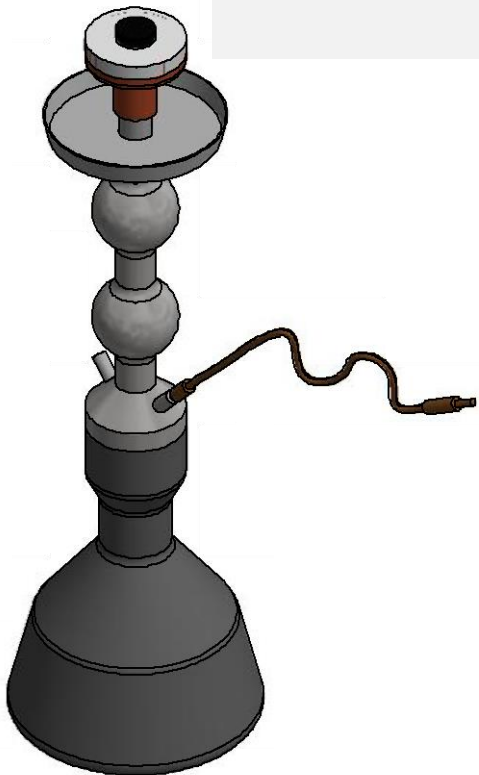


# The role of the Tobacco Free Initiative (TFI) in supporting waterpipe regulations

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# Outline



Prevalence of waterpipe use among students



Sources of waterpipe smoke



Regulating the sources



Regulating the emissions

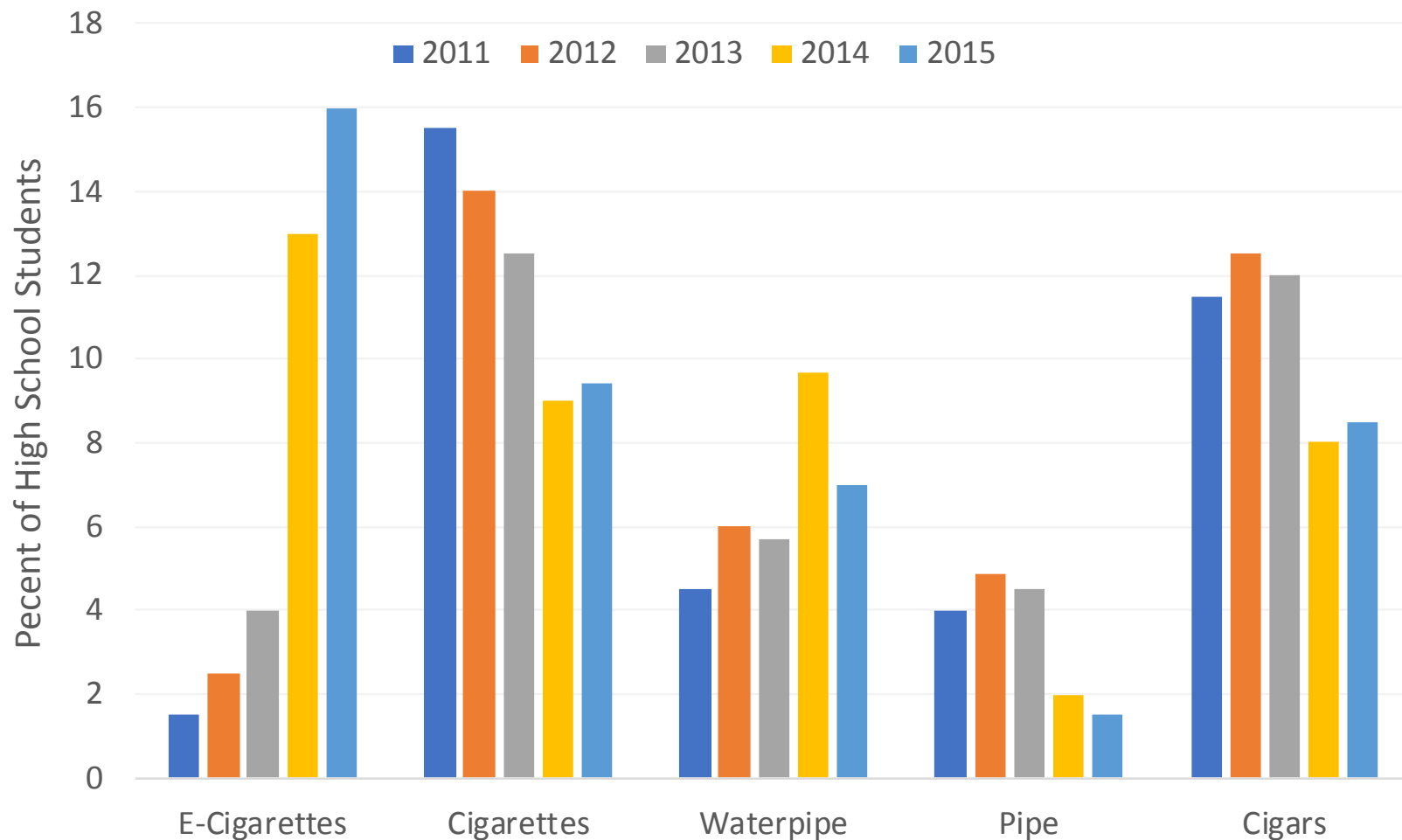


Applicability of the TobLabNet standard operating procedures to waterpipe smoke testing



# Estimated percentage of high school students who currently use any tobacco products

National Youth Tobacco Survey 2011–2015





How do we protect the end users?  
(regulating mainstream and sidestream smoke)

