



PMI RESEARCH & DEVELOPMENT

An improved nose-only flow-past chamber for chronic inhalation exposure of rats

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Motivation

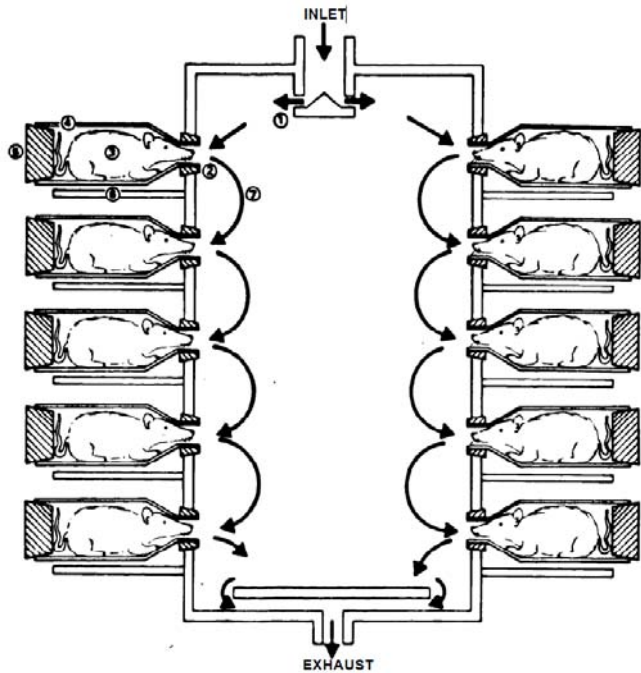
- For a chronic aerosol inhalation study of room-aged cigarette sidestream smoke (RASS) and diesel engine exhaust (DEE), nose-only exposure chambers that enable the simultaneous exposure of 5 groups of approx. 200 rats each were required.¹
 - The nose-only exposure mode was preferred, because it prevents deposition of aerosol particles on skin and fur, thereby minimizing the uptake of aerosol particles by grooming.^{2,3}
 - Re-breathing of exhaled test aerosol was to be kept to a minimum.
 - Limited laboratory floor space was available, so, none of the commercially available nose-only flow-past chambers were suitable.^{4,5}

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2. Mauderly JL, Bechtold WE, Bond JA, Brooks AL, Chen BT, Cuddihy RG, Harkema JR, Henderson RF, Johnson NF, Rithidech K, Thomassen DG. 1989. *Exp. Pathol.* **37**: 194-197.
3. Hausmann HJ., Gerstenberg B, Göcke W, Kuhl P, Schepers G, Stabbert R, Stinn W, Teredesai A, Tewes F, Anskeit E, Terpstra P. *J. Inhal. Toxicol.* **10**(7): 663 - 697(1998).
4. Cannon WC, Blanton EF, McDonald KE. 1983. *Am. Ind. Hyg. Assoc. J.* **44**(12): 923-928.
5. Pauluhn J. 1994. *J. Appl. Toxicol.* **14**(1): 55-62.

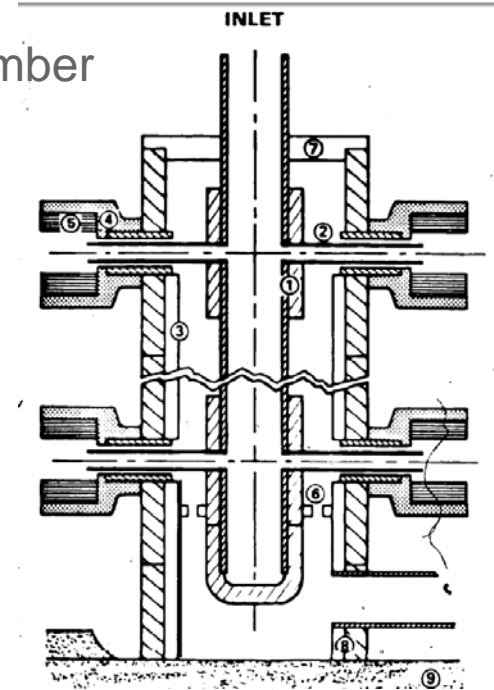
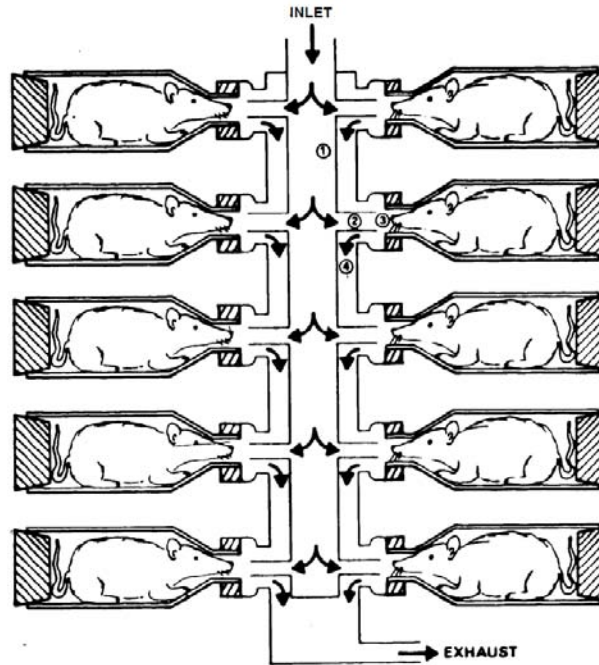


