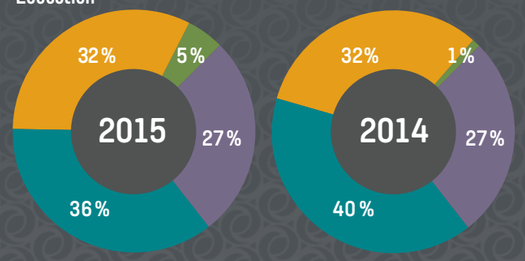
kSEK	2015	2014
Turnover excl. expenses	1,098	1,010
Payroll costs	652	625
Profit after financial items	31	53

Length of service



Length of service, year

Education



- Ph.D.
- MSc
- Other academic education
- Secondary school or post-secondary school education

Proposed Appropriation of Profit

AVAILABLE FOR DISTRIBUTION BY THE ANNUAL GENERAL MEETING (SEK):	
Retained earnings	45,538,198
Net profit for the year	3,067,431
Total	**48,605,629**

THE BOARD OF DIRECTORS AND THE CHIEF EXECUTIVE OFFICER PROPOSE THAT THE PROFIT BE DISTRIBUTED THUS.

To be carried forward	48,605,629
Total	**48,605,629**

For more information on the Company's and the Group's results for the financial year and its financial position on 31 December 2015, see the following: Income Statements, Balance Sheets, Statements of Cash Flows and Notes to the Financial Statements.

Income Statements

		GROUP		PARENT COMPANY	
kSEK		2015	2014	2015	2014
OPERATING INCOME					
Net turnover	Note 3	274,232	264,488	272,812	263,272
Change in work in progress	Note 4	-22,073	-22,794	-19,856	-23,095
Other operating income		155	214	150	214
		252,314	**241,908**	**253,106**	**240,391**
OPERATING EXPENSES					
Project expenses		-37,857	-33,207	-37,857	-33,207
Other external expenses	Note 6	-50,300	-49,284	-49,924	-48,863
Personnel costs	Note 7	-154,839	-144,402	-154,224	-143,878
Depreciation of intangible and non-current assets	Note 8	-4,349	-4,130	-4,334	-4,118
		-247,345	**-231,023**	**-246,339**	**-230,066**
OPERATING PROFIT/LOSS		**4,969**	**10,885**	**6,767**	**10,325**
NET FINANCIAL ITEMS					
Interest income	Note 9	517	1,793	500	1,773
Interest expense	Note 9	-94	-135	-94	-126
PROFIT/LOSS AFTER FINANCIAL ITEMS		**5,392**	**12,543**	**7,173**	**11,972**
Appropriations	Note 10			-2,926	-3,186
Income taxes on profit for year	Note 11	**-1 375**	**-3,336**	**-1,180**	**-2,486**
Net profit/loss for year		**4,017**	**9,207**	**3,067**	**6,290**

Balance Sheets

kSEK		GROUP 2015	2014
ASSETS			
NON-CURRENT ASSETS			
Intangible non-current assets	Note 12		
Capitalized software development costs		6,353	4,712
Goodwill		116	149
Tangible non-current assets	Note 13		
Machinery and equipment		23,415	18,084
Financial non-current assets	Note 14		
Other long term securities		5	5
Total non-current assets		**29,889**	**22,950**
CURRENT ASSETS			
Current receivables			
Accounts receivable		50,618	52,370
Receivables from Group companies		10,722	9,086
Income taxes recoverable		3,632	2,439
Other receivables		749	951
Income earned but not invoiced	Note 5	5,142	4,972
Prepaid expenses	Note 15	6,055	5,490
Total current receivables		**76,918**	**75,308**
Short term investments	Note 22	**26,968**	**26,492**
Cash and bank balances		**63,019**	**48,004**
Total current assets		**166,905**	**149,804**
TOTAL ASSETS		**196,794**	**172,754**
EQUITY AND LIABILITIES			
Equity	Note 16		
Share capital (7 000 shares)		7,000	7,000
Other equity, including net profit for the year		76,900	72,865
TOTAL EQUITY		**83,900**	**79,865**
Provisions	Note 18	7,306	7,143
Long term liabilities			
Liabilities to credit institutions	Note 20	2,487	1,765
Current liabilities			
Liabilities to credit institutions	Note 20	1,655	2,176
Work in progress on behalf of others	Note 4	61,371	38,200
Accounts payable		15,482	16,810
Other liabilities		9,379	11,155
Income invoiced but not earned	Note 5	3,338	3,017
Accrued expenses	Note 19	11,876	12,623
Total current liabilities		**103,101**	**83,981**
TOTAL EQUITY AND LIABILITIES		**196,794**	**172,754**
MEMORANDUM ITEMS			
Pledged assets and contingent liabilities	Note 21	5,000	5,000

Balance Sheets

kSEK		PARENT COMPANY 2015	2014
ASSETS			
NON-CURRENT ASSETS			
Intangible non-current assets	Note 12		
Capitalized software development costs		5,485	4,232
Goodwill		116	149
Tangible non-current assets	Note 13		
Machinery and equipment		19,209	14,094
Financial non-current assets			
Group companies	Note 14	1,237	1,230
Other long term securities	Note 14	5	5
Total non-current assets		**26,502**	**19,710**
CURRENT ASSETS			
Current receivables			
Accounts receivable		48,816	51,065
Receivables from Group companies		12,610	11,194
Income taxes recoverable		3,700	2,513
Other receivables		56	166
Income earned but not invoiced	Note 5	5,142	4,972
Prepaid expenses	Note 15	6,055	5,483
Total current receivables		**76,379**	**75,393**
Short-term investments	Note 22	**26,968**	**26,492**
Cash and bank balances		**61,481**	**45,475**
Total current assets		**164,828**	**147,360**
TOTAL ASSETS		**190,880**	**167,070**
EQUITY AND LIABILITIES			
Equity	Note 17		
Restricted equity			
Share capital (7 000 shares)		7,000	7,000
Statutory reserve		1,400	1,400
Total restricted equity		**8,400**	**8,400**
Unrestricted equity			
Retained earnings		45,539	39,240
Net profit for the year		3,067	6,299
Total unrestricted equity		**48,606**	**45,539**
Total equity		**57,006**	**53,939**
Untaxed reserves	Note 10	**15,292**	**12,366**
Current liabilities			
Work in progress on behalf of others	Note 4	78,852	58,028
Accounts payable		15,304	16,387
Other liabilities		9,370	11,142
Income earned but not invoiced	Note 5	3,338	3,017
Accrued expenses	Note 19	11,718	12,191
Total current liabilities		**118,581**	**100,765**
TOTAL EQUITY AND LIABILITIES		**190,880**	**167,070**
MEMORANDUM ITEMS			
Pledged assets and contingent liabilities	Note 21	5,000	5,000