Mainstream Smoke



Sidestream Smoke

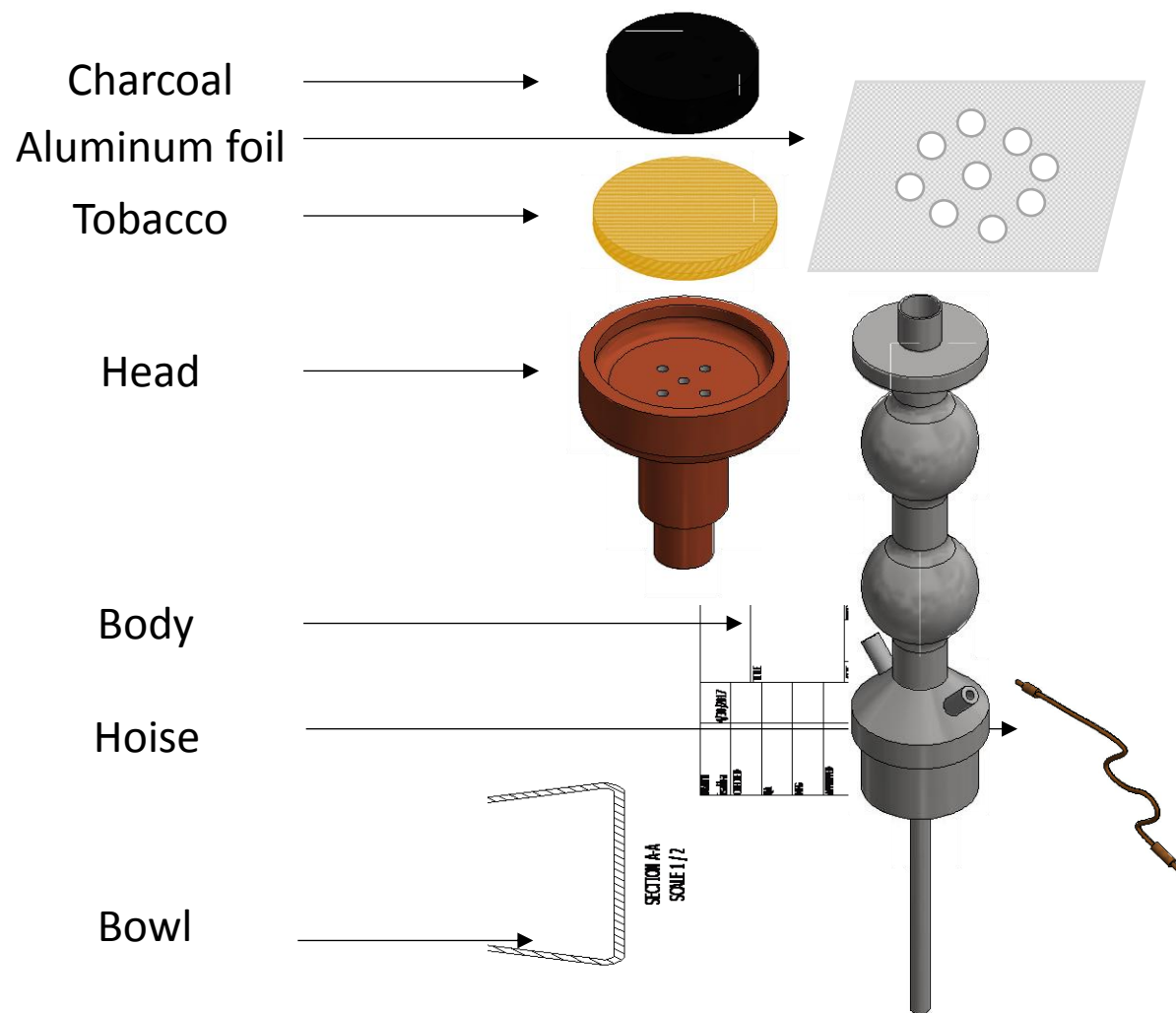


Mainstream Smoke





# Sources affecting mainstream smoke





# Variations in the sources affecting the smoke in the waterpipe

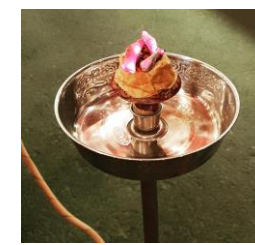
## 1. Charcoal



## 2. Tobacco



## 3. material and packing

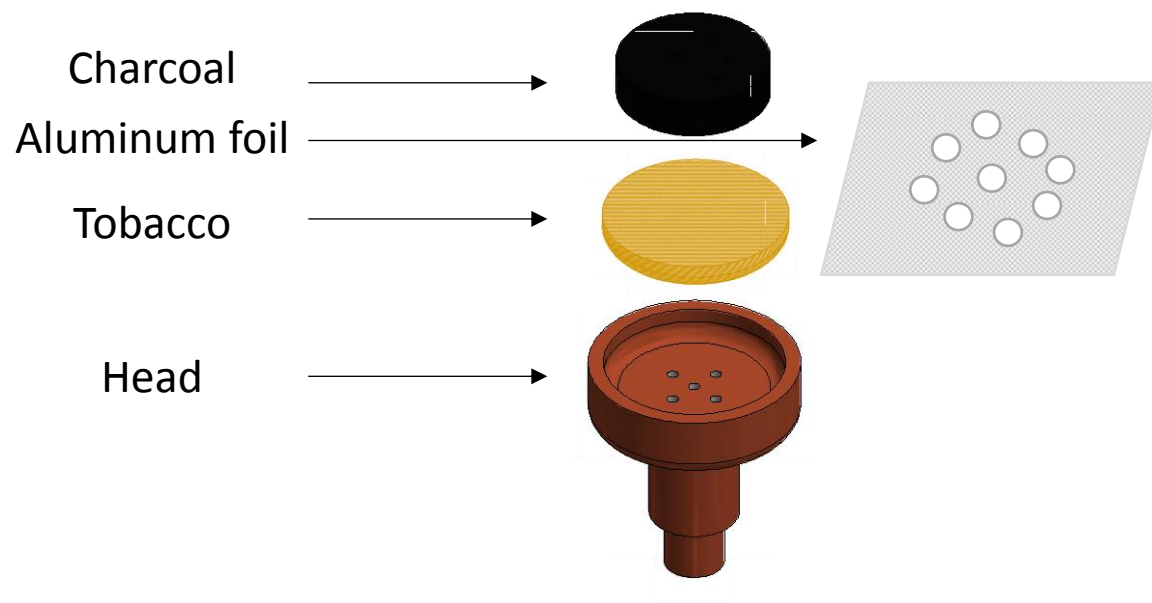


# Sidestream Smoke



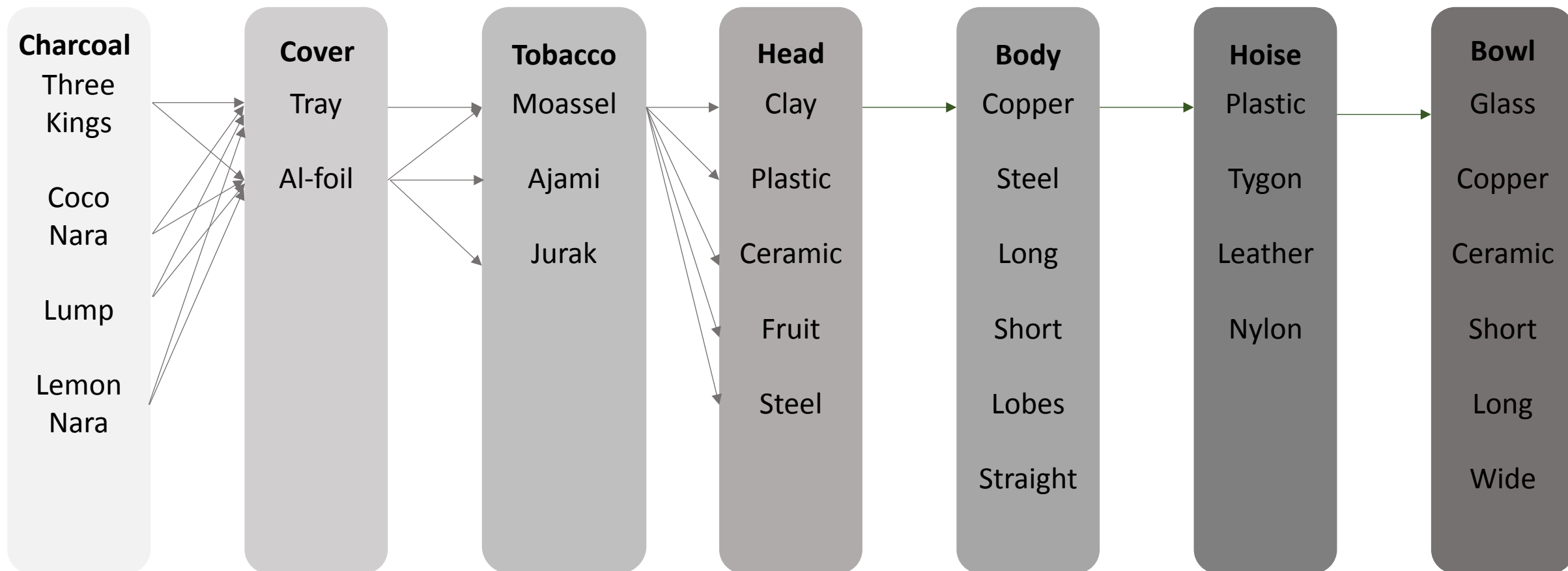


# Sources affecting sidestream smoke





# How many variables should we account for in designing a quality control experiment?





How does the scientific community account  
for the variations?



# 1. Define the puffing topography

## Puffing Topography

- Puff duration
