



**NIC**

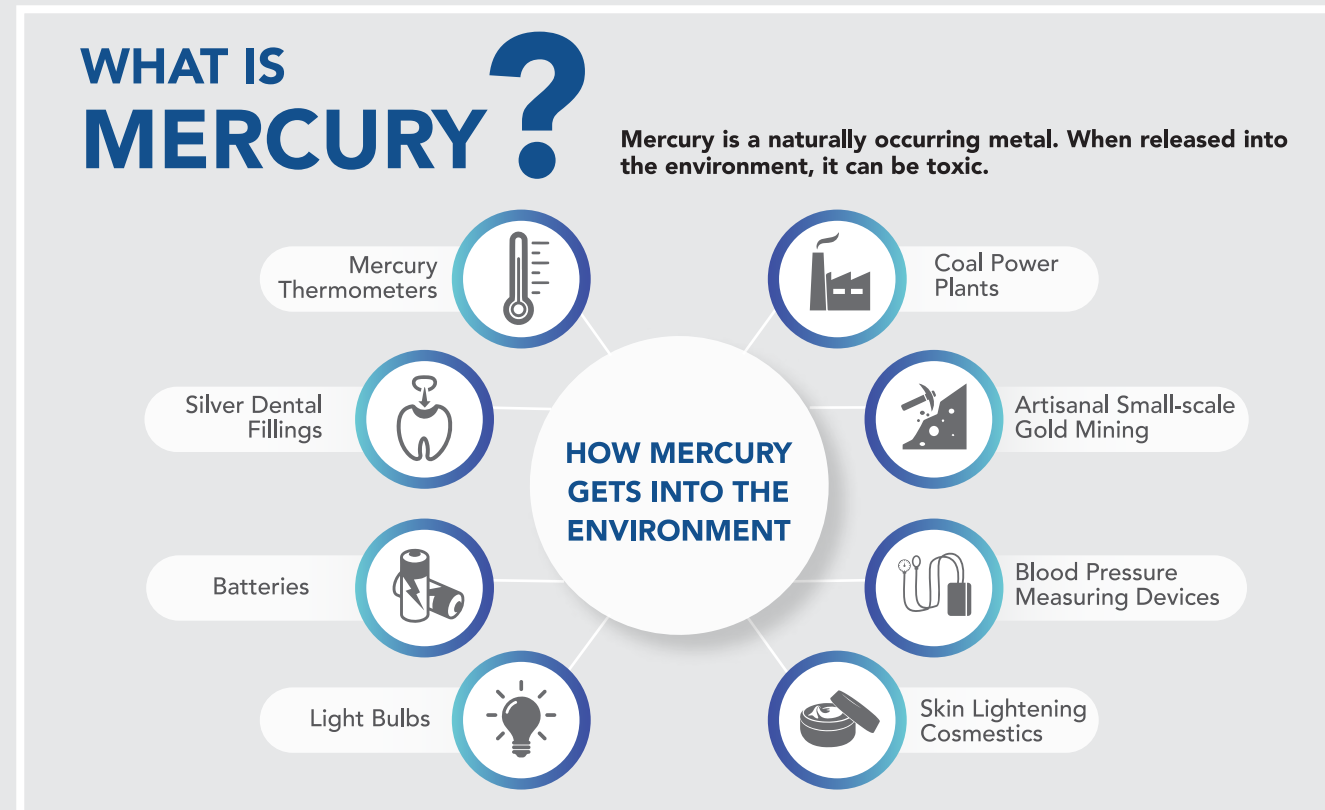
**NIPPON  
INSTRUMENTS  
CORPORATION**




*ENVIRONMENTAL  
SOLUTIONS FOR  
MERCURY ANALYSIS*

# ABOUT MERCURY & THE MINAMATA TREATY

Mercury is a toxic metallic element that poses serious health risks to our lungs, kidneys, nervous system, and more, while being especially concerning for the development of unborn children. Mercury exists in multiple forms: elemental (or metallic), typically found in air or gases; inorganic (e.g. mercuric chloride), typically found in water; and organic (e.g. methyl- and ethyl-mercury), which is commonly found in fish, each with different toxicity and pathways into our bodies.



The primary sources of anthropogenic (human-related) mercury emissions include coal-fired power generation, residential heating systems, waste incinerators and the mining of mercury, gold & other metals. Once released into the environment, elemental mercury transitions into our water sources and naturally transforms into methylmercury that bioaccumulates in fish and shellfish. In the end, mercury makes its way into the air we breathe, the water we drink, and even the food that we eat.



