

WHO TobLabNet  
Official Method  
**SOP 09**

# **STANDARD OPERATING PROCEDURE FOR DETERMINATION OF VOLATILE ORGANICS IN MAINSTREAM CIGARETTE SMOKE UNDER ISO AND INTENSE SMOKING CONDITIONS**

Tobacco Free Initiative  
Tobacco Laboratory Network (TobLabNet)



**World Health  
Organization**





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**Standard operating procedure for  
determination of volatile organics  
in mainstream cigarette smoke under  
ISO and intense smoking conditions**



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World Health  
Organization

**World Health Organization  
Tobacco Laboratory Network**

**Standard operating procedure for method**

**Determination of volatile organics  
in mainstream cigarette smoke under  
ISO and intense smoking conditions**

<b>Method:</b>	Determination of volatile organics in mainstream cigarette smoke under ISO and intense smoking conditions
<b>Analytes:</b>	Benzene (CAS# 71-43-2) 1,3-butadiene (CAS# 106-99-0)
<b>Matrix:</b>	Tobacco cigarette mainstream smoke particulate matter
<b>Last update:</b>	31 August 2018



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No machine smoking regimen can represent all human smoking behaviour: machine smoking testing is useful for characterizing cigarette emissions for design and regulatory purposes, but communication of machine measurements to smokers can result in misunderstanding about differences between brands in exposure and risk. Data on smoke emissions from machine measurements may be used as inputs for product hazard assessment, but they are not intended to be nor are they valid as measures of human exposure or risks. Representing differences in machine measurements as differences in exposure or risk is a misuse of testing with WHO TobLabNet standards.



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## FOREWORD

This document was prepared by members of the World Health Organization (WHO) Tobacco Laboratory Network (TobLabNet) as an analytical method standard operating procedure (SOP) for measuring volatile organics in mainstream cigarette smoke under ISO and intense smoking conditions.

## INTRODUCTION

In order to establish comparable measurements for testing tobacco products globally, consensus methods are required for measuring specific contents and emissions of cigarettes. The Conference of the Parties (COP) to the WHO Framework Convention on Tobacco Control (WHO FCTC) at its third session in Durban, South Africa, in November 2008, recalling its decisions FCTC/COP1(15) and FCTC/COP2(14) on the elaboration of guidelines for implementation of Articles 9 (Regulation of the contents of tobacco products) and 10 (Regulation of tobacco product disclosures) of the WHO FCTC, noting the information contained in the report of the working group to the third session of the Conference of the Parties on the progress of its work ... requested the Convention Secretariat to invite WHO's Tobacco Free Initiative to "validate, within five years, the analytical chemical methods for testing and measuring cigarette contents and emissions".<sup>1</sup>

Using the criteria for prioritization set at its third meeting in Ottawa, Canada, in October 2006, the working group on Articles 9 and 10 identified the following contents for which methods for testing and measurement (analytical chemistry) should be validated as a priority:

- nicotine
- ammonia
- humectants (propane-1,2-diol, glycerol (propane-1,2,3-triol) and triethylene glycol (2,2-ethylenedioxybis(ethanol))).

Measurement of these contents will require validation of three methods: one for nicotine, one for ammonia and one for humectants.

Using the criteria for prioritization set at the meeting in Ottawa mentioned above, the working group identified the following emissions in mainstream smoke for which methods for testing and measurement (analytical chemistry) should be validated as a priority:

- 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)
- N-nitrosonornicotine (NNN)

<sup>1</sup> Decision, third session of the Conference of the Parties to the WHO FCTC; 2008 ([http://apps.who.int/gb/fctc/PDF/cop3/FCTC\\_COP3\\_REC1-en.pdf](http://apps.who.int/gb/fctc/PDF/cop3/FCTC_COP3_REC1-en.pdf)).



- acetaldehyde
- acrylaldehyde (acrolein)
- benzene
- benzo[a]pyrene
- 1,3-butadiene
- carbon monoxide
- formaldehyde

Measurement of these emissions with the two smoking regimens described below will require validation of four methods: one for tobacco-specific nitrosamines (NNK and NNN), one for benzo[a]pyrene, one for aldehydes (acetaldehyde, acrolein and formaldehyde), one for volatile organic compounds (benzene, 1,3-butadiene) and one for carbon monoxide.

The table below sets out the two smoking regimens for validation of the test methods referred to above.

Smoking regimen	Puff volume (mL)	Puff frequency	Filter ventilation holes
ISO regimen: ISO 3308; Routine analytical cigarette smoking machine—definitions and standard conditions	35	Once every 60 s	No modifications
Intense regimen: Same as ISO 3308, but modified as indicated	55	Once every 30 s	All ventilation holes must be blocked 100% as described in WHO TobLabNet SOP 01.

This method SOP was developed to direct participating labs in the specifics of carrying out the analysis of volatile organic components in mainstream cigarette smoke. For tobacco products other than cigarettes, specific parameters may have to be adjusted from those given in the document

#### 1. SCOPE

This method is suitable for quantitative determination of the following two volatile organics in mainstream cigarette smoke: benzene and 1,3-butadiene by combined

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