- Inter-puff interval
- Session duration
- Puff volume
- Total number of puffs
- Total puff volume



## 2. Define the waterpipe physical design

### Waterpipe characteristics

- Head type
- Head depth
- Head diameter
- Hose type
- Hose diameter
- Body
- Water volume
- Perforation geometry



# Is it enough to



define the puffing topography



define the physical design of the waterpipe?

## How much variations in the toxicant yields were measured



Within each laboratory

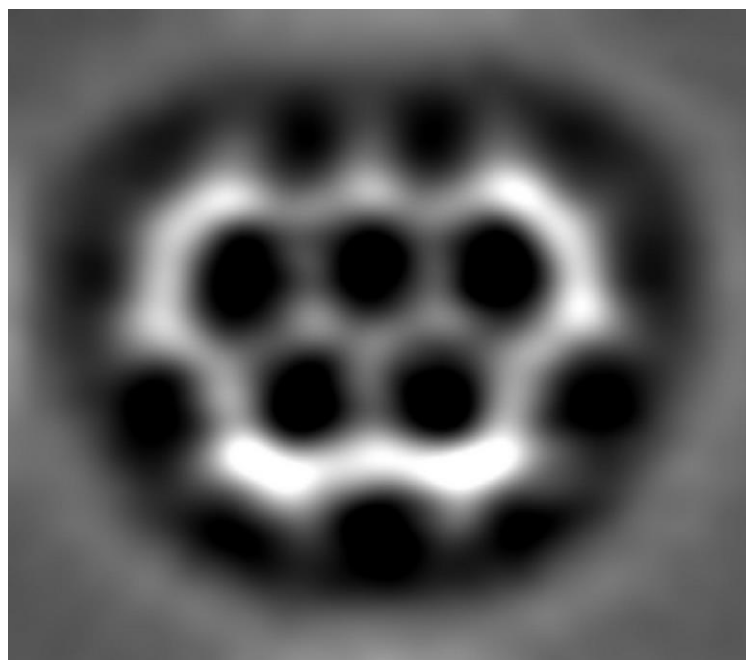


Between different laboratories?

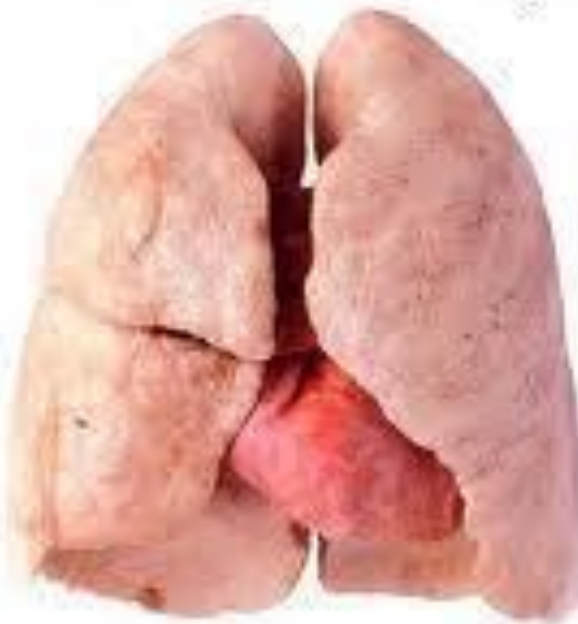


Consider Benzo[a]pyrene (BaP) a congener of polycyclic aromatic hydrocarbon as a an example

Benzo[a]pyrene (BaP)