Minamata Disease, also known as Mercury Disease, is a neurological syndrome caused by severe mercury poisoning. Signs and symptoms include ataxia, numbness in the hands and feet, general muscle weakness, loss of peripheral vision, and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms. A congenital form of the disease can also affect fetuses in the womb.

The first known case occurred in the 1950's on the island of Kyushu in Japan in the Yatsushiro Sea off the coast of Minamata City. Industrial mercury pollution in the Minamata Bay bioaccumulated in the fish and shellfish, which were consumed daily by the local inhabitants. Over 1,700 of the over 2,200 victims of this tragic event lost their lives, as well as many dogs, cats & other animals. In the wake of this tragedy, the local community also suffered through social and political issues in addition to long lasting economic effects.

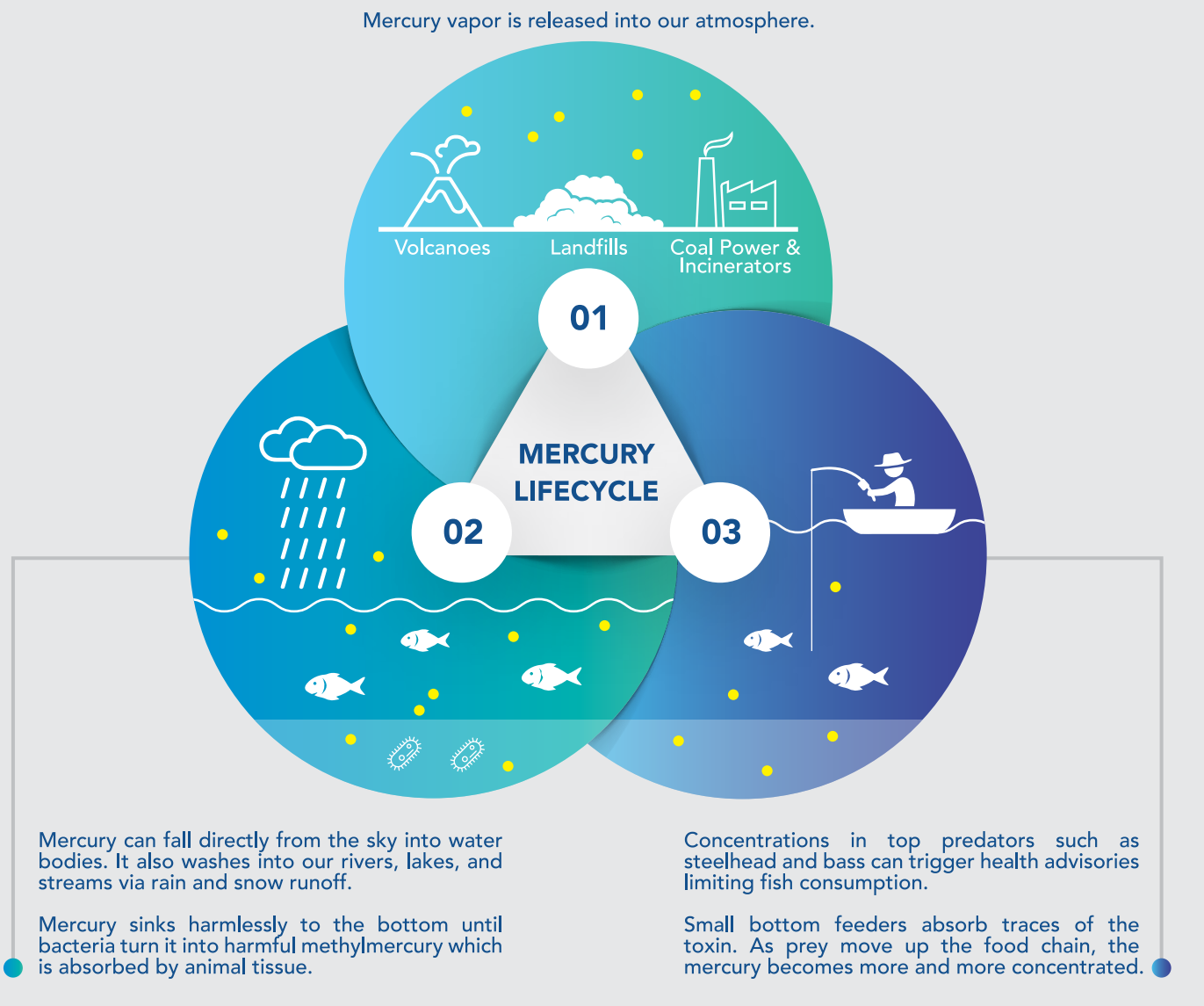
*"Courtesy photo taken by W. Eugene Smith, Copyright belongs to Aileen Archive"*

In October 2013, under the United Nations Environment Programme (UNEP), delegates from 128 countries gathered in Kumamoto, Japan to officially adopt and sign the "Minamata Convention on Mercury". The objective of the Minamata Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. It contains provisions that relate to the entire life cycle of mercury, including controls and reductions across a range of products, processes and industries where mercury is used, released or emitted.