Cannon *et al.*¹ improves the standard nose-only exposure chamber

Standard nose-only chamber



Cannon flow past nose-only chamber

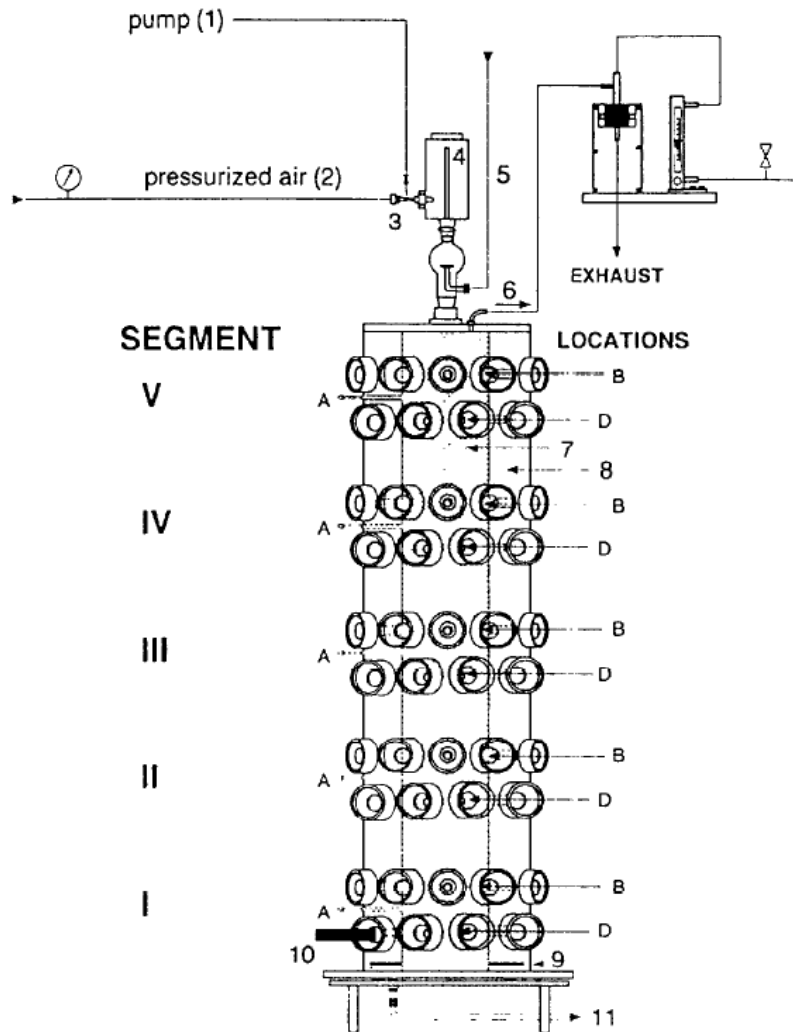


- 40 ports available (5 reserved for sampling; 35 used for rat exposure).
- Decreased effect of non-uniform distribution of aerosol concentration.

1. Cannon WC, Blanton EF, McDonald KE. 1983. *Am. Ind. Hyg. Assoc. J.* 44(12): 923-928.



Pauluhn *et al.*¹ further improves the nose-only exposure chamber



- Uniform spatial exposure of aerosol.

