

Welcome

Please stand by. We will begin shortly.

Thirdhand Cigarette Smoke: A Persistent Environmental Contaminant

Thursday, June 23, 2016 2pm ET (120 minutes)



SMOKING CESSATION
LEADERSHIP CENTER

Disclosure

Dr. Suzaynn Schick and Catherine Saucedo have disclosed no financial interest/arrangement or affiliation with any commercial companies who have provided products or services relating to their presentation or commercial support for this continuing medical education activity.

Moderator



Catherine Saucedo

- Deputy Director,
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Thank you to our funders



Robert Wood Johnson Foundation



truth initiative
INSPIRING TOBACCO-FREE LIVES



National Behavioral Health Network
For Tobacco & Cancer Control

Housekeeping

- All participants will be in **listen only mode**.
- Please **make sure your speakers are on** and adjust the volume accordingly.
- If you do not have speakers, please request the dial-in via the chat box.
- **This webinar is being recorded** and will be available on SCLC's website, along with the slides.
- **Use the chat box to send questions** at any time for the presenters.

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- Instructions on how to claim credit will be included in our post-webinar email



Today's Speaker



Suzaynn Schick, PhD

- Assistant Professor,
School of Medicine,
University of California,
San Francisco

Thirdhand Cigarette Smoke: A Persistent Environmental Contaminant

Suzaynn F. Schick, PhD

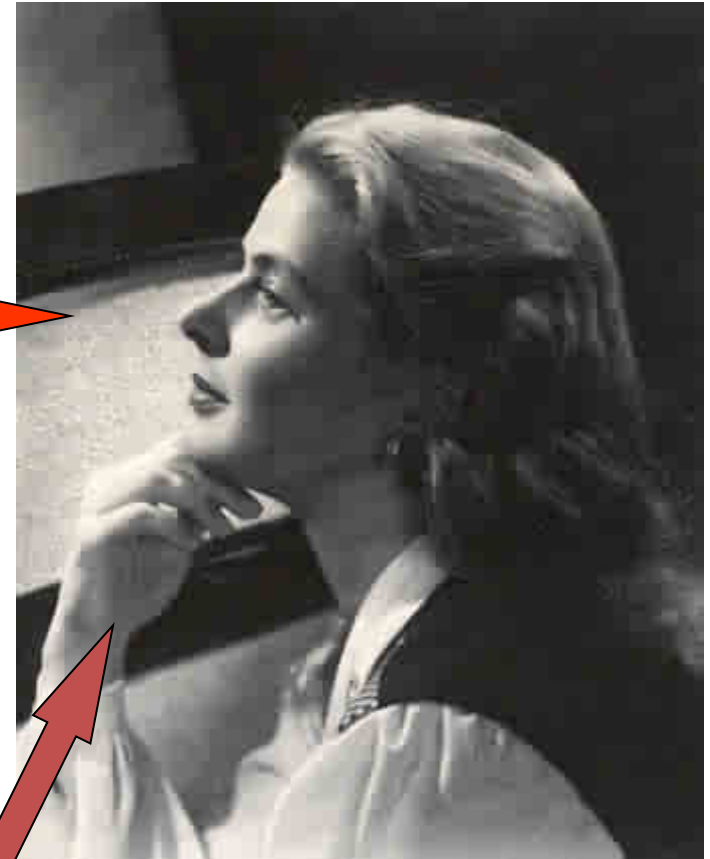
University of California, San Francisco

Thanks

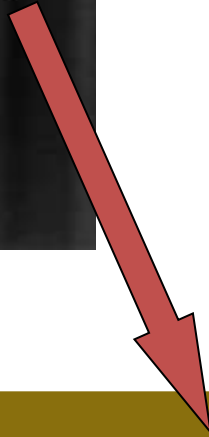
- **Lab Staff**
 - Kelly Pratt, Adam Whitlatch, Abel Huang
- **UCSF**
 - John Balmes, Neal Benowitz, Peyton Jacob, Chris Havel, Lisa Yu, Pura Tech
- **Lawrence Berkeley Lab**
 - Lara Gundel, Mohamad Sleiman, Hugo Destailats
- **UC Tobacco-Related Disease Research Program**
 - Grant #s 12FT-0114, 21 ST-011, 20PT-0184 and 24RT-0039



SHS



THS



Indoor Surfaces

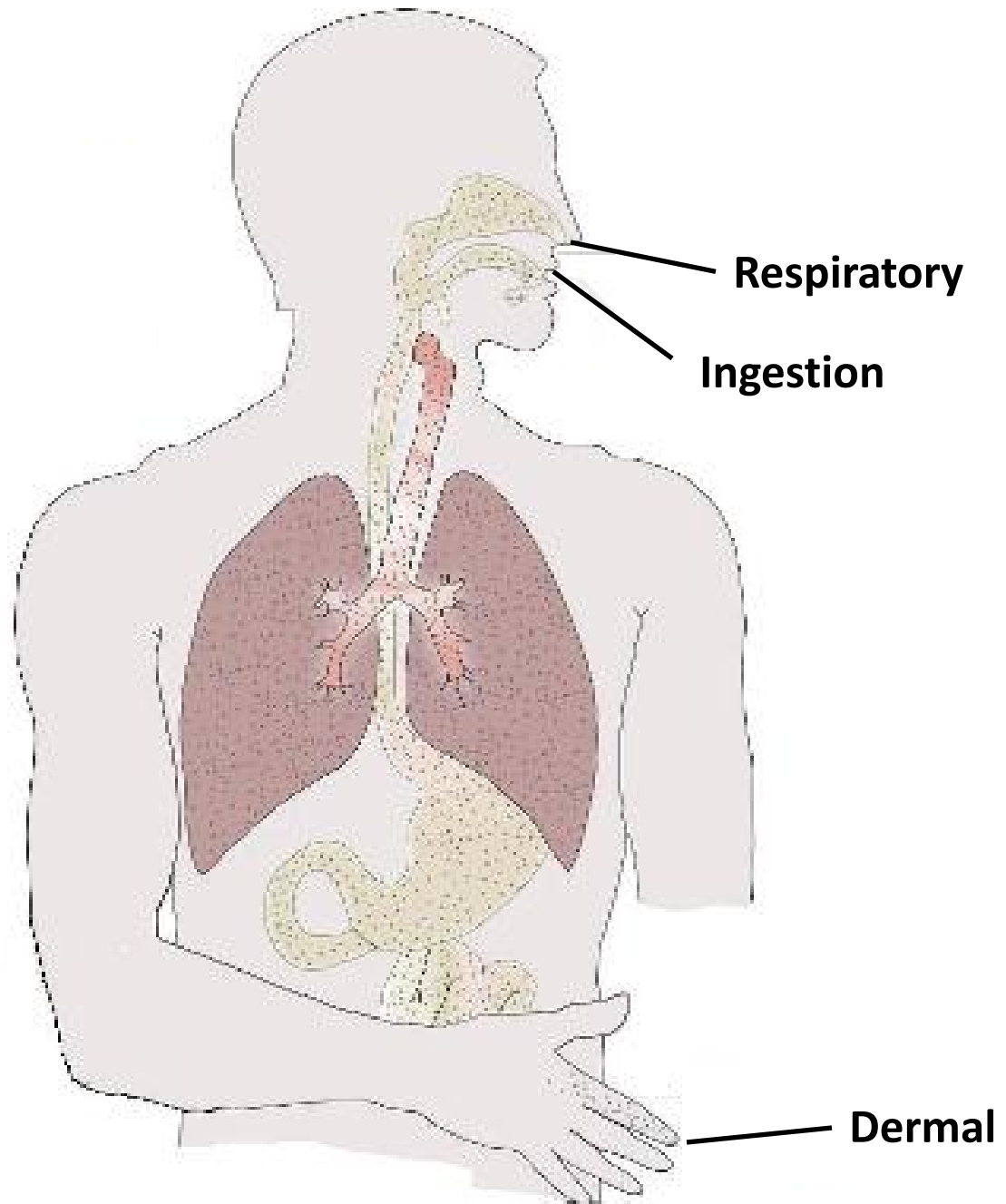
What is Thirdhand cigarette smoke?

The 3 R's

Chemicals in cigarette smoke that:

- **Remain** on surfaces and in dust
- **Re-emit** back into the gas phase
- **React** with other chemicals in the environment to make new chemicals

Chemical Exposure Routes



What is smoke?

- Gases
- Particles and droplets of oils and waxes (Tar)
- 10% of secondhand smoke is tar

Thirdhand Smoke starts with Tar

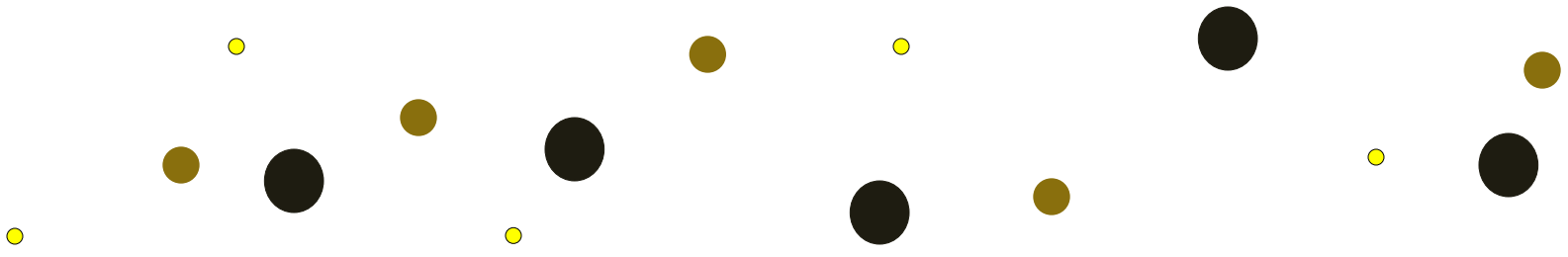
Remain

- Tar chemicals stick to surfaces before they can be removed by ventilation
 - Walls, carpet, dust, people...
- Tar absorbs into porous materials
- Tar contains nicotine and many toxins and carcinogens
 - Nitrosamines
 - Polycyclic aromatic hydrocarbons
- Persistence increases exposure time

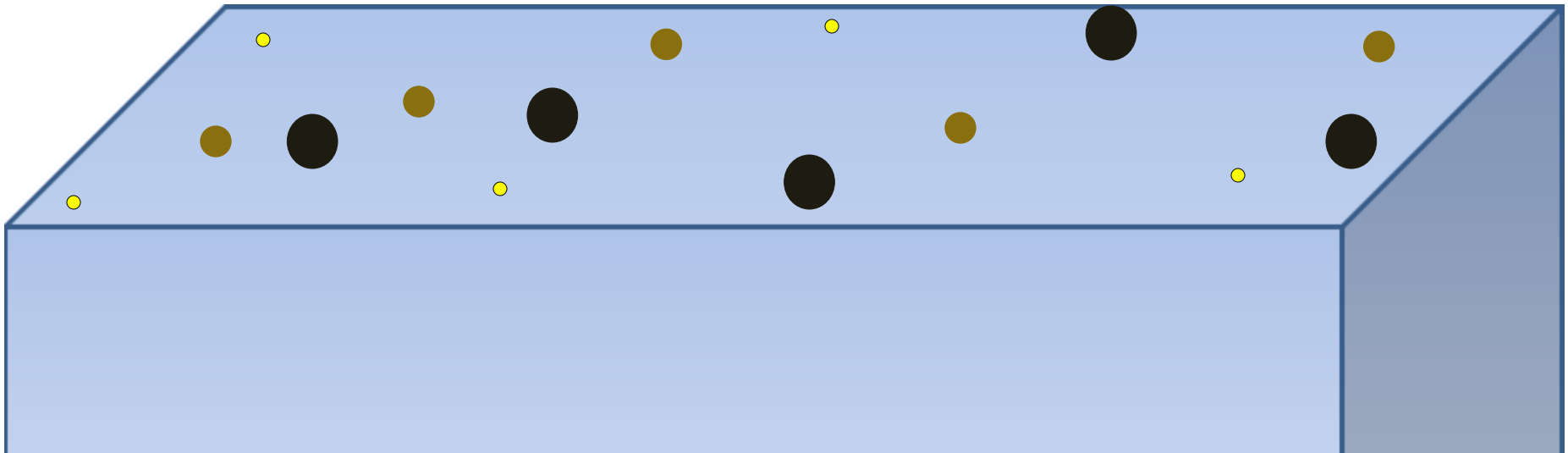
Re-Emit

- Combustion forces tar chemicals (normally solids or liquids) into the air
- Tar cools, condenses and sticks to surfaces
- Once on a surface, each chemical reaches equilibrium
- Fraction in the air depends on the chemical