# MERCURY SOURCES & LIFECYCLE

Mercury is released into the atmosphere, waters and land as a result of both anthropogenic (human-related) activities and natural sources such as volcanoes and erosion. Mercury in the atmosphere has the ability to travel for hundreds or thousands of miles, being transported around the world, where it is eventually deposited in the earth's soil, waters and plants. From there, mercury can be re-volatilized into the air, transported by rivers and streams, and absorbed into plant and animals that humans consume for food. For example, inorganic mercury in waters can be converted to methylmercury via microbial action. The methylmercury is then absorbed by small fish and shellfish. Larger fish consume the small fish, further concentrating the mercury within them through a process called bioaccumulation. It is highly important that we have an understanding of this global mercury lifecycle, so that we then understand how critical the monitoring and reduction of mercury emissions into our environment affect all life on earth.



Per the UNEP Global Mercury Assessment Report of 2015, the global inventory of mercury emissions to the atmosphere from anthropogenic sources was estimated to be 2,220 tons. Such emissions account for about 30% of the mercury emitted annually to the atmosphere. An additional 60% of the global mercury emissions are from other environmental processes, much of which involves recycling (or re-emission) of previously deposited anthropogenic mercury. The remaining 10% comes from natural resources such as volcanoes. This global inventory total does not include emission sources that cannot yet be reliably quantified. These unquantified sectors may add hundreds of tons of mercury to the actual emission totals.

As such, it is extremely crucial that we are able to reliably and accurately quantify mercury emissions & releases into every aspect of our environment (air, water & soil) with proven technologies and solutions. This is what drives Nippon Instruments Corporation to continuously advance & improve mercury analyzer technologies, and it's why we are The Global Leading Provider of Mercury Analyzers & Monitors.

## SOLUTIONS FOR ATMOSPHERIC AIR & GASEOUS

Mercury emitted in flue gas from coal-fired plants or open-flame flares in petroleum refineries can drift through the air for hundreds or thousands of miles before depositing into our water and soil. This mercury is then directly absorbed or methylated, transferring the mercury into our food web.



WA-5 series

### MODEL WA-5 FOR MERCURY IN AIR & GASES

Highly versatile, the WA-5 can be setup for "Grab-Tube Sampling" or fully automated, continuous sampling to measure Total Gaseous Mercury (TGM) in ambient air. An autosampler with 30 sample tube capacity is available to improve productivity. With your choice of Atomic Absorption and Atomic Fluorescence Spectroscopy detectors, the WA-5 complies with most regulatory methods for mercury in air, such as USEPA IO-5 (AF), ISO-20552 (AA or AF), EN-15852 (AA or AF) and more.



EMP-Gold+ series

### MODEL EMP-GOLD+ FIELD PORTABLE MERCURY ANALYZER FOR AIR & GASES

Unique, battery-operated & field portable Gold-Amalgam Mercury Analyzer for measurement & monitoring of mercury in ambient air in remote locations or where electricity is not available. The EMP-Gold+ offers excellent sensitivity with accurate quantification for Total Gaseous Mercury (TGM) down to 4 ng/m<sup>3</sup> in the field.



MA-3000 series

### MODEL MA-3000 / MA-3 SOLO FOR MERCURY IN PASSIVE SAMPLERS

Passive samplers are an economical and practical method for collecting Total Gaseous Mercury (TGM) in several locations for mercury deposition mapping as well as remote or inaccessible locations. Rapid, accurate analysis of passive samplers can be performed by Direct Combustion Mercury Analyzers, the MA-3000 & MA-3 Solo, without the need for acidic digestion.

## SOLUTIONS FOR OCCUPATIONAL HEALTH

Workers within industrial facilities may be exposed to mercury through inhalation or skin contact. They may also be exposed if a process, instrument or other apparatus containing mercury breaks, releasing mercury-containing dust, liquid or vapor. Long term exposure to mercury can have serious health effects. NIOSH requires employers to protect and monitor employees for mercury exposure on the job.



EMP-3 series

### MODEL EMP-3 HANDHELD MERCURY SURVEY METER

Light-weight, compact, high-sensitivity mercury survey meter, allows direct real-time mercury measurements in the workplace, satisfying occupational hygiene and environmental safety guidelines like WHO, OSHA, NIOSH, ACGIH and more. Real-time results, which are highly crucial, in order to allow for quick decision making to minimize human exposure.

