Review

Environmental Analysis Technology for Peace of Mind

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The needs of the environmental analysis market have developed considerably over the past 50 years, covering a wider range of objects, and demanding improved measurement accuracy. HORIBA has responded to these more demanding needs with advances in technology to provide analytical instruments for every field of environmental analysis. In this paper, we outline global development in the environmental analysis field of the HORIBA group. And we review the activity of HORIBA to contribute to the development of industry and support of human health, safety and peace of mind through the analysis and measurement of environmental pollution.

Introduction

Along with industrial development has come rapid growth in the consumption of energy and enormous advances in heavy and chemical industries that has resulted in the rapid deterioration of the environment. Pollution, for example, the contamination of air and water, has become a major social issue, resulting in new laws and regulations from administrative authorities. Analytical technology makes this legislation effective, by allowing us to quantify levels of pollution which cannot be detected by human sight or sense of smell. Early on, the demands of the environmental analysis market were for new technology which would permit continuous assessment using analytical instruments designed for outdoor use, instead of periodic assessment using analytical instruments designed for use in laboratory research. HORIBA possessed technological expertise in atmospheric analysis in the form of their medical gas infrared analysis technology (used to analyze human breath), and in liquid analysis in the form of laboratory-use pH analyzers. Combining this expertise with new technology, HORIBA developed analyzers which met the requirements of the environmental analysis market for continuous monitoring of pollutants. These efforts resulted in the established analytical technology used in our modern atmospheric analysis, engine exhaust and flue gas analysis, water quality analysis for rivers and other fresh water sources, and analysis of factory effluents (Figure 1,2).

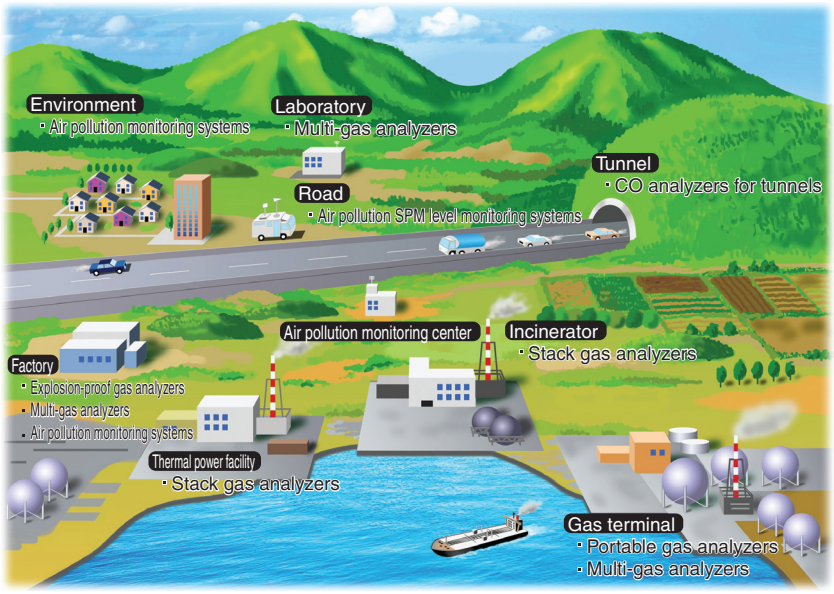

Figure 1 Typical Applications for Air Pollution Analyzers, Engine Exhaust and Flue Gas Analyzers