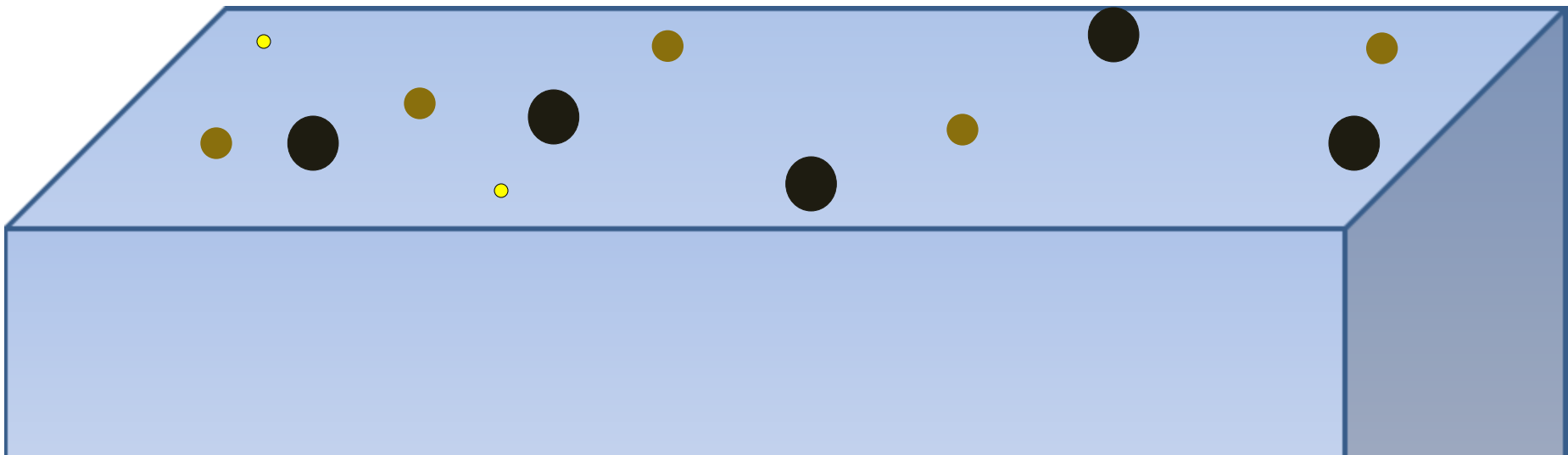
● Acetone ● Nicotine ● NNK



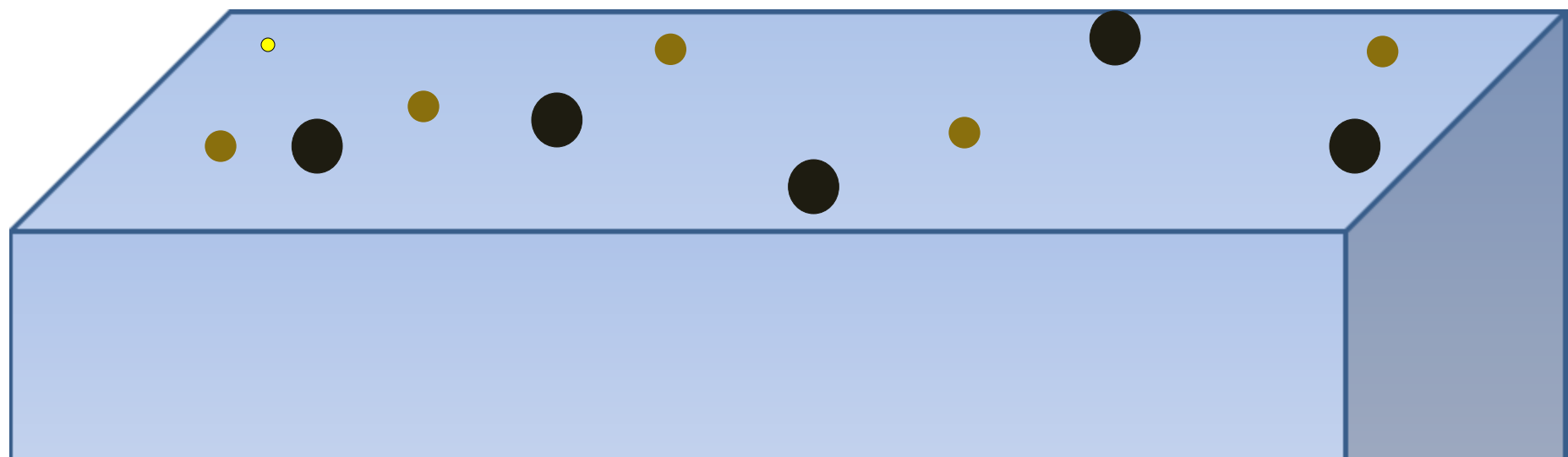
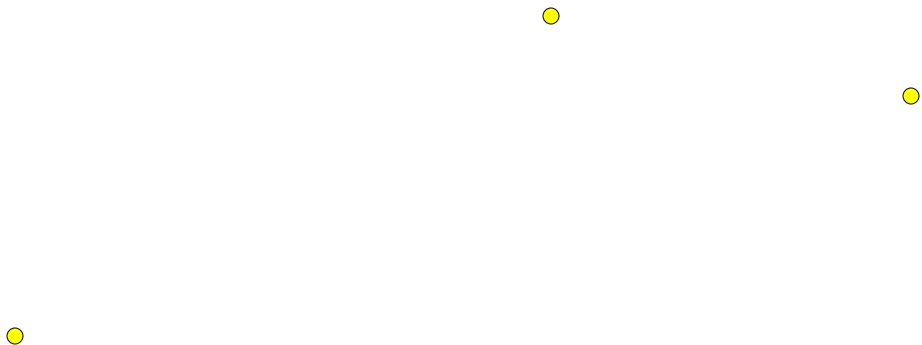
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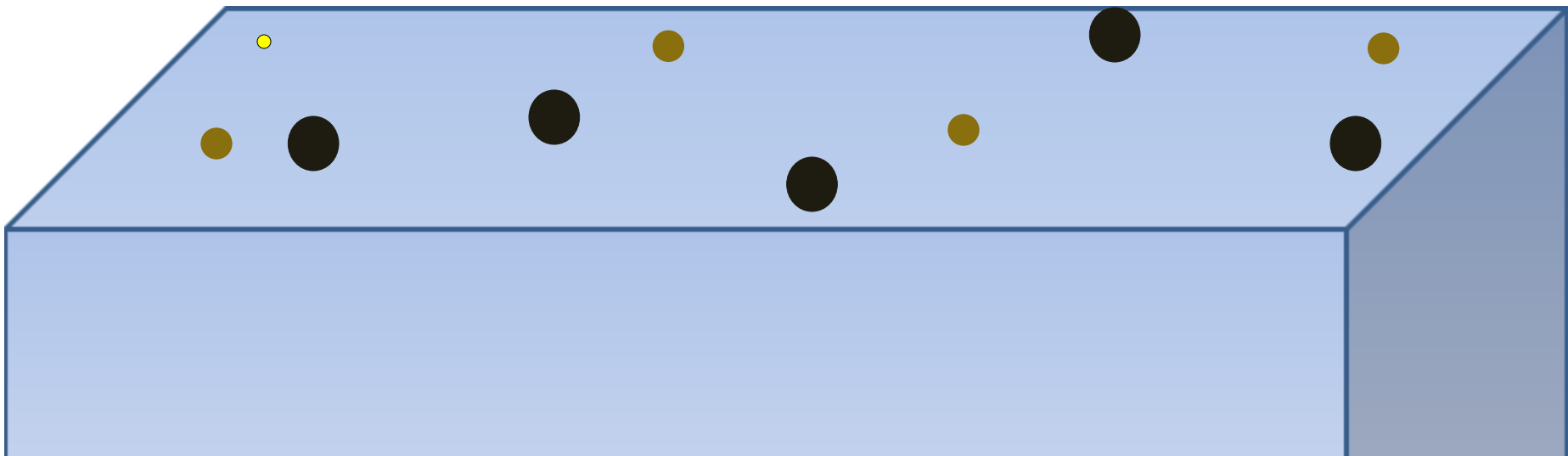
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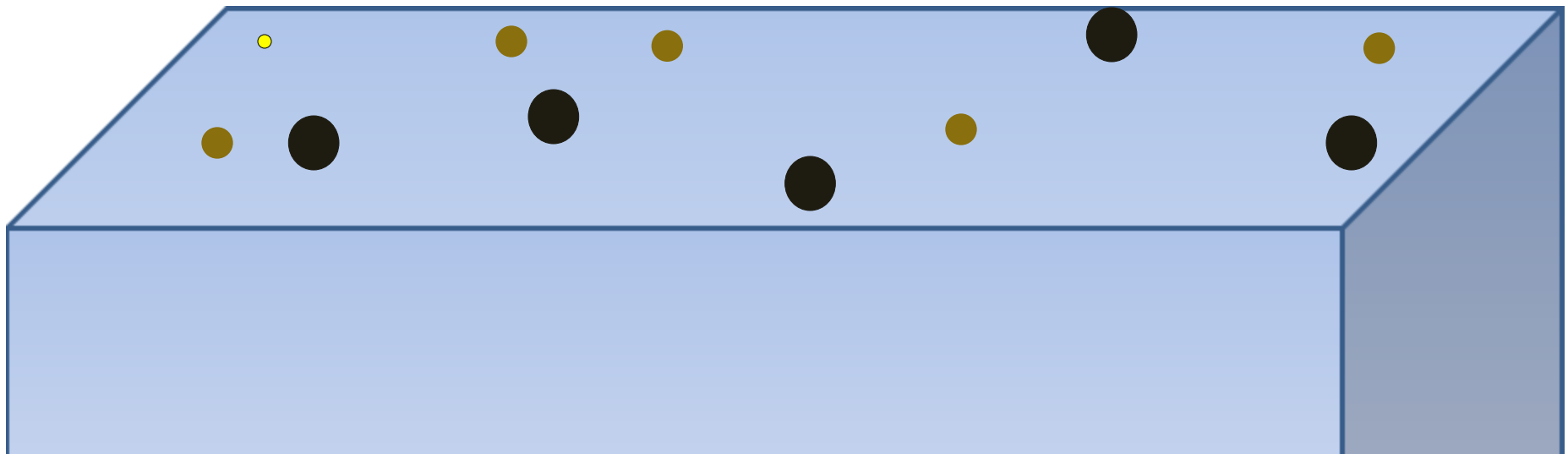
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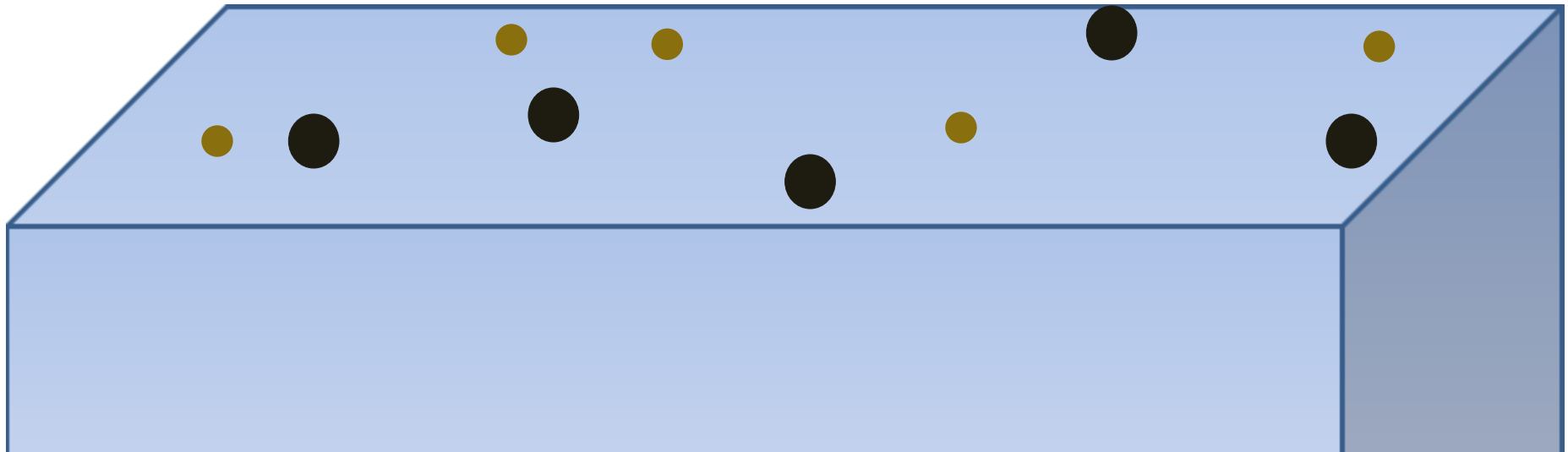
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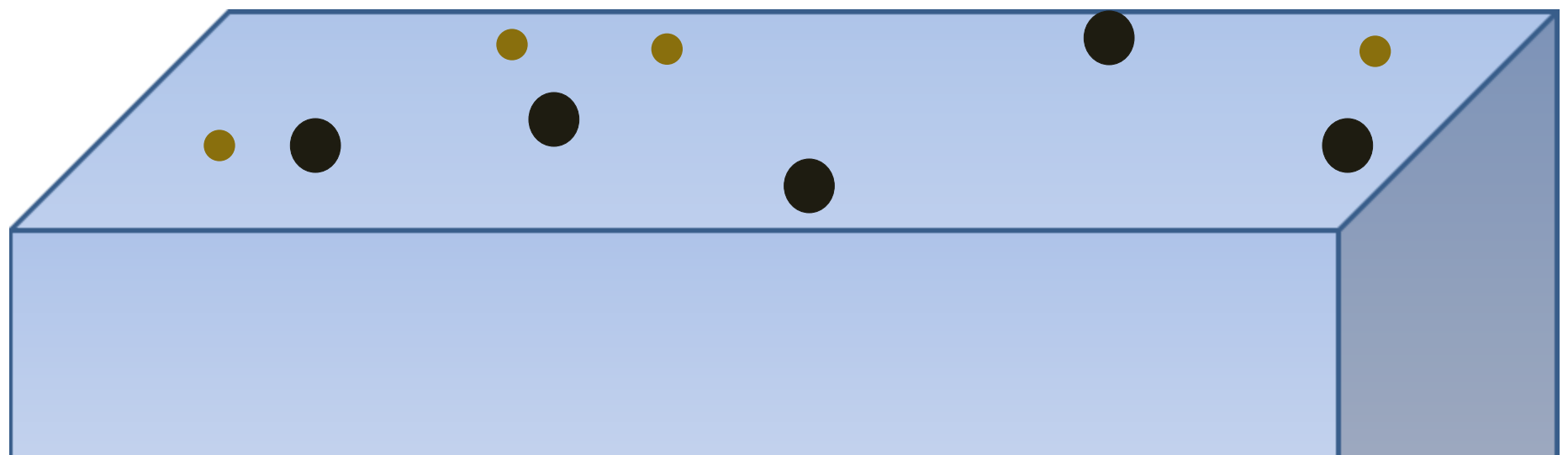
● Acetone ● Nicotine ● NNK