## SOLUTIONS FOR INDUSTRIAL WASTES

Most industrial processes encounter mercury at some point in the operation. The mercury may come from the natural resources or raw materials used in the process; it may be used as a catalyst or critical component of a process; or it may be included in a finished product. As such, most industries are required to monitor and report the mercury in their waste discharges to the environment. Improper handling and treatment of mercury in these industrial processes could lead to devastating consequences to human & animal health, as well as to our global environment. We only need to see what happened in Minamata Bay, Japan to understand the reality of this issue.



RA-5000 series

### DIRECT PURGE, COLD VAPOR ATOMIC ABSORPTION SPECTROSCOPY MERCURY ANALYZER

Cold Vapor Atomic Absorption Spectroscopy (CVAAS) is a well-known and reliable mercury analysis technique for trace level (sub-ppb) mercury analysis. The NIC RA-series offers multiple CVAAS configurations to meet your laboratory's requirements for sample throughput, automation and investment. All RA-series configurations are fully compliant with regulatory test methods & permits, such as USEPA 245.1, 245.5, 7470A, 7471B, APHA-3112B, EN-1483, ISO-17846, ASTM D3223, JIS K0102 and more.

#### RA-5000A-Series

Economical, entry-level configuration with modular upgrade capability to increase automation.



RA-4000 series

#### RA-4000A-Series

High-throughput trace-level CVAAS mercury analyzer that surpasses the requirements of most regulatory methods and permits. Available with an 80-position automated system for analysis (RA-4300A) or the unique all-in-one, fully automated 80-position in-situ acid digestion and analysis mercury analyzer (RA-4500A).



RA-4300FG+ series

### DIRECT-PURGE, COLD VAPOR ATOMIC FLUORESCENCE SPECTROSCOPY MERCURY ANALYZER

Completely automated solution for ultra-trace (sub-ppt) mercury analysis by CVAFS according to regulatory methods such as USEPA 1631E & 245.7, EN-1483, ISO 17852 and more. The RA-4300FG+ offers the innovative & unmatched capability to automatically add oxidation, quenching & reduction reagents for completely automated operation combined with the NIC direct purge technology within a fully enclosed HEPA/Carbon filtered cabinet. Ultra-trace mercury analysis has never been easier.



MA-3000 series

### MODEL MA-3000 / MA-3 SOLO DIRECT MERCURY ANALYZERS FOR SOLID & LIQUID WASTES

Mercury analysis by direct combustion, gold-amalgamation and atomic absorption spectroscopy is a highly effective and versatile technique to accurately measure mercury in just about any solid or liquid sample matrix without the need for sample preparation. USEPA 7473 is the most common reference method for measuring mercury in environmental sample types by this technique.

#### MA-3 Solo-Series

Economical & portable, the MA-3 Solo is small in size, only occupying the bench space of a standard sheet of paper, but it is big on performance with a vast range of available applications. The MA-3 Solo has single, manual sample introduction, and yet it has the capability to measure a wide range of solids, liquids & gases with ease.



MA-3000 3-in-1 Combination

#### MA-3000-Series

Largest available autosampler for any direct mercury analyzer with 100 sample capacity that allows for quick, accurate and unattended mercury analysis of solid & liquid sample types. Standard dual-cell optics allows for a wide measurement range with integrated auto-blanking features to further enhance the unattended operation. Versatile options for the addition of CVAAS and gas measurement are available.

## SOLUTIONS FOR EMISSIONS

One of the largest anthropogenic sources of mercury in our environment comes from flue gas emissions. As such, it is highly critical that these emissions are not only continuously monitored for mercury content but also accurately quantified to understand the environmental impacts.

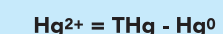


SGM-9 series

### MODEL SGM-9 MERCURY MONITOR IN FLUE GASES

Compact, portable, reliable & accurate monitoring system for measuring mercury in flue gases in real time. The SGM-9 is designed as a temporary, real-time monitoring system to be used for reference testing, process optimization, research & more. Using the NIC handheld CVAAS mercury monitor combined with the NIC pre-treatment system, each SGM-9 system has the ability to directly measure total gaseous mercury (TGM) or elemental mercury.

With a dual-SGM-9 configuration, the ability to accurately & continuously perform mercury speciation measurements is added. One system directly measures total gaseous mercury, the second system directly measures elemental mercury, and the oxidized mercury is calculated from these results in real-time.



MA-3000 series

### MODEL MA-3000/MA-3 SOLO FOR MERCURY IN SORBENT TRAP ANALYSIS

Sorbent traps are an alternative procedure to continuous emission monitoring that require laboratory analysis of the sorbent trap materials to quantitate the mercury collected over time. Accurate measurement is critical, as the final measurement is used to quantify the mercury content from a very large volume of flue gas. The MA-3000 and MA-3 Solo Mercury Analyzers can both accurately and quickly measure the mercury in these sorbent traps without any sample preparation.

## SOLUTIONS FOR NATURAL RESOURCES, MERCURY RESEARCH & MORE

Mercury can be found everywhere in our environment, so it is common to find researchers measuring mercury in ambient air, rain, snow, lakes, rivers, our oceans, soil, plants, animals & more. If not minimized, mercury will pollute our natural resources, infiltrating our food sources through the air, soils and waters used for agriculture and aquaculture as well as through its uptake in fish and shellfish. Research for mercury in the environment often uses a specific species of plant, animal or insect as an Environmental Indicator. A high level of accuracy is required for such ultra-trace (sub-ppt) mercury analysis, as the sample sizes of Environmental Indicators are often small while the potential impact of the results may be critical to human health.



RA-4300FG+ series

### MODEL RA-4300FG+ DIRECT-PURGE, COLD VAPOR ATOMIC-FLUORESCENCE SPECTROSCOPY MERCURY ANALYZER

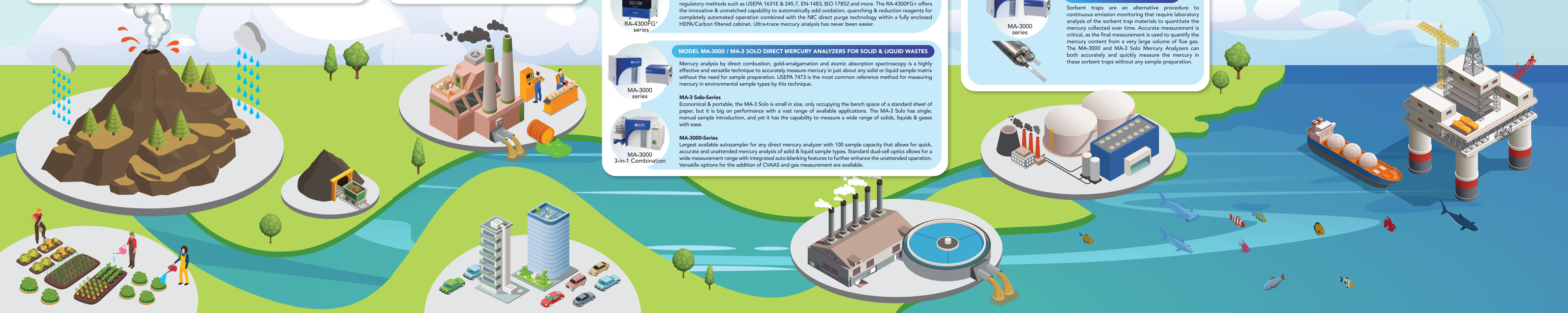
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MA-3000 series

### MODEL MA-3000 / MA-3 SOLO DIRECT MERCURY ANALYZERS FOR SOLIDS & LIQUIDS

Many researchers also find the need to measure mercury in a diverse range of sample types, such as feathers, eggs, adsorbents, fish tissues, hair, fingernails & more. Direct mercury analysis is the ideal technique for trace (sub-ppb) mercury in a wide range of sample types without the need for sample preparation...just load the samples and go, the NIC MA-3000 or MA-3 Solo will do the rest.





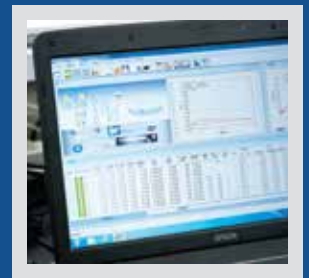
# NIPPON INSTRUMENTS CORPORATION

*Leading In Innovation*



Nippon Instruments Corporation (NIC), the global leader in Mercury Analyzer automation and instrumentation, commercialized the world's first direct thermal decomposition Mercury Analyzer back in the 1970s'. Since that time, we have continued to develop, sell and install a vast range of Mercury Analyzers and customized solutions around the world for regulatory agencies and institutions, universities, research groups, oil & gas refineries, petrochemical industries, food providers, biology & toxicology science groups and more.

Thanks to our strong R&D capacities and technological innovations, NIC is the driving force in the Mercury Analyzer market, setting the standards for functional scope and user-friendliness. With a dense network of knowledgeable sales partners and qualified service partners we provide scientifically sound and environmentally responsible solutions for our customers around the globe.



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