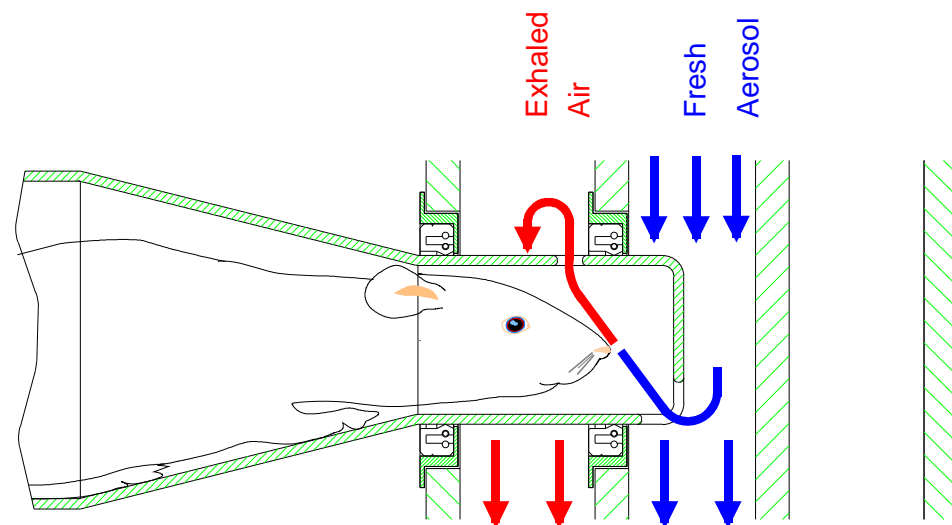
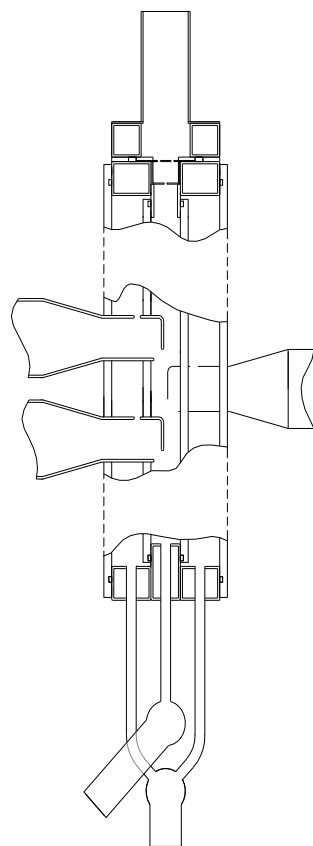
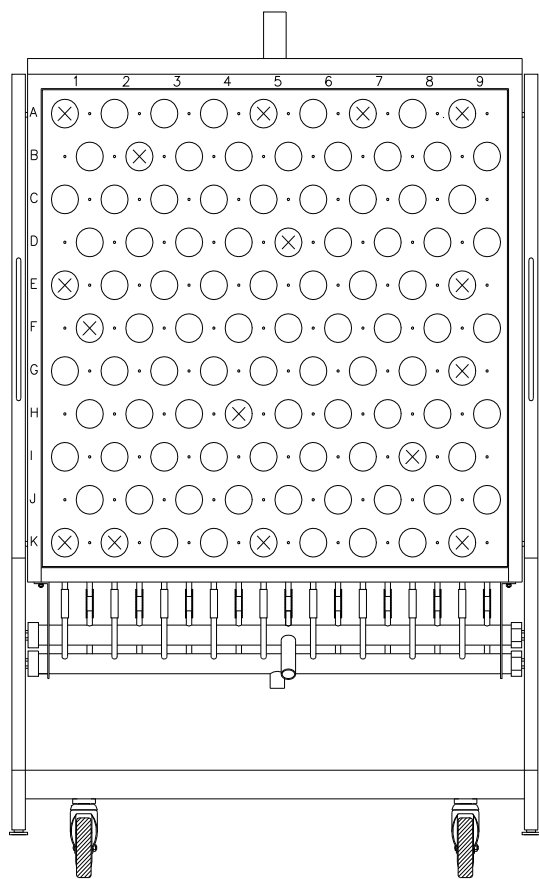
1. Pauluhn J. 1994. *J. Appl. Toxicol.* **14**(1): 55-62.



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The PMI nose-only flow past chamber

- Uniform spatial exposure of aerosol.
- Increased number of ports: 200.
- Minimal re-breathing of exhaled air.
- Minimal irritation.