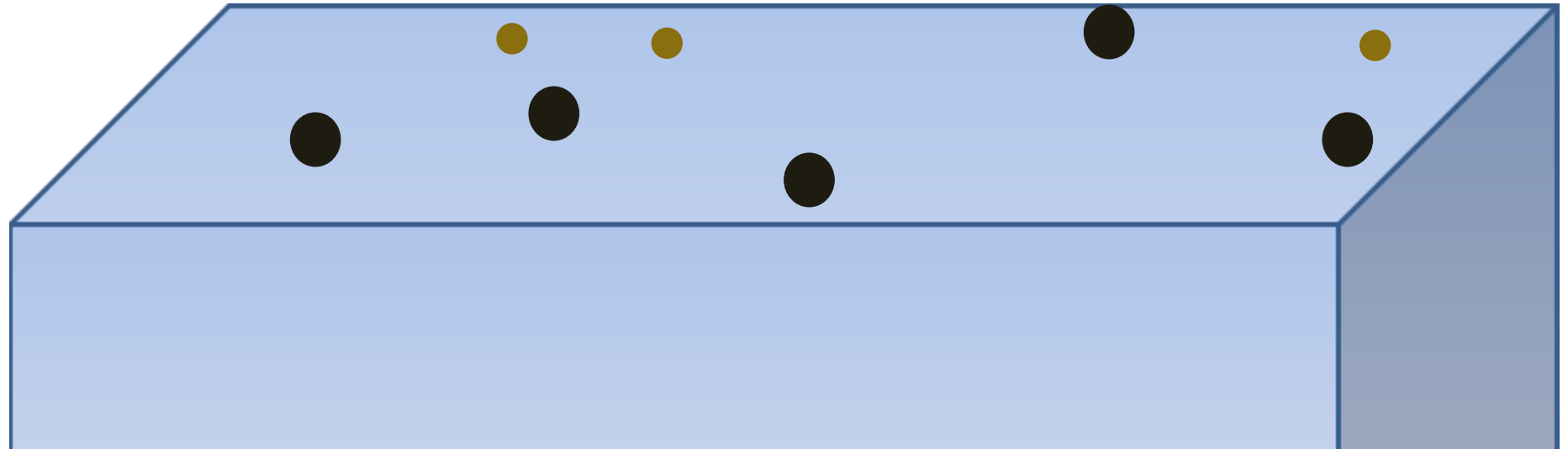
● Acetone ● Nicotine ● NNK



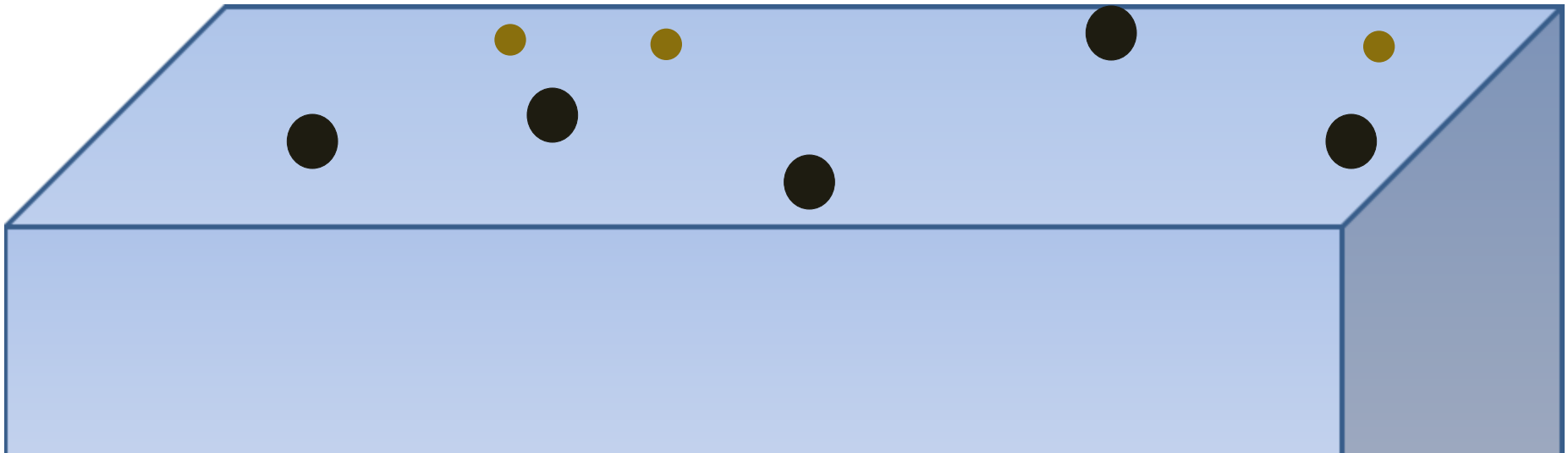
● Acetone ● Nicotine ● NNK



● Acetone ● Nicotine ● NNK



● Acetone ● Nicotine ● NNK



React

- Where there are chemicals, there are chemical reactions
- Which reactions do we know about?
 - Nicotine + nitrous acid = **NNK**
 - » Carcinogen
 - Nicotine + ozone = **formaldehyde**
 - » Carcinogen
 - Tar + ozone = **ultrafine particles**
 - » Can cause heart and lung disease

Truth Initiative Tobacco Documents Library

The screenshot shows a web browser window with the URL <https://industrydocuments.library.ucsf.edu/tobacco/>. The page header includes the University of California, San Francisco logo, navigation tabs for 'ALL INDUSTRIES', 'TOBACCO', and 'DRUG', a 'Take a tour' button, and a 'My Library' dropdown menu. The main title is 'TRUTH TOBACCO INDUSTRY DOCUMENTS' with a 'Collections' dropdown. Below the title is a descriptive paragraph: 'An archive of 14 million documents created by tobacco companies about their advertising, manufacturing, marketing, scientific research and political activities, hosted by the UCSF Library and Center for Knowledge Management.' A search bar is prominently displayed with a 'SEARCH' button and a 'GUIDED SEARCH' link. Below the search bar are checkboxes for 'Hide Restricted Documents', 'Hide Folders', and 'Hide Possible Duplicates', along with links for 'What can I search?' and 'Tips for better results'. A 'Search Options' dropdown menu is open, showing 'Document Date Ranges (no dates selected)' and 'Tobacco Collections (all tobacco collections selected)'. The main content area features four large image-based tiles: 'MARKETING TO WOMEN' (with a woman's face), 'E-CIGARETTES' (with a cigarette), 'POPULAR TOBACCO DOCUMENTS' (with a cigarette pack), and 'MARKETING TO YOUTH' (with a person's face). The footer contains links for 'About...', 'Latest News...', and 'Media...', along with the UCSF Library and Truth Initiative logos, and a 'Feedback' button.

RESEARCH PAPER

Philip Morris toxicological experiments with fresh sidestream smoke: more toxic than mainstream smoke

S Schick, S Glantz

Tobacco Control 2005;14:396–404. doi: 10.1136/tc.2005.011288

RESEARCH PAPER

Sidestream cigarette smoke toxicity increases with aging and exposure duration

Suzaynn Schick, Stanton A Glantz

See end of article for authors' affiliations

Tobacco Control 2006;15:424–429. doi: 10.1136/tc.2006.016162

1547

Concentrations of the Carcinogen 4-(Methylnitrosamino)-1-(3-Pyridyl)-1-Butanone in Sidestream Cigarette Smoke Increase after Release into Indoor Air: Results from Unpublished Tobacco Industry Research

Suzaynn F. Schick and Stanton Glantz

Center for Tobacco Control Research and Education and the Lung Biology Center, Department of Medicine, University of California, San Francisco, California

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Thirdhand Smoke Studies at Philip Morris

