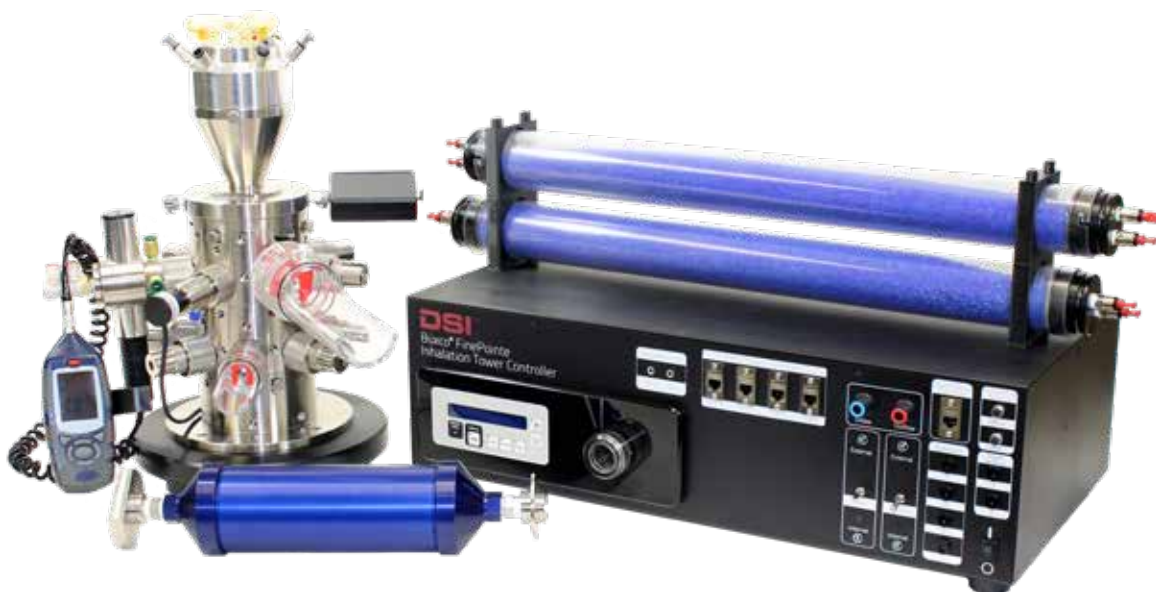


# Guide to the Buxco<sup>®</sup> Inhalation Exposure System

- Inhalation Toxicology
- Bioaerosol
- Environmental
- Disease Models
- Pharmaceutical



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Harvard Bioscience, Inc.