Statement of CashFlows

kSEK, (DIRECT METHOD)	GROUP 2015	GROUP 2014	PARENT COMPANY 2015	PARENT COMPANY 2014
OPERATING ACTIVITIES				
Profit/loss after financial items	5,392	12,543	7,173	11,972
Adjustment for non-cash items	3,202	4,190	3,288	3,063
Income taxes paid	-2,568	-2,425	-2,367	-1,897
Cash flow from operating activities before changes in working capital	**6,026**	**14,308**	**8,094**	**13,138**
CASH FLOW FROM OPERATING ACTIVITIES BEFORE CHANGES IN WORKING CAPITAL				
Increase/decrease in receivables	148	-9,624	773	-9,626
Decrease/increase in accounts payable	-1,328	-115	-1,083	-500
Increase/decrease in other liabilities	-1,976	1,742	-1,451	1,933
Decrease/increase in advance payments for work in progress	23,171	-22,324	20,824	22,023
Cash flow from operating activities	**26,041**	**-16,013**	**27,157**	**-17,078**
INVESTING ACTIVITIES				
Acquisition of intangible non-current assets	-1,641	-1,786	-1,253	-1,306
Acquisition of tangible non-current assets	-9,644	-5,293	-9,416	-4,846
Acquisition of financial non-current assets		5	-7	-584
Acquisition of short-term investments	-473	-1,485	-473	-1,485
Cash flow from investing activities	**-11,758**	**-8,559**	**-11,149**	**-8,221**
FINANCING ACTIVITIES				
Cash flow from financing activities	**722**	**639**		-
Cash flow for the year	**15,005**	**-23,933**	**16,008**	**-25,299**
Opening cash and bank balances	**48,004**	**71,805**	**45,475**	**70,775**
Exchange rate differences in cash and cash equivalents	**10**	**132**	**-2**	**-1**
Cash in hand and on deposit at year end	**63,019**	**48,004**	**61,481**	**45,475**

Notes

to the financial statements and accounting principles

NOTE 1 ACCOUNTING PRINCIPLES

1.1 Compliance with standards and legislation

The consolidated accounts have been prepared in accordance with BFNAR 2012:1 *Annual Report and Consolidated Accounts (K3)*. The Company opted for voluntary application of K3 for 2013 in order to facilitate the regulatory transition to K3 in 2014. In cases where guidance is not available from the K3 regulation, it has been obtained from the Swedish Annual Accounts Act (1995:1554).

The Parent Company applies the same accounting policies as the Group, other than is indicated below in the section "Parent Company's accounting policies". Divergences between the Parent Company's and the Group's policies arise from limitations in the applicability of K3 to the Parent Company through the requirements of the Annual Accounts Act and, in some cases, tax considerations.

1.2 Basis of preparation of the financial statements of the Parent Company and the Group

The Parent Company's functional currency is the Swedish krona (SEK), which is also the reporting currency for the Parent Company and the Group. The financial statements are therefore presented in SEK. Assets and liabilities are recognized at historical cost, with the exception of certain financial assets and liabilities that are measured at fair value.

The preparation of financial statements under K3 requires the Company management to make judgements, estimates and assumptions that affect application of the accounting principles and the amounts reported for assets, liabilities, income and expenses. The estimates and assumptions are based on historical experience and a number of other factors that in the prevailing circumstances are judged to be reasonable. The results of these estimates and assumptions are then used to assess the carrying amounts for assets and liabilities that are not otherwise revealed clearly from other sources. The actual outcome may differ from these estimates and judgements. Typically, these estimates and assumptions are made during preparation of the year-end and mid-year accounts. As a result of changes at the Company or in its business environment, it may become necessary to revise these estimates and assumptions.

1.3 Changes in accounting principles and disclosure requirements

In 2015, no new accounting policies with any impact on the Group entered into force. The regulations state that the K3 regime was to be implemented as of the 2014 financial year. From 2014, short-term investments are accounted for separately from cash and cash equivalents and the figures for the comparison year have been amended accordingly. Short-term investments are measured at fair value on the balance sheet date.

1.4 Classification etc.

Non-current assets and financial liabilities of the Parent Company and the Group consist essentially only of amounts expected to be recovered or paid after more than twelve months from the balance sheet date. Current assets and current liabilities of the Parent Company and the Group consist essentially only of amounts expected to be recovered or paid within twelve months from the balance sheet date.

1.5 Principles of consolidation

Subsidiaries are entities over which IVL exercises a controlling influence. A controlling influence consists of a right, directly or indirectly, to control the financial and operational strategies of another company in order to gain economic benefits. In establishing whether a controlling influence exists, account shall be taken of shares with potential voting rights that may be used or converted without delay.

Subsidiaries are accounted for using the proportional method. Under this method, as large a proportion as possible of the owned company's income and expenses, and of its assets and liabilities, are recognized in the consolidated financial statements. The reason for choosing this principle of consolidation is that IVL was involved in the original establishment of Group companies and did not acquire them at a surplus or deficit value. Intra-Group receivables and liabilities, income and expenses and unrealized gains or losses arising from transactions between Group companies are eliminated in their entirety during preparation of the consolidated financial statements.

1.6 Foreign currency

Foreign currency transactions are translated to the functional currency at the exchange rate prevailing on the transaction date. Monetary assets and liabilities in foreign currencies are translated to the functional currency at the exchange rate prevailing on the balance sheet date.

Exchange rate differences arising on translation are recognized in the income statement. Non-monetary assets and liabilities recognized at historical cost are translated at the exchange rate on the transaction date. Non-monetary assets and liabilities recognized at fair value are translated to the functional currency at the rate prevailing at the time of measurement at fair value; any exchange rate difference is then recognized in the same way as for other changes in value for the asset or liability. The functional currency is the currency of the countries in which the companies included in the Group conduct their operations. The functional and reporting currency of the Parent Company is the Swedish krona. The reporting currency of the Group is the Swedish krona. Assets and liabilities of foreign operations are translated to Swedish kronor at the exchange rate prevailing on the balance sheet date. Income and expenses in foreign operations are translated to Swedish kronor at an average rate that is an approximation of the rates at the times of the respective transactions. Any translation differences arising during translation of foreign net investments are recognized in other comprehensive income.

1.7 Income

The percentage of completion method is used for all projects where the outcome can be calculated reliably. Projects are conducted on an open account basis, in which income is recognized as the work is performed and normally invoiced to the customer the following month. In cases where a fixed price is agreed, the income is recognized in the income statement, based on the percentage of completion on the balance sheet date. The percentage of completion for a project is determined by comparing expense incurred on the balance sheet date with the estimated total expense. If it is probable that the total expense for the project will exceed the total income from the project, the anticipated loss is immediately recognized in its entirety as a cost. Income is not recognized if it appears probable that the economic benefits will not accrue to the Group. If major uncertainty is attached to a payment or associated costs, no income is recognized.

