

# WHO study group on tobacco product regulation

---

Report on the scientific basis of tobacco product regulation:  
Sixth report of a WHO study group



World Health  
Organization

The World Health Organization was established in 1948 as a specialized agency of the United Nations serving as the directing and coordinating authority for international health matters and public health. One of WHO's constitutional functions is to provide objective and reliable information and advice in the field of human health, a responsibility that it fulfils in part through its extensive programme of publications.

The Organization seeks through its publications to support national health strategies and address the most pressing public health concerns of populations around the world. To respond to the needs of Member States at all levels of development, WHO publishes practical manuals, handbooks and training material for specific categories of health workers; internationally applicable guidelines and standards; reviews and analyses of health policies, programmes and research; and state-of-the-art consensus reports that offer technical advice and recommendations for decision-makers. These books are closely tied to the Organization's priority activities, encompassing disease prevention and control, the development of equitable health systems based on primary health care, and health promotion for individuals and communities. Progress towards better health for all also demands the global dissemination and exchange of information that draws on the knowledge and experience of all WHO's Member countries and the collaboration of world leaders in public health and the biomedical sciences.

To ensure the widest possible availability of authoritative information and guidance on health matters, WHO secures the broad international distribution of its publications and encourages their translation and adaptation. By helping to promote and protect health and prevent and control disease throughout the world, WHO's books contribute to achieving the Organization's principal objective – the attainment by all people of the highest possible level of health.

The *WHO Technical Report Series* makes available the findings of various international groups of experts that provide WHO with the latest scientific and technical advice on a broad range of medical and public health subjects. Members of such expert groups serve without remuneration in their personal capacities rather than as representatives of governments or other bodies; their views do not necessarily reflect the decisions or the stated policy of WHO.

For further information, please contact WHO Press, World Health Organization; 1211 Geneva 27, Switzerland; [www.who.int/bookorders](http://www.who.int/bookorders); tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: [bookorders@who.int](mailto:bookorders@who.int).

W H O T e c h n i c a l R e p o r t S e r i e s  
1 0 0 1

# WHO Study Group on Tobacco Product Regulation

---

Report on the Scientific Basis of Tobacco Product Regulation:  
Sixth Report of a WHO Study Group

*This report contains the collective views of an international group of experts and  
does not necessarily represent the decisions or the stated policy of the World Health Organization*



**World Health  
Organization**

## WHO Library Cataloguing-in-Publication Data

WHO study group on tobacco product regulation: report on the scientific basis of tobacco product regulation: sixth report of a WHO study group

(WHO technical report series; n° 1001)

1. Tobacco Use Disorder – prevention and control. 2. Tobacco Industry – legislation. 3. Tobacco Control Campaigns. 4. Tobacco – chemistry. I. World Health Organization. II. WHO Study Group on Tobacco Product Regulation. III. Series.

ISBN 978-92-4-121001-0

ISBN 978-92-4-069660-0 (PDF)

ISSN 0512-3054

© World Health Organization 2017

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo>).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: "This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition".

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization.

**Suggested citation.** WHO study group on tobacco product regulation: report on the scientific basis of tobacco product regulation: sixth report of a WHO study group. Geneva: World Health Organization; 2017 (WHO technical report series; no. 1005). Licence: CC BY-NC-SA 3.0 IGO.

**Cataloguing-in-Publication (CIP) data.** CIP data are available at <http://apps.who.int/iris>.

**Sales, rights and licensing.** To purchase WHO publications, see <http://apps.who.int/bookorders>. To submit requests for commercial use and queries on rights and licensing, see <http://www.who.int/about/licensing>.

**Third-party materials.** If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

**General disclaimers.** The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

This publication contains the collective views of an international group of experts and does not necessarily represent the decisions or the policies of the World Health Organization.

Printed in Switzerland

# Contents

<b>Participants in the eighth meeting of the WHO Study Group on Tobacco Product Regulation</b>	<b>vii</b>
<b>Acknowledgements</b>	<b>ix</b>
<b>Abbreviations and acronyms</b>	<b>x</b>
<b>1. Introduction</b>	<b>1</b>
<b>2. Cigarette characteristics and design features</b>	<b>3</b>
2.1 Introduction	4
2.2 Cigarette characteristics that influence perception and use	5
2.2.1 Overview	5
2.2.2 Cigarette characteristics that influence user perception	6
2.2.3 Cigarette characteristics that influence user behaviour	9
2.3 Cigarette characteristics that affect the content of smoke emissions	12
2.3.1 Tobacco	12
2.3.2 Paper	13
2.3.3 Filter	14
2.3.4 Physical dimensions	16
2.4 Design features and additives that modify smoke pH and addictiveness	19
2.4.1 Overview	19
2.4.2 Ammonia, sugars and reconstituted tobacco	20
2.4.3 Other ingredients	21
2.4.4 Tobacco blend and physical characteristics	21
2.4.5 Measuring “smoke pH”	22
2.5 Innovations that could influence either perception or delivery	22
2.5.1 Overview	22
2.5.2 Reduced-nicotine cigarettes	23
2.5.3 Coloured cigarette paper	24
2.5.4 Specialty filters	25
2.5.5 Tobacco industry research on delivery through special filters and with treated tobacco	26
2.6 Research that would inform scientific evaluation of the public health impact of design characteristics	28
2.7 Conclusions	29
2.8 Recommendations	31
2.8.1 Policy recommendations	32
2.8.2 Research recommendations	32
2.9 References	33