Nonsmoker's Lungs



Smoker's Lungs





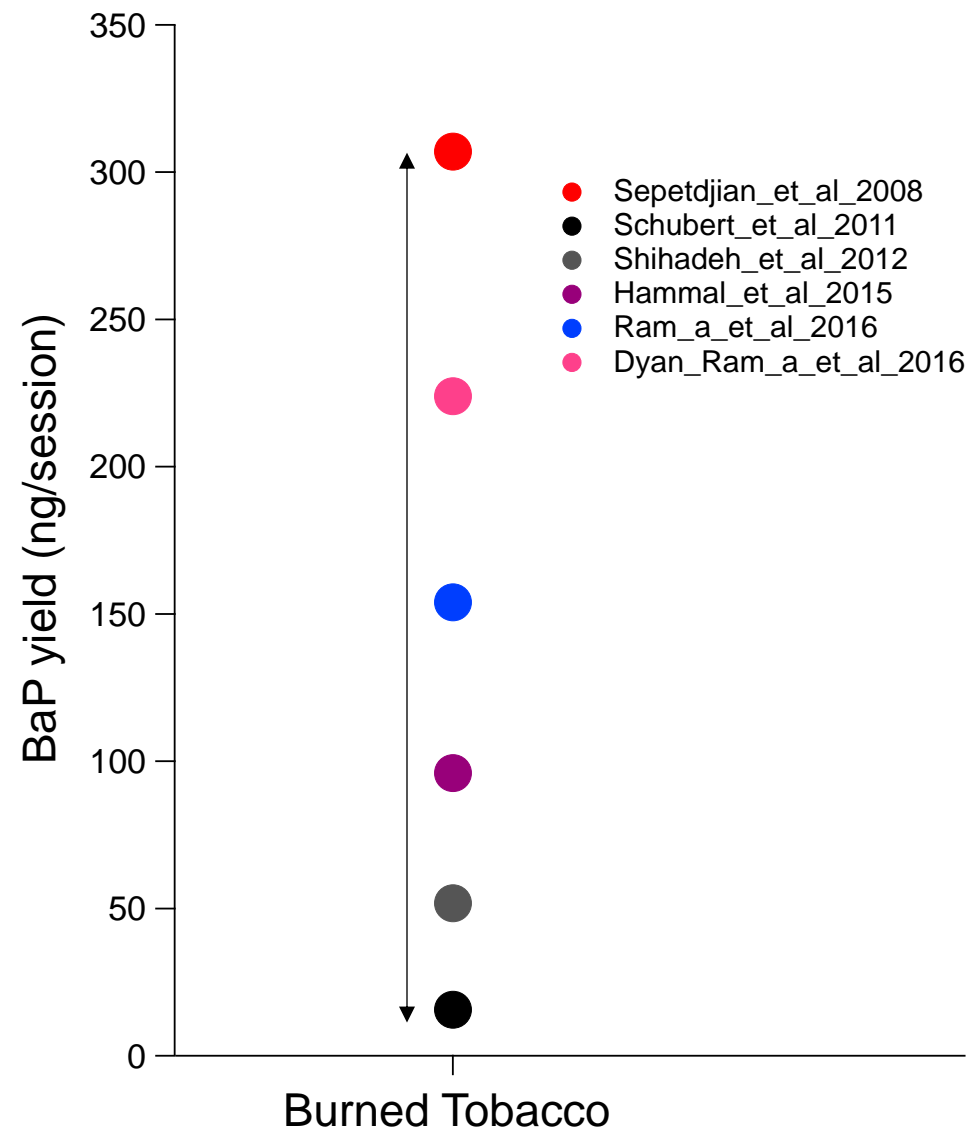
# BaP in mainstream smoke

Reference	Shihadeh & Saleh, 2005	Sepetdjian et al.2008	Apsley et al.2011	Schubert et al.2011	Shihadeh et al.2012	Hammal et al.2015	Ramôa et al.2016
<b>Sampling</b>	Digitally programmable smoking machine	Digitally controlled waterpipe smoking machine	Smoking machine mimic Shihadeh (2005)	Shisha Smoker machine connected to standard laboratory waterpipe using plastic hose	Digitally controlled puff-replicating WTS machine	Digitally programmable smoking machine	Digitally programmable smoking machine
<b>Water-pipe Preparation</b>	Shihadeh 2003	Shihadeh 2003	Shihadeh 2003	Shihadeh 2003	Blank et al.2011	Shihadeh 2003	Shihadeh 2003
<b>Smoking regime</b>	Beirut Method	Beirut Method	Beirut Method	Beirut Method	Beirut Method	Beirut Method	Ramôa et al.2016
<b>Tobacco Product</b>	Moassal-Two Apple	Moassal-Two Apple	Moassal-Banana & strawberry		Moassal-Two Apple	Moassal-Two Apple	Moassal-Two Apple
<b>Charcoal Product</b>	Three Kings	Three Kings	Swift-Lite		Three Kings	Al-Fakher	Al-Fakher
<b>Sample Analysis</b>	RP-HPLC-DAD	GC-MS	GC-MS	GC-MS	GC-MS	GC-MS	GC-MS

Shihadeh A.& Saleh R .2005. Food and Chemical Toxicology 43 :655–661  
 Sepetdjian E.et al.2008.Food and Chemical Toxicology 46 :1582–1590  
 Apsley A.et al.2011.Journal of Environmental Health Research 11:93-104  
 Schubert J.et al.2011.Toxicology Letters 205:279– 284  
 Shihadeh A et al.2012.Food and Chemical Toxicology 50:1494–1498  
 Hammal F et al.2015. Tob Control.24:290–297  
 Ramoa C.et al.2016.Nicotine & Tobacco Research 770–776