In grant-funded projects in which IVL functions as a contractual partner with the research funder and allocates project funding to other participant in the projects, such funds are not recognized as income but accounted for directly under the heading of work in progress on behalf of others. As a result, the invoicing and costs of expenses are deducted from the funds received, which are then paid out to other project partners.

1.8 Operating expenses and financial income and expense

The Parent Company's costs under operating leases are recognized in the income statement on a straight-line basis over the term of the lease. Benefits obtained in connection with the signing of a lease are recognized in the income statement as part of the total leasing cost. Variable charges are recognized as expense in the periods in which they are incurred.

Minimum lease fees under finance leases in the Group are allocated between interest expense and amortization of the outstanding liability. Interest expense is distributed over the term of the lease so that each accounting period is charged with an amount corresponding to a fixed interest rate for the liability recognized in each period. Variable fees are recognized as expense in the periods they are incurred.

Financial income and expense consist of interest income from bank deposits and receivables and interest expense to suppliers.

1.9 Receivables and liabilities

Accounts receivable are recognized in the amounts expected to be received, that is, after deduction of bad debts, which are assessed on a case-by-case basis. Impairments of accounts receivable are recognized under the heading of operating expenses. Other receivables are classified as long-term receivables if outstanding for more than a year and as other receivables if the period is less than that. Cash and cash equivalents consist of cash and demand deposit accounts with banks and similar institutions.

Loans and other financial liabilities, including accounts payable, are measured at accumulated acquisition cost. Accounts payable have a short expected term and are measured undiscounted at the nominal amount. Long-term liabilities have an expected term of more than a year, while current liabilities have a term of less than a year.

1.10 Tangible non-current assets

1.10.1 OWNED ASSETS

Tangible non-current assets are recognized as assets on the balance sheet if it is probable that future economic benefits will accrue to the Company and that the acquisition cost for the asset may be calculated reliably. Tangible non-current assets are recognized in the Group at acquisition cost after deduction of accumulated depreciation and any impairment losses. Acquisition cost includes the purchase price and costs direct attributable to bringing the asset on to site and into a condition such that it is fit for use in accordance with the intention of the acquisition.

The carrying amount for a property, plant and equipment item is removed from the balance sheet upon scrapping or disposal or when no future economic benefits are expected from the use or the scrapping or disposal of the asset. Any gain or loss arising from disposal or scrapping of an asset is determined as the difference between the selling price and the carrying amount of the asset, less direct costs of sale. Any gain or loss arising is recognized as operating income/expense.

1.10.2 LEASED ASSETS

In the consolidated financial statements, leases are classified as either finance or operating leases. A finance lease exists when the economic risks and benefits associated with ownership are substantially transferred to the lessee; where this is not the case, the lease is an operating lease. Assets leased under finance leases are recognized as assets on the consolidated balance sheet. The obligation to pay future lease fees is recognized under non-current and current liabilities. The leased assets are depreciated according to plan, while the lease fees are recognized as interest and amortization of the liabilities. Under operating leases, the lease fee is recognized as an expense on a straight-line basis over the term of the lease.

1.11 Intangible assets

1.11.1 GOODWILL

Goodwill is defined as the difference between the acquisition cost of operating acquisitions and the fair value of assets acquired, liabilities assumed and contingent liabilities.

Goodwill is allocated to cash-generating units and groups of cash-generating units and is tested annually for impairments. Goodwill is thus measured as acquisition cost less any accumulated impairments.

1.11.2 CAPITALIZED SOFTWARE DEVELOPMENT COSTS

Other intangible assets acquired by the Group are recognized at acquisition cost, less accumulated amortization. Subsequent expenditure on capitalized intangible assets is recognized on the balance sheet only when this results in an increase in future economic benefits associated with the specific asset to which it relates. All other expenses are recognized as costs as incurred.

1.12 Impairment of assets and testing for impairments

The carrying amounts for the Group's assets are tested for impairment on every balance sheet date to determine whether there is any indication of impairment. If any such indication is found, the recovery value for the asset is calculated. Any impairment loss is charged to the income statement.

The recoverable amount is the fair value, less costs of sale, and value in use, whichever is the higher. In calculating the value in use, future cash flows are discounted by a discount factor that takes into account the risk-free interest rate and the risk associated with the specific asset. The recoverable value of goodwill and other non-current assets with indeterminable useful lives and intangible assets not yet ready for use is calculated annually.

At each reporting date, the Company assesses whether any objective evidence exists to indicate impairment of any financial assets or group of assets. Objective evidence includes partly observable events that have occurred and that adversely affect the possibility of recovering the acquisition cost, and partly a significant or prolonged decline in the fair value of an investment in a financial investment classified as a financial asset available for sale.

1.13 Employee benefits

Obligations relating to defined-contribution pension plans are recognized as an expense in the income statement as they arise. IVL does not operate any defined-benefit pension plans.

Provisions in connection with terminations of employment are recognized only if the Company is demonstrably obligated to terminate employment before the normal date, or when compensation is offered as an incentive to voluntary departure. In the event that the Company is obligated to terminate employment, actions shall include a detailed plan stating, at least, details of workplace, positions affected and the approximate number of employees, together with compensation amounts for each personnel category or position and the time for implementation of the plan.

1.14 Provisions

Provisions are recognized in the balance sheet when the Group has an existing obligation (legal or constructive) arising from an event that has occurred and when it is probable that an outflow of financial resources will be required in order to discharge such an obligation, and when the amount can be estimated reliably.

1.15 Income taxes

Income taxes consist of current and deferred tax. Income taxes are recognized in the income statement.

Current tax is tax that is to be paid or recovered for the current year, based on the tax rates enacted or in substantively enacted on the balance sheet date, including adjustment of current tax attributable to earlier periods. Deferred tax is calculated using the balance sheet method, which focuses on temporary differences between the carrying amount of an asset or a liability and its taxable amount. Measurement of deferred tax is based on how the underlying assets or liabilities are expected to be capitalized or settled.

Deferred tax is based on the tax rates enacted or in practice substantively enacted on the balance sheet date.

1.16 Parent Company's accounting policies

The Parent Company's accounts have been prepared in accordance with BFNAR 2012:1 Annual Report and Consolidated Accounts (K3) and the Swedish Annual Accounts Act (1995:1554).

DIFFERENCES BETWEEN THE ACCOUNTING POLICIES OF THE GROUP AND THE PARENT COMPANY:

In the Parent Company, participations in subsidiaries and associated companies are recognized using the cost method. Dividends received are recognized as income. In the Parent Company, all leases are accounted for in accordance with the rules on operating leases. In the Parent Company, untaxed reserves are recognized including deferred tax liability. In the consolidated financial statements, on the other hand, untaxed reserves are divided into income tax liability and equity.