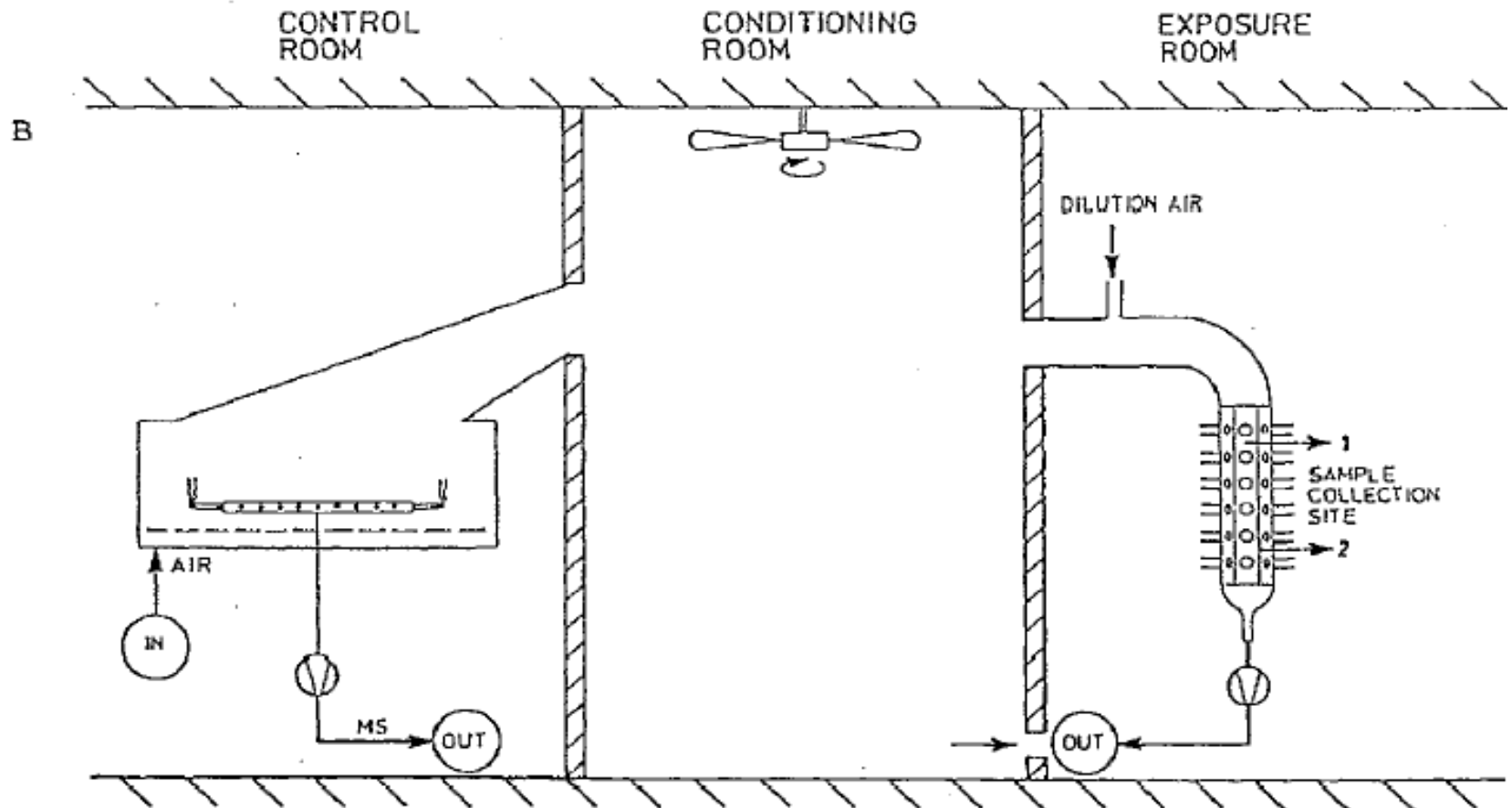
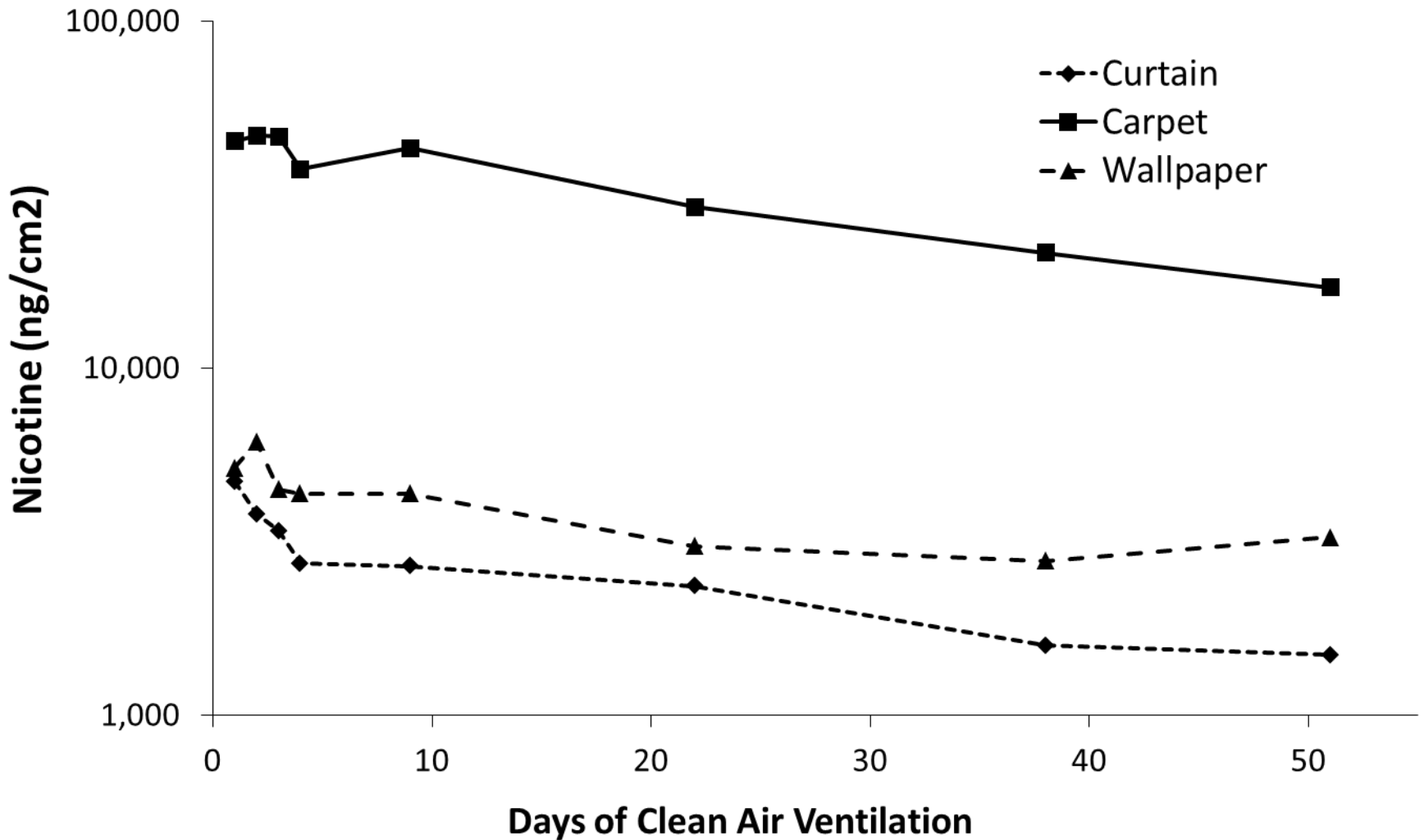
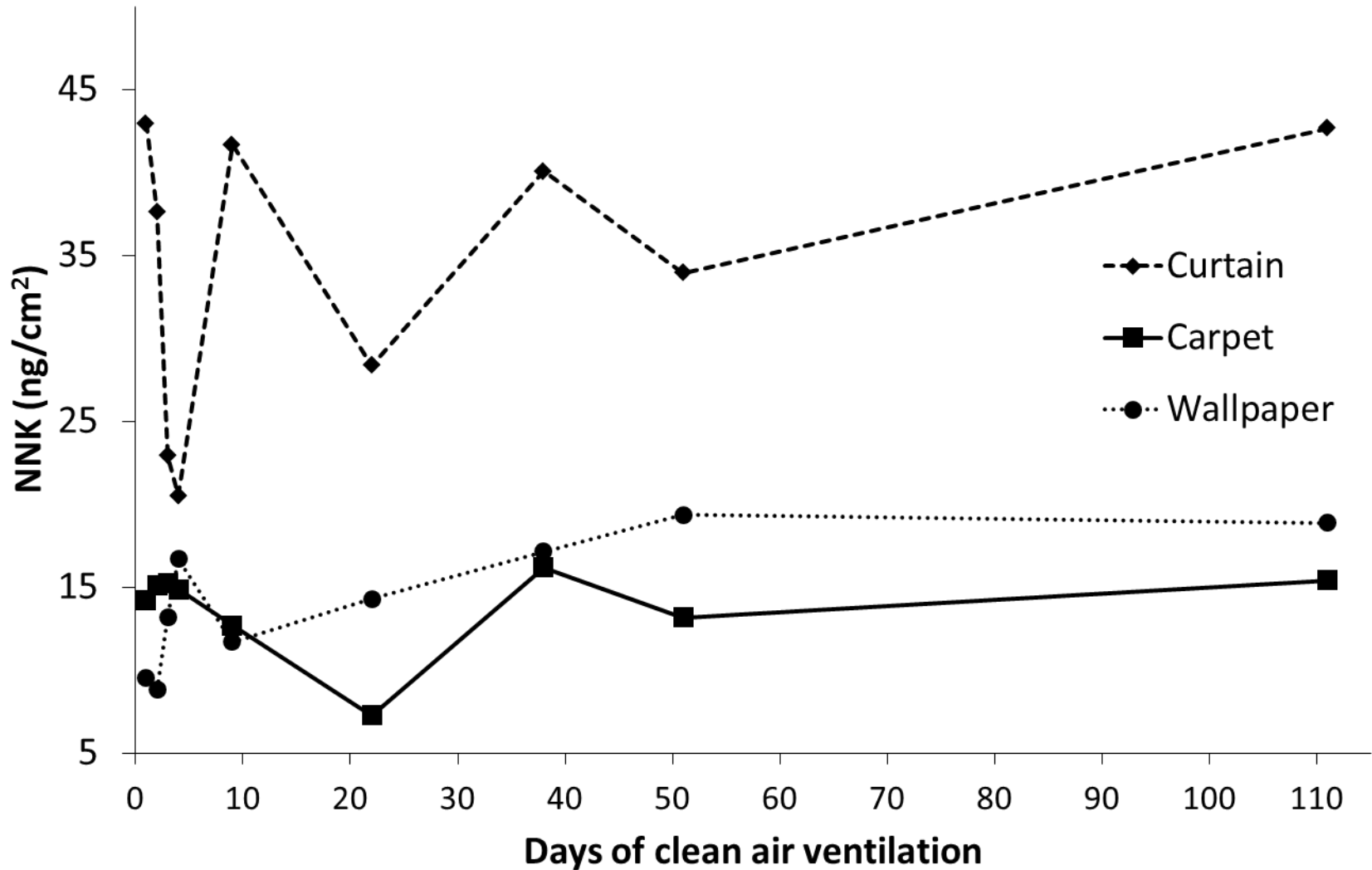


FIGURE 1 EXPERIMENTAL SETUP FOR SMOKE GENERATION

Nicotine persisted in surfaces (after smoking ended)



NNK persisted in surfaces (after smoking ended)



Thirdhand Smoke at Philip Morris

- **Remains**

- *Aging decreases concentration of particles and nicotine in air*
- *Adding carpet and cloth to room increased losses*
- Chemicals persisted on/in surfaces after 50-110 days of constant ventilation with clean air

- **Re-Emits**

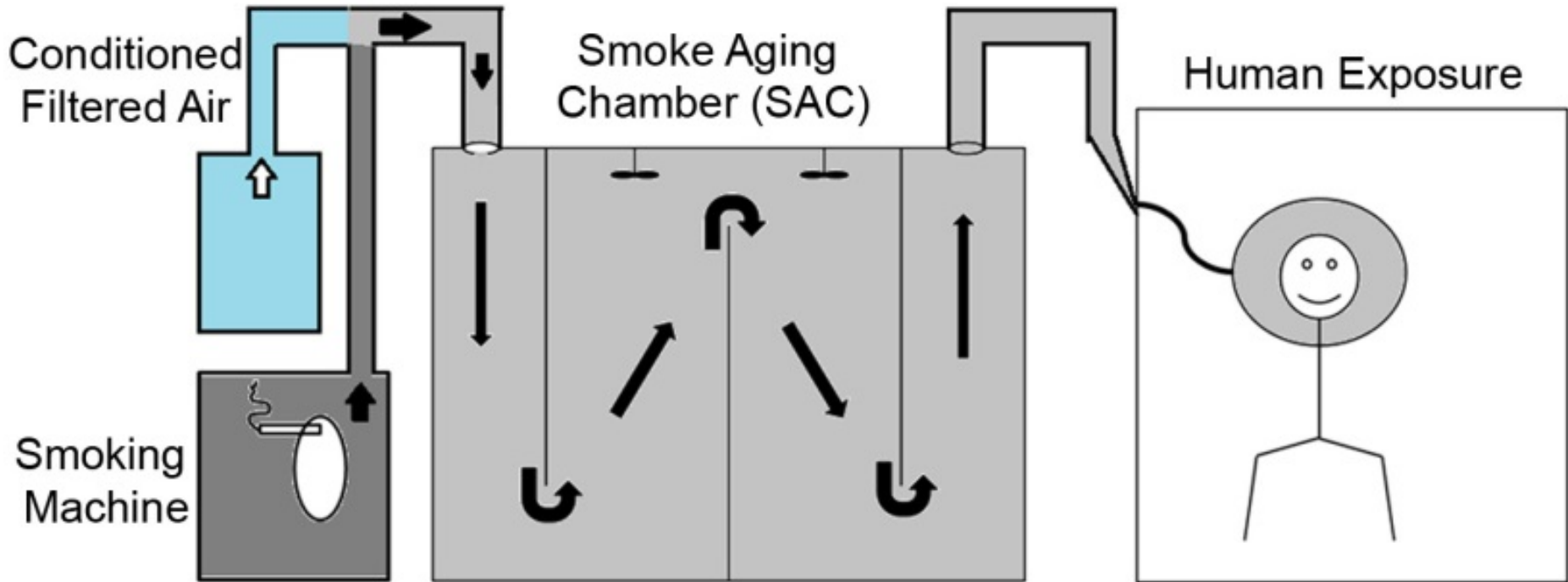
- After ventilation with clean air overnight, the air still contained lots of nicotine