<b>3. Possible application of WHO Tobacco Laboratory Network standard operating procedures to evaluation of electronic nicotine delivery systems</b>	<b>41</b>
3.1 Background	42
3.2 General methodological considerations in evaluating electronic nicotine delivery systems (ENDS)	44
3.3 Nicotine	45
3.3.1 Nicotine in ENDS liquid	45
3.3.2 Nicotine in ENDS aerosol	46
3.4 Tobacco-specific nitrosamines	47
3.4.1 Tobacco-specific nitrosamines in ENDS liquid	47
3.4.2 Tobacco-specific nitrosamines in ENDS aerosol	48
3.5 Benzo[a]pyrene	48
3.5.1 Benzo[a]pyrene in ENDS liquid	48
3.5.2 Benzo[a]pyrene in ENDS aerosol	49
3.6 Additional analytes	49
3.6.1 Carbonyls	49
3.6.2 Solvents	51
3.6.3 Volatile organic compounds	52
3.6.4 Phenolic compounds	53
3.6.5 Metals	53
3.6.6 Flavours	54
3.7 Recommendations for extension of methods	55
3.7.1 Nicotine	57
3.7.2 Tobacco-specific nitrosamines	58
3.7.3 Benzo[a]pyrene	58
3.7.4 Volatile organic compounds	59
3.7.5 Carbonyls	59
3.8 Research that will inform future regulatory use of data on ENDS	59
3.9 Conclusions	60
3.10 Recommendations	63
3.11 References	65
<b>4. Waterpipe toxicant content and emissions</b>	<b>71</b>
4.1 Introduction	71
4.2 Puff topography and emissions testing regimens	73
4.3 Toxicant content and emissions	75
4.4 Influence of testing protocols on measurements of toxicant emissions from waterpipes	79
4.4.1 Puffing regimen	81
4.4.2 Heat source	81
4.4.3 Temperature of tobacco	82
4.4.4 Effect of water	82
4.5 Influence of waterpipe design on levels of emissions of waterpipe tobacco products	82
4.5.1 Components and accessories	82
4.5.2 "Real-world" and research-grade waterpipes	83

4.5.3	Waterpipe hose	84
4.5.4	Waterpipe tray versus foil	84
4.6	Conclusions	86
4.7	Recommendations for regulators	87
4.8	References	87
<b>5.</b>	<b>Applicability and adaptability of the WHO Tobacco Laboratory Network standard operating procedures for cigarettes to waterpipe tobacco</b>	<b>91</b>
5.1	Introduction	91
5.2	Smoking methods	92
5.2.1	Heat sources	92
5.2.2	Head	93
5.2.3	Head covering	93
5.2.4	Water	94
5.2.5	Hose	94
5.2.6	Filter	94
5.3	Smoking machines	95
5.4	Sampling of waterpipe tobacco	96
5.5	Sample preparation	97
5.6	Determination of contents and emissions	99
5.6.1	Contents of waterpipe tobacco	99
5.6.2	Emissions of tar, nicotine and carbon monoxide	100
5.7	Discussion	102
5.8	Conclusions and recommendations	105
5.8.1	Recommendations for regulators	105
5.8.2	Recommendation for researchers	106
5.9	References	106
<b>6.</b>	<b>Toxic contents and emissions of smokeless tobacco products</b>	<b>109</b>
6.1	Introduction	109
6.1.1	Global prevalence	111
6.1.2	Diversity in the manufacture and physical properties of smokeless tobacco products	111
6.2	Product composition	112
6.2.1	Tobacco	112
6.2.2	Additives	112
6.3	Emissions from smokeless tobacco products	114
6.3.1	Nicotine	114
6.3.2	Toxic and carcinogenic agents	116
6.3.3	Microbes and their constituents	120
6.4	Reducing the concentrations of toxicants in smokeless tobacco products	121
6.5	Conclusions and recommendations	123
6.6	References	125

<b>7. Applicability or adaptability of standard operating procedures for nicotine, tobacco-specific <i>N</i>-nitrosamines and benzo[<i>a</i>]pyrene in cigarette contents and emissions to tobacco products other than cigarettes, particularly smokeless tobacco products</b>	<b>131</b>
7.1 Introduction	131
7.2 Nicotine, tobacco-specific <i>N</i> -nitrosamines and benzo[ <i>a</i> ]pyrene in smokeless tobacco products	133
7.2.1 Nicotine	133
7.2.2 Tobacco-specific <i>N</i> -nitrosamines	133
7.2.3 Benzo[ <i>a</i> ]pyrene	133
7.3 Evaluation of applicability of WHO standard operating procedures for analysis of smokeless tobacco products	133
7.3.1 Analytical considerations	133
7.3.2 Determination of nicotine	134
7.3.3 Determination of tobacco-specific <i>N</i> -nitrosamines	134
7.3.4 Determination of benzo[ <i>a</i> ]pyrene	135
7.4 Discussion and recommendations	136
7.5 References	138
<b>8. Overall recommendations</b>	<b>141</b>

预览已结束，完整报告链接和二维码如下：

[https://www.yunbaogao.cn/report/index/report?reportId=5\\_25993](https://www.yunbaogao.cn/report/index/report?reportId=5_25993)