NOTE 2 SUMMARY OF FINANCIAL POSITION AND KEY RATIOS

	GROUP					PARENT COMPANY				
kSEK	2015	2014	2013	2012	2011	2015	2014	2013	2012	2011
TURNOVER AND PROFIT/LOSS										
Net turnover	274,232	264,488	255,353	247,827	239,924	272,812	263,272	254,200	247,139	239,014
Operating profit/loss after depreciation	4,969	10,885	9,709	7,529	11,308	6,767	10,325	10,555	7,874	5,527
Operating profit/loss after financial items	5,392	12,543	10,381	7,692	12,053	7,173	11,972	11,205	8,009	6,270
Profit margin, %	2.0	4.7	4.1	3.1	5.0	2.6	4,5	4.4	3.2	2.6
CAPITAL STRUCTURE										
Non-current assets	29,889	22,950	19,999	13,803	12,564	26,052	19,709	17,092	14,420	13,182
Current assets	66,905	149,804	162,360	137,396	128,116	164,828	147,360	160,992	136,322	127,074
Equity	83,900	79,865	70,519	61,171	55,889	57,006	53,939	47,640	40,962	36,696
Untaxed reserves						15,293	12,366	9,180	6,444	4,717
Current liabilities	103,101	83,981	104,369	82,883	78,000	118,581	100,765	121,264	103,336	98,843
Long-term liabilities	2,487	1,765	1,126							
Provisions	7,306	7,143	6,355	7,145	6,791					
Total assets	196,794	172,754	182,359	155,199	140,680	190,880	167,070	178,084	150,744	140,256
Adjusted equity						68,935	63,584	54,800	45,711	40,172
Equity, mean value for year	81,883	75,192	65,845	58,530	50,708	66,260	59,192	50,226	42,292	37,127
Total capital, mean value for year	184,774	177,557	168,779	147,940	133,121	178,975	172,577	164,414	145,500	132,670
Equity ratio, %	42.6	46.2	38.7	39.4	39.7	36.1	38.1	30.8	30.3	28.6
Current ratio, mult.	1.62	1,78	1.56	1.66	1.64	1.39	1.46	1.33	1.32	1.29
PROFITABILITY										
Return on adjusted equity, %	5.1	13.0	12.3	9.7	17.5	8.4	15.8	17.4	13.7	12.4
Return on adjusted equity 5 year mean, %	11.5	9.5	8.5	8.1	7.0	13.6	11.1	8.6	7.8	6.0
Return on total capital, %	2.9	7.1	5.7	5.5	9.1	4.1	7.0	6.9	6.0	4.8
OTHER										
Investment in non-current assets	11,285	7,074	10,789	6,215	3,145	10,676	6,736	7,264	6,208	3,145
Invoicing/employee, incl. expenses	1,188	1,157	1,77	1,239	1,290	1,197	1,175	1,182	1,242	1,299
Invoicing/employee, fees and analysis	1,090	998	992	1,049	1,097	1,098	1,010	1,002	1,051	1,104
Chargeability ratio, %	66.3	66.3	66.4	66.2	67.0	66.3	66.3	66.4	66.2	68.0
Full-year employees	232	228	217	198	186	228	224	215	197	184
Payroll cost per employee	607	616	606	614	608	652	625	611	617	614

PROFIT MARGIN

Profit/loss after net financial items, as % of net turnover.

RETURN ON TOTAL CAPITAL

Profit after net financial items with interest expenses added back, as % of average balance sheet total.

ADJUSTED EQUITY

Equity plus untaxed reserves, less tax at standard rate of 22%.

CHARGEABILITY RATE

Hours charged to customer, as % of total hours of attendance.

EQUITY RATIO

Adjusted equity, as % of balance sheet total.

FULL-TIME EMPLOYEES

The number of employees during the year, expressed as full-year positions. The actual number of employees is higher, partly because the organization has part-time employees and partly because certain employees work during part of the year.

RETURN ON EQUITY

Profit after net financial items and after tax at a standard 22%, as % of total adjusted equity.

CURRENT RATIO

Current liabilities divided by current liabilities.

NOTE 3 NET TURNOVER

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
Net turnover by				
Invoiced fees and analysis	251,173	227,550	250,311	226,334
Invoiced expenses	22,500	36,938	22,500	36,938
Total net turnover	**274,232**	**264,488**	**272,811**	**263,272**

Of net turnover for the year, invoicing to other Group companies – comprising remuneration for co-funded research that the Company has conducted on a contract basis – accounted for 26.4 (24.4)%. In addition, compensation was received from Group companies for personnel services performed.

NOTE 4 CHANGE IN WORK IN PROGRESS/WORK IN PROGRESS ON BEHALF OF OTHERS

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
Project costs	477,165	496,305	459,554	476.477
Advance invoicing	-538,536	-534,505	-538,406	-534,505
Change recognized in				
Income Statement	22,073	22,794	19,856	23,095
Balance Sheet	1,098	-470	968	-1,072
Total change for year	23,171	22,324	20,824	22,023
Total net turnover	**274,232**	**264,488**	**272,811**	**263,272**

NOTE 5 INCOME EARNED BUT NOT INVOICED/ INCOME INVOICED BUT NOT EARNED

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
Income earned but not invoiced				
Project costs	45,193	37,832	45,193	37,832
Advance invoicing	-40,001	-32,860	-40,001	-32,860
Book value	**5,142**	**4,972**	**5,142**	**4,972**
Income invoiced but not earned				
Project costs	28,612	23,454	28,612	23,454
Advance invoicing	-31,950	-26,470	-31,950	-26,471
Book value	**3,338**	**3,017**	**3,338**	**3,017**

NOTE 6 OTHER EXTERNAL EXPENSES

Auditor's fees

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
R3 Revisionbyrå KB				
Audit assignment	278	225	250	225
Other auditing services	39		39	-
Rödl & Partner Nordic AB				
Audit assignment		22	-	22
Other auditing services		100	-	100
Other services	168	405	-	405
Other auditors				
Audit assignment	13	8	5	-
Total	**498**	**760**	**294**	**752**

Lease costs

Lease fees for operating leases during 2015 totalled SEK 15,140 (15,275) thousand. Lease fees include charges for leases on properties, company cars used by the Company's personnel, computers and some office equipment. The costs relating to future lease payments on these contracts are payable in the following years:

kSEK	2016	2017	2018	2019	2020
Lease costs	1,655	836	1,109		
Office rent	13,591	13,795	14,002	14,212	14,425
Total	**15,246**	**14,631**	**15,111**	**14,212**	**14,425**