- **Reacts**

- Nicotine reacts to form NNK

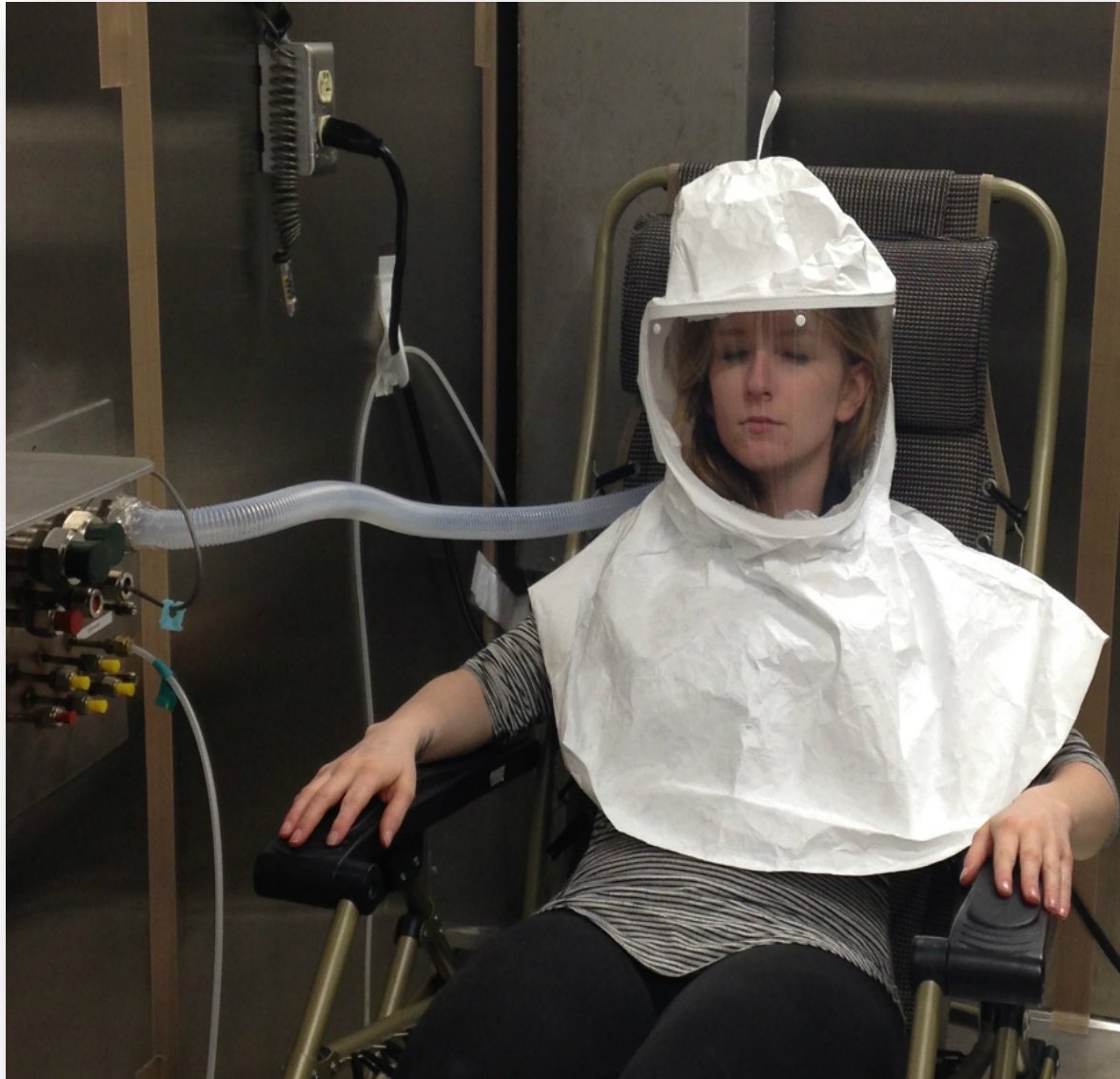
Thirdhand Smoke Studies at UCSF

Secondhand Smoke at UCSF



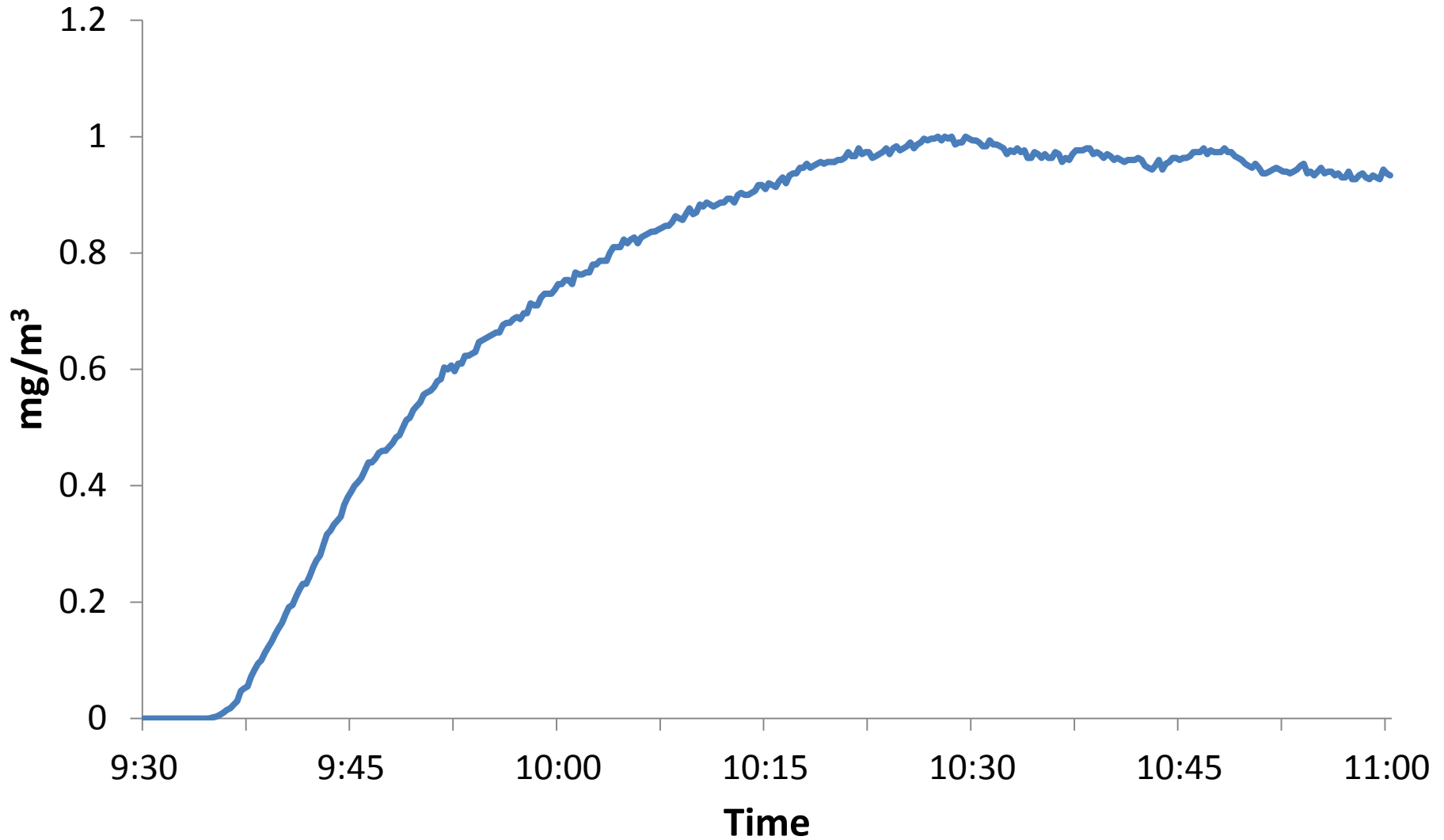
Smoke from cigarette smoking machine is diluted with filtered air, aged 30 minutes, then delivered to the study participant