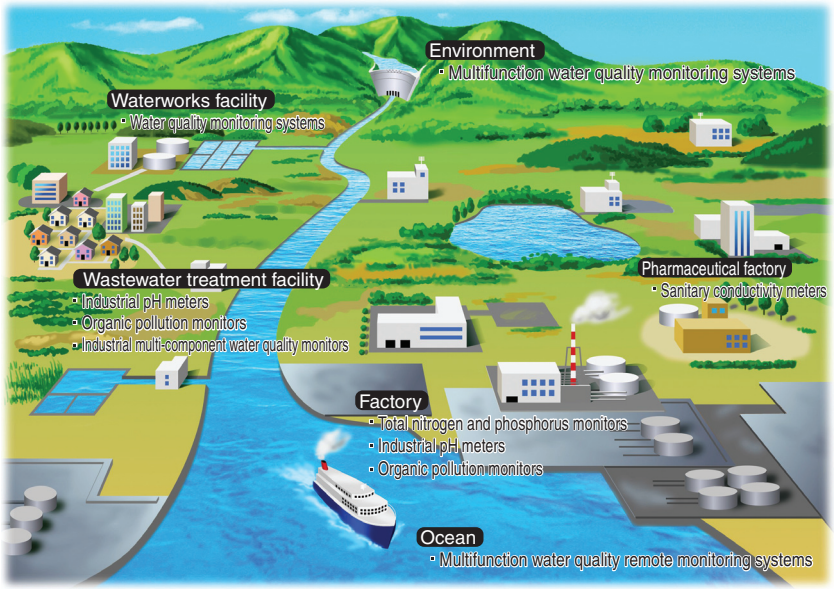

Figure 2 Typical Locations where Water Quality Analyzers are Used

Developments in Environmental Analysis Technology

As pollution emerged as a social issue, efforts began to reduce the levels of pollutants in various industrial processes, resulting in a need for technology capable of analyzing pollutants at significantly lower concentrations. From that period on, trends toward improved productivity and energy conservation in the industrial world generated a demand for instruments with greater reliability and stability. Environmental analyzers in particular are required to accurately measure specific pollutants continuously for more than a decade. Therefore we pressed ahead with technical improvements aimed at insuring accurate analysis for long time periods by any means possible.

In addition to these technical improvements, the provision of maintenance services to keep precision equipment such as analyzers in good condition is also vitally important. HORIBA Group has built up a nationwide

service system, that has now developed into a group company known as HORIBA Techno Service, a professional maintenance organization. In the process of developing technology for environmental analysis, we made advances in identifying the analytical principles best suited to each type of measurement, and have established numerous analysis technologies, such as the chemiluminescence method for detecting traces of nitrogen oxides, and ultraviolet spectrophotometry for detecting sulfur oxides. HORIBA has also developed a wide range of technologies for water quality analysis, ranging from electrochemical to optical sensors. Since the Japan's water quality total pollutant load control regulation was introduced in 1979, HORIBA's water analysis technology has played a major role in water quality monitoring.
These new technologies have been honed and developed by the need to support newly introduced legislation as well as industrial development (Figure 3).