NOTE 7 PERSONNEL EXPENSES

GROUP

kSEK	2015 SALARIES AND OTHER REMUNERATIONS	2015 SOCIAL COSTS AND PENSIONS	2014 SALARIES AND OTHER REMUNERATIONS	2014 SOCIAL COSTS AND PENSIONS
Board and CEO	2,468	1,469 (560)	2,403	1,824 (863)
Other employees	98,628	47,081 (13,400)	92,592	43,930 (12,260)
Total	**101,096**	**48 550 (13,960)**	**94,994**	**45,755 (13,123)**

AVERAGE NUMBER OF EMPLOYEES* IN THE GROUP DURING THE YEAR:

	2015 MEN	2015 WOMEN	2015 TOTAL	2014 MEN	2014 WOMEN	2014 TOTAL
Stockholm	66	55	121	72	56	128
Göteborg	40	53	93	35	51	86
Lysekil	0	2	2	1	2	3
Malmö	1	3	4	-	1	1
Beijing	4	5	9	3	4	7
Tianjin	2	1	3	2	1	3
Total	**113**	**119**	**232**	**113**	**115**	**228**

** Defined as number of salaried full-year employees.*

PARENT COMPANY

kSEK	2015 SALARIES AND OTHER REMUNERATIONS	2015 SOCIAL COSTS AND PENSIONS	2014 SALARIES AND OTHER REMUNERATIONS	2014 SOCIAL COSTS AND PENSIONS
Board and CEO	2,389	1,445 (560)	2,336	1,804 (863)
Other employees	98,275	47,037 (13,400)	92,328	43,893 (12,260)
Total	**100,664**	**48,482 (13,960)**	**94,664**	**45,697 (13,123)**

AVERAGE NUMBER OF EMPLOYEES* IN THE PARENT COMPANY DURING THE YEAR:

	2015 MEN	2015 WOMEN	2015 TOTAL	2014 MEN	2014 WOMEN	2014 TOTAL
Stockholm	66	55	121	72	56	128
Göteborg	40	53	93	35	51	86
Lysekil	0	2	2	1	2	3
Malmö	1	3	4	-	1	1
Beijing	4	4	8	3	3	6
Total	**111**	**117**	**228**	**111**	**113**	**228**

** Defined as number of salaried full-year employees.*

A NUMBER OF EMPLOYEES IN COMPANY'S MANAGEMENT GROUP (OF WHOM, IN EXECUTIVE MANAGEMENT):

	2015	2014
Men	4 (4)	5 (4)
Women	8 (1)	7 (0)

BOARD MEMBERS

	2015	2014
Men	5	5
Women	5	5

Senior executives

PARENT COMPANY

In accordance with a decision by the AGM, Board of Directors' fees totalling SEK 515 (593) thousand, including social security expenses, were recognized as costs. Of this amount, SEK 94 (88) thousand, excluding social security expenses, was paid to the Chair.

The period of notice for CEO of the Parent Company is 12 months and severance pay in an amount corresponding to 12 times the CEO's fixed monthly salary is due if employment is terminated by the Company. Should the CEO's role or areas of responsibility be altered as a result of material changes in the Company's operations or as a result of any change in the ownership structure affecting the majority of shares in issue, the CEO is entitled to terminate his/her employment by giving 6 months' notice and is entitled to receive severance pay corresponding to 18 times his/her fixed monthly salary. The CEO is entitled to retire from the age of 62 years. The CEO's pension is of the defined-contribution type and an annual allocation is made in amount corresponding to 35 per cent of the salary for the particular year, including company car benefit. At retirement on attainment of the age of 62 years, retirement pension premium payments will be paid as if the CEO had worked until attaining the age of 65 years.

GROUP

The CEO of the joint venture company has an employment relationship of 1 year from 1 June 2015. There is no entitlement to any pension other than statutory pension.

NOTE 8 DEPRECIATION OF INTANGIBLE AND NON-CURRENT ASSETS

Group and Parent Company

Capitalized expenditure for software development is depreciated according to plan annually at a rate of 20 per cent of acquisition cost, from the date of completion during the year. Business goodwill is depreciated at 20 per cent of acquisition cost. Any impairment is assessed on the basis of the present value of future surpluses.

Machinery and equipment is depreciated according to plan at an annual rate of 10 to 20 per cent of acquisition cost, from the date of acquisition by the Parent Company during the year.

Machinery and equipment is also depreciated according to plan on the basis of the remaining economic life of the asset, in accordance with a measurement conducted specifically for an international joint venture.

NOTE 9 INTEREST INCOME AND EXPENSES

Group and Parent Company

The Group recognizes bank interest income of SEK 504 (739) thousand, and the Parent Company SEK 492 (1,762) thousand, while interest expense for the Parent Company includes SEK 32 (81) thousand pertains to Group companies.

NOTE 10 APPROPRIATIONS AND UNTAXED RESERVES

kSEK	PARENT COMPANY 2015	PARENT COMPANY 2014
Opening balance, untaxed reserves	**12,366**	**9,180**
Change in acc. depreciation acc. to plan (machinery & equipment)	1,493	232
Changes in tax allocation reserve	1,433	2,954
Total appropriations	**2,926**	**3,186**
Closing balance, untaxed reserves	**15,292**	**12,366**

NOTE 11 INCOME TAXES ON PROFIT FOR YEAR

ESTIMATE OF EFFECTIVE TAX RATE, kSEK	GROUP 2015	GROUP 2014	PARENT COMPANY 2015	PARENT COMPANY 2014
Profit/loss before tax	**5,392**	**12,543**	**4,247**	**8,784**
Tax at current tax rate 22 %	969	2,001	935	1,932
Non-taxable income	-77	-2	-77	-2
Non-deductible expenses	153	436	153	436
Tax from previous year(s)	17	4	17	4
Current tax cost, foreign operations	152	116	152	116
Deferred tax	161	781	-	-
Recognized effective tax	**1,375**	**3,336**	**1,180**	**2,486**
Recognized effective tax rate	**25,5 %**	**26,6 %**	**27,8 %**	**28,3 %**

NOTE 12 INTANGIBLE NON-CURRENT ASSETS

Group

	DEVELOPMENT EXPENDITURE 2015	DEVELOPMENT EXPENDITURE 2014	GOODWILL 2015	GOODWILL 2014
Opening balance, accumulated acquisition value	**5,989**	**4,369**	**1,966**	**1,800**
Acquisitions during the year	1,641	1,620	-	166
Closing balance, accumulated acquisition costs	**7,630**	**5,989**	**1,966**	**1,966**
Opening balance, amortization	-1,277	-1,277	-1,817	-1,800
	-	-	-33	-17
Depreciation for the year	-1,277	-1,277	-1,850	-1,817
Closing balance, planned residual value	**6,353**	**4,712**	**116**	**149**