Aerosol loss and uniform distribution within the PMI nose-only flow past chamber

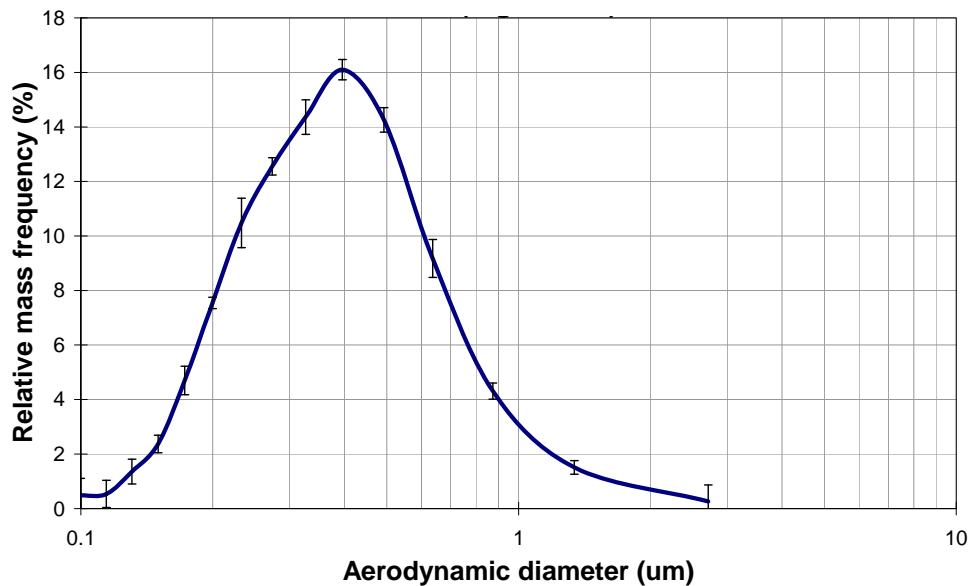
Parameter	Unit	RASS		DEE	
		Low dose	High dose	Low dose	High dose
TPM concentration	mg/m ³	3	10	3	10
Aerosol distribution	RSD (%)	5.0	2.4	4.0	2.0
TPM loss	%	2.9	1.2	2.6	0.2

TPM = total particulate matter

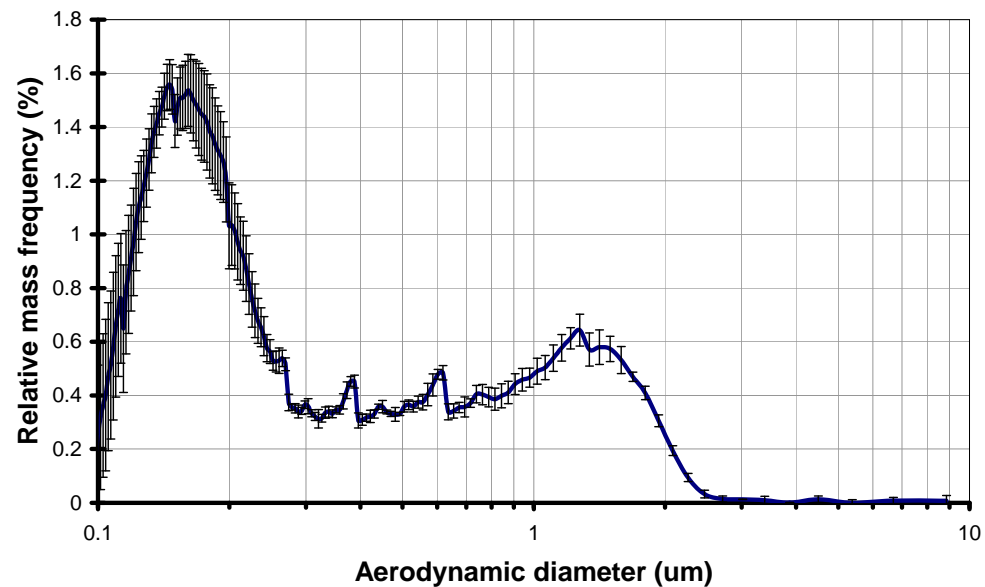


Particle size distribution of test aerosol within the PMI nose-only flow past chamber

RASS



DEE



The PMI nose-only flow-past chamber

- Uniform and consistent spatial aerosol distribution within the exposure chamber
 - ⇒ aerosols undergo no significant changes in particle size distribution on their way through the exposure chamber
- Flow direction of the aerosol in the breathing zone passes the nose of the rat at 90° to the flow direction of the exhaled air
 - ⇒ minimizes re-breathing of exhaled air
- Aerosol velocity in the breathing zone of the rat at a flow rate of 1 l/min through each holding tube is only 0.1 m/s
 - ⇒ protects the rats from irritative effects
- Increased number of exposure ports: 200
 - ⇒ more efficient use of laboratory floor space



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Co-authors:

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- Johannes Doll
- Walter Stinn
- Falk Radtke