Respiratory exposure

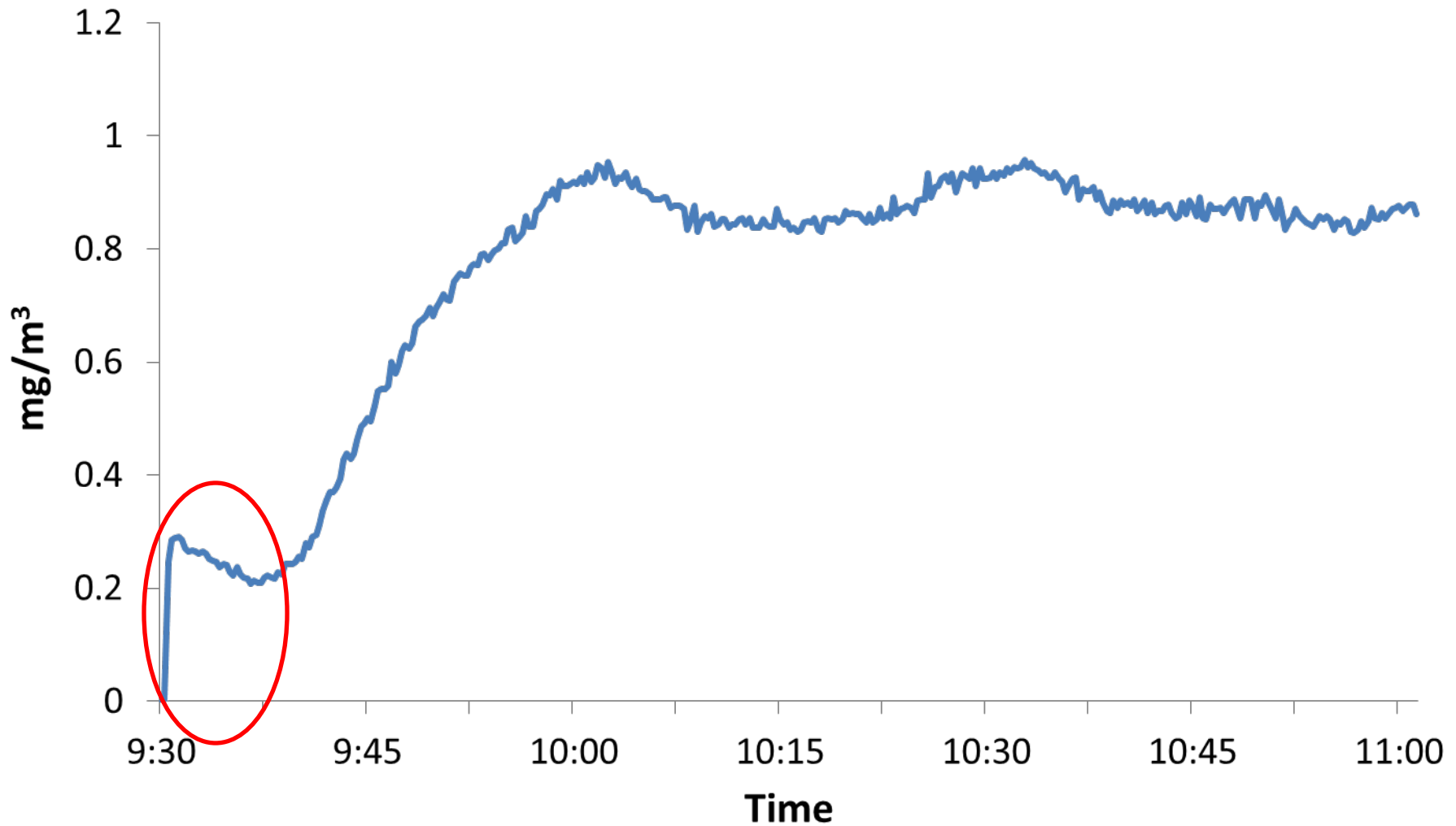


Thirdhand Smoke Emits Particles

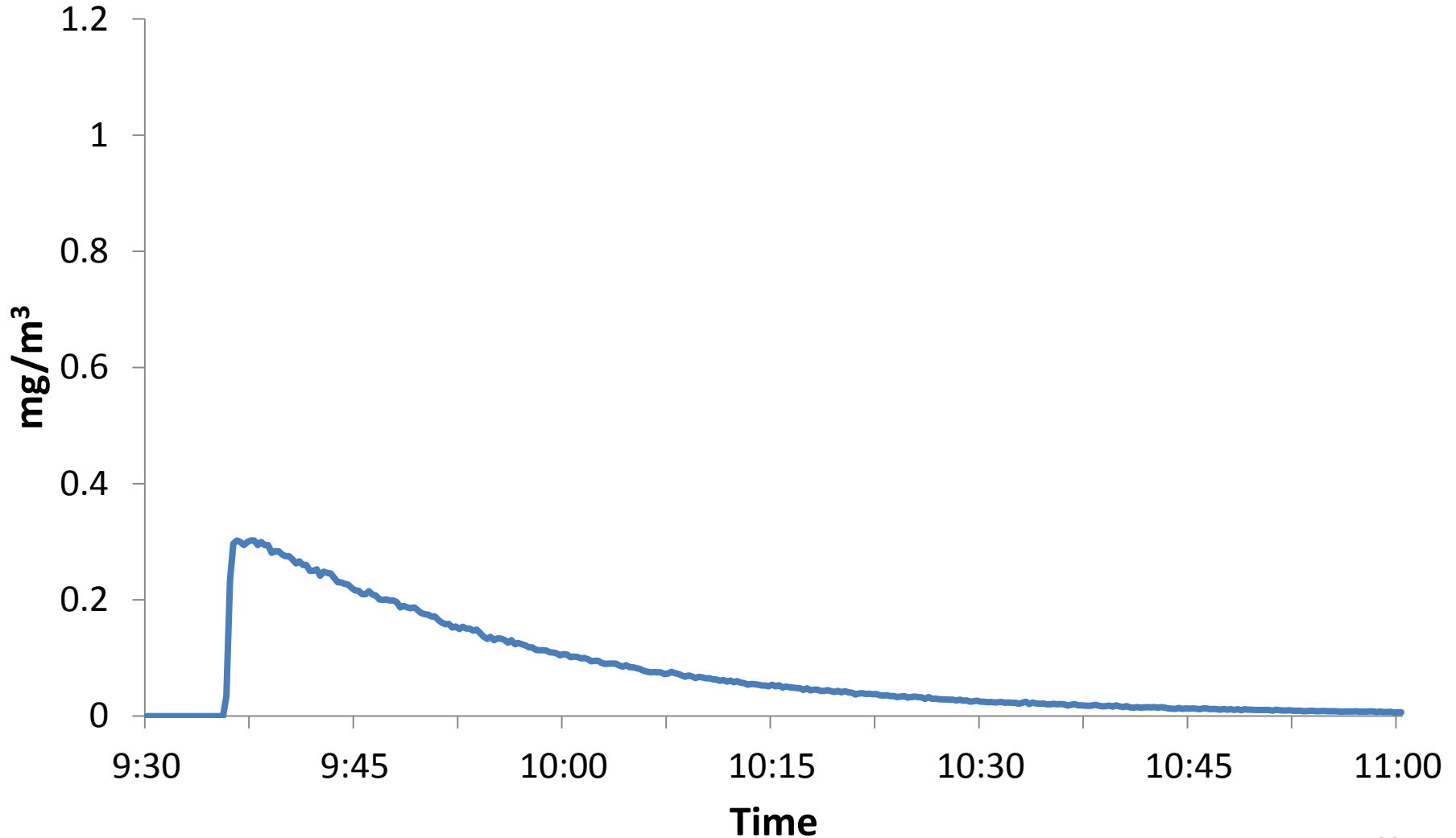
Normal particle output



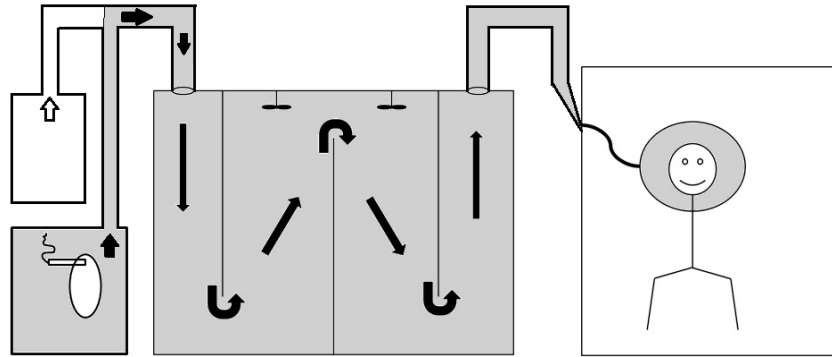
Something coming out before start the smoking machine



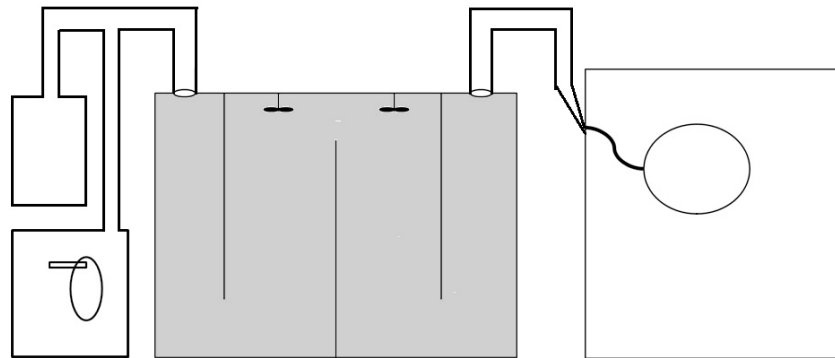
“Secondary” particles from Thirdhand Smoke