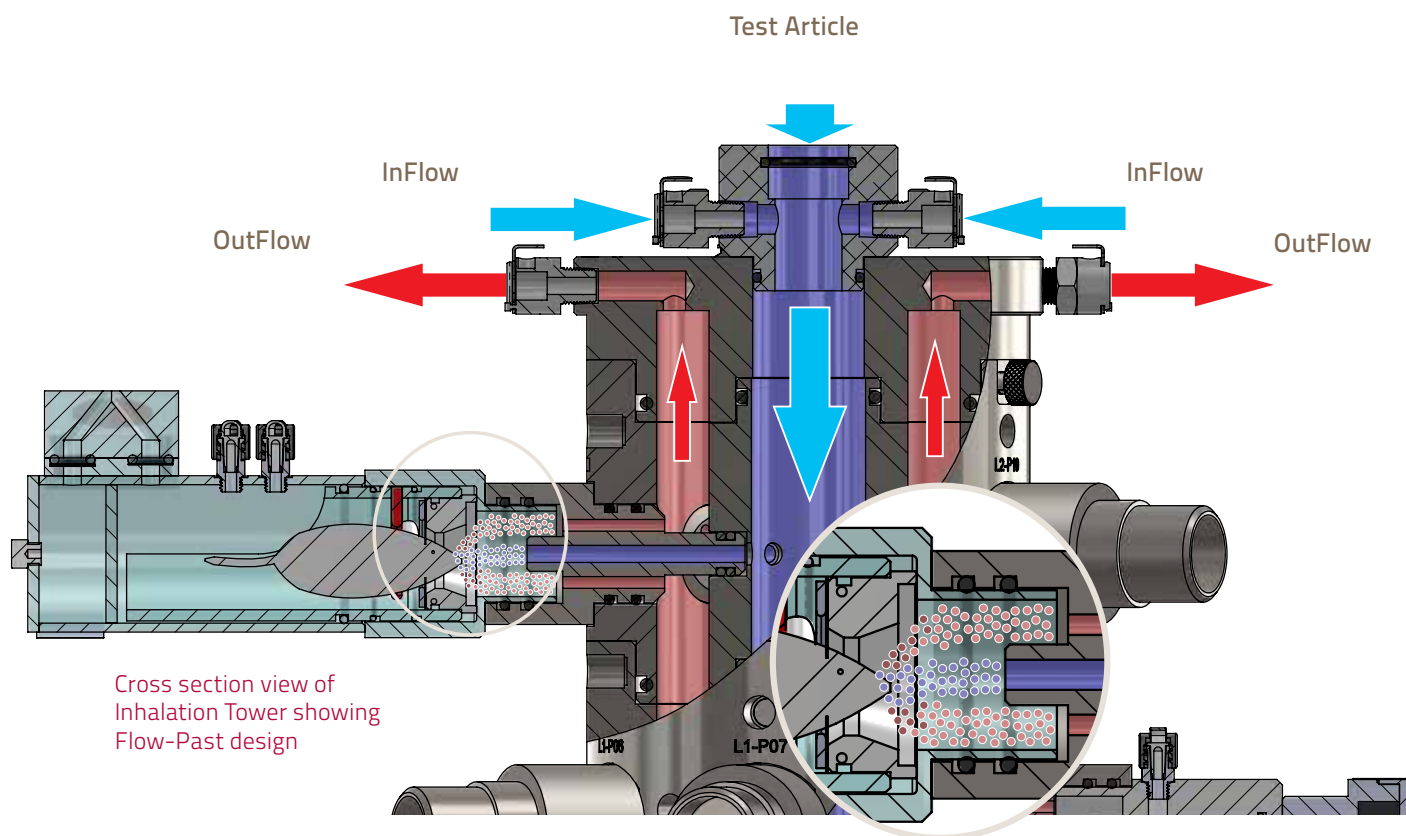
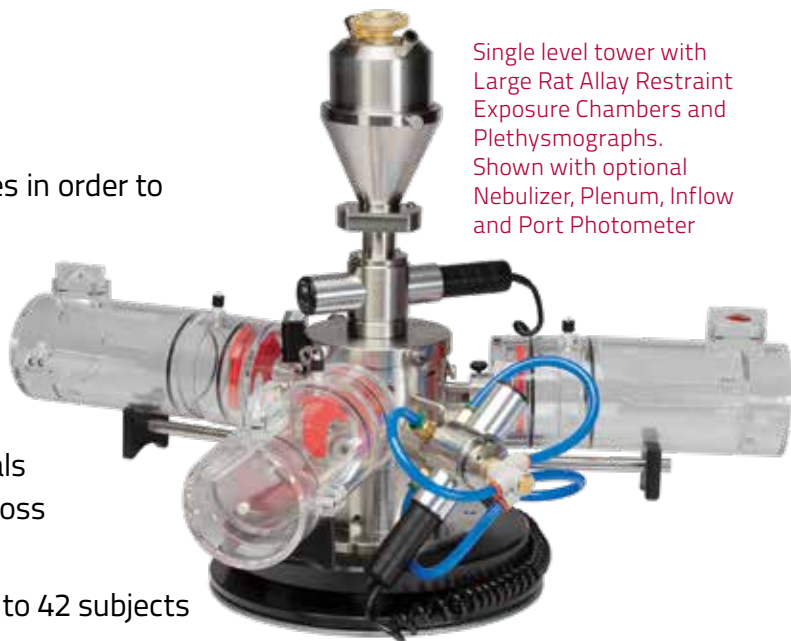
## Get More from Inhalation Exposure Studies

The DSI Buxco inhalation exposure system is easy to use for researchers who are new to inhalation exposure studies, while providing the performance and flexibility required by the experts. Unique to DSI's solution is the ability to perform accurate real-time respiration monitoring during exposure using FinePointe software—critical for animal welfare and determining accurate deposition levels.

### Unique Tower Design

- Flow-past design utilizes inner and outer cores in order to
  - eliminate rebreathing, reducing CO<sub>2</sub> levels
  - improve port-to-port uniformity
- Species Supported: mouse, rat, guinea pig, and ferret
- Stainless steel construction
  - corrosion resistant, ideal for harsh chemicals
  - ultra-smooth finish minimizes test article loss
- Modular design
  - Stackable tower design for 1 to 6 levels, up to 42 subjects
  - Easily separates into manageable size pieces
  - Simple to clean for quick turnaround between experiments

Single level tower with Large Rat Alloy Restraint Exposure Chambers and Plethysmographs. Shown with optional Nebulizer, Plenum, Inflow and Port Photometer



Cross section view of Inhalation Tower showing Flow-Past design

## Buxco® Allay™ Restraint Exposure Chamber & Plethysmographs

Designed through customer collaboration, the patented Buxco Allay restraint secures the animal without compressing the thorax and keeps airways completely unobstructed. This is achieved by using a neck restraint clip positioned between the base of the skull and shoulders as compared to traditional plunger systems that compress the subject. Several sizes of the Allay neck restraint are provided to ensure comfortable restraint no matter the size of the animal.