Parent Company

	DEVELOPMENT EXPENDITURE 2015	DEVELOPMENT EXPENDITURE 2014	GOODWILL 2015	GOODWILL 2014
Opening balance, acquisition value	**5,509**	**4,369**	**1,966**	**1,800**
Acquisitions during the year	1,253	1,140	-	166
Closing balance, accumulated acquisition costs	**6,762**	**5,509**	**1,966**	**1,966**
Opening balance, amortization	-1,277	-1,277	-1,817	-1,800
Depreciation for the year	-	-	-33	-17
Closing balance, accumulated depreciation	-1,277	-1,277	-1,850	-1,817
Closing balance, planned residual value	**5,485**	**4,232**	**116**	**149**

NOTE 13 TANGIBLE NON-CURRENT ASSETS

kSEK	GROUP 2015	GROUP 2014	PARENT COMPANY 2015	PARENT COMPANY 2014
Opening balance, acquisition value	**104,864**	**99,532**	**100,661**	**95,815**
Purchases for the year, finance leases	9,644	5,293	9,416	4,846
Exchange difference	9	39	-	-
Retirements for the year	-38,720		-38,720	-
Closing balance, accumulated acquisition value	**75,797**	**104,864**	**71,357**	**100,661**
Opening balance, depreciation	**-86 780**	**-82,635**	**-86,568**	**-82,466**
Exchange difference	-8	-32		-
Disposal equipment for the year	38,720		38,720	-
Depreciation for the year	**-4,314**	**-4,113**	**-4,301**	**-4,101**
Closing balance, accumulated depreciation for equipment	**-52,382**	**-86,780**	**-52,148**	**-86,568**
Closing balance, planned residual value	**23,415**	**18,084**	**19,209**	**14,094**

Financial leases

In the Group, equipment held under finance leases is recognized in a carrying amount of SEK 4,142 (3,941) thousand. The headings of current and non-current liabilities in the Group's balance sheet includes future payments in connection with lease commitments recognized as costs. See also Note 20, "Liabilities to credit institutions".

NOTE 14 GROUP COMPANIES AND OTHER LONG-TERM SECURITIES

Shares and participations

	GROUP			PARENT COMPANY	
COMPANY	NUMBER	SHARE	BOOK VALUE	QUOTIENT VALUE	BOOK VALUE
Share in IVL Swedish Environmental Research Institute AB, Personnel Foundation	1		5	5	5
Basta Online AB	600	60 %	-	60	60
EPD International AB	500	100 %	-	50	50
Sino-Swedish (Tianjin) Environmental Technology Development Co., Ltd	1	50 %	-	581	581
IVL Environmental Technologies (Beijing) Company Ltd	1	100 %	-	546	546
Total			5	1,242	1,242

NOT 15 PREPAID EXPENSES

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
Rent, offices and premises	4,013	3,445	4,013	3,445
Other prepaid expenses	2,042	2,045	2,042	2,036
Closing balance	**6,055**	**5,490**	**6,055**	**5,481**

NOTE 16 EQUITY

Group

kSEK	SHARE CAPITAL	OTHER EQUITY INCLUDING RESULT FOR THE YEAR	TOTAL
Opening balance	**7,000**	**72,865**	**79,865**
Translation difference		18	**18**
Net profit/loss for the year		**4,017**	**4,017**
Closing balance	**7,000**	**76,900**	**83,900**

NOTE 17 EQUITY

Parent Company

kSEK	SHARE CAPITAL	RESTRICTED RESERVES	BALANCED OUTCOME	NET INCOME	TOTAL
Opening balance	7,000	1,400	39,240	6,299	53,939
Appropriation of profit by decision of AGM			6,299	-6,299	
Net profit/loss for the year				3,067	3,067
Closing balance	7,000	1,400	45,539	3,067	57,006

NOTE 18 PROVISIONS

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
Deferred tax liability	7,306	7,143		-
Closing balance	**7,306**	**7,143**		**-**

IVL takes the view that deferred tax due for payment in 2015 will be low, as IVL's investment levels will continue to be high and interest rates low. As a result, use of tax allocation reserves for consolidation purposes will continue to be advantageous. In the subsequent five-year period, the tax allocation reserves for 2012 and 2013 and 2014, totalling SEK 8,161 thousand, will in any event be dissolved.

NOTE 19 ACCRUED EXPENSES

	GROUP		PARENT COMPANY	
kSEK	2015	2014	2015	2014
Holiday and overtime liabilities	4,791	5,662	4,791	5,662
Accrued social costs	5,997	5,426	5,997	5,426
Other accrued expenses	1,088	1,535	929	1,103
Closing balance	**11,876**	**12,623**	**11,717**	**12,191**

NOTE 20 LIABILITIES TO CREDIT INSTITUTIONS

	GROUP	
kSEK	2015-12-31	2014-12-31
Long-term liabilities		
Closing balance	1,765	-1,126
Current liabilities to credit institutions	722	639
Closing balance	**2,487**	**1,765**
Opening balance	2,176	-2,378
Current liabilities to credit institutions	-521	202
Closing balance	**1,655**	**2,176**

NOTE 21 PLEDGED ASSETS AND CONTINGENT LIABILITIES

	GROUP AND PARENT COMPANY	
kSEK	2015-12-31	2014-12-31
Collateral pledged for liabilities to credit institutions		
Corporate mortgages	5,000	5,000
Total	**5,000**	**5,000**
Contingent liabilities	**None**	**None**

NOT 22 SHORT TERM INVESTMENTS

	GROUP		PARENT COMPANY	
kSEK	2015-12-31	2014-12-31	2015-12-31	2014-12-31
Opening balance	26,492	25,007	26,492	25,007
Change in value	476	1,485	476	1,485
Closing balance	**26,968**	**26,492**	**26,968**	**26,492**

Stockholm 10 March 2016

Annika Helker Lundström
Chairman of the Board

Gunilla Saltin — Peter Nygårds — Johan Kuylenstierna

Anders Furbeck — Bo Olsson — Christer Forsgren

Maria Ågren — Anders Björk, Employee Representative — Pernilla Bengtsson, Employee Representative

Tord Svedberg
Chief Executive Officer

Our Auditor's report was submitted 19 April 2016
R3 Revisionsbyrå KB

Tomas Nöjd
Authorized Public Accountant

Christina Kallin Sharpe
Authorized Public Accountant

Audit Report

To the Annual General Meeting of IVL AB, CIN 556116-2446

We have conducted an audit of the annual report of IVL Swedish Environmental Research Institute (Publ.) for the year 2015.

REPORT ON THE ANNUAL REPORT

Responsibilities of the Board of Directors and the CEO for the annual report

The Board of Directors and the CEO are responsible for preparing an annual report that provides a true and fair view in accordance with the Swedish Annual Accounts Act, and for the internal systems of control that the Board of Directors and CEO deem to be necessary, in order to prepare an annual report that is free of material misstatement, whether caused by irregularity or error.

