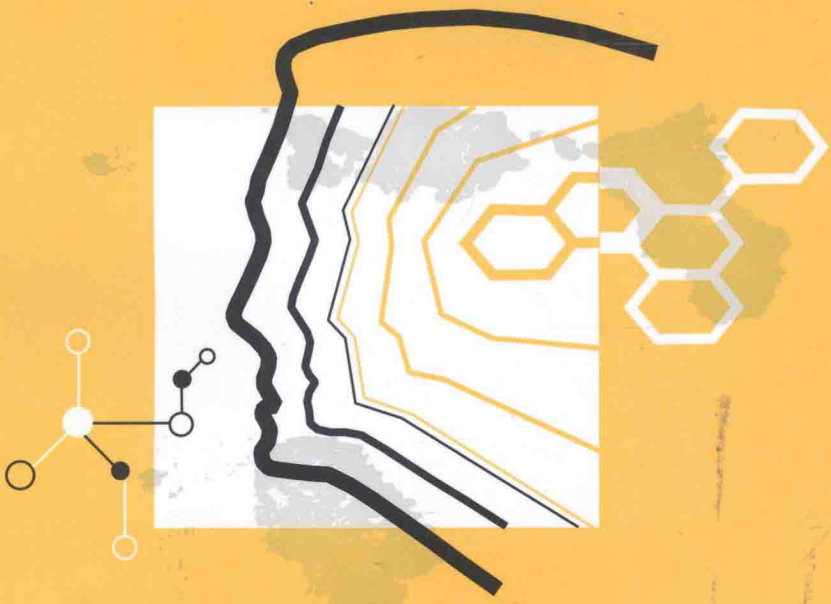
IPCS

INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

Environmental Health Criteria 243

Aircraft disinsection insecticides



IOMC INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS
A cooperative agreement among FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD

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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

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The **International Programme on Chemical Safety (IPCS)** was established in 1980. The overall objectives of the IPCS are to establish the scientific basis for assessment of the risk to human health and the environment from exposure to chemicals, through international peer review processes, as a prerequisite for the promotion of chemical safety, and to provide technical assistance in strengthening national capacities for the sound management of chemicals.

This publication was developed in the IOMC context. The contents do not necessarily reflect the views or stated policies of individual IOMC Participating Organizations.

The **Inter-Organization Programme for the Sound Management of Chemicals (IOMC)** was established in 1995 following recommendations made by the 1992 UN Conference on Environment and Development to strengthen cooperation and increase international coordination in the field of chemical safety. The Participating Organizations are: FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD. The purpose of the IOMC is to promote coordination of the policies and activities pursued by the Participating Organizations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

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TERMINOLOGY, ABBREVIATIONS AND ACRONYMS

ADI	acceptable daily intake
a.i.	active ingredient
AOEL	acceptable operator exposure level
ARfD	acute reference dose
ATSDR	Agency for Toxic Substances and Disease Registry
BMD	benchmark dose
BMDL	lower 95% confidence limit on the BMD
EFSA	European Food Safety Authority
GLP	good laboratory practice
guideline scenario	the insecticide is used according to the instructions given on the product label and in WHO guideline information
IARC	International Agency for Research on Cancer
IHR	International Health Regulations (2005)
IPCS	International Programme on Chemical Safety
JECFA	Joint FAO/WHO Expert Committee on Food Additives
JMPM	Joint FAO/WHO Meeting on Pesticide Management
JMPR	Joint FAO/WHO Meeting on Pesticide Residues
lax standard scenario	a scenario representing less than optimum conditions, such as minor deviations from instructions, missing or inadequate protective clothing, equipment not functioning perfectly
LD_{50}	median lethal dose
LOAEL	lowest-observed-adverse-effect level
NOAEC	no-observed-adverse-effect concentration
NOAEL	no-observed-adverse-effect level
OECD	Organisation for Economic Co-operation and Development
OEL	occupational exposure level
PPE	personal protective equipment

PSD	Pesticides Safety Directorate of the United Kingdom
RfC	reference concentration
RfD	reference dose
TSD	tolerable systemic dose
TSD_{AC}	tolerable systemic dose for acute exposure
TWA	time-weighted average
UF	uncertainty factor
USEPA	United States Environmental Protection Agency
WHO	World Health Organization

PREFACE

The Environmental Health Criteria monographs are intended to assist national and international authorities in making risk assessments and subsequent risk management decisions. They represent a thorough evaluation of risks and are not, in any sense, recommendations for regulation or standard setting. These latter are the exclusive purview of national and regional governments.

The World Health Organization, through the International Health Regulations (2005), recommends the use of disinsection techniques in aircraