

VAISALA

# NEWS

200/2017

**Sun Shines Brightly  
on the Solar Industry**

/ Page 6

**Creating Value for  
Our Stakeholders**

/ Page 14

**First Metropolitan Network to  
Measure Air Quality**

/ Page 24

**Expanding to Vaporized  
Hydrogen Peroxide**

/ Page 26

# VAISALA NEWS

## Contents 200/2016

- 3** Doing Good is Good Business
- 4** Over 100 Audits without a Single Observation or Deviation
- 6** Sun Shines Brightly on the Solar Industry
- 8** Using Lightning Education and Data to Reduce Injuries and Fatalities in Agriculture
- 10** Reliable Measurements Helps Make Buildings Smarter
- 12** Practical Science – Vaisala Customers Turned Experts
- 14** Creating Value for Our Stakeholders
- 18** Predicting Atmospheric Rivers to Better Inform Reservoir Management
- 20** Proactive Maintenance through Online Monitoring
- 20** TVO Nuclear Power Plant Monitors Transformer Condition in Real-Time
- 22** Gassing Transformers Require Continuous Monitoring
- 24** First Metropolitan Network to Measure Air Quality
- 26** Expanding to Vaporized Hydrogen Peroxide

### Vaisala in Brief

Vaisala is a global leader in environmental and industrial measurement. Building on 80 years of experience, Vaisala contributes to a better quality of life by providing a comprehensive range of innovative observation and measurement products and services for chosen weather-related and industrial markets. Headquartered in Finland, Vaisala employs approximately 1,600 professionals worldwide and is listed on the NASDAQ Helsinki stock exchange.

### Events & Webinars

[www.vaisala.com/events](http://www.vaisala.com/events)  
[www.vaisala.com/webinars](http://www.vaisala.com/webinars)

### Publishing Information

Published by: Vaisala Oyj  
P.O. Box 26  
FI-00421 Helsinki  
FINLAND  
Phone (int.): + 358 9 894 91  
Internet: [www.vaisala.com](http://www.vaisala.com)

Editor-in-Chief: Marina Stenfors  
Contributors: Katri Ahlgren, Anne Hänninen (CoComms), Francesca Davidson, Melanie Scott, Frank DeFina, Riika Pikkuvirta, Jon Tarleton, Tiina Vainio, Kati Andersin, Tomi Rintanen, Kirsi Linsuri-Sipilä and Tiina Kiianlehto  
Cover photo: Shutterstock  
Design, Layout: Grapica Oy  
Printed in Finland by: Grano Oy  
ISSN 1238-2388

### Subscriptions

For subscriptions, cancellations, feedback and changes of address, please email: [vaisala.news@vaisala.com](mailto:vaisala.news@vaisala.com)

### Disclaimer and Copyright

This publication may include forward-looking statements or other explicit or implied statements on future expectations, results or performance. Such statements may materially differ from actual future results or performance and, being subject to certain risks and uncertainties, are not to be relied on.

The copyright of this publication is reserved by Vaisala. This publication may not be reproduced in whole or in part in any form or by any means without the prior written consent of Vaisala.

# Doing Good is Good Business

At Vaisala we are very fortunate to work for a company that really makes a difference in the world. At best, we can say without any hesitation that we help save lives.

Our work is also instrumental in improving people's living and working conditions, ensuring products are manufactured as efficiently and safely as possible, resulting in dependable and high-quality products, and saving energy or producing energy more efficiently.

In short, we try to be net positive: in our vision that means doing business in a way which puts back more into society, the environment, and the global economy than it takes out – having a bigger handprint than footprint.

The impact can be seen in many articles in this magazine. Improving water reservoir management is essential in drought-riddled California, lightning data helps decrease fatalities and injuries caused by lightning in U.S. agriculture, and a new observation network in the Helsinki area in Finland will monitor air quality and hence provide information essential for assessing the environment.

Being net positive is in no way in contrast with doing business, quite the opposite. Doing our part to help solve the issues our world is and will be facing – climate change, fossil fuel based economy, urbanization, aging population – benefits us in many ways.

Of course, we can provide products, services, and expertise to our clients, who prefer solution providers that have proven themselves to be good corporate citizens. So, increasing our handprint improves our competitive advantage.



The idea of improving the world keeps our employees highly motivated and helps us attract the best talent. This again makes sure we can stay on the crest of innovation, enhancing our ability to serve the most discerning customers. This spirit of innovation also covers our own operations, driving us to constantly improve and better ourselves.

We have found that doing good is good business.

*Kjell Forsén*  
President and CEO



# Over 100 Audits without a Single Observation or Deviation

## Environmental Monitoring Helps Answer Auditors' Questions before Being Asked

*Robust environmental monitoring system makes McKesson Specialty Health's audit process efficient, and helps build confidence in potential and existing customers.*

Since 2006, McKesson Specialty Health (MSH) has partnered with a nation-wide vaccination program that serves approximately 1.8 million uninsured and underinsured children.

Since its inception, the program has renewed its vaccine program contract with MSH in what is one of the largest national partnerships of this kind. MSH now distributes more than 80 million vaccinations to more than 40,000 providers each year.

One of the ways MSH became a world-class logistics provider was through focusing on facilities management and maintenance, design

engineering tailored to GxP regulatory requirements, and extensive system installations, validation, and expansions.

McKesson's Third Party Logistics (3PL) model goes far beyond storage and shipping services to provide a package of services based on robust reporting, elite information technology systems, and customized logistic solutions.

### Impressing Auditors

One of the people helping lead the MSH distribution team is **Timothy Phelps**, Facilities Engineering Man-

ager-Specialty Distribution. Since installing the viewLinc system in all three of the facilities he manages, Phelps and his team find audits more efficient.

"Now we find more companies wanting to partner with us after we walk them through our processes, show our data, the alarming functionality, our validation master plan and other quality documentation," says Phelps.

"We will sit down in front of a monitor, open viewLinc, and go through every single environment we have, drilling down into data along the way, checking trends in real-time, or for any historical period. Our auditors – ranging from state and federal regulatory bodies to drug manufacturers – are always impressed."

Showing the reports, the raw data, and the live interface of the viewLinc system is now a standard part of the audit process for MSH.



“Not only does it make the audit process efficient, the transparency goes a long way toward building confidence in potential and existing customers. They can trust we are going to take care of their product because we give them the evidence.”

### Zero Findings

With audits and customer visits happening on a near-weekly basis, streamlining the process is crucial.

Using viewLinc and other systems, MSH has provided auditors with an information package that includes raw temperature data, reports, MKT over a given period, and other information in anticipation standard and in-depth questions.

“In the last three years, we’ve had zero findings with regard to temperature and environmental related items,” says Phelps. “These days, we can do an entire environmental audit in about four hours.”

Zero findings in audits translates into significant savings on overhead and resources.

### Robust System Essential

The reliability of the environmental monitoring system is also important. Not only is the product portfolio of McKesson incredibly valuable, local climate conditions can be a challenge. In Memphis, the humidity can fluctuate from 35% to 90% and the controlled temperature environments range from -80 to 22 °C.

Reliable, accurate and stable sensors are required to maintain system performance. Proactive notification of out-of-specification conditions prevents product loss or adulteration.

“There are many advantages to maintaining systems that are extremely robust: efficient audits, the trust of our customers, and a strong operational model,” says Phelps.

“Most importantly, the products MSH handles – including oncology drugs, and complex items like plasma products, which hospitals can’t keep on-hand – demand reliable technology that is designed for GxP compliance.”

ferent points of delivery including other wholesalers, clinics, doctors’ offices, hospitals, and pharmacies.

“With that kind of scale and all those products going to end-users, our temperature and humidity monitoring has to be technologically rigorous,” says Phelps.

“After years of working with the system, generating the kind of reports that make auditors happy, we’ve found Vaisala’s viewLinc Monitoring System to be bullet-proof.”

### Bullet-proof Solution

The MSH Memphis Distribution Facility alone ships to 70,000 dif-



**McKesson Corporation**, currently 5th on the FORTUNE 500, is a global leader in healthcare supply chain management. Named “Most Admired Company” in the healthcare wholesaler category by FORTUNE, McKesson has a stellar reputation as a wholesale distributor and 3rd Party logistics provider.

**McKesson Specialty Health**, a division of McKesson Corporation, provides integrated technology systems, unites independent providers with manufacturers and payers, and delivers technologically innovative methods of distributing high-value healthcare products.

MSH focuses on drugs and biotechnology for complex diseases, serving the commercialization and logistics needs of specialty physicians like oncologists and rheumatologists, as well as pharmaceutical and biotech manufacturers.



# Sun Shines Brightly on the Solar Industry

*With solar power gaining ground, Vaisala develops its offering to better meet the needs of customers, in both the investment and operational phases.*

Solar technology is presenting major opportunities for the energy sector and businesses around the world. In 2016, global solar capacity saw a recorded 71 gigawatts of new installed capacity, up from 57.8 gigawatts in 2015.

To put that in perspective, this incremental increase is larger than the total installed capacity worldwide in 2008 – a ten-fold increase in only eight years – and there are no signs of a slowdown in sight.

## Gaining New Ground

While this growth is driven by the leading markets of China, the United States, Japan, and India, new markets

frequently emerge. When opportunity strikes, it is critical for global energy players to act quickly and make investments at the right time.

Latin America is a prime example. In the last few years there has been a great deal of focus on Chile and Brazil, but now Argentina is the market to watch.

At the end of 2015, the Argentine government announced a renewable energy goal of getting 8 percent of its energy from renewables by 2017 and 20 percent by 2025. After signing this into law, policymakers spent the first half of 2016 putting the framework in place to help drive the development and investment required to meet the aggressive target.

The initial result of this work was the country's first renewable energy auction, held in September 2016.

## Predicting Solar Performance

To submit a project bid in the auction, developers were required to provide a long-term energy estimate. To be competitive, this estimate had to be as accurate as possible, demonstrating a strong solar resource and low uncertainty around projected performance.

In this aspect of the auction, Vaisala played a key role, supporting 30 percent of the solar auction bids with due diligence services.

In the solar industry, weather is both the project's fuel and operating environment. As the leader in applied weather science, Vaisala is uniquely positioned to help the industry adapt and mitigate weather risk while making informed decisions that reduce costs and increase profitability.

Through its 3TIER consulting services, Vaisala has been active in the solar space since 2009, assisting customers in translating weather conditions into long-term solar energy estimates in the pre-construction phase and observing and forecasting real-time performance in the operational phase.

## Global Dataset Available for Research

Vaisala was also the first to map the world's solar energy resource potential through a high-resolution dataset that continues to be used today by developers, project owners, policymakers and governments to make high-level financial, infrastructure and operational decisions.

Recently Vaisala partnered with IRENA, the International Renewable Energy Agency, to make portions of this dataset publicly available through its Global Atlas platform. The aim is to increase access to high-

quality resource data for large-scale planning and remove information barriers for countries trying to promote renewable energy.

Vaisala's significant data capabilities are also put to work in the operational space. For example, we often monitor the impact of large-scale weather trends on wind and solar performance.

Last fall, we published a study illustrating the impact of California's summer wildfires and the resulting smoke and haze on energy production in areas with a high concentration of solar capacity.

## Easier Evaluation of Potential Projects

Vaisala is always looking for ways to innovate in the solar measurement and consulting services field to better support clients who must respond quickly in a challenging and ever-changing industry.

These customers need a partner who can deliver both on speed and accuracy to help them enter new markets and put forward only the most competitive and profitable

projects for auction or investor consideration.

It is with these customers in mind that we recently introduced two new products that help developers better evaluate potential projects.

Solar Time Series Tools offer easy access to bankable solar resource records at any location around the world, at a low annual subscription cost. These online tools allow developers to visualize, compare, and order information from up to five global datasets and receive data files within 24 hours to meet tight deadlines while reducing project performance uncertainty.

The new SP-12 Solar Weather Station is an all-in-one system specifically designed for the solar industry to help collect reliable ground measurements. It is rugged and ready to install, equipped with state-of-the-art sensors, and a data logger proven to withstand extreme conditions.

With more and more opportunities on the horizon, Vaisala is making solar a strategic company focus and will continue investing in practical innovations that provide value to customers.



# Using Lightning Education and Data to Reduce Injuries and Fatalities in Agriculture

The agriculture industry shares an obvious connection with weather – rain helps irrigate crops, severe storms can damage crops, and temperatures can be helpful for growth or too extreme. Agriculture workers experience all types of weather, including thunderstorms and lightning. Because of the outdoor work environment, their exposure to lightning is higher and this increases their risk of injury or death. In addition, they are more at risk because of their proximity to a safe shelter.

If we consider the United States alone, according to the National Weather Service, 34% of work-related lightning fatalities are associated to farming or ranching. Outside of the United States, there have been 445 events recorded since 1993, where injury or death of an agricultural worker occurred because of lightning. In these recorded incidents, there were 969 deaths caused by lightning, and as many as 597 injuries (Holle, 2016). There are many more unrecorded injuries and deaths as well that could easily double the figures above.

While we cannot control the weather, we can improve education, safety procedures, and obtain thunderstorm and lightning information for advance warnings. This will result in a reduced number of injuries or fatalities due to lightning.

## Lightning Education

Beginning with education, agriculture workers all over the world can benefit from knowing basic



information about thunderstorms. Information such as, what types of clouds produce thunderstorms and lightning, knowing that when you hear thunder, you should move to a safe place right away, and even understanding that it does not have to be raining for lightning to strike is valuable knowledge. In the U.S., for example, many children learn about weather safety at school and even practice safety procedures. Media, as well as other national educational programs, are also used for educating people about severe weather. This education has helped to reduce the amount of lightning fatalities in the past 30 years.

## Safety Procedures

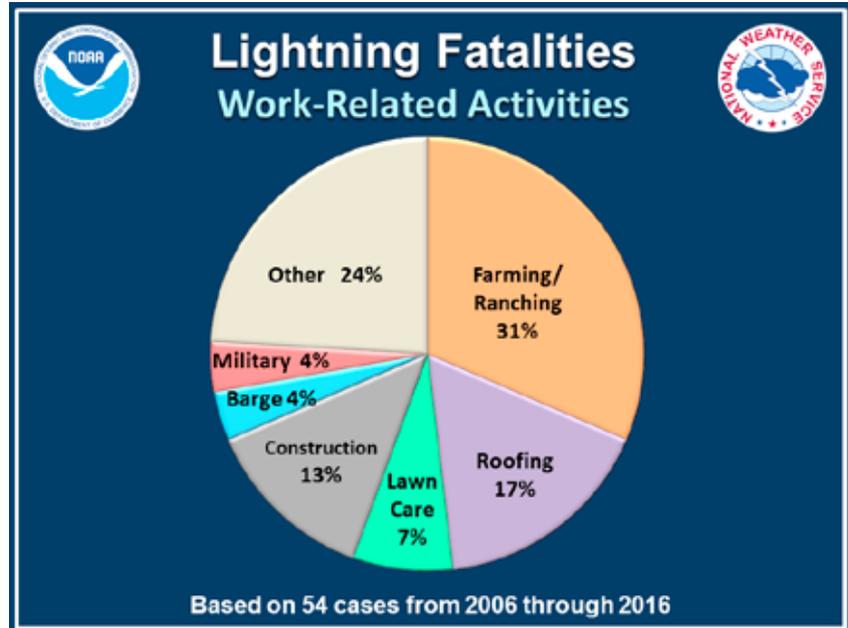
Improving safety procedures is another way to reduce the risk of

lightning injuries and fatalities. Many times workers do move to safety during storms; however, sometimes they do not leave themselves enough time to move to safety or their structure is not safe. Often, tents are provided as the only method of shelter from lightning, but these are not an adequate solution. According to **Ron Holle**, Meteorologist and Lightning Safety Expert at Vaisala, there are only two safe places. One is large, well-constructed buildings, where people live and work, where there are certain requirements about the wiring and plumbing and the infrastructure in the walls, and everything else that can take a direct hit and take the lightning safely into the ground. The only other reliably safe place from lightning is a fully enclosed metal top vehicle.” Simply knowing what types of structures

are safe, and which ones are not, can save lives.

### Lightning Data

Finally, one of the most effective ways to protect against lightning strikes in agriculture is to be ahead of the storm and invest in an alerting system. Farmers are typically aware of approaching storms, but having the ability to know how close storms are, or which way they are moving can also help reduce the risk of the threat of lightning. Technology, such as Vaisala's Thunderstorm Manager tracking and alert system, allows workers to monitor conditions, and make decisions about if or when workers should leave their positions, and move to safety. Thunderstorm Manager uses lightning data from Vaisala's global lightning network, the GLD360 Global Lightning Dataset. The GLD360 lightning network detects lightning anywhere in the world, and Thunderstorm Manager displays the data for the user. Monitoring changing weather using real-time information allows workers to move to safety at the appropriate



time, and reduce their risk of being injured or killed by lightning.

Education, proper safety and data monitoring are three key elements to improving the safety and work environment during thunderstorms and lightning in the agriculture industry. Implementing these methods does not happen overnight. It takes time, money and resources to

implement an educational program, build or provide safe structures, and purchase a monitoring system. But by working together with government agencies, local authorities, sharing resources, and committing to creating a safe work environment, the industry can improve working conditions and keep workers safe from lightning.



### Lightning Safety Facts

- You are not safe anywhere outside when lightning is near
- Hearing thunder indicates a storm is within 16km – move to safety immediately
- Lightning can strike even if it is not raining
- Stay in a safe place for 30 minutes after you hear the last thunder



# Reliable Measurements Helps Make Buildings Smarter

*Buildings must be made smarter to save energy and keep their inhabitants happy and healthy. To achieve sustainable results, building system control needs to be based on reliable indoor air measurements.*

Population growth, urbanization and climate change are driving the need for energy efficiency to curb the growing demand for power.

Buildings, commercial and residential, are one of the biggest consumers of energy. According to the U.S. Energy Information Administration, they accounted for about 40 percent of total U.S. energy use in 2015, which makes them an obvious target for potential energy savings.

People are also becoming more aware of the environment and their impact on it. Many want to optimize energy use to protect the environment, but at the same time their expectations are rising when it comes to the quality of their living and working environments.

## **Smart Buildings Have a Smaller Footprint**

To address both the demands, buildings are becoming smarter.

What is a smart building? Definitions vary, but there seems to be a consensus that in a smart building, different systems providing heating, ventilation, air-conditioning, lightning, and access control are connected to each other and form one integrated system.

The goal is to optimize the conditions inside a building and to ensure comfort and safety to its users or residents, by keeping indoor air quality high. Optimization also helps keep the building's energy consumption to a minimum, reducing the building's environmental footprint.

## Energy savings and a comfortable, healthy environment for the building users

McGraw Hill Construction's SmartMarket Report stated that intelligent buildings use 20–40 percent less energy and result in 8–9 percent lower operating expenses, with valuations 7.5 percent higher than those with legacy systems.

### Long-run Optimization

Optimizing the conditions indoors requires integrated control systems, and they can only work properly and to their full potential when their operations are based on accurate and reliable measurements.

Even the most sophisticated control algorithms and systems are of no use if their operation is based on inaccurate data. Even more important is the stability of the sensors used to measure indoor conditions. The instruments used are often left to their own devices for years on end, so they need to be able to produce consistent and dependable results year after year.

However, the end users and owners often have to rely on measurement instruments the builders and system integrators have selected. In today's cost-driven world, the instruments are frequently chosen based on their price only, and used for years or even decades.

While this may keep the initial costs to a minimum, in the long run, it can be difficult to keep maintenance costs down. Additionally, this approach is less likely to lend itself



to all of the advantages that come along with smart buildings – such as energy savings and a comfortable, healthy environment for the building users.

This is why special attention must be paid to the design of smart buildings and the selection of instruments that serve the interests of the building owners and users in the long term.

### Taking the Outdoors into Account

Going forward, buildings can be made even smarter by including outdoor data – on weather and air quality – in the equation.

Even today, the most advanced buildings have their own weather stations, providing information that helps optimize air intake and process the air – heating, cooling, drying, or humidifying it.

Smart buildings of the future are likely to have access to other weather data, too, as weather information can even be used to

tweak building automation settings in advance. For example, if a system knows the sun will start shining in an hour, it can proactively turn down the heat, taking the sun's warming effect into account.

Weather also impacts another factor that is becoming increasingly important: air quality. Pollution gases, like carbon monoxide, nitrous oxides, sulfur dioxide, hydrogen sulfide and ozone, as well as particles are of great concern, as they have serious negative health effects.

For example, particle pollution needs to be filtered from the outside air as it is brought into a building. When the particle content is high, you want to bring in as little air as possible. Carbon dioxide measurements indicate exactly how much fresh air is needed.

Using a combination of measurements from outdoors and indoors, buildings can become more intelligent and work autonomously to optimize comfort and energy at the highest level.

## Practical Science

# - Vaisala Customers Turned Experts



### **Pasi Piirainen,** Lead Consultant Aviation, Transportation Weather Consulting

**Pasi Piirainen** was brought on board, when we began offering a new solution that can calculate how long an aircraft can remain on the ground prior to takeoff before needing more anti-icing fluid. He joined Vaisala two years ago, having worked for 25 years for Finnair, an airline that knows winter operations all too well.

#### **What sort of role did you have?**

I was responsible for winter operations and aircraft fueling procedures.

#### **What made you decide to come work for Vaisala?**

I had been collaborating with Vaisala on CheckTime for almost 10 years.

Once CheckTime was implemented in Finnair operations, I felt it was time to seek new challenges.

#### **Did anything surprise you about Vaisala?**

Even though I had a long working relationship with Vaisala while at Finnair, I was surprised how wide the range of expertise Vaisala has in areas other than aviation weather.

#### **What is the most rewarding thing about working with customers?**

I really enjoyed discovering what challenges a particular client has, and then working on providing a solution. I have so many other experts and tools available to me that really helps us solve problems.

#### **What is your role now?**

My role is to promote our de-icing decision solution CheckTime. I also work with others to find airlines needing assistance with winter operations. As Lead Consultant to Airlines and Airports, I am looking to help them optimize ways to handle winter operations. My focus is to find methods that are suitable to that particular environment, share best

practices, and then help them to execute a new plan.

#### **What changes can we expect in the aviation industry over the coming years?**

Coming soon is a mandatory aircraft air-to-ground connectivity that will open up new possibilities to provide a real-time weather information to the aircraft cockpit. Another change will be an increase of remote air traffic towers at remote airports requiring accurate and reliable weather information. This will allow data to be seen and shared anywhere in the world.

#### **What is something you think customers do not know about Vaisala?**

I would have to say it is the amount of internal emphasis and expertise in so many areas of science. People may think that of course, Vaisala knows about hardware and sensor technology, but the overall deep knowledge in science may surprise them.

*Two Vaisala employees, both former customers, discuss their new perspective to their area of expertise.*

For Vaisala to understand our customers, it is vital that we have experts in various fields and industries. When it comes to our solutions for operations impacted by weather, such as aviation and roadways, Vaisala hired two experts with different backgrounds from these industries.



**Mark DeVries**  
Lead Consultant Roads,  
Transportation  
Weather Consulting

To strengthen Vaisala's understanding of road maintenance and Intelligent Transportation agencies' decisions and challenges, **Mark DeVries** was brought on-board. He spent 30 years with McHenry County Illinois Department of Transportation.

#### **What sort of roles did you have?**

From operator, I was promoted to supervisor of the road maintenance crew and then to superintendent of operations, overseeing all aspects of maintenance, including overseeing our snow and ice operations.

#### **What made you decide to come work for Vaisala?**

I believed the company could utilize my expertise, and that I would be able to continue to share my experiences and educate others in what I learned in my career at McHenry County.

#### **Was there anything that surprised you about Vaisala?**

I was very surprised at how big the company actually was, and all the different areas the company was involved in. Plus, as a customer, I had no idea of all the technology behind the products. I was also amazed with the people that I work with and the knowledge and scientific expertise that they have.

#### **What is your role now?**

Currently, I am working on three different consulting projects. I continue to be involved in winter maintenance committees, and in winter maintenance conferences, and I help internally with product development and future strategies for the company. I get to share my experience, mentor some of my colleagues, and help them understand our industry better.

#### **What is the most rewarding thing about working with customers?**

One is the opportunity to continue working with the agencies that maintain our transportation systems. There is nothing more flattering than to share your experience with someone else and see him or her benefit from it, and improve their own agency.

#### **How do you recommend an agency get started?**

First, educate yourself on what is available, and what others in the industry are doing. Second, if you are going to implement a program it is always best to find a champion within your agency. Once you have this, you can start a program, it does not need to be full implementation from day one.

#### **What is something you think customers do not know about Vaisala?**

I do not believe our customers know much about our ability to help in the area of consulting. Our experts can help in any area of transportation, and we have many different services to offer. Our global presence means we have access to experts and solutions all around the world.



# Creating Value for Our Stakeholders

*Vaisala believes  
in a world where  
environmental  
observations improve  
the safety, efficiency,  
and quality of life in  
societies.*



*With a modern weather forecasting network, covering the whole expanse of the country, The Bahamas will be able to keep its citizens and numerous visitors safe from the ravages of extreme weather.*

In Vaisala, as in businesses everywhere, focus on sustainability is shifting from reducing negative impacts to creating sustained value over time as well as positive societal impacts. We also want to present improved ways of expressing our purpose and tangible impacts on the society and our stakeholders.

With this in mind, we started to seek out important stakeholder groups for Vaisala and engaged their key people in this research to get a refreshed understanding of how they see Vaisala and how they understand our purpose and opportuni-

ties arising from sustainability in business.

### **Creating Value to Vaisala's Stakeholders**

The key question for any company must be how to create value for its stakeholders, such as customers, investors, its employees, and even for the whole society. What is the reasoning of the company and its purpose in society?

We have determined that Vaisala creates different types of value to each of its stakeholders. To describe

this in more detail, we have summed up these impacts in the Value Creation Model, a holistic graphical representation of Vaisala's key aims and benefits our four most important stakeholder groups.

In the model, we present the megatrends and business drivers that stimulate Vaisala's business, the resources we need to succeed in delivering our mission, the strategic focus, and the concrete values we create to our most important stakeholders.



## Purpose and Mission

We at Vaisala believe strongly in the company's purpose and mission, 'Observations for a better world'. It guides both our daily work and sets the long-term vision for us all. Employees in Vaisala feel that there is a greater purpose in what they do and we are able to affect the safety of people.

CEO & President **Kjell Forsén** echoes this sentiment: "Many of our partners have come to learn that the work we do has a profound effect on the world as a whole. Many of our customers work in fields that have lifesaving consequences to people and we help them fulfill their mission."

## Solutions to Global Challenges

We are ever more conscious of how the surrounding world affects our business. We track megatrends that we believe are shaping the world, and we actively embrace the opportunities they provide.

Chairman of the Board **Raimo Voipio** talks more about the most challenging changes in our time:

"Vaisala is directly affected by and helps in addressing many of the megatrends reshaping the world now and in the future. In my opinion, the most disruptive trends are urbanization, digitalization, and, in a fundamental way, climate change. Urbanization, as it is taking

place now, is inherently unsustainable," Voipio reminds us.

"We often envision smart cities with complex infrastructures in place, but where urbanization is most intense, they are distant luxuries. Acute challenges are related to air quality, lack of clean energy, and safe transportation. Vaisala's instruments help tackle these everyday issues," he points out.

## Answering Societal Challenges

Vaisala's operations are right at the heart of establishing strong foundations for better environmental sustainability. Through sustainable technologies, Vaisala ensures the operations of their customers are safe, efficient, and reliable.

Favorable and negative weather conditions can have a huge impact on societies, whether it be in the form of renewable energy or natural disasters. Vaisala helps societies to take advantage of situations where conditions are good and mitigate against instances when they can be destructive.

Ultimately, Vaisala's technology and solutions help our customers safeguard life and property, while enabling critical decision-making that facilitates effective and efficient operations.

Vaisala's products are inherently nonintrusive, require low energy input, need little servicing, and can be maintained remotely. The common denominator is that by measuring the environment accurately, the outcome is safer, more efficient, reliable, and sustainable operations in any application area.

Vaisala is in a unique position to promote sustainable development through the technologies it offers to its customers.





Vaisala's value creation model is a holistic representation of our impacts in the world and shows the value we create to our different key stakeholders.

### The World of Observations

To succeed in bringing the best technologies to the market and fulfilling our mission, we must ensure that all the resources we need are at our disposal.

Talented and knowledgeable personnel is a key requirement for our success, and that is why we want to ascertain that employees are always learning on their job and are healthy and motivated at their work place.

A strong financial position gives us freedom to carry out investments in due course and signals to the capital markets that we are both a safe company for lending as well as a reliable and profitable investment.

Our long and robust partnerships within both the business commu-

nity and academia help us stay on the cutting edge of technological advancements. We also work in cooperation with our customers, when developing new solutions.

We seek to minimize our impact on the environment, and through our technologies, we strive to have a net positive effect on society and the environment as a whole.

### Integrating Sustainability into our Business

Vaisala believes in a world where environmental observations improve the safety, efficiency, and quality of life in societies. This is why we named this year's sustainability report after our mission

“Observations for a Better World 2016.”

Vaisala has published sustainability reports since 2009, making this the ninth in the series and our first report to take definite steps towards Integrated Reporting, whose primary purpose is to describe how a company creates value over time.

By creating the Value Creation Model – the World of Observations – we have now laid the groundwork for taking Integrated Reporting further.

**More information and the full report can be found at [www.vaisala.com/sustainability](http://www.vaisala.com/sustainability)**

# Predicting Atmospheric Rivers to Better Inform Reservoir Management

*The Center for Western Weather and Water Extremes in California is using radiosondes to monitor water vapor transport as part of its research program to improve reservoir management.*

## Room for Improvement

California has been through a rough set of years in terms of weather. The state has seen drought conditions for over five years, which has affected its agriculture production, the economy, and it has increased the risk of health concerns. Finally, in 2017, the state has seen a break in the drought, with record-breaking precipitation. The extreme conditions have made it more important than ever to closely monitor the state's reservoirs.

The Center for Western Weather and Water Extremes (CW3E) at Scripps Institution of Oceanography, UC San Diego, is conducting research

on atmospheric rivers, which are narrow bands of high water vapor concentration that extend from the tropics, as part of FIRO, or Forecast Informed Reservoir Operations. FIRO is a proposed management strategy that uses data from watershed monitoring, and modern weather and water forecasting, to help water managers selectively retain or release water from reservoirs in a manner that reflects current and forecasted conditions. The goal is to provide water managers more lead-time, so that they can optimize operations, and improve water supply and environmental flows without diminishing flood control or dam safety.

## Research Methods

As part of the research for FIRO, CW3E conducted a field campaign to collect observations of atmospheric conditions during atmospheric river events. This included monitoring weather conditions at two sites between January and March 2017, one near the coast and one inland. A variety of weather instruments were used at each site, including the Vaisala Radiosonde RS-41, which collects upper-air atmosphere observations. FIRO's objectives for each site location were:



1. To take observations of atmospheric rivers (ARs) at the coast, as well as inland, in order to assess water vapor transport as the AR interacts with the terrain.
2. To collect precipitation measurements to support numerical weather prediction modeling, and better understand precipitation accumulations and intensities, and their effect on the watershed.

Atmospheric rivers are relatively long, narrow regions in the atmosphere – like rivers in the sky – that transport water vapor, and they were, “particularly strong this year,” comments Dr. Anna Wilson, Research Scientist with CW3E working on FIRO. Scientists are familiar with monitoring atmospheric rivers, and adding radiosonde observations allows for a better understanding of the vertical profile and transport of water vapor. This is the second year that FIRO has been monitoring weather conditions, and Wilson added, “Unique this year was the use of concurrent soundings at two locations. We chose the Vaisala RS-41 because it is the most trusted device for this type of observation.”

### Using the Data

Observations were taken at regular intervals, based on weather forecasts and model data – every three hours during storm events, and more frequently during peak times, which may last anywhere from 10 hours to 100 hours. Wilson shared that collecting observations was exciting and sometimes stressful because lead times were often short. “Quick deployment was key to successful data collection, so the portability of the RS-41 was a definite benefit. Also, it was great to be able to see the radiosonde data in real-time, which

provided immediate details about the height and range of water vapor transport.” The radiosonde data, along with other observations were valuable for several purposes:

- The vertical profiles determined where the highest winds, and thus, farthest transport of water vapor was occurring.
- Near-real time data was provided to the local National Weather Service (NWS) forecast offices, and in turn, they used it for helping to validate forecast models.
- New observation data helped validate a community mesoscale forecast model tailored by CW3E to predict precipitation in the western U.S.
- The observations allowed for better tracking of maximums and strong storms.
- The project provided a trusted set of data for further analysis and research.