# BaP in mainstream smoke





# BaP in sidestream smoke

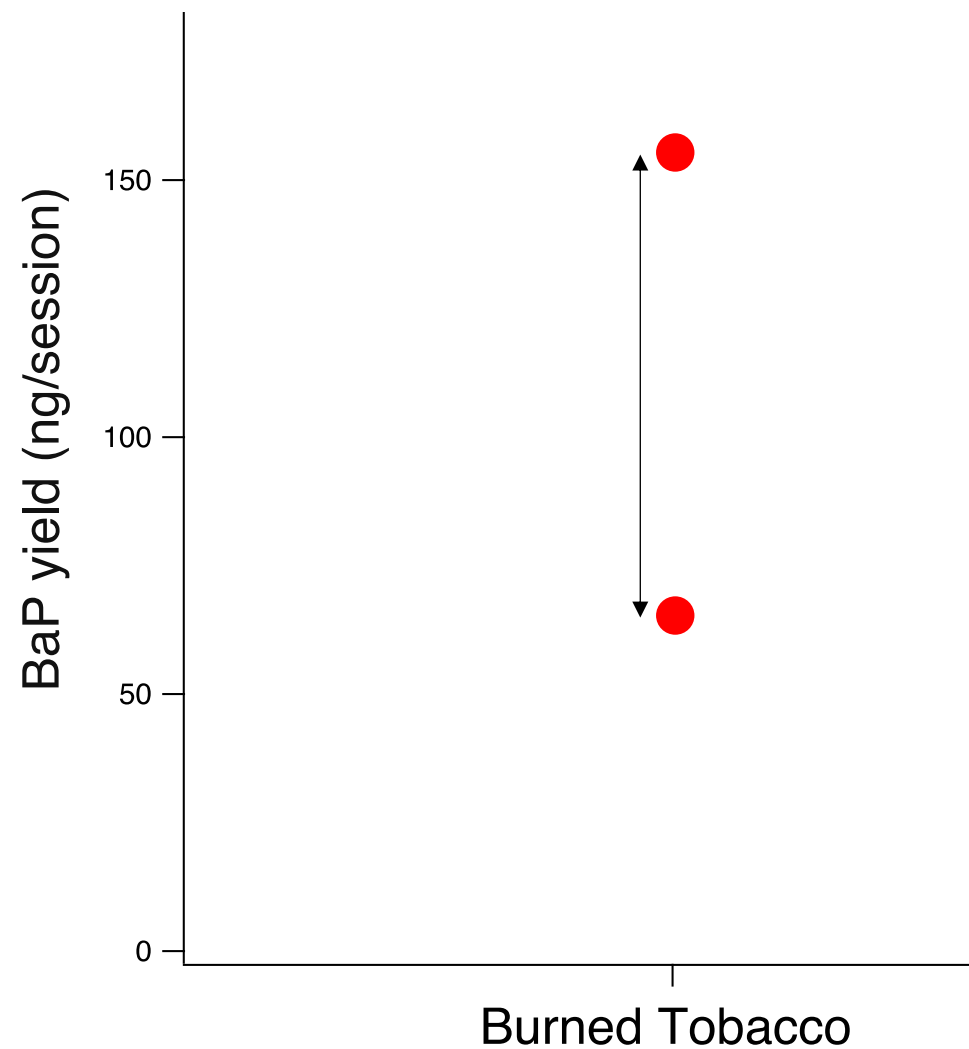
Reference	Daher et al.2010	Hammal et al.2015
<b>Sampling</b>	Digitally controlled waterpipe smoking machine	Digitally programmable smoking machine
<b>Water-pipe Preparation</b>	WT is placed in a vertically oriented cylindrical dilution tunnel fitted with a tapered cone roof. Tunnel captures smoke coming off the head, dilutes it, & routes it to ageing chamber that is connected to external sampling pump.	WT is placed in a vertically oriented cylindrical dilution tunnel fitted with a tapered cone roof. Tunnel captures smoke coming off the head, dilutes it, & routes it to ageing chamber that is connected to external sampling pump.
<b>Smoking regime</b>	Beirut Method	Beirut Method
<b>Tobacco Product</b>	Moassel-Two Apple	Moassal-Two Apple
<b>Charcoal Product</b>	Three Kings	Al-Fakher
<b>Sample Analysis</b>	GC-MS	GC-MS

Daher N.et al.2010.Atmospheric Environment 44:8–14

Hammal F et al.2015. Tob Control.24:290–297



# BaP in sidestream smoke





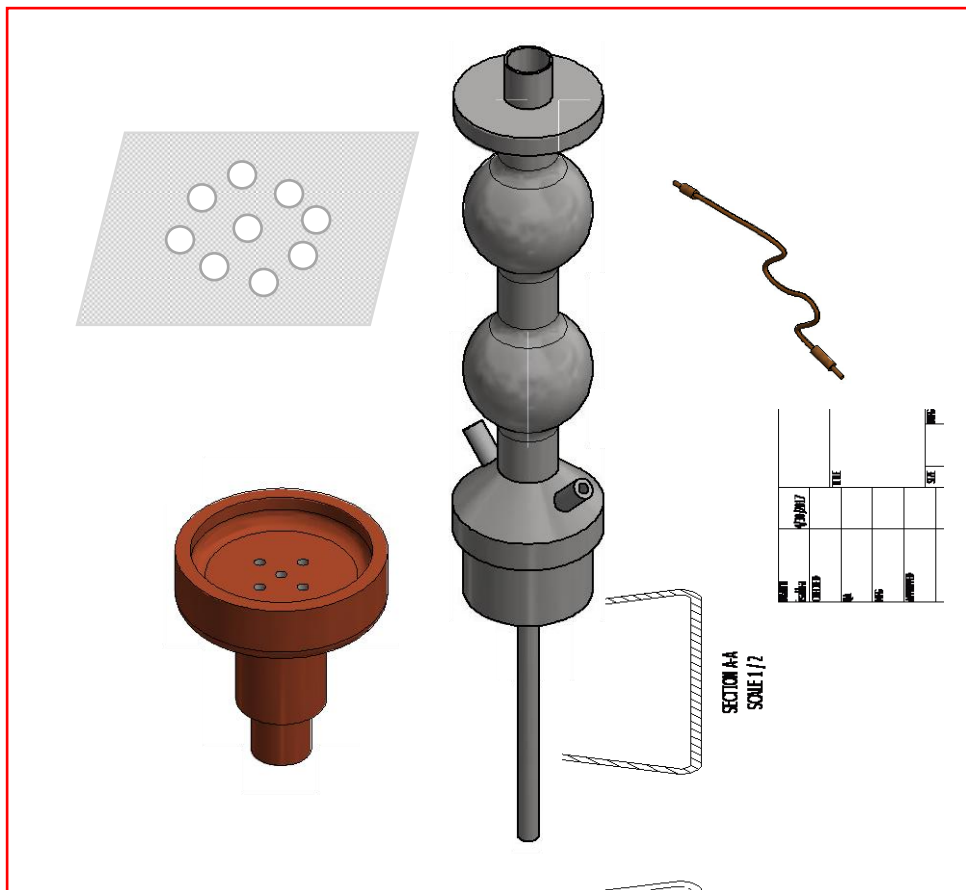
# The need to divide the problem

## Starting with the chemical content and the materials

Content



Materials





# BaP in charcoal (content)

Reference		Monzer et al.2008	Sepetdjian et al.2010	Nguyen et al.2013				
Charcoal Product		Three Kings	Three Kings	Starlight	Al Fakher	Superior	Hookah	Three Kings El Wady
Sample Preparation	Extraction Solvent	15 ml toluene	15 ml toluene	5 ml ACN				
	IS Concentration	None	None	None				
	Extraction Technique	Sonication for 2 h at 50 °C	Sonication for 2 h at 50 °C	Rotor Mix for 2h				
Sample Clean-up	Technique	SPE silica	SPE silica	Centrifuge				
	Conditioning	10 ml hexane	10 ml hexane	—				
	Elution solvent volume	10 ml hexane	10 ml hexane	—				
Sample Concentration	Technique	Nitrogen evaporation	Nitrogen evaporation	—				
	Concentrate volume	0.1 ml Acetonitrile	0.1 ml Acetonitrile	Supernatant filtered using 0.2 um syringe filter				
Sample Analysis		GC-MS	GC-MS	HPLC-DAD-FLD				

