

Nose-Only Inhalation Exposure

2008 Air Monitoring Users Group Meeting

Las Vegas, NV

April 29, 2008 - May 1, 2008

Larry E. Bowen
Southern Research
Birmingham, AL

Overview

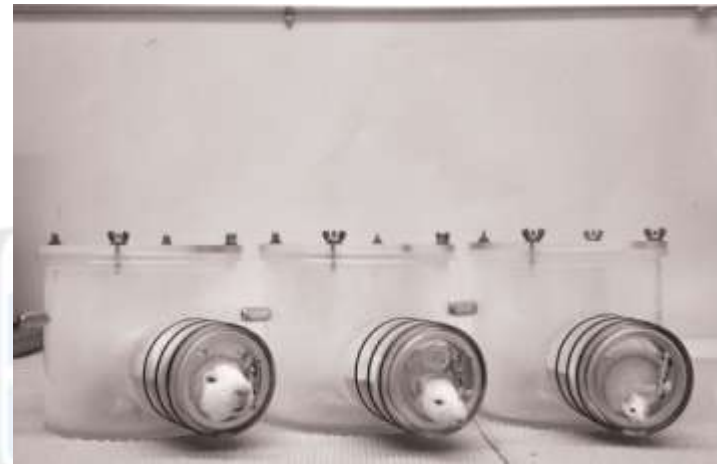
- History of Inhalation
- Types of Inhalation Exposure
- Nose-Only Inhalation Exposure
- Plastic versus Metal Plenums
- In-Tox Products Nose-Only Exposure Plenums
- Plenum Design & Characterization
- Applications & Flexibility

History of Inhalation

- Historical
 - Airborne pollutants → Disease
- WWI
 - use of poisonous gases
- WWII
 - chemical, biological, and radioactive materials
- Post WWII
 - engine exhaust, cigarette smoke

Types of Inhalation Exposure

- Whole Body
- Head Only
- Lung Only
- Partial Lung
- Nose Only



Nose-Only Inhalation

- Types of Chambers
 - Flow-past
 - Directed flow



Nose-Only Inhalation

- Advantages
 - Efficient use of test and challenge articles
 - Reduces exposure routes
 - Increases containment
 - Even distribution of test article in lungs
 - Most natural route of exposure

Nose-Only Inhalation

- Disadvantages
 - Labor intensive
 - Indirect measurement of inhaled and deposited doses
 - Restraint related stress

INTOX
PRODUCTS

Problems With Plastic

- Issues
 - Age rapidly with use
 - Temperature and pressure effects
 - Decontamination
 - Disposal
 - Static charge