There were some interesting discoveries during this phase of the project. With the record amount of precipitation, the research team was very busy. Wilson noted that they were able to sample several strong storms this year, and it was interesting to see the high concentrations in water vapor transport. “The reliable and

robust radiosonde equipment especially gave us confidence in the data.”

### Next Steps

With a dependable set of data, CW3E will conduct further analysis to determine the potential viability of these new methods for water managers. Wilson notes, “We are researching this new process for its potential to support improved operations. We are taking a careful and considerate look at the science and methodology, so that if these new methods are proven viable by this research, water managers can enhance the timing and amount of retention or release of water from local reservoirs, with procedures that will both enhance water supply and decrease flood risk.” Updated operational procedures will take place over time, as this program continues its research. Vaisala looks forward to working with CW3E for future observation needs that result in a successful program.





# Proactive Maintenance through Online Monitoring

TVO Nuclear Power Plant Monitors Transformer Condition in Real-Time

*Continuous monitoring of transformer status helps Teollisuuden Voima plan its maintenance activities proactively, decreasing the likelihood of costly failures.*

For a power company like Teollisuuden Voima (TVO), reliable transformer functionality is critical for the power plant to operate in a planned manner. This is why the company has a well-thought-out maintenance and monitoring plan for their transformers. For example, the plan includes regular manual oil sampling of the transformers.

The industry recommendation is to take samples once a year, and TVO has implemented strict controls to all safety and reliability related matters. To improve the situation further,

TVO has decided to start monitoring their transformers in real-time.

After thorough evaluation, they selected Vaisala's MHT410 Moisture, Hydrogen and Temperature Transmitter for Online Transformer Condition Monitoring.

## **Cost Efficient Hydrogen Monitoring**

The MHT410 monitor provides continuous, real-time data of moisture, hydrogen and temperature. Of these, the rising hydrogen gas concentra-

Teollisuuden Voima (TVO) is a Finnish nuclear power company with almost 40 years of experience in the safe and reliable production of reasonably priced electricity. The net output of its two nuclear plant units currently in operation is 880 megawatts. Together, these units produce one sixth of all the electricity consumed in Finland.

For its own electricity needs, the utility has high-voltage transformers for stepping down the energy from a 400 or 110 kV network. One of these is a stand-by transformer, which turns on automatically, if any of the other transformers suddenly stop operating.



tion in the transformer oil is an indication of a fault in the transformer, while moisture monitoring is important to know e.g. the insulation ability of the oil.

The online data allows the transformer operators, for example, to apply real-time trending to analyze the condition of the transformer.

“When selecting the hydrogen monitor, we compared several products, and the features of Vaisala MHT410 convinced us,” say TVO’s System Engineer **Janne Jurkola** and Maintenance Engineer **Pasi Pietilä**.

“The MHT410 is suitable for this purpose, and it is simple to install. It has all we need, but nothing extra we don’t need. Also the price and the cost of ownership are on the right level”, they continue.

That the online monitor is made by a Finnish company with long roots in the measurement business in

general, and in oil measurement in particular, also factored in the decision-making.”

### Easy Installation and Reliable Results

TVO installed the first MHT410 monitor to their stand-by transformer, as it was conveniently next in line for a regular maintenance. The device sends alarms to the utility’s 24/7 control room, according to pre-defined limits set by the maintenance team.

TVO has used the MHT410 now for 12 months.

“When comparing online results from the MHT410 to the manual samplings we’ve taken, they are well aligned. The results are cred-

## Installation of the MHT410 is very intuitive and easy.

ible,” says Pietilä, who is responsible for the maintenance of the transformers.

Both Janne Jurkola and Pasi Pietilä believe online monitoring will be part of the future

picture in the industry.

“Failures with large and long-standing financial consequences can be mitigated with relatively small investments to online monitoring, as it gives information when to take proactive maintenance steps,” says Janne Jurkola of TVO.

# Gassing Transformers Require Continuous Monitoring

*A study made by Vaisala and Fingrid demonstrated that real-time data is critical in assessing the health of assets, particularly ones with a history of faults.*

Online monitoring is essential in keeping tabs on developing gas trends in a transformer and assessing the efficacy of repairs. This was demonstrated in a study Vaisala conducted together with Fingrid, the national grid operator of Finland.

As part of the study, Vaisala deployed its Optimus online Dissolved Gas Analysis (DGA) device to monitor both the removal of dissolved gases from a 400 MVA transformer, and the gas trends in the following 14 months.

The study demonstrates that, for transformers with a fault history, online measurement of dissolved gas levels is crucial, even after repair and maintenance work.

## Managing a Recurring Problem

Once significant levels of fault-generated gases are detected in its oil, a transformer must be taken offline and have its fault diagnosed. Often, the transformer oil is also treated during or after the actual repair of the fault, in a process known as degassing.

When the gases are removed from the oil, a new baseline reference

is formed to detect any increasing gas trends in the future. This in turn is essential to reveal internal thermal activity or fault, which generates gases.

However, it is difficult to achieve full removal of all dissolved gases, meaning that gas levels may begin to rise again shortly after degassing, even without any fault being involved. As a result, online DGA monitoring is required, since the transformer continues in operation after the fault has been repaired.

In conjunction with Fingrid, Vaisala equipped a 400 MVA power transformer in Finland with a multi-gas Optimus DGA monitor prototype, which remained in place before, during and after scheduled degassing work.

The monitor tracked changes in dissolved gas levels in real time, demonstrating how an underlying thermal issue remained, even after the transformer in question had undergone repair and initial degassing.

“The results show that utilizing a multi-gas monitoring device is essential also going forward, to monitor this transformer continuously and with enough accuracy



and good repeatability to illustrate gas trends consistently,” tells **Senja Leivo**, Senior Industry Expert at Vaisala.

## ‘Health Check’ after Repairs

“When it comes to transformer maintenance, there really is no such thing as a quick fix,” commented Senja Leivo.

“As transformer fleets continue to operate past their designed life span, online DGA monitoring is essential, if internal faults are to be detected and addressed promptly and efficiently. It also provides an invaluable ‘health check’ following repairs and other service actions, demonstrating exactly how effective this work has

been in targeting the root causes of gas build-up.”

The full findings of this collaboration were first presented by Senja Leivo and **Juha Mertanen**, an Adviser at Fingrid, in TechCon 2016 industry seminar in the UK. The

research paper is entitled ‘Transformer Fault Detection and Repair Followed by Degassing Monitored with Online DGA’. It can be downloaded at

[www.vaisala.com/dga](http://www.vaisala.com/dga)



### Installation in Two Hours

Vaisala has recently launched its new Optimus DGA Monitor for Transformers. As a result of its careful design and the patented technology, the monitor measures reliably without giving any false alarms.