Responsibilities of the auditor

Our responsibility is to express an opinion on the annual report based on our audit. We conducted our audit in accordance with International Standards on Auditing and generally accepted auditing practice in Sweden. Those standards require that we observe the requirements of professional ethics and that we plan and perform the audit to obtain reasonable assurance that the annual report is free from material misstatement.

An audit includes obtaining, by variety of measures, accounting evidence supporting the amounts and disclosures in the annual report. The auditor decides which actions should be taken, for example by determining the risks of material misstatements in the annual report, whether caused by irregularity or error. In determining risks in this way, the auditor considers which aspects of internal systems of control are relevant to how the company prepares the annual report in order to provide a true and fair view, in order to devise audit measures that are fit-for-purpose with regard to the circumstances, but not in order to state an opinion as to the efficacy of the company's internal systems of control. An audit also includes an assessment of the suitability of the accounting policies applied and of the reasonableness of the estimates by the Board of Directors and the CEO in the accounts, as well as an assessment of the overall presentation of the annual report.

We believe that the accounting evidence we have obtained provides an adequate and appropriate basis for our opinions.

Statement

In our view, the annual report has been prepared in accordance with the Swedish Annual Accounts Act and provide in all material respects a true and fair view of the parent company's and the group's financial position on 31 December 2015 and of its financial results and cash flows for the year in accordance with the Swedish Annual Accounts. Act. The statutory administration report is consistent with the other parts of the annual accounts.

We therefore recommend to the Annual General Meeting that the parent company and consolidated income statements and balance sheets be adopted.

REPORT ON OTHER REQUIREMENTS UNDER LEGISLATION AND OTHER REGULATIONS

In addition to our audit of the annual report, we have examined the proposed treatment of the company's profit or loss and the administration by the Board of Directors and the CEO of IVL Swedish Environmental Research Institute [Publ.] for the 2015 financial year.

Responsibilities of the Board of Directors and the CEO

The Board of Directors is responsible for the proposed treatment of the company's profit or loss, and the Board and CEO are responsible for administration under the Swedish Annual Accounts Act.

Responsibilities of the auditor

Our responsibility is to express an opinion with a reasonable degree of assurance as to the proposed treatment of the company's profit or loss and as to the administration based on our review. We conducted our audit in accordance with generally accepted auditing practice in Sweden.

As a basis for our opinion on the Board of Director's proposed treatment of the company's profit or loss, we have examined whether such arrangements are consistent with the Swedish Annual Accounts Act.

As a basis For our opinion concerning discharge from personal liability, we examined, in addition to our review of the annual report and the consolidated accounts, significant decisions, actions taken and circumstances of the company in order to be able to determine the liability, if any, to the company of any director or the CEO. We also examined whether any director or the CEO has, in any other way, acted in contravention of the Companies Act, the Annual Accounts Act or the Articles of Association.

We believe that the accounting evidence we have obtained provides an adequate and appropriate basis for our opinions.

Statement

We recommend to the Annual General Meeting that the profit be dealt with in accordance with the proposal in the administration report and that the members of the Board of Directors and the CEO be discharged from personal liability for the financial year.

Stockholm, 19 April 2016

Tomas Nöjd
Authorized Public Accountant

Christina Kallin Sharpe
Authorized Public Accountant

Corporate Governance

Corporate Governance at IVL Swedish Environmental Research Institute (Publ.) is based on Swedish legislation and generally accepted practices, with due account taken of the Swedish Code of Corporate Governance.

OWNERSHIP

The reason why the The Swedish Code of Corporate Governance is not observed in every respect is that it is mainly designed for listed companies and companies with diversified ownership. IVL has been wholly owned by the Swedish Institute of Water and Air Conservation Research Foundation (SIVL) since 2004. At conversion of the then Swedish Institute of Water and Air Conservation Research Foundation into public limited company form in 1982, SIVL's original share capital was allocated in equal part by an agreement between, the Swedish government and the Swedish business sector.

SIVL's purpose is to develop the long-term conditions for environmental research and, through ownership, to guarantee IVL an independent status. SIVL is responsible for the funds provided for environment- and sustainability-related research at IVL co-funded by the Swedish government and the Swedish business sector.

THE BOARD OF DIRECTORS

IVL is governed by a representative Board of Directors, of whom the chair and six members are appointed by the Swedish government and seven members by the Swedish business community. The Chair has the casting vote.

ANNUAL GENERAL MEETING (AGM)

The AGM is generally held at the end of May. Members are notified of the AGM by post. The owner, SIVL, is represented at the AGM by SIVL's Chair. At the the 2015 AGM, held in late May, all Board members were re-elected.

NOMINATION PROCEDURE

SIVL, the sole owner of IVL, proposes members for IVL's Board of Directors, partly by inviting nominations from business sector representatives for four regular members and one deputy member for IVL's Board of Directors, and partly by inviting nominations from the government for the Chair and three regular members and one deputy for IVL's Board of Directors.

IVL's Board of Directors shall consist of no less than four and no more than eight members, plus no less than one and no more than two deputies. In addition, the trade union representatives are entitled to nominate two members and two deputies.

The members of IVL's Board of Directors are presented on pages 74–75.

THE BOARD OF DIRECTORS AND ITS WORK IN 2015

Under the Swedish Companies Act and the Company's Articles of Association, the Board of Directors is responsible for the organization and administration of the Company. Every year, the Board adopts rules of procedure. This document is accompanied by instructions for work by the CEO, governing the allocation of tasks between Board and CEO. In accordance with the rules of procedure, the Board held four ordinary meetings in 2015 in addition to the statutory meeting held in May. As is customary, the ordinary Board meetings were held in conjunction with reporting of the Company's full-year or interim results.

Items on the agenda for the Board meeting in May included adoption of new rules of procedure for the Board and instructions for work by the CEO. At the Board meeting in December, the agenda included the Company's budget for 2016, as well as goals and strategy documents. At an extended meeting in September, the Board discussed the Company's long-term strategy.

REMUNERATION COMMITTEE

Under the rules of procedures for the Board of Directors for IVL Swedish Research Institute (Publ.), the Board is to appoint a remuneration committee to deal with issues relating to terms and conditions of employment and remuneration. The committee proposes salary, other forms of remuneration and other terms and conditions of employment for the CEO, which are then presented to the Board of Directors for approval. Similarly, terms and conditions for other members of executive management of the Company are proposed by the CEO, which are then presented to the Remuneration Committee for approval. The Company does not operate any incentive programme.

BOARD OF DIRECTORS' REMUNERATION

At the 2015 AGM, fees were approved for the Chair and members of the Board. The fees approved were kSEK 94 (88) for the Chair and a total of kSEK 515 (593) for the other members of the Board. No fee is payable to the employee representatives.

EXTERNAL AUDIT

The auditors' task is, on behalf of the owner, to conduct an impartial review of the administration by the Board of Directors and the CEO, as well as of the Company's annual report and accounting records.