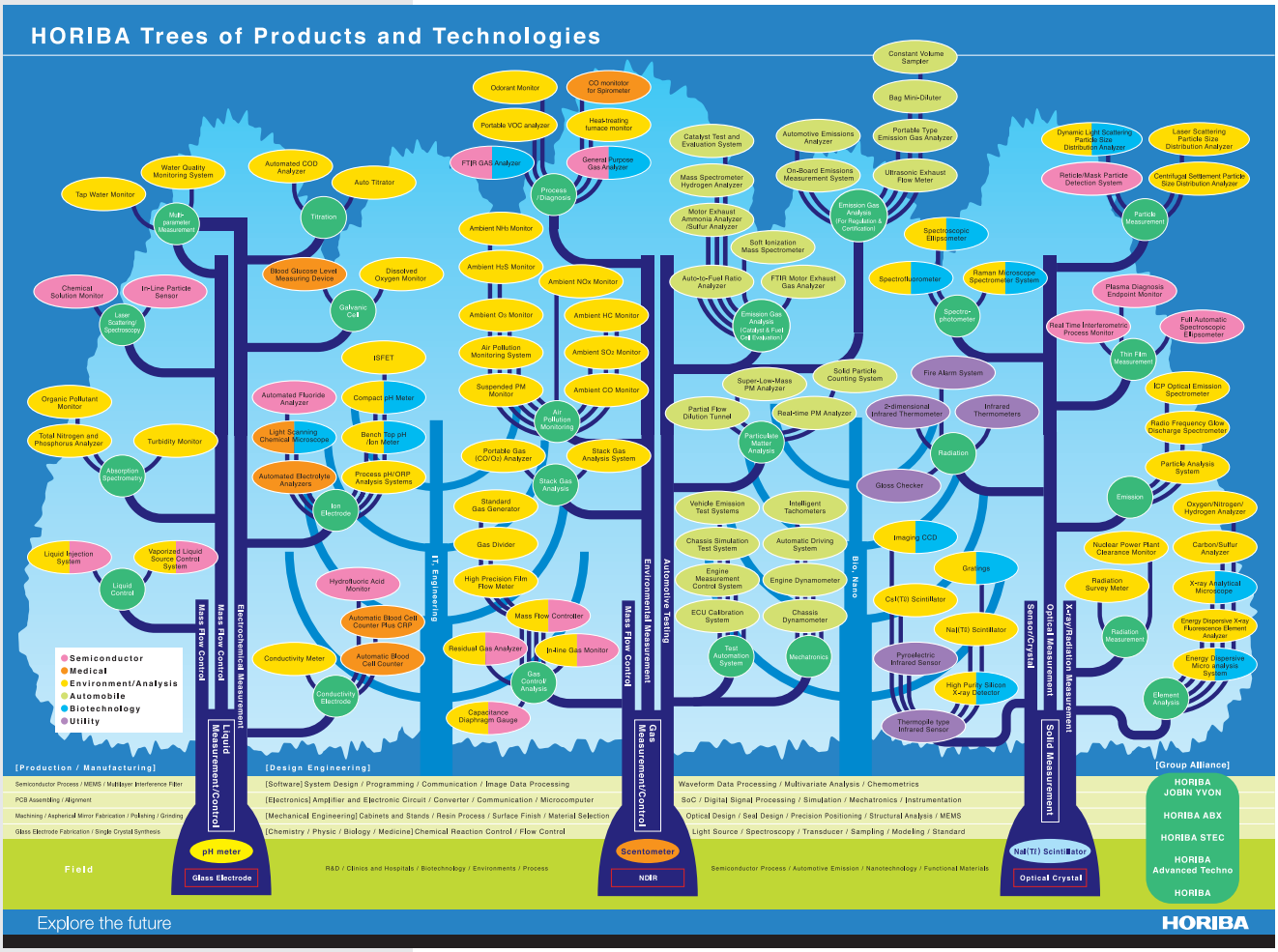

Figure 3 HORIBA Products and Technologies

Initiatives Affecting Global Development and the World Environment

The HORIBA Group provides technology not only for Europe and the U.S.,

but also for Asia, an area experiencing rapid economic growth. In Europe, an early adopter of environmental protection initiatives, HORIBA has achieved a high market share in trace element gas analyzers, especially in the field of environmental atmospheric analysis. Technology used in the analysis of trace element gases has made it possible to analyze extremely low concentrations of compounds in the atmosphere on the order of several ppb (parts per billion) - we like to call it nanotechnology for gas analysis.

In analysis of gases produced during the combustion process, we provide CEMS (Continuous Emissions Monitoring System) to power plants and factories of all types in the U.S. We believe that these results indicate that the market recognizes the value of the HORIBA brand in terms of stable, high quality analytical equipment.

Asian countries have more recentry followed the environmental policies of Japan, Europe and the U.S. For example, Korea has introduced stricter regulations for control of gaseous pollutants and this has encouraged many clients to start utilizing HORIBA analyzers for monitoring their emissions of regulated pollutants. In China, rapid industrial development boosted energy consumption, and environmental pollution is increasing rapidly. This has made water quality monitoring at pollution sources a priority. Organic contaminants, for example, are measured using the COD_{Cr} method[*1]. The emission of toxic chrome has also become a serious issue, and ultraviolet spectrophotometry analyzers are attracting attention because they do not emit toxic reagents.

At present, regions where environmental problems are now under scrutiny and policies to reduce or eliminate pollutants are being put in place, are fortunate to be able to introduce advanced analytical and antipollution technology honed by the developed countries, to their own developing industries. We feel that our role is to provide the analytical technology in whatever form is best suited to the needs of each region, as one step toward protection of our global environment, and to prevent pollution problems experienced by developed countries.