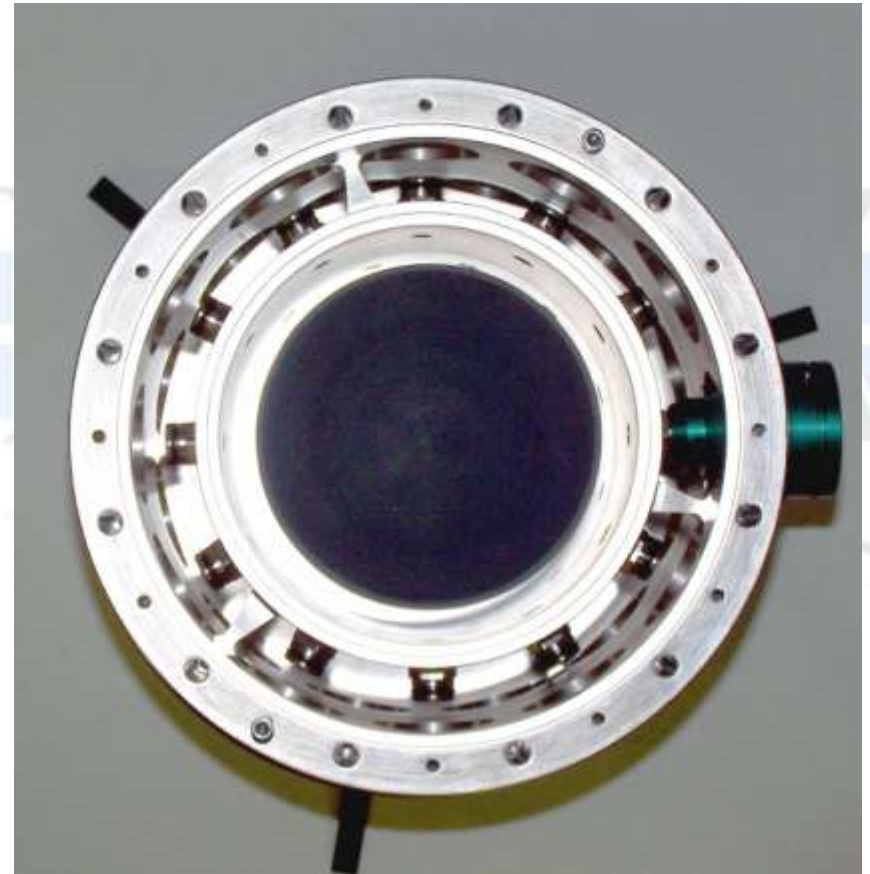
In-Tox Nose-Only Plenums

- Design
- Characterization
- Applications
- Flexibility



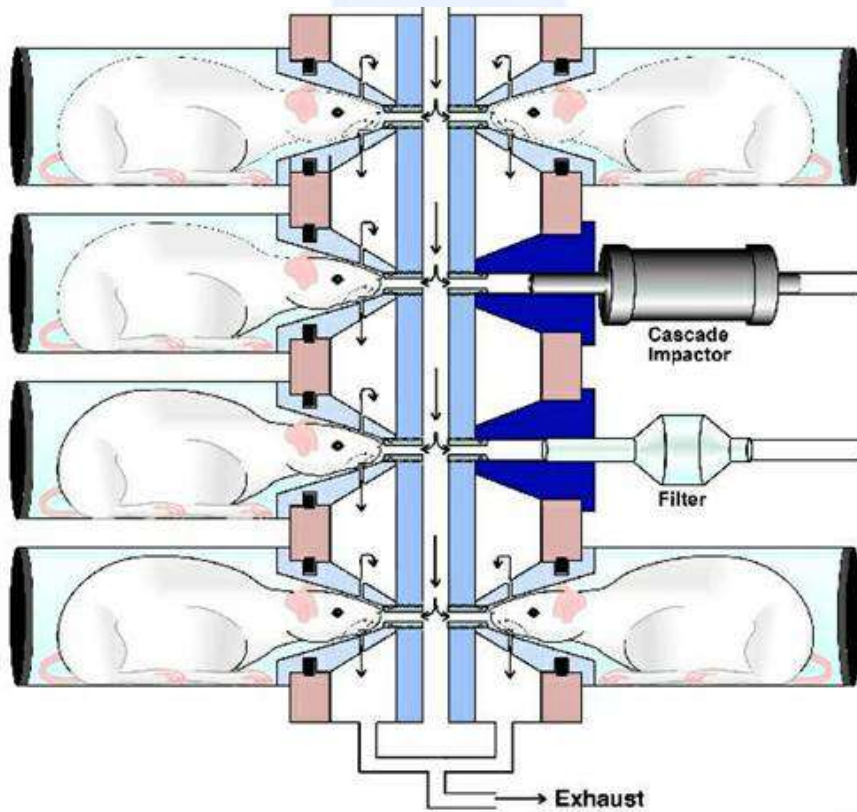
In-Tox Nose-Only Plenums

- Design
 - Directed flow
 - Positive Flow-By™ nose cones
 - Negative pressure operation
 - Non re-breathing