### Allay Restraint Exposure Chamber

- Subjects positioned for normal breathing in a reduced stress environment
- Provides consistent placement of nose from subject to subject
- Restraint provides better access to subject during exposure



Mouse Allay Restraint Exposure Chamber

### Allay Plethysmograph

- Accurately measure respiratory parameters during exposure
- Record minute volume and rate, critical for determining amount of inhaled compound
- Ensure animal welfare with real-time respiratory monitoring



Mouse Allay Restraint Exposure Chamber with Plethysmograph

## Accumulated Inhaled Aerosol (AIA)

By integrating real-time digital aerosol concentration with live respiratory parameters, FinePointe software calculates and reports each subject accumulated inhaled aerosol (AIA), also known as delivered dose (DD). This crucial parameter can be used in the following major study approaches:

Time	f	TV	MV	AV	Cnc	IA	AIA
00:05:28.13	128.4	0.2456	31.54	11.72	349.8	8.593e-05	0.003624
00:05:28.64	117.4	0.2553	29.97	11.98	347.7	8.877e-05	0.003713
00:05:29.15	119.1	0.2436	29.03	12.22	347.7	4.471e-05	0.003798
00:05:29.70	109	0.3161	34.46	12.54	347.7	0.0001097	0.003907
00:05:30.21	116.4	0.2989	34.81	12.84	346.7	0.0001036	0.004011
00:05:30.73	116.3	0.2897	33.69	13.13	347	0.0001005	0.004111
00:05:31.22	121.6	0.198	24.07	13.32	347.1	6.871e-05	0.00418

Illustration of AIA real-time report with calculation in FinePointe

- Ensures uniform delivery to the lung across all monitored subjects. This method reduces variability due to different animal breathing patterns and changes in aerosol concentration:
  - AIA reported live in numerical and graphical representation for each animal
  - Once target AIA is reached, the user can pull a subject off the tower without aerosol contamination, resulting in accurate exposure uniformity
- Produce AIA reports post-study. This method summarizes the different inhaled aerosol amounts and allows the researcher to make educated dose/effect conclusions:
  - Various reports automatically generated by FinePointe software
  - Longitudinal protocols available while tracking and accumulating subject AIA throughout study

## Aerosol Generation Options

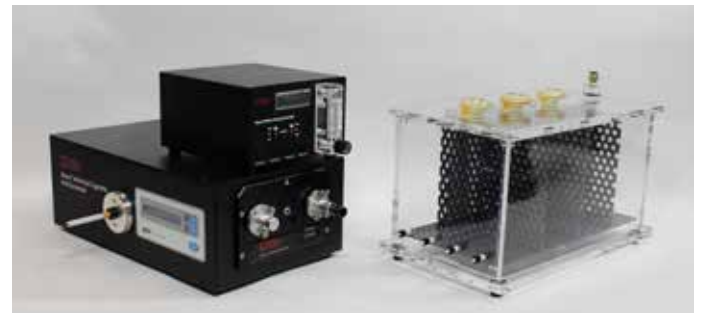
- Aerogen nebulizer integration
  - Single and multi-head options
  - Fully integrated into study protocol yielding reproducible experiments
  - Unique nebulizer efficiency calibration producing accurate, microprocessor controlled, aerosol delivery
- Jet nebulizers
- Metered Dose Inhalers (MDI)
  - Fully automated 5-cannister design allows flexible actuation protocols
  - Comparatively efficient aerosol delivery option
- Dust and powders
- Traditional and electronic cigarettes
  - Includes adaptators for JUUL and NJOY brands
  - Compatible with various tobacco cigarettes
  - Conforms to FDA approved puff regimen



Multi Nebulizer Configuration



MDI Aerosol Configuration



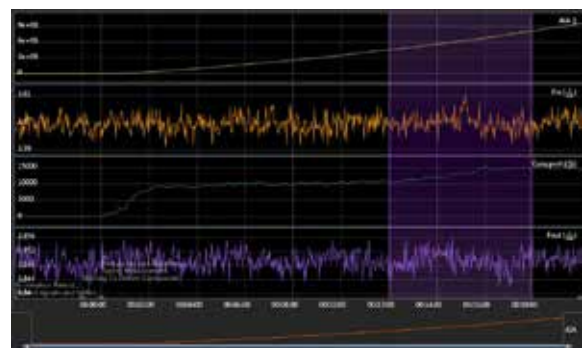
E-cig/vape generator with whole body exposure chamber

## Environmental Measurements

- Aerosol concentration, digital and gravimetric
- Particle size analysis, digital and gravimetric
- O<sub>2</sub>/CO<sub>2</sub> measurement, at breathing zone and chamber (tower inner core)
- Digital temperature and humidity at breathing zone and inlet air

## Software Controlled Parameters

- All system flows and pressures
- External gas sources flow management
- Aerosol output according to user requirements
- System flow management adheres to specific user setup



Sample of inhalation parameters displayed in Finepointe

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