Monzer B.et al.2008.Food and Chemical Toxicology 46:2991–2995

Sepetdjian E. et al.2010.Food and Chemical Toxicology 48 :3242–3245

Nguyen T.et al.2013.Journal of Environmental Science and Health, Part B (2013) **48**, 1097–1102



# BaP in burned charcoal (Ash residues)

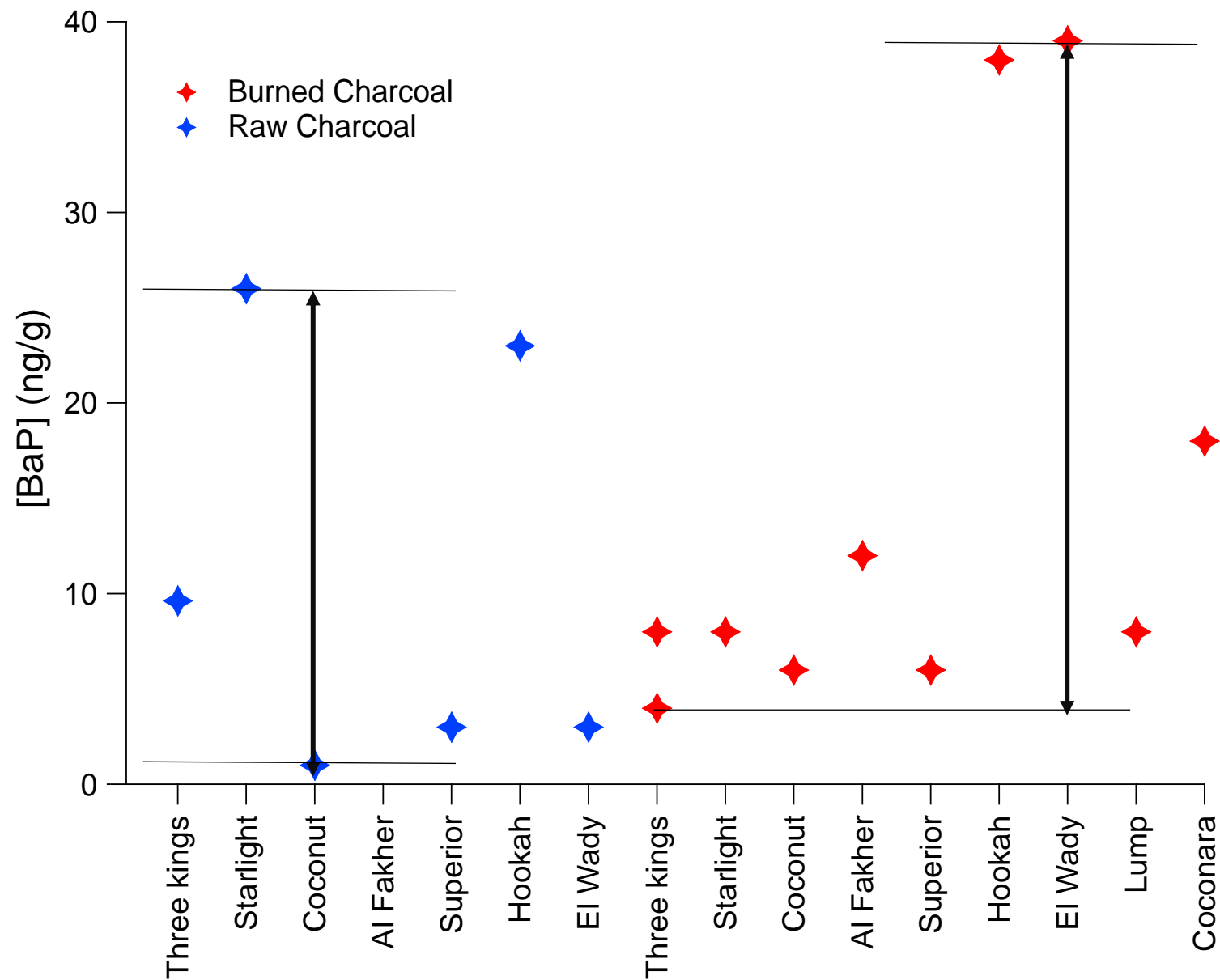
Reference		Sepetdjian et al.2010			Nguyen et al.2013						
Sampling		Digitally controlled waterpipe smoking machine			Mimic Waterpipe smoking						
Water-pipe Preparation		Shihadeh 2003			None						
Smoking regime		Beirut Method			Beirut Method						
Charcoal Product		Lump	Three Kings	Coconara	Starlight	Coconut	Al Fakher	Superior	Hookah	Three Kings	El Wady
Sample Preparation	Collection media	47 mm glass fiber filter			Water & ACN trap						
	Extraction Solvent	15 ml toluene			20 ml H2O & 20 ml ACN						
	IS Concentration	None			None						
	Extraction Technique	Sonication for 2 h at 50 °C			Low vaccum for 15 min						
Sample Clean-up	Technique	SPE silica			—						
	Conditioning	10 ml hexane			—						
	Elution solvent volume	10 ml hexane			—						
Sample Concentration	Technique	Nitrogen evaporation			—						
	Concentrate volume	0.1 ml Acetonitrile			—						
Sample Analysis		GC-MS			HPLC-DAD-FLD						

Sepetdjian E. et al.2010.Food and Chemical Toxicology 48 :3242–3245

Nguyen T.et al.2013.Journal of Environmental Science and Health, Part B (2013) **48**, 1097–1102