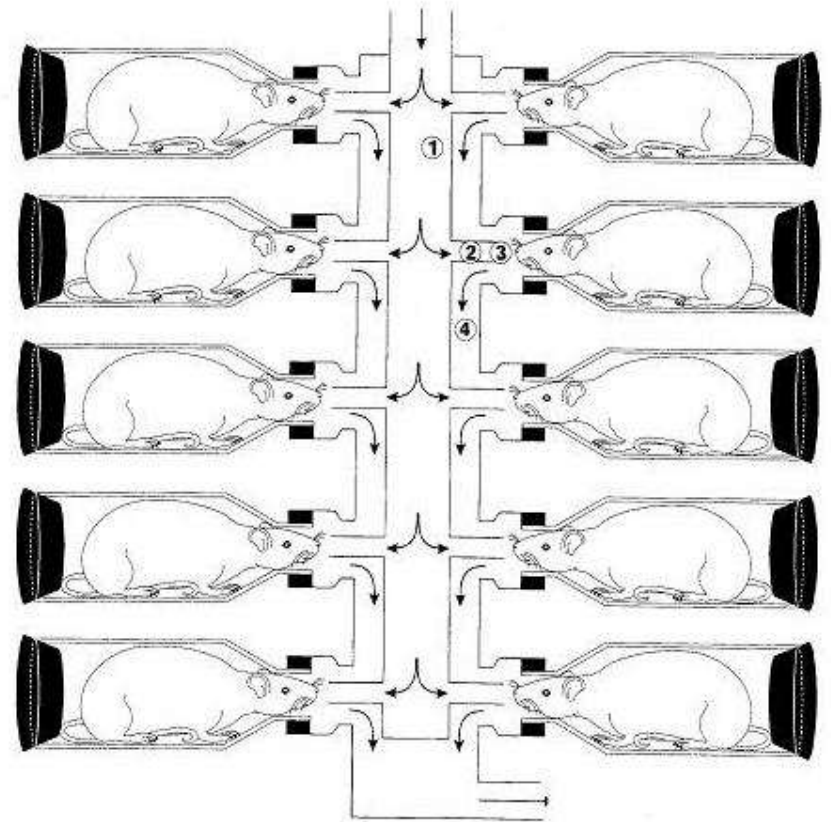


Plenum Design

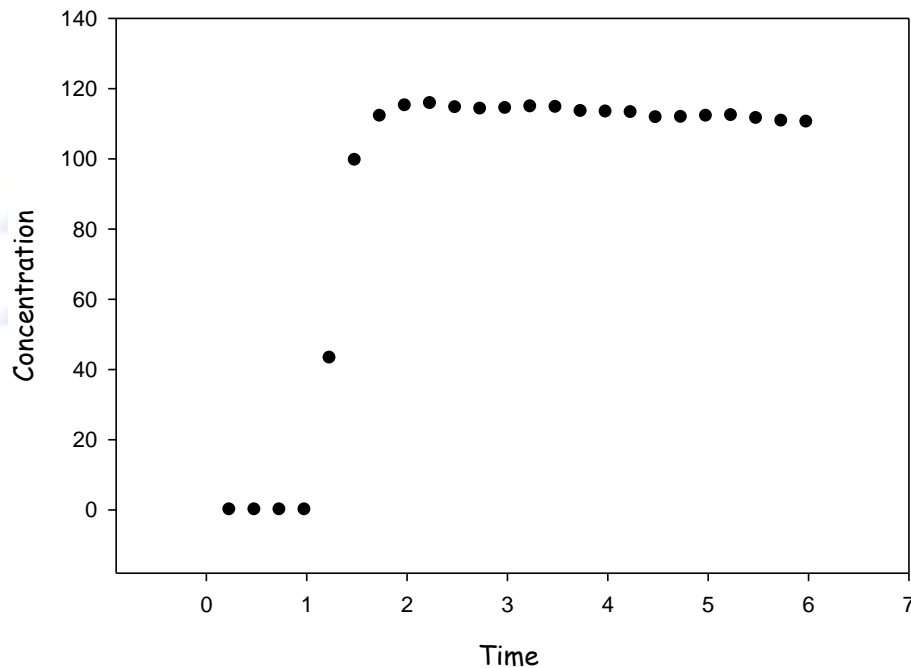
In-Tox



Others



Plenum Time-to-Concentration



Time	Conc.	Time	Conc.	Time	Conc.
0.00	0.000	2.23	115.710	4.23	113.12
0.23	0.002	2.48	114.500	4.48	111.66
0.48	0.006	2.73	114.120	4.73	111.77
0.73	0.005	2.98	114.310	4.98	112.08
0.98	0.003	3.23	114.810	5.23	112.27
1.23	43.210	3.48	114.620	5.48	111.44
1.48	99.550	3.73	113.440	5.73	110.67
1.73	112.090	3.98	113.300	5.98	110.43
				T_{max}	2.23
				T_{90}	2.11