*1: Chemical Oxygen Demand: When reducible organic matter in water reacts under certain oxidizing conditions, the amount of oxidant consumed is shown by conversion to the equivalent quantity of oxygen. This method of analysis makes use of potassium dichromate as the oxidant.

Adapting Environmental Analysis Technology for Industrial Processes

Technology refined by the demands of environmental analysis has been adapted to improve productivity and to assist research and development in industry. Environmental instrumentation has been adapted for a wide variety

of objectives in industry, such as new more precise analytical needs created by the development of new technologies such as semiconductors, or by the shift from quality control dependent on human senses to management by highly quantitative new monitoring devices. Fuel cells, a promising technological development, use hydrogen, a non-polluting source of clean energy. HORIBA environmental analysis technology addresses needs which arise from the fact that hydrogen fuel cells generate methane and carbon dioxide when used.

Semiconductor devices, now an essential part of comfortable modern life, are produced in "clean rooms", where even microscopic particles of dust are removed from the air. Clean room management uses HORIBA technology in quality control, removing not only dust, but also impurities other than oxygen and nitrogen. Introducing and defining new analytical technology is an essential part of HORIBA's ongoing provision of solutions which meet the analysis needs of industry. Conventional technology is not enough, if we are to provide our clients with optimum solutions, giving them online/in-situ analysis of emissions through simultaneous analysis of a great many elements as analytical objects.

Newly developed UV dispersion analyzers are less easily affected by moisture, and can also carry out simultaneous analysis of numerous elements. These instruments are therefore used to quantify sulfur content in petroleum and natural gas, and in the manufacture of chemical products. These analyzers are used to provide solutions for a wide variety of industrial applications.

Maintaining product safety has become a major issue in the food and beverage industry. This has placed further demands on environmental analysis technology, as these fields require further advances to determine the presence of E. coli bacteria, and to monitor the safety of production processes.

Contributing to Safety, Peace of Mind, and Good Health

Very few people in Japan 20 years ago would have entertained the idea of buying drinking water in plastic bottles. The concept of buying water is seen as a desire to maintain peace of mind or guarantee safety, or as concern for health. If buying a product is done in order to deal with something unsafe, we must consider the cause of these anxieties. People feel uneasy when their current knowledge and experience does not enable them to predict possible future events. Environmental analysis confirms that concentrations of pollutants are within permitted limits, allowing us to determine the influence of pollution on our health, and reassure us. In industrial processes, analysis allows us to quantify productivity and quality, providing peace of mind and

safety in industrial activities. Analysis of CO_2 concentrations provides basic data used to prevent global warming, and gives us an accurate picture of the current condition of our environment. These are just some of the ways in which analysis technology gives numeric values for things which cannot be quantified by human senses, and provides a firm basis for predictions.

Local bodies throughout Japan make great efforts to maintain the safety of their water supply. Although chlorine is added to the water supply to prevent bacterial growth, the residual chlorine concentration drops when water is stagnant. Residual chlorine is necessary, but it is vital to manage the level of concentration - if it is too high, problems such as metal corrosion occur, or if it is too low harmful substances form. In the past, simple manual analysis was conducted periodically to manage water quality at pipeline terminals or in holding tanks on high-rise buildings, but this has given way to a demand for continuous monitoring devices aimed at improving safety and productivity.

Conclusion

Environmental analysis technology has developed from the compulsory analysis demanded by environmental regulations arising from pollution issues. However, it has evolved into a basic technology for environmental improvement and will no doubt continue to develop to meet the independent needs of non-regulatory analysis to help provide solutions for the safety, reassurance, and health concerns of the 21st century.

The HORIBA Group, as an industry leader in providing total solutions for protecting the environment, and for industrial processing analysis, believes that our mission is to provide peace of mind, and to maintain safety and contribute to human health through the development of new technology and ideas.

We are delighted and also thankful that remaining alert to our clients' concerns has allowed us to harness so many aspects of analysis technology to provide solutions which excel in quality and reliability.

Reference

[1] Ministry of the Environment ,White Paper on the Environment 2002 Version, Ministry of Finance Japan, (2002).

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