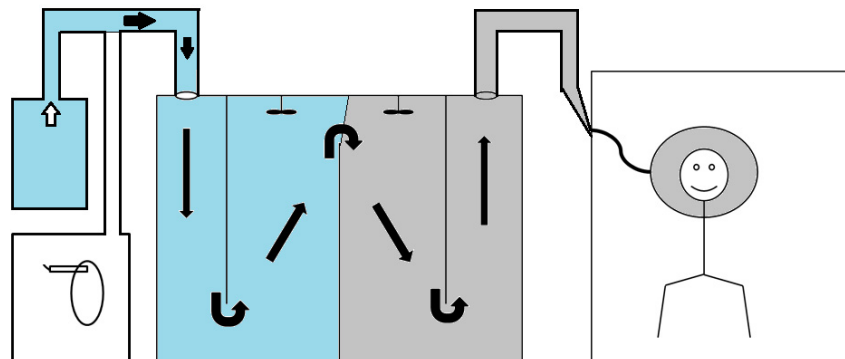
Secondhand Smoke Generation Mode



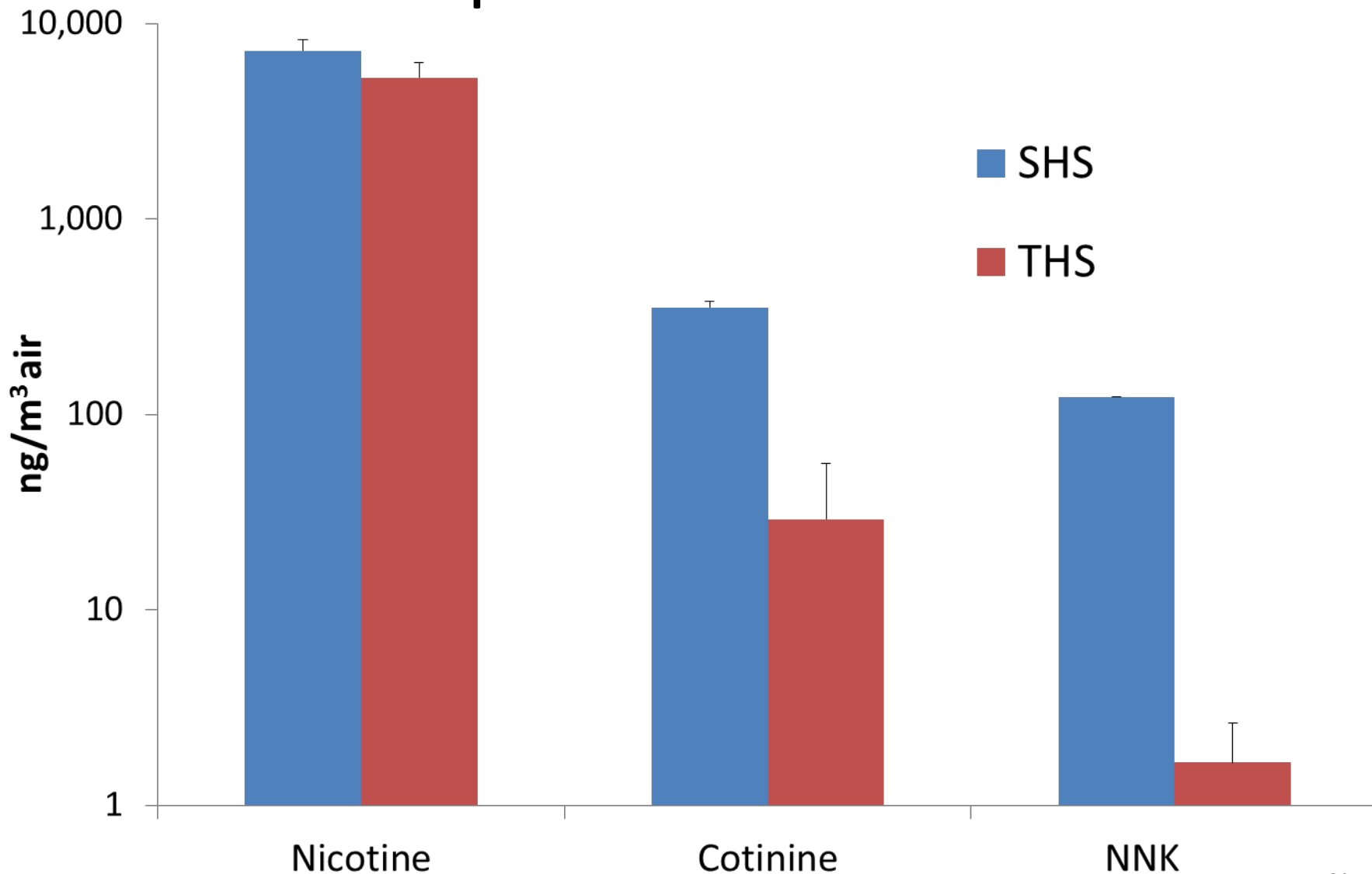
Thirdhand Smoke Deposition Mode



Thirdhand Smoke Exposure Mode

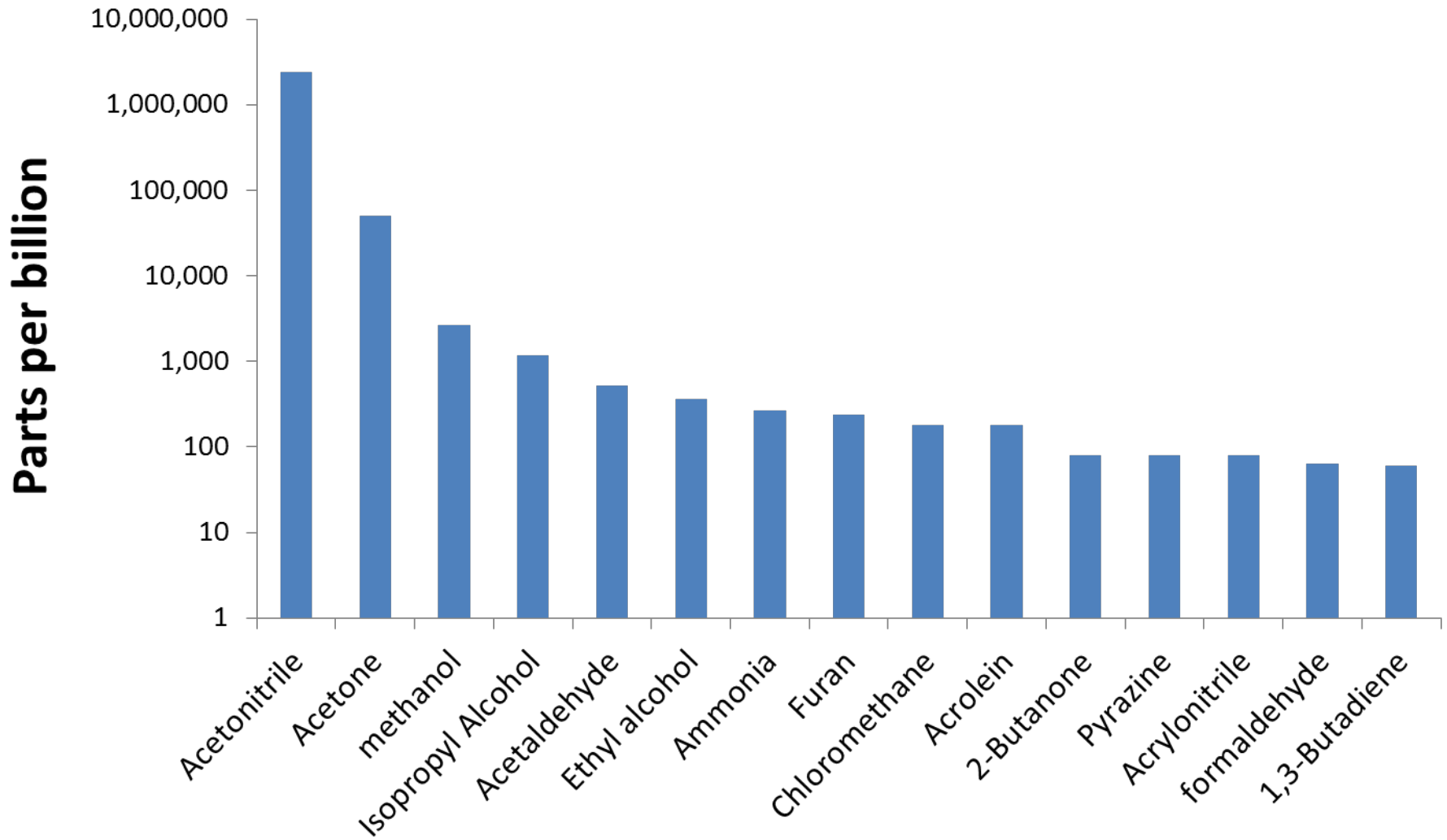


Secondhand and Thirdhand Smoke particles differ

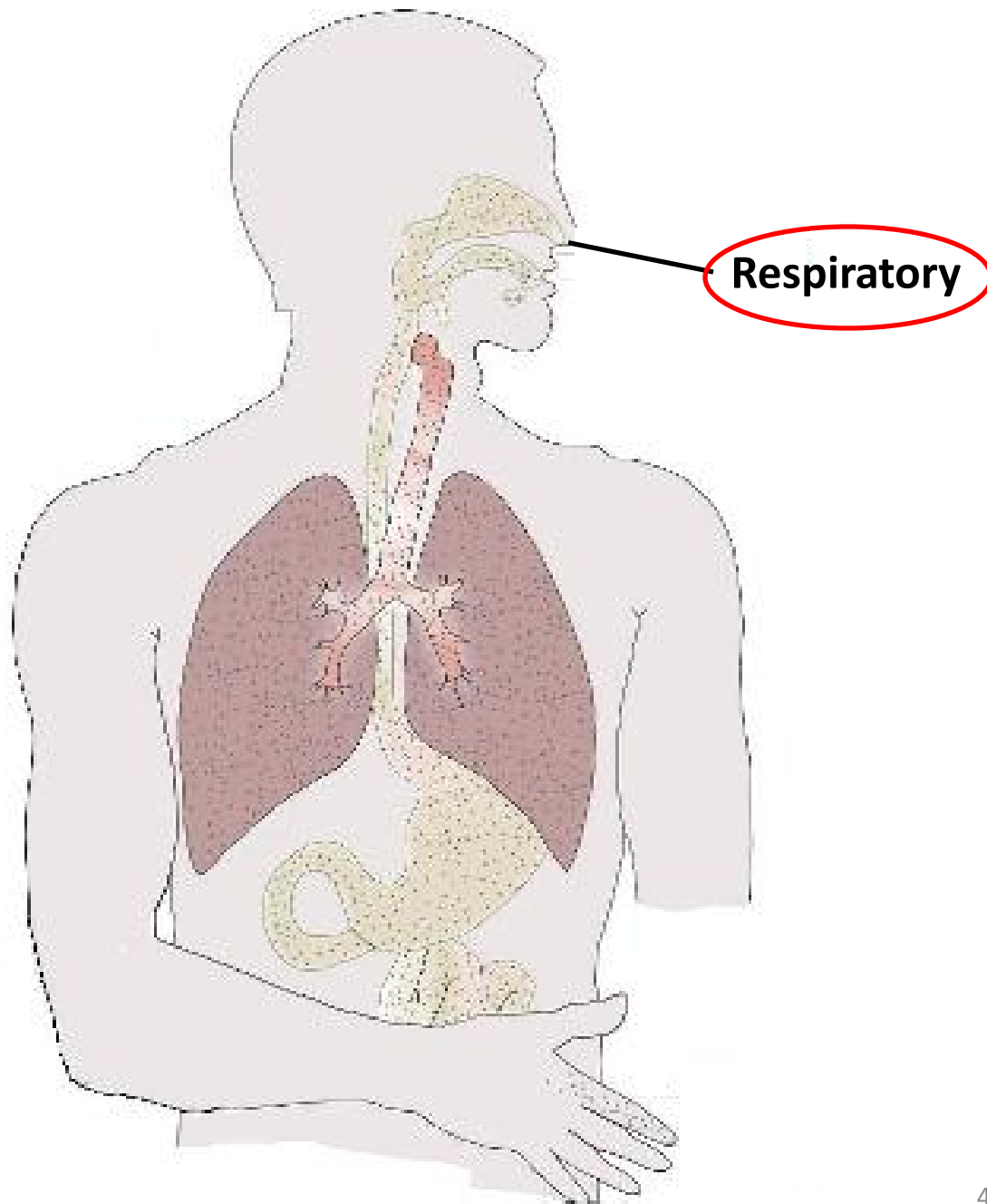


Thirdhand Smoke Emits Volatile Chemicals

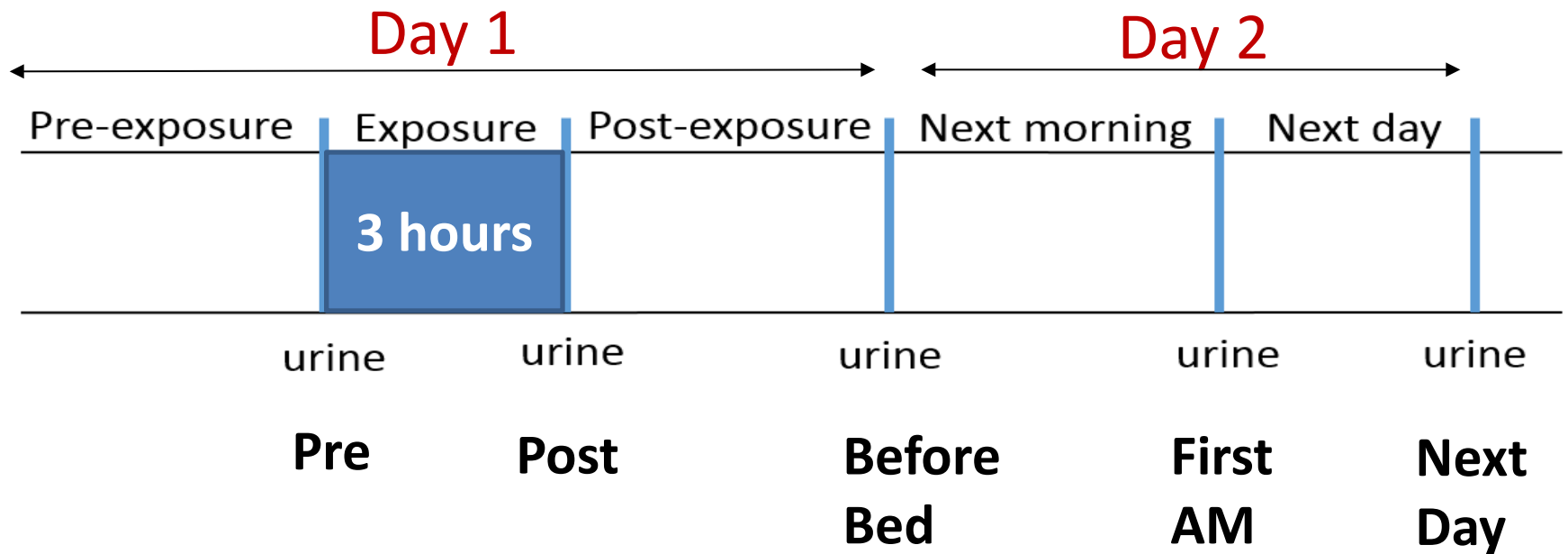
Paper exposed to smoke emits volatile chemicals



Respiratory Exposure to Thirdhand Smoke In Human Participants



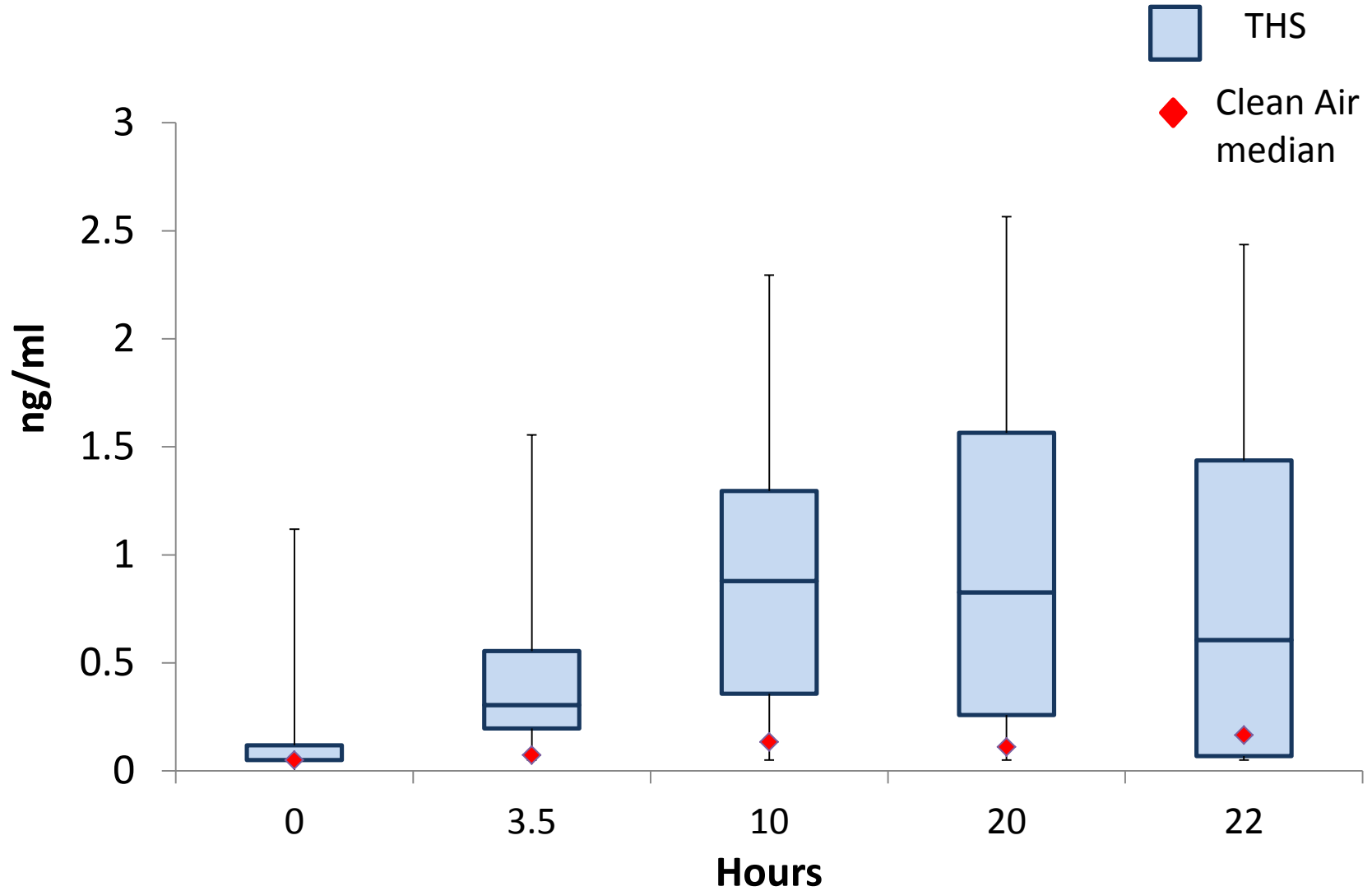
Study design and sample collection



Cotinine is a biomarker of nicotine exposure

- Metabolite of Nicotine
- Biomarker of smoking and exposure to Secondhand Smoke and Thirdhand Smoke
- Half-life of 16 hours

Breathing Thirdhand Smoke increases **cotinine**



Health effects of Thirdhand Smoke exposure in mice

- Smoke cages (curtain, carpet, cloth swatches inside)
- Mice live in cages for 6 months
- Depilate backs weekly
 - Nair on mice...
- Change cages weekly
- Control mice live in separate room in unsmoked cages