Plenum Homogeneity/Distribution

$$(\%CV_{\text{spatial}})^2 = (\%CV_{\text{total}})^2 - (\%CV_{\text{temporal}})^2$$

- In-Tox Plenum

- $\%CV_{\text{total}} = 6.0$
- $\%CV_{\text{temporal}} = 4.3$
- $\%CV_{\text{spatial}} = 4.2$

- Canon Plenum

- $\%CV_{\text{total}} = 9.1$
- $\%CV_{\text{temporal}} = 1.5$
- $\%CV_{\text{spatial}} = 8.7$



Applications



X
TS

Applications



Applications

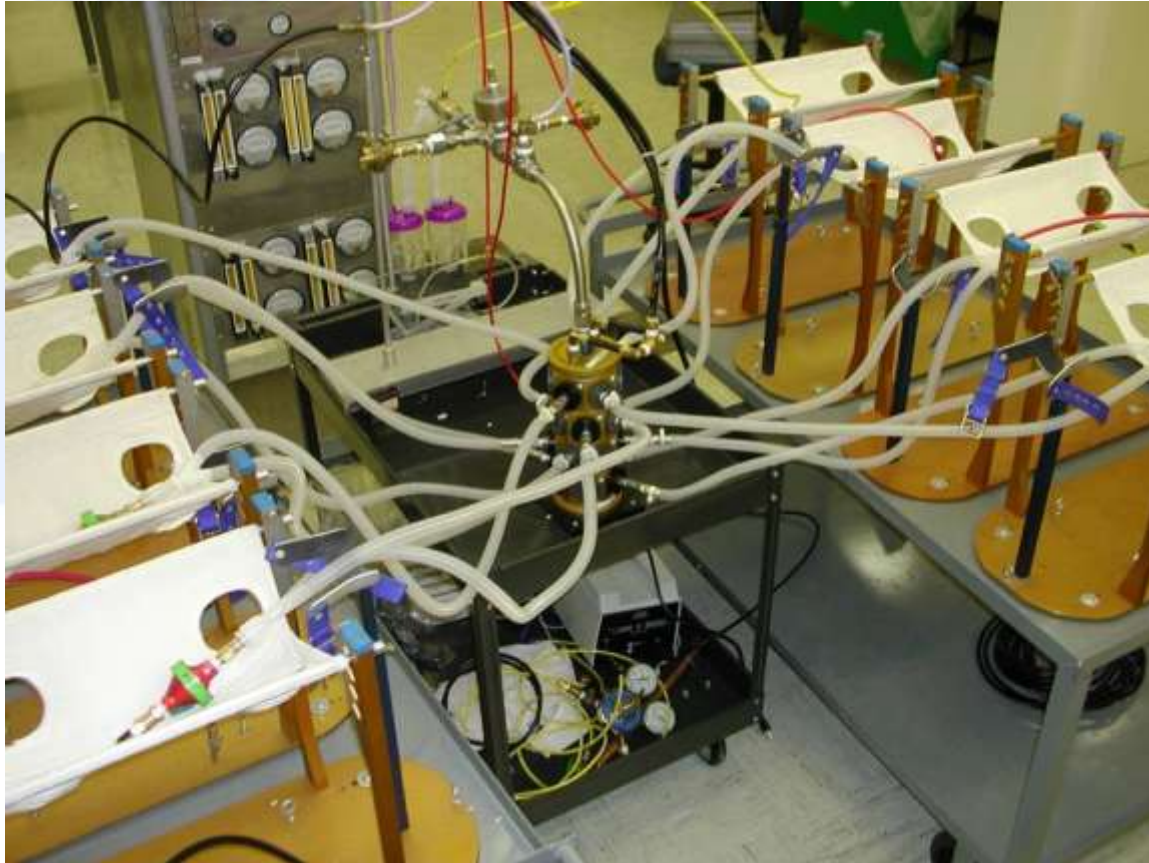


OX
CTS

Versatility



Versatility



OX
CTS



X

TS



Questions?

INTOX
PRODUCTS