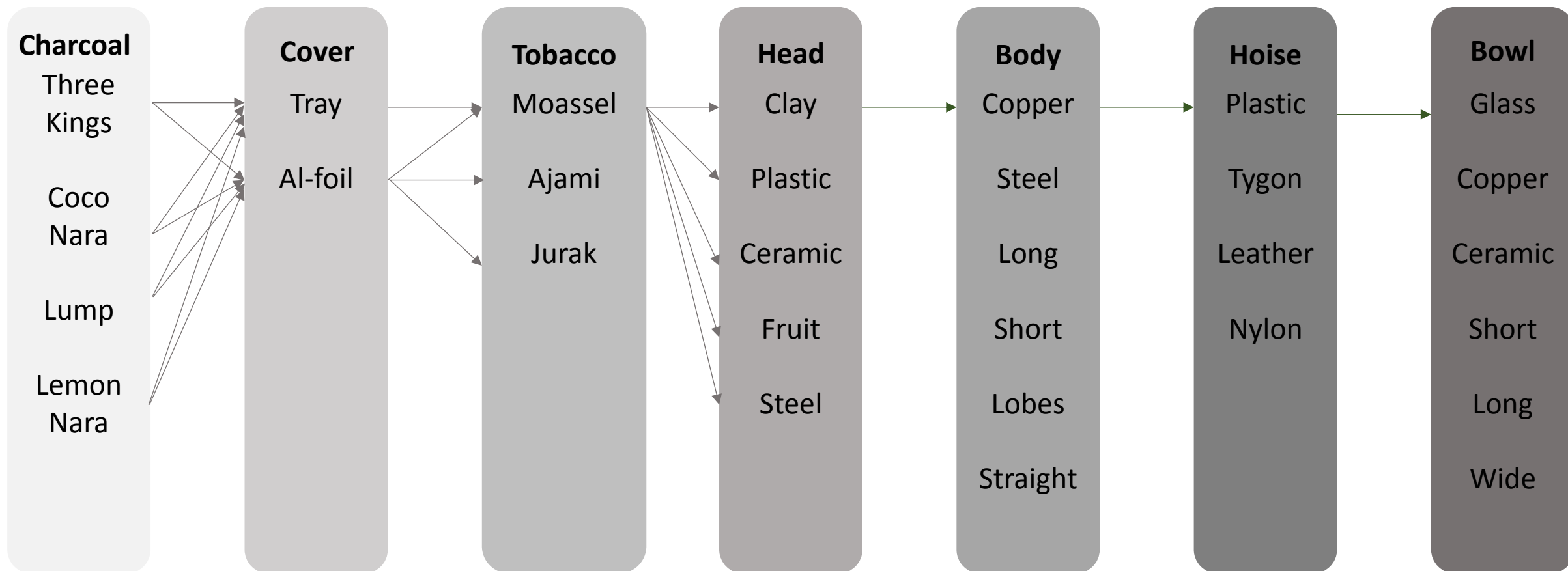


# BaP in raw and burned charcoal (Ash residues)





# Where do we start?





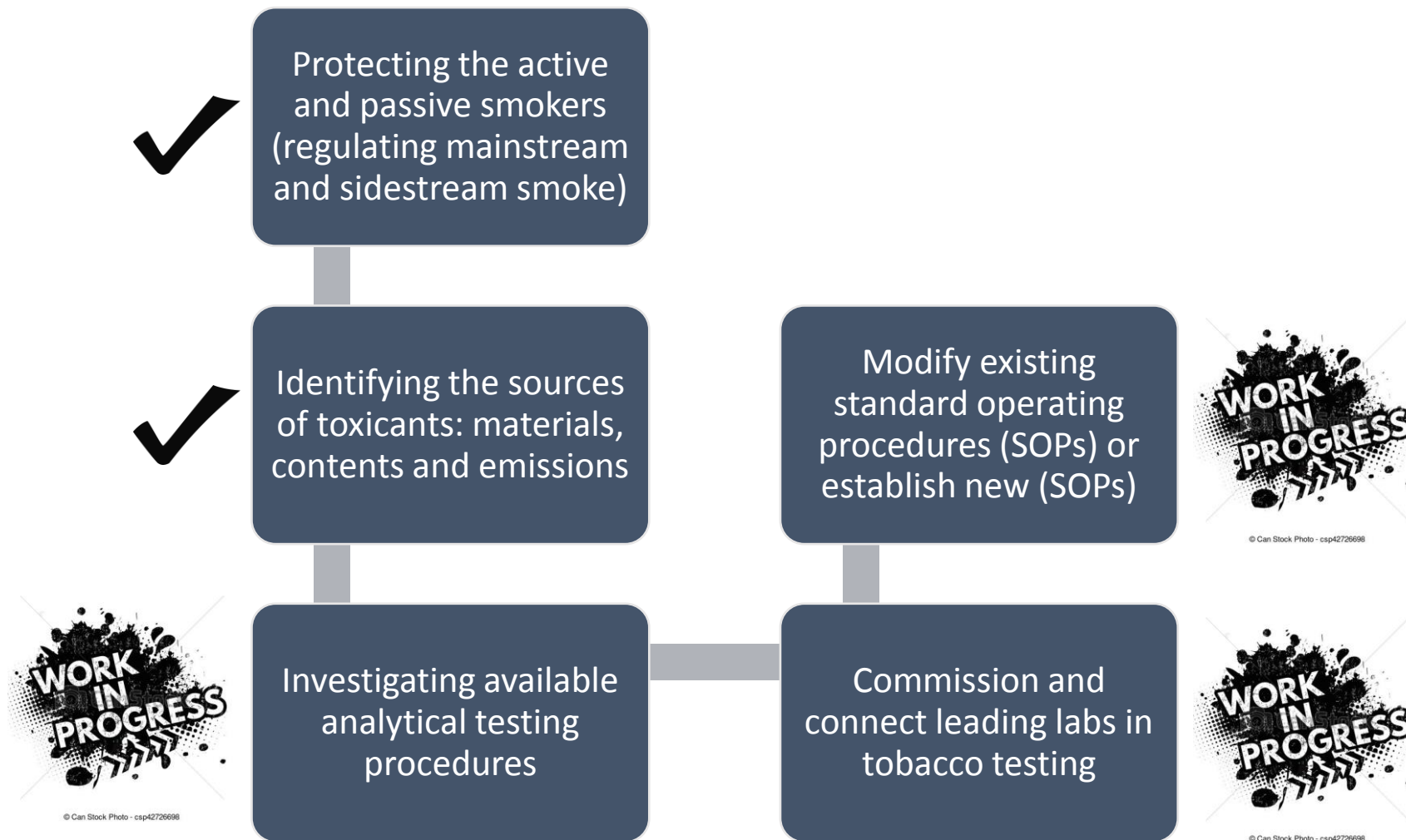
# The Tobacco Free Initiative (TFI) and the Tobacco Laboratory Network (TobLabNet)



The WHO Tobacco Laboratory Network (TobLabNet) is a **global network of government, academic, and independent laboratories** aiming to strengthen national and regional capacity for the testing and research of the contents and emissions of tobacco products, in accordance with Article 9 of the WHO Framework Convention on Tobacco Control (WHO FCTC).