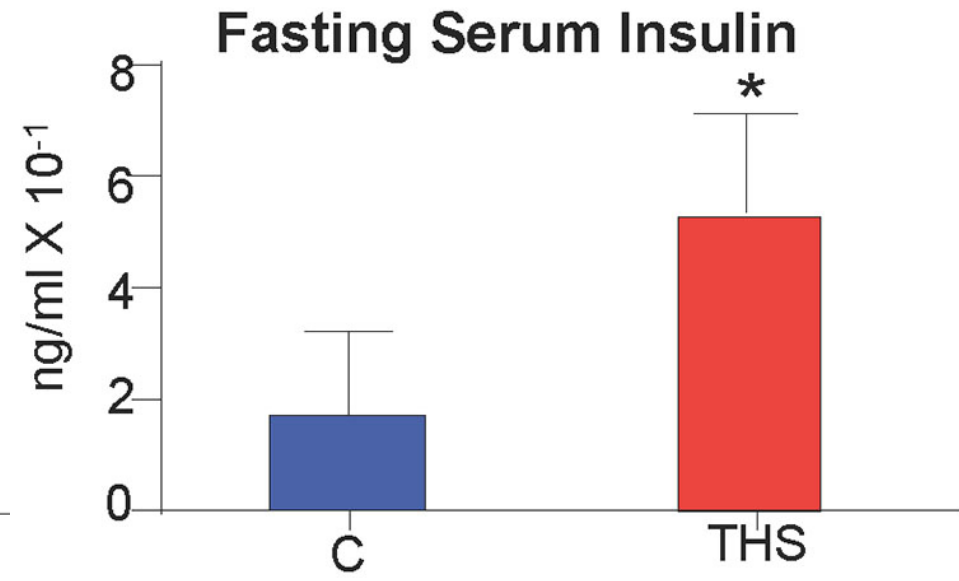
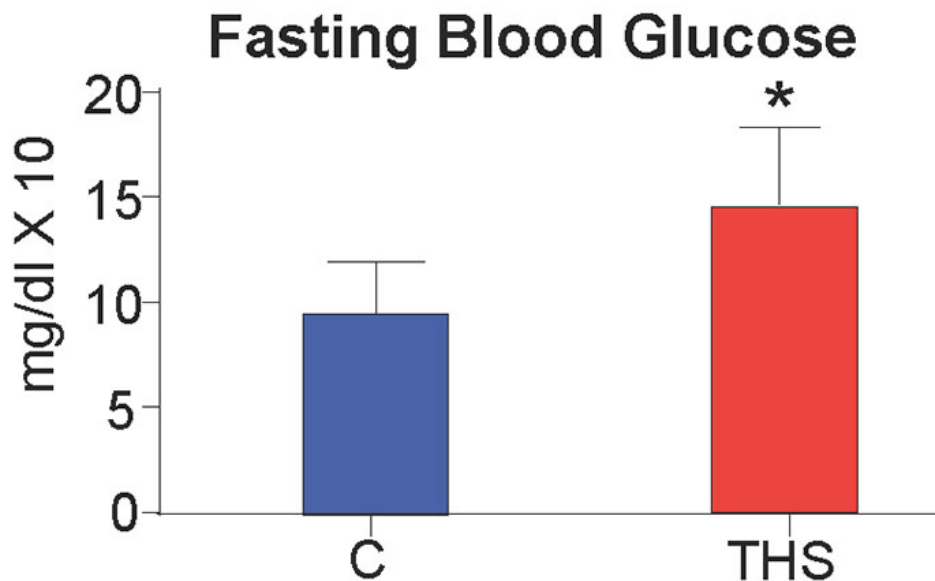


Health effects in mice

- Induces type II diabetes
- Causes hyperactivity
- Speeds up blood clotting
- Slows wound healing/changes skin structure
- Damages liver/elevates blood lipids
- Increases oxidative stress
- Slows growth

Non-obese type II diabetes

- 49% of exposed mice showed these effects

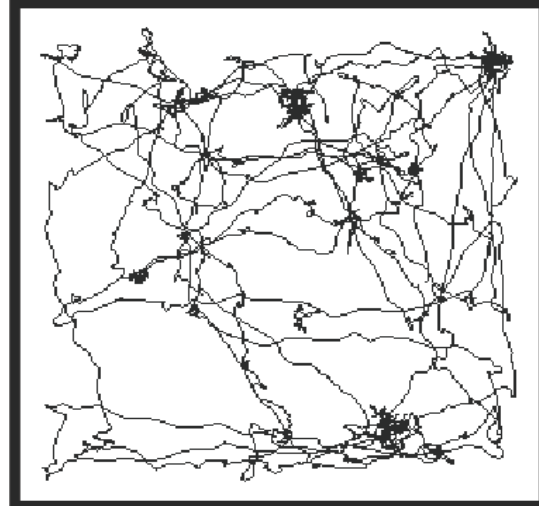
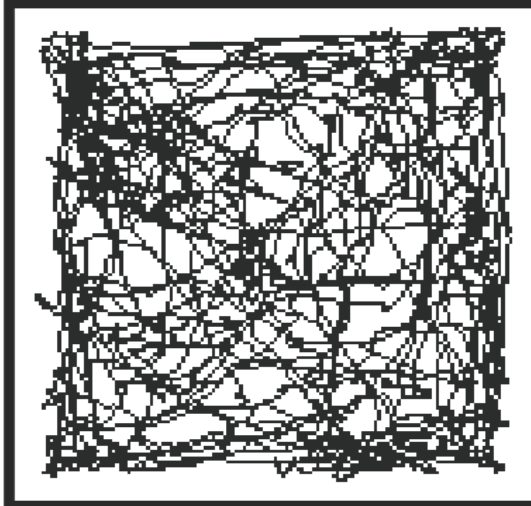


Hyperactivity

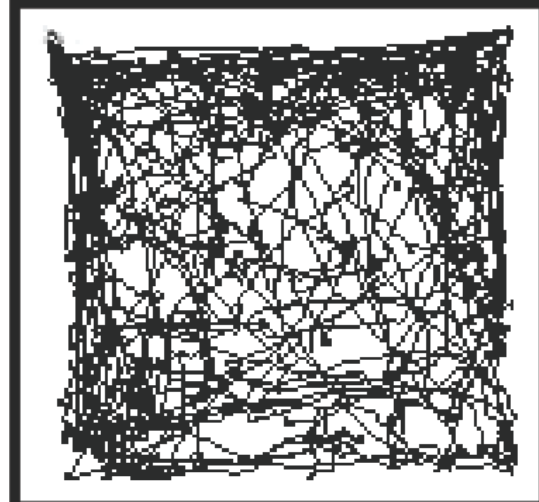
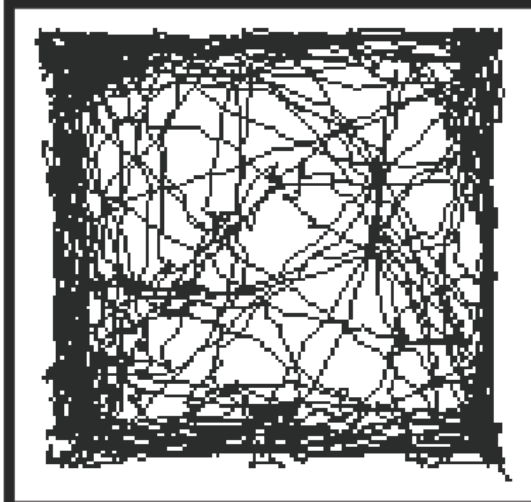
First 10 mins

Last 10 mins of 1 Hour

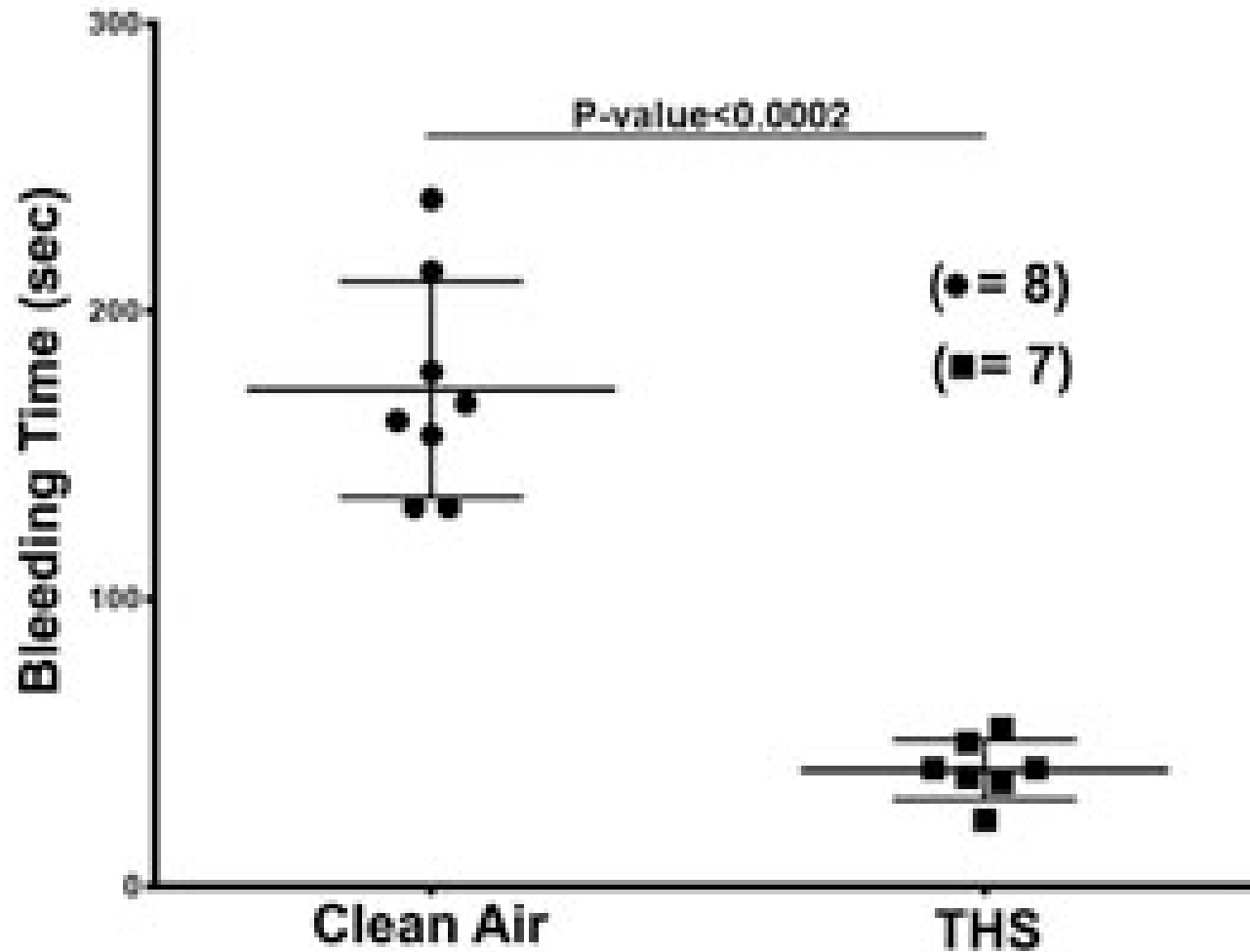
Control



THS



Faster blood clotting



Charting the Unknown: Data from Marijuana and E- Cigarettes

Similarities between tobacco and marijuana smoke

- Leaf contains high concentrations of oils and waxes
- Nicotine and THC both survive combustion
- It doesn't matter what you burn: **Combustion creates complex, toxic aerosols**

Toxins in Sidestream

	Health Effects	Tobacco	Marijuana
weight (mg)		788	769
puffs		13	15
tar (mg)	Multiple	24	50
CO (mg)	Inhibits respiration	62	54
Ammonia (mg)	Irritant	5.6	14.3
Nicotine (mg)	Addictive	5	0
NOx (mg)	Inflame lung	1.2	2.3
Formaldehyde (μg)	Carcinogen	886	383
Acrolein (μg)	Cardiotoxin	437	566
HCN (μg)	Toxin	84	685
Benzo (a) pyrene (ng)	Carcinogen	91	101
NNK (ng)	Carcinogen	92	0

Terpenes, cannabis and particle formation

- Terpenes are odorant, bioactive chemicals found in cannabis, tobacco and e-liquids
 - Limonene, Pinene, Linalool, Myrcene and others
- Secreted by plant glands that make THC
- Used to reduce viscosity of hash oil in vape pens
- React to form ultrafine particles in air

Thirdhand Smoke is a persistent environmental contaminant

- **Remains**

- Chemicals stick to surfaces
- Weeks and months of ventilation do not remove Thirdhand Smoke

- **Re-Emits**

- Nicotine, formaldehyde, acetonitrile, acetone and other volatile chemicals

- **Reacts**

- Nicotine reacts to form NNK
- THS reacts to form particles

E-Cigarette Toxins

- THS potential unknown
- Aerosol contains smaller particles
 - Median diameter for cigarettes: 110-340 nm
 - Median diameter for e-cigarettes: 5-50 nm
 - E-cigarette particles evaporate faster
- Nicotine
 - No sidestream but, more spills and leaks
- Flavorings: benzaldehyde (cherry), cinnamonaldehyde ...

Summary I

- 10% of the smoke of every cigarette persists in the environment
- Thirdhand smoke is toxic and carcinogenic
- Thirdhand smoke on surfaces emits constant low levels of particles and chemicals

Summary II

- Breathing thirdhand smoke causes detectable increases in the levels of nicotine in the body
- Thirdhand smoke may have health effects
- Marijuana smoke probably creates THS too
- E-cigarettes probably also create THS

Conclusions

- Living in spaces where people have smoked increases exposure to toxins and carcinogens
- The concentrations are lower, but the exposure is continuous and persistent
- Smoking bans in housing, workplaces, hotels and rental cars will reduce thirdhand smoke exposure

Questions and Answers



- Submit questions via the **chat box**

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