This is possible, firstly, because the monitor carries an IR sensor based on Vaisala core measurement technology and components manufactured in the Vaisala in-house cleanroom. Secondly, the monitor uses vacuum gas extraction, which gives a fully representative sample and means no data fluctuation due to oil temperature, pressure, or type.

The monitor stays reliable over time, as hermetically sealed and protected optics prevent sensor contamination, and long-term drift is eliminated with a unique autocalibration functionality.

The Vaisala Optimus™ DGA Monitor is designed to be installed in less than two hours – the users need only to connect the oil, power, and data connections. The user interface is browser-based, and no additional software is needed.





# First Metropolitan Network to Measure Air Quality

*The first city-wide air quality measurement network will cover the whole Helsinki region, providing local data and forming a platform for new innovations.*

In 2017–2018, the Smart & Clean project parties will build a new network to measure air quality in the Helsinki region. It will be the first monitoring system of such accuracy in the world to cover the whole city.

## Local Information Essential for Improvements

The new monitoring network will help compile much more comprehensive information about the air quality in different parts of the Helsinki metropolitan region. The Smart & Clean project aims at improving air quality in the Helsinki region as well as creating new, innovative applications, and piloting solutions suitable for export.

“Actions taken to improve air quality can only be successful when based on measured data which again gives rise to insights,” says **Jarkko Sairanen**, Vaisala EVP for the Weather Business Area.

“Air quality varies significantly even in very small areas due to e.g. weather, emissions, and traffic flows, so we need local information to

improve people’s quality of life and to achieve a deep understanding of metropolitan air quality.”

Air quality is a growing health problem around the world. More than 80% of people living in urban areas are exposed to air pollution levels that exceed WHO limits. According to WHO estimates, approximately 7 million people died prematurely because of air pollution in 2012.

Even in Finland, where air quality is generally good, 40% of city dwellers get symptoms from street dust, and air pollution is estimated to cause about 1,600 premature deaths per year.

## Latest Technology Employed

The monitoring network project uses the latest technology and cutting-edge air quality knowhow from Finland. The parties involved include the Finnish Meteorological Institute, Helsinki Region Environmental Services Authority HSY, University of



Helsinki, Pegasor, and Helsinki Metropolitan Smart & Clean Foundation, in addition to Vaisala.

Traditionally, air quality is measured using reference measurement stations that are very expensive, so their number and regional coverage is highly limited.

The network uses Vaisala instruments, launched in the fall of 2016, that can be used to significantly improve local coverage of the measurements at a very reasonable cost. The AQT400-series transmitters are a low-cost solution to measuring reliably the most important air pollutants: particles, nitrogen dioxide, sulfur dioxide, ozone and carbon monoxide.

The instruments are easy to install and deploy as well as to maintain. They can also be connected to Vaisala's weather measurement equipment as well as different air quality modeling systems. The combination can significantly improve the reliability of real-time air quality measurements in diverse terrain and city environments.



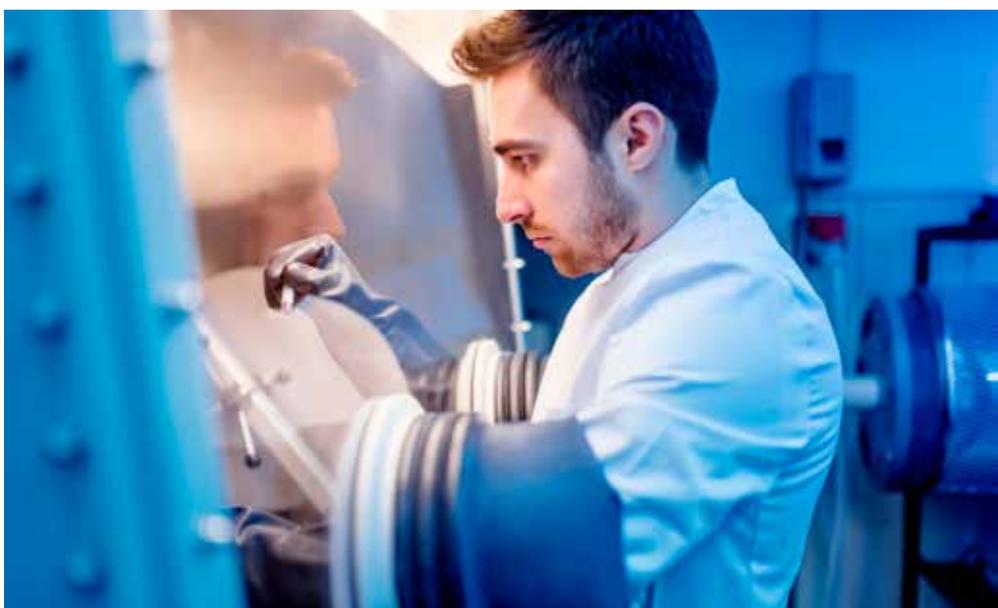
# Expanding to Vaporized Hydrogen Peroxide

*Vaisala's new solution for the measurement of vaporized hydrogen peroxide helps pharmaceutical manufacturers and healthcare providers keep their equipment and facilities clean efficiently.*

The manufacture of pharmaceuticals and treatment of people require thoroughly clean equipment and facilities. Today, vaporized hydrogen peroxide is an ideal bio-decontaminant of choice.

To get rid of the unwanted microorganisms, the decontamination process has to use a sufficient amount of vaporized hydrogen peroxide. This is where Vaisala steps in, with its new HPP272 probe, which takes the company to a completely new area of measurements.

"The measurement of vaporized hydrogen peroxide is an interesting possibility for growth for us, as the need for more pharmaceuticals and treatment facilities is growing in the



world. The need for bio-decontamination and sterilization grows at the same pace," says **Sampsa Lahtinen**, EVP, Vaisala's Industrial Measurements business area.

## **Eco-friendly Destroyer of Germs**

Vaporized hydrogen peroxide destroys even the most resistant microorganisms, like bacterial spores, mycobacteria, and viruses at room temperature and low concentrations.

Unlike many other decontaminants, it has no toxic by-products and leaves no residue, simply turning into water and oxygen, its constitu-

ent parts. This also means it can be used with a wide variety of materials and products.

The surfaces to be cleansed are exposed to vaporized hydrogen peroxide, to bio-decontaminate and sterilize rooms, facilities, and equipment. For example, isolators, material transfer hatches, treatment rooms in hospitals, or even whole aircraft can be decontaminated this way.