# Regulating mainstream and sidestream smoke: Work in progress....





# Established standard operating procedures (SOPs) by TobLabNet

**WHO TobLabNet SOP 1 - Standard operating procedure for intense smoking of cigarettes**

**WHO TobLabNet SOP 2 - Standard operating procedure for validation of analytical methods of tobacco product contents and emissions**

**WHO TobLabNet SOP 3 - Standard operating procedure for determination of tobacco-specific nitrosamines in mainstream cigarette smoke under ISO and intense smoking conditions**

**WHO TobLabNet SOP 4 - Standard operating procedure for determination of nicotine in cigarette tobacco filler**

**WHO TobLabNet SOP 5 - Standard operating procedure for determination of benzo[a]pyrene in mainstream cigarette smoke**

**WHO TobLabNet SOP 6 - Standard operating procedure for determination of humectants in cigarette tobacco filler**

**WHO TobLabNet SOP 7 - Standard operating procedure for determination of ammonia in cigarette tobacco filler**

**WHO TobLabNet SOP 8 - Standard operating procedure for determination of aldehydes in mainstream cigarette smoke under ISO and intense smoking conditions**

**WHO TobLabNet SOP 9 - Standard operating procedure for determination of volatile organics in mainstream cigarette smoke under ISO and intense smoking conditions**

**WHO TobLabNet SOP 10 – Standard operating procedure for determination of nicotine and carbon monoxide in mainstream cigarette smoke under intense smoking conditions**



# Connected testing laboratories across the globe

## PART III: CURRENT WHO COLLABORATING CENTRES FOR TOBACCO CONTROL



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### Quality of the scientific and leadership of the Lab

Tobacco control economics a. the place the institution occupies in the country's health, scientific or educational structures: [Back to the list of objectives](#)

### Experience with tobacco products

Publications e. the institution's ability, capacity and readiness to contribute, individually and within networks, to TobLabNet program activities; f. experience with tobacco product testing or research or demonstrable intent to obtain capacity for tobacco product testing or research, e.g. commitment to train

### Evidence of collaboration

j. the scientific and technical standing of the institution concerned at the national and international levels.

Figure 1: ● WHO Collaborating Centres for Tobacco Control around the world as of July 2005.



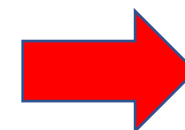
# Activities of the collaborating laboratories

## WHO Tobacco Laboratory Network (TobLabNet)

### Proposed Activities

TobLabNet will carry out collaborative activities aimed at meeting the goals of the organization as given above. These activities include:

- Provide remedial support for laboratory staff to improve current capabilities to meet testing requirements.
- Develop a method compendium for use by laboratories seeking to expand their capabilities for analysis of tobacco products and emissions.
- Train laboratory staff in new analytical methodologies using experts experienced in a wide range of analysis methods and techniques.
- Develop common materials for standardization, proficiency testing, and quality control to provide better consistency of results.
- Identify best laboratory practices so that more reliable laboratory information can be generated for research and regulation.
- Test new methods using multiple laboratories to determine ruggedness and applicability under widely varying infrastructures.
- Carry out projects for analyzing, evaluating, and comparing global and regional tobacco products and emissions.
- Perform collaborative research on improving methods for tobacco and smoke testing, better understanding product use, and the impact of different products on biomarkers of exposure and adverse health effects.
- Provide access to world-wide expertise in laboratory techniques, instrumentation, product and smoke analysis methods, product regulation, toxicology and addiction.
- Provide means for electronic communications within the network for accessing information and sharing expertise.





# Applicability of TobLabNet SOP04 to test and measure nicotine content in waterpipe tobacco products

	Standard #	WHO TobLabNet SOP 4	Applicability to waterpipe
	Standard title	Standard operating procedure for the determination of nicotine in cigarette tobacco filler	
Sampling	Cigarette sampling	According to ISO 8243 or any other representative approach	Applicable to waterpipe tobacco products
Cigarette preparation	Cigarette conditioning	According to ISO 3402	Assess humectant evaporation unless reported per dry tobacco
	Butt length	According to ISO 4387 and WHO TobLabNet SOP01	Not applicable
Smoking regime		Not applicable	Not applicable
Sample preparation	Sample weight	1.5 g ± 0.001 g	Applicable for waterpipe tobacco products
Nicotine standard stock	Preparation technique	Liquid liquid extracted	Applicable
	Nicotine mass	20 mg	Applicable

Recommendation WHO TobLabNet SOP04 is applicable to test and measure nicotine content in waterpipe tobacco product with slight adjustments. The method needs to be verified through an intra-lab studies.



# Applicability of TobLabNet SOP06 to test and measure humectant content in waterpipe tobacco products

	Standard #	WHO TobLabNet SOP 6	Applicability to waterpipe
	Standard title	Standard operating procedure for the determination of humectants in cigarette tobacco filler	
	Analytes	Propylene glycol (propane-1,2-diol) Glycerol (propane-1,2,3-triol) triethylene glycol (2,2' ethylenedioxybis(ethanol))	Applicable
Sampling	Cigarette sampling	According to ISO 8243 or any other representative approach	Applicable
Cigarette preparation	Cigarette conditioning	According to ISO 3402	Care must be taken to avoid humectant losses during conditioning
	Butt length	According to ISO 4387 and TobLabNet SOP01	Not applicable
Smoking regime		Not applicable	Not applicable
Sample preparation	Sample weight	4g	Applicable
	Extraction solvent	Mixture of Methanol and 1,3-butanediol (2mg/ml)	Applicable with modifications in the solvents' concentration and volume if needed
	Extraction technique	Shaking-remove supernatant	Applicable
	Internal standard	1,3-Butanediol	Applicable
Humectants standard stock	Propylene glycol Mass	10 mg in 1,3-Butanediol (2mg/ml)	Applicable

Recommendation WHO TobLabNet SOP04 is applicable to test and measure nicotine content in waterpipe tobacco product with slight adjustments. The method needs to be verified through an intra-lab studies.

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WHO



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