

FEATURES SHEET

ASAP[®] SYSTEM MODEL 2800 BIOAEROSOL SAMPLER

The Airborne Sample Analysis Platform (ASAP System) provides a flexible means of collecting representative samples of particles 1 to 10 microns in diameter for confirmatory biological analysis in a laboratory. The sampler combines a number of features that make it a compelling platform for collecting bioaerosol samples for analysis using PCR (polymerase chain reaction) or other methods. The system electronics allow the device to be incorporated in a "command and control" network for centralized reporting and control.

The unit is an outgrowth of Thermo Electron Corporation's involvement in the Biological Aerosol Sentry and Information System (BASIS) deployed during the 2002 Salt Lake City Winter Olympic Games. The developers of the BASIS hardware, including the company, Los Alamos and Lawrence Livermore National Laboratories, received the prestigious R&D 100 award in 2003 for the innovation.

At its heart, the ASAP unit implements a particle sampling technology patented by the Harvard School of Public Health. The method enables concentrated aerosol samples to be collected with a high sampling flow rate, high particle collection efficiency, and low power consumption. The unit's small size and low noise allow it to be used in most outdoor, indoor or mobile sampling applications.

The particle collection substrate is housed in a cartridge that is closed prior to and following use, and contains a nonvolatile radio frequency identification (RFID) tag that records information about the sample. The cartridge is available in a single-sample configuration or in a format that allows for time-resolved information to be collected over up to eight sub-periods.

The ASAP System is made up of the following major components:

- The sample inlet system draws in ambient air, directing it toward the sampling components in the enclosure.

- The sample handling system directs the particles in the air stream onto the collection substrate.
- The iBASS[®] cartridge (Integrated Bio Aerosol Smart Sample) protects the collection substrate(s) when not in use, and also contains an encapsulated negative control substrate and an RFID tag for storing sampling data.
- Real-time sensors radiation (alpha, beta, and gamma) and sample temperature provide environmental information during sampling. Optional inputs are available for wind speed/direction and global positioning system (GPS).
- An optional trigger input connector allows sampler operations to be controlled by a local sensor or device.
- The hinged communications and electronics enclosure at the base of the device can be accessed by opening an internal latch, and houses electronics boards and communications components such as a customer-supplied wireless modem or router.

The basic envelope of the ASAP unit is an enclosure that is approximately 33 cm (13") on each side, an inlet 22 cm (8.6") in height, and weighing 14.5 kg (32 lb). Integral ears on the back of the sampler provide for convenient installation. The unit's front access door opens outward to allow for installations with rigidly affixed sample lines, and to ease the exchange of collection cartridges under adverse weather conditions.

The sample inlet system has the following features:

- An omnidirectional sample inlet allows particle collection to take place independent of wind direction, and is located approximately 15.2 cm (6") above the sampler enclosure to avoid interference from the base.
- The standard sample line can be extended using rigid or flexible tubing to meet special installation requirements.
- Sound baffling in the sample line allows the system to be used in quiet indoor environments, with a noise level of 55 dB at 1m.

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- Sample inlet components, including an integral bug screen and downstream slit impactor, can be easily disassembled for cleaning.

The sample handling system operates as follows:

- A specially designed straight slit accelerates the 200 l/min sample stream in the direction of a polyurethane foam (PUF) substrate. This causes particles between 1 and 10 microns in diameter to collect on the surface of the PUF through impaction while smaller particles and gas molecules flow to the sides.
- The collected aerosol accumulates on two abutting lengths of PUF in a highly concentrated stripe approximately 5 cm (2") in total length. The particles collect on the upper surface of the PUF by means of impaction. Each length of PUF is pre-cut into two sections for easy retrieval. In the laboratory, the particle extraction efficiency from the PUF substrate is equal to or better than the retrieval efficiency of filter media.
- To maintain a constant volumetric sample flow rate, the system measures the differential pressure across the impaction slit, and maintains it at a constant level by dynamically adjusting the speed of the blower. The flow control feedback system also uses the sample stream temperature measured by the unit and the altitude setting entered by the user during system setup.

The iBASS cartridge used for collecting, transporting and archiving the particle sample has the following features:

- The module is in its closed position until it is installed in the sampler, and is re-closed prior to its retrieval. Following its insertion, the sampler determines whether the cartridge has previously been used, and activates a green or red internal LED to indicate whether the module is valid. The insertion and removal of the iBASS cartridge is a quick, single-handed operation that can be accomplished by a user wearing a protective glove.
- The iBASS cartridge contains an encapsulated piece of PUF material as a field blank.
- Two internal spools within the iBASS cartridge rotate in relation to the outer shell to position internal components in the appropriate positions:

- The single-interval version contains a single length of PUF in each spool for sampling over an entire period.
- The multi-interval version contains one length of PUF in the duration spool for collection during the entire sampling interval, and up to eight lengths in the interval spool for time-resolved sampling.

- A nonvolatile, pre-serialized RFID tag automates the recording of chain-of-custody information. It can record the identity of the replenisher who installs and retrieves the cartridge, and data about the collected sample such as the location, starting and ending times, and existence of status conditions. When the iBASS cartridge is used to archive particle samples, the attached RFID tag maintains a nonvolatile record of the sampling information.

The ASAP System includes the following other features:

- The ASAP System can easily be made a part of a "command and control" network for obtaining environmental (radiation, sample temperature, optional wind speed/direction, and optional global positioning) and sampler state-of-health information. A built-in compact flash (CF) writer stores backup information.
- The aerosol collection and extraction capabilities of the sampler have been verified in tests by Lovelace Respiratory Research Institute of Albuquerque, New Mexico.

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