## **Repeatability Cycle after Cycle**

Earlier, it has been difficult to reach sufficient stability in vaporized hydrogen peroxide measurements, and the measurement solutions have

often been prone to breaking or awkward to use, requiring a special setup, like a pump, to work.

The small and robust HPP272 achieves accurate and exceptionally repeatable measurements. It can measure not only the hydrogen peroxide content (ppm) of bio-decontamination but also temperature, relative humidity (RH, only water vapor), and relative saturation (RS, whole gas mixture).

“The repeatability of measurements is extremely important to achieve reliable verification of the bio-decontamination process cycle after cycle,” says Vaisala Product Manager **Sanna Lehtinen**.

The main factors in the probe’s repeatability are its new PEROXCAP® sensor, intelligent algorithm, and heating function.

### New Sensor Purges to Stay Accurate

The PEROXCAP® is based on the company’s relative humidity sensor HUMICAP®, which is known for its accuracy, repeatability, and stability, and it brings these qualities now to the measurement of vaporized hydrogen peroxide.

The reliability of PEROXCAP® also depends on its intelligent measurement algorithm and heating function, which ensures water cannot condense on the sensor. This keeps measurement data reliable even in extremely high humidities.

Moreover, the sensor has a purge function that helps maintain measurement accuracy between calibrations and extends the operating life of the probe. This function heats the sensor rapidly to remove possible impurities left in the sensor’s polymer films.



### HPP272 Hydrogen Peroxide, Humidity, and Temperature Probe

- For demanding bio-decontamination process control and monitoring
- Corrosion-resistant stainless steel housing
- Two-point traceable hydrogen peroxide calibration
- Standalone probe with digital Modbus RTU over RS-485 or 2 analog outputs
- Plug-and-play compatible with INDIGO series of transmitters with 3 analog outputs
- H<sub>2</sub>O<sub>2</sub> vapor measurement range: 0...2000 ppm with accuracy +/- 10 ppm or 5% of reading (whichever is greater)

PEROXCAP® is a registered trademark of Vaisala Oyj in the European Union.

# VAISALA

## Europe

### Vaisala Oyj

P.O. Box 26  
FI-00421 Helsinki  
FINLAND

### Vaisala Oyj

Malmö Office  
Drottninggatan 1 D  
S-212 11 Malmö  
SWEDEN

### Vaisala Oyj

Stockholm Office  
Johanneslundsvägen 2, 1tr  
S-194 61 Upplands Väsby  
SWEDEN

### Vaisala GmbH

Bonn Office  
Adenauerallee 15  
D-53111 Bonn  
GERMANY

### Vaisala GmbH

Hamburg Office  
Notkestr. 11  
D-22607 Hamburg  
GERMANY

### Vaisala Ltd

Birmingham Operations  
Elm House  
351 Bristol Road  
Birmingham B5 7SW  
UNITED KINGDOM

### Vaisala Ltd

Bury St Edmunds Office  
Unit 2b Hillside Business Park  
Kempson Way  
Bury St Edmunds, Suffolk, IP32 7EA  
UNITED KINGDOM

### Vaisala SAS

Paris Office  
39/41, avenue des 3 Peuples,  
Bât. B-Entrée B1,  
78180 Montigny-le-Bretonneux  
FRANCE

### Vaisala SAS

Lyon Office  
12, Avenue des Saules  
F-69600 Oullins  
FRANCE

## Middle East

### Vaisala Oyj

Single Business Tower, 9th Floor  
Office No. 906  
Sheikh Zayed Road, Dubai  
UNITED ARAB EMIRATES

## Americas

### Vaisala Inc.

Boston Office  
10-D Gill Street  
Woburn, MA 01801  
USA

### Vaisala Inc.

Boulder Operations  
194 South Taylor Avenue  
Louisville, CO, 80027  
USA

### Vaisala Inc.

Houston Office  
1120 NASA Road, Suite 220-E  
Houston, TX 77058  
USA

### Vaisala Inc.

San Jose Office  
6980 Santa Teresa Blvd.  
San Jose, CA 95119-1393  
USA

### Vaisala Inc.

St. Louis Office  
2055 Craigshire Road, Suite 120  
St. Louis, MO 63146  
USA

### Vaisala Inc.

Seattle Operations  
2001 6th Avenue, Suite 2100  
Seattle, WA 98121  
USA

### Vaisala Inc.

Tucson Operations  
2705 East Medina Road  
Tucson, AZ 85756  
USA

### Vaisala Inc.

Westford Office  
3 Lan Drive, Suite 100  
Westford, MA 01886  
USA

### Vaisala Canada Inc.

110 - 13551 Commerce Parkway,  
Richmond BC, Canada, V6V 2L1  
CANADA

### Vaisala Serviços de Marketing Ltda

Ladeira Madre de Deus, 5 - Gamboa  
20-221-090 Rio de Janeiro  
BRASIL

## Asia and Pacific

### Vaisala KK

Tokyo Office  
Jimbocho Mitsui Building  
1-105 Kanda-Jimbocho  
Chiyoda-ku  
Tokyo 101-0051  
JAPAN

### Vaisala KK

Osaka Office  
Soken Midosuji Bldg 2F  
3-5-13 Awaji-machi  
Chuo-ku, Osaka-shi  
Osaka 541-0047  
JAPAN

### Vaisala KK

Nagoya Office  
GS Sakae Bldg 3F  
5-26-39 Sakae,  
Naka-ku, Nagoya-shi  
Aichi 460-0008  
JAPAN

### Vaisala China Ltd

Beijing Office  
2F, EAS Building  
21 Xiaoyun Road  
Chaoyang District  
Beijing 100027  
PEOPLE'S REPUBLIC OF CHINA

### Vaisala China Ltd

Shanghai Office  
Room 1102, Information Tower  
No. 1403 Minsheng Road  
Pudong New District  
200135 Shanghai  
PEOPLE'S REPUBLIC OF CHINA

### Vaisala Oyj

Korea Liaison Office  
16th Floor, Gangnam Bldg  
1321-1 Seocho-dong  
Seocho-gu  
Seoul 137-070  
SOUTH KOREA

### Vaisala Pty Ltd

Melbourne Office  
3 Guest Street  
Hawthorn, VIC 3122  
AUSTRALIA

### Vaisala Oyj

Regional Office Malaysia  
Level 11, West Block  
Wisma Selangor Dredging  
142-C Jalan Ampang  
50450 Kuala Lumpur  
MALAYSIA

### 3TIER R&D India Private Ltd.

T-2, Farhaan Centre, # 24/1  
Walkers lane, Langford Road Cross  
Richmond Town, Bangalore- 560025  
Karnataka  
INDIA