

Why Choose the RA-4300FG+ for Trace Mercury Analysis?

The Model RA-4300FG+ Mercury Analyzer from Nippon Instruments Corporation (NIC) is **fully compliant with EPA Methods 1631E and 245.7**, and it performs them at a level that has never been available in a trace mercury analyzer.

- 1) What specifically makes the RA-4300FG+ the **best performing trace mercury analyzer**?
 - Direct Purge Technology: The original versions of EPA Method 1631E used a direct purge process to liberate the mercury from samples. The reason that this technique was used is that it allows for 100% transfer of all the mercury in the sample to the gold amalgamator (gold trap). When measuring for trace level mercury at low part per trillion concentrations, this complete transfer allows for the highest level of performance in measuring all the mercury present in the sample. The RA-4300FG+ provides full automation of this direct purge process. It will individually seal each sample tube, add reagents, and then purge the mercury out of the sample and onto the gold trap. In addition, the direct purge technology of the RA-4300FG+ does not require a complicated liquid-gas phase separation device that is required by continuous flow systems. These devices are prone to contamination and are not 100% efficient in the transfer of mercury to the gas phase. Direct purge is simple and highly effective.
 - Advanced Automation: The direct purge technology also allows for additional automation that no other trace mercury analyzer can provide.
 - Automated Oxidant Addition: The RA-4300FG+ can automatically add the bromine monochloride (BrCl) reagent that is required for sample preparation in EPA Method 1631E to every sample. It will then hold these samples for a preset time, usually 12 hours, and then proceed with analysis without any user intervention.
 - Automated Oxidant Quenching: The RA-4300FG+ can also automatically add the quenching reagent (hydroxylamine hydrochloride) to every sample prior to analysis. Whether the samples were oxidized automatically using the automated oxidant addition, or if they were oxidized manually, the RA-4300FG+ can perform this oxidant quenching step automatically, even making sure to remove the liberated chlorine before transitioning to analysis. This extra step of automation is not available from any other trace mercury analyzer, and the benefits can be seen both in time saved but also consistency from sample to sample.
 - Active Environment Control:
 - Built-in “Clean-Room” Environment: The RA-4300FG+ has a built-in active filtration system that continuously forces purified air into the cavity of the analyzer, creating a “clean-room” type environment within the analyzer.

Samples in the autosampler are all maintained within this environment, protecting them from contamination while waiting to be analyzed.

- Continuous Reagent Purging: In addition to the active filtration system, the RA-4300FG+ also continuously purges the reduction reagents with Argon to maintain a consistently low reagent blank from your first sample to the last.
- High Quality Optical Components:
 - Light Source: We use a very high quality Hg-discharge lamp that emits a very strong line emission at 253.7nm. This eliminates the need for any optical filtering to limit the light source to the 253.7nm wavelength used for maximum absorbance by elemental mercury. Optical filters reduce the intensity of the light source that is available to pass through the absorbance cell, which is why we don't use them. In addition, the lamp is maintained at a consistent temperature with a heater jacket around the lamp. This keeps the output from the lamp very consistent over time and protects against ambient temperature fluctuations.
 - Detectors: Through the use of high-quality components, the RA-4300FG+ is able to offer superior results. It uses a reference detector to further stabilize the background from the light source, and then an independent detector is located at a 90-degree angle from the source for the fluorescence measurement. Interior components protect this detector from seeing any reflected or scattered light from the light source, maximizing the detector sensitivity. We use wavelength-specific photo tubes for our detectors, which don't require any wavelength filtering and have a peak intensity of measurement at 253.7nm.

2) How can the RA-4300FG+ **handle both EPA Method 1631E and EPA Method 245.7 effectively?**

- The RA-4300FG+ has a very wide Linear Range
 - EPA Method 1631E has a range of 0.5 ng/L to 100 ng/L. The RA-4300FG+ has a linear range in 1631-mode from less than 0.5 ng/L (ppt) up to 10 ug/L (ppb).
 - EPA Method 245.7 has a range of 5.0 ng/L to 100 ng/L. The RA-4300FG+ has a linear range in 245.7-mode of less than 5.0 ng/L (ppt) up to 100 ug/L (ppb).
 - These trace level detection limits and extended linear ranges are all accomplished with **only 5-mL of sample** required.
- Virtually no sample to sample carryover!
 - Despite the extended linear range of the RA-4300FG+, there is essentially no measurable sample to sample carryover.

- The use of Direct-Purge, Discrete Technology eliminates the potential for carryover to occur. With this technique, the liquid samples themselves are never transferred or moved in any way that would allow for carryover to occur. The reagents are injected directly into each sample tube directly, and then the mercury is purged from the sample as a gas until 100% of the mercury is removed from the sample. Therefore, when the sample probe is leaving a sample, there is no longer any mercury present to be carried over to the next sample. In addition, since only the mercury gas is transferred into the flow path, if an over-range sample is encountered, it is easily flushed out prior to the next sample.
 - With virtually no sample carryover, the RA-4300FG+ can easily handle the transfer between EPA Methods 1631E and 245.7.
- 3) The RA-4300FG+ Software is **packed with features**, is very **user-friendly**, and was **designed with EPA Methods 1631E and 245.7 in mind**.
- List of Top Software Features:
 - The RA-4300FG+ software works in all recent versions of Windows (XP, 7, 8, and 10). The software is very easy to use and includes flow-path animation that keeps the user informed of the current status throughout each measurement.
 - The sequence table is Excel-based and allows for simple functions such as cut/copy/paste. With a simple right-click to the sequence table, you can save the data as a CSV file for direct importation into LIMS.
 - The software also continuously monitors key diagnostics, such as all heater temps, flow rates, valve actuations, and voltages. This allows the software to automatically prompt the user if there is an issue with the system, and it also allows us quick and easy troubleshooting. You can read a full display of voltages to us over the phone, and we can typically know the cause of any issues right away.
 - Measurement counts, lamp hours, reagent pump usage, etc are tracked and monitored at all times. The software will then notify the user when it is nearing time to replace key items. This early warning ensures that you can get replacements ordered in advance, eliminating costly downtime.
 - There are EPA 1631E and EPA 245.7 software modes that include the full quality control package required by these methods. Many of our customers find that this feature helps them maintain their compliance with these methods. When using the software in these modes, quality control samples can be easily selected from a drop-down menu, and all QC performance criteria are already built-in for automatic compliance evaluation.

4) The RA-4300FG+ is very **cost-effective and dependable**.

- What makes the RA-4300FG+ Cost-Effective?
 - **Limited Consumables:** With the use of our direct-purge, discrete technology, there are no gas-liquid phase separators, no routine replacement of membrane dryers (permeation tubes), no permeation membranes, and no continuously running peristaltic pumps that need new tubing every week. Other than sample tubes and reagents, the RA-4300FG+ only needs a new set of reagent tubes and a few inexpensive membrane filters per year. All such items are monitored by the software to make sure that you aren't caught off-guard when they are ready to be replaced.
 - **Reduced Reagents and Waste:** With only a 5-mL sample size, the reagents required are already reduced relative to other trace mercury analyzers. Through the use of direct-purge, discrete technology, the RA-4300FG+ reagent requirements are reduced even further. Here is a summary:
 1. Waste Produced: < 1 Liter per full day of operation
 2. Hydroxylamine Hydrochloride: 300 microliters per sample
 3. Stannous Chloride: 300 microliters per sample
 - **Certified Trace Metals Reagents and Consumables:** AGS Scientific now offers reagents and other laboratory products specifically designed for use with our RA-4300FG+ that are certified for EPA Methods 1631E and 245.7. Below are approximate costs per sample for each reagent:
 1. Hydroxylamine Hydrochloride
 - a. \$25 per 400mL of Reagent Solution
 - b. >1,300 Samples per 400mL
 - c. Approximately \$0.02 per Sample
 2. Stannous Chloride
 - a. \$25 per 400mL of Reagent Solution
 - b. >1,300 Samples per 400mL
 - c. Approximately \$0.02 per Sample
 3. Bromine Monochloride (Oxidizing / Prep Reagent)
 - a. \$65 per Set of 20 Sealed Pillow Packs
 - b. One Pillow Pack per 500-mL Sample
 - c. Approximately \$3.25 per Sample
 4. Sub-Boiled Distilled Hydrochloric Acid (Used for Reagents / Rinse)
 - a. \$210 per 500-mL Bottle
 - b. >1,500 Samples per 500-mL
 - c. Approximately \$0.14 per Sample
 5. Disposable Sample Tubes for Trace Mercury Analysis
 - a. \$600 per Box of 1,000 Tubes
 - b. Approximately \$0.60 per Sample
 6. **Total Cost of Analysis using AGS Scientific Certified Products:**
 - a. **Approximately \$4.03 per Sample**

- What makes the RA-4300FG+ so Dependable?
 - Simple Design with Fewer Moving Parts: The direct-purge, discrete technology used by the RA-4300FG+ drastically simplifies the entire analysis process versus flow-based systems. In the process, this design results in fewer moving parts and fewer areas for contamination and break-down. Any time there are fewer consumables and fewer parts that need routine maintenance, this will result in more consistent performance over time.
 - Other Hardware: The design alone greatly improves dependability, and when you combine this with top quality components throughout the system, the results speak for themselves. We use a high-quality mass flow controller for our carrier gas, and we use very long-life components throughout the system. Our mercury lamp lasts 3-5 years, while others may last only 3-5 months. Also, the entire flow path is designed specifically to handle mercury without suffering carryover or memory effects.

In summary, better optics, better detectors, better components, and a better design, that is produced and supported by **Nippon Instruments Corporation**, an expert, focused team that has designed and manufactured nothing but mercury analyzers since the 1970's. We have many years of experience as a company strictly **dedicated to mercury analysis**, and we can help you with your mercury analyzer needs.