R3 Revisionsbyrå KB, represented by Tomas Nöjd and Christina Kallin as senior auditors, has been elected as auditor to serve during the period until the 2016 AGM. Tomas Nöjd and Christina Kallin are authorized public accountants and have conducted the auditing assignment on behalf of IVL since 2014.

COMPANY MANAGEMENT

The CEO is responsible for the day-to-day administration of the Company in accordance with the guidelines and other instructions issued by the Board. The instructions for the work of the CEO were adopted on 27 May 2015 at the Board's statutory meeting.

The Company's executive management group consists of the CEO, Executive Vice President, CFO, Vice President Business Development and Director of Research. The Company's management group also includes, four heads of unit, Director of Human Resources and Director of Communication. The Director of Quality and Environmental Issues is co-opted member.

- Tord Svedberg, born 1958, M. Sc. in Chemistry, KTH (1983) has served as Chief Executive Officer at IVL since 2008. He formerly served in a range of executive roles at Pharmacia (1984–1990), Astra (1990–1999) and AstraZeneca (1990–2007), including as head of production at the company in Sweden and member of executive management. Member of the Royal Swedish Academy of Sciences, Department IV, Board member at Unimedic AB (since 2008) and member of SMHI's advisory council (since 2015).
- Östen Ekengren, born 1952, M. Sc. in Chemistry, KTH (1978), serves as Executive Vice President and Head of the Business Development and Market Unit. Employed since 1978.
- Anna Jarnehammar, born 1965, M. Sc. Mechanical Engineering, 1991, Luleå University, Director of Business Development and Marketing. Employed by the company since 2005, first as Head of Unit and then in 2014 as head of Business Development. Anna Jarnehammar is chairman of IVL subsidiary Bastaonline AB.
- John Munthe, born 1960, Ph. D. in Chemistry at the University of Gothenburg (1992), Head of Research since 2010. He joined the Company in 1992 and was appointed Head of Department in 1994.
- Mats Ridner, born 1955, MBA, Stockholm School of Economics, has served as CFO since 1994.

The unit heads, CFO and head of research report to the CEO. Management is supported by executive staff functions for financial management, HR, communication, business development and quality and environmental management systems. ▶

INTERNAL CONTROL

Internal control at the Company is based on IVL's operational and management system. At the same time, this represents the Company's integrated quality and environmental management systems, which are certified in accordance with ISO 9001 and ISO 14001. The management system focuses on IVL's core operations, that is to say, "to offer/market and conduct research and consultancy projects in the environmental field", and includes governing documents, procedures and tools for all processes within the Company.

Internal control of financial reporting consists of the control environment of organization, decision-making paths, powers and responsibilities that are documented and communicated via governing documents. All governing documents, procedures and tools are available via the Company's Intranet.

Every year, the Board adopts rules of procedure that govern the division of responsibilities between Board and CEO, and the Company's financial reporting to the Board. Financial reports are presented to the Board at every meeting. These comprise outcomes, budget and comparison with the preceding year, as well as order backlog, investments and a number of key ratios.

EVALUATION OF THE BOARD AND CHIEF EXECUTIVE OFFICER

The performance of the Board is evaluated annually. In 2015, this evaluation was carried out via a survey, conducted by the Swedish Academy of Board Directors, and presented at the December meeting.

The Board continually evaluates the CEO's performance by monitoring progress against objectives. Once a year, in conjunction with the March board meeting, a more formal evaluation is discussed with the Chief Executive.

RISK ANALYSIS AND MANAGEMENT

The management system also includes procedures and methodology for annual risk analysis of everything from economic risks and conditions, IT security, external factors and customer relations to loss of skills/expertise and image- and brand-related risks. The risk analyses are accompanied by action plans. The management system is subject to internal audit twice a year, as well as ongoing checks by independent quality and environmental auditors.

Board of Directors

Annika Helker Lundström
Chair
Member since 2010
National Environmental Goal Coordinator

Pernilla Bengtsson
Member since 2014
Employee Representative

Anders Björk
Member since 2014
Employee Representative

Christer Forsgren
Member since 2008
Director Stena Metall

Anders Furbäck
Member since 2014
Director LKAB

Johan Kuylenstierna
Member since 2014
CEO Stockholm Environment Institute

Peter Nygårds
Member since 2008
Chair, Swedish Institute of Water and Air Conservation Research Foundation

Bo Olsson
Member since 2014
Head of Innovation and Safety, IKEM

Gunilla Saltin
Member since 2010
CEO Södra Cell

Maria Ågren
Member since 2014
Director-General, Swedish Transport Agency

DEPUTIES

Christina Lindbäck
Head of Sustainability NCC

Hanna Ljungkvist
Employee Representative

Maria Ohlman
Assistant Under-Secretary, Swedish Ministry of the Environment

Linda Åmand
Employee Representative

SIGNIFICANT EXTERNAL ASSIGNMENTS CARRIED OUT BY IVL BOARD MEMBERS

Christer Forsgren
- Board Member, Stena Aluminium AB
- Board member, Återvinningsindustrierna AB
- Board Member, Strategiska Innovationsprogrammet Re:Source (Energimyndigheten)
- Board Member, Competence Center Recycling (Chalmers)

Anders Furbäck
- Chair, SNS Luleå

Johan Kuylenstierna
- Board Member, Wateraid

Peter Nygårds
- Chair, Mittuniversitetet
- Chair, Ecoclime Comfort Ceilings AB
- Chair, PN Extended Strategies AB
- Member, Elmarknadsinspektionens insynsråd

Maria Ågren
- Vice-Chair, Arbetsgivarverkets styrelse
- Board Member, Luleå Tekniska universitet
- Board Member, Transportstyrelsen
- Member, Havs- och vattenmyndighetens insynsråd

Bo Olsson
- Chair, Chemnotia AB
- Chair, Googol Innovation Academy AB

Christina Lindbäck
- Chair, Miljömärkning Sverige AB
- Board Member at Axfoundations

IVL ANNUAL REPORT 2015

Management Group

Tord Svedberg
Chief Executive Officer

Östen Ekengren
Executive Vice President

Mats Ridner
Chief Financial Officer

John Munthe
Vice President, Research

Anna Jarnehammar
Director – Business Development & Market

Elin Eriksson
Director – Organizations, Products and Processes

Mona Olsson Öberg
Director – Natural Resources & Environmental Impact

Karin Sjöberg
Director – Air Pollution & Abatement Strategies

Jenny Gode
Head of Unit – Climate & Sustainable Social Systems

Eva Bingel
Director – Communication

Anna Westberg
Director – Human Resources

CO-OPTED

PO Skough
Director of Environment & Quality up to 2015-12-31

Jenny Arnell
Director of Environment & Quality as of 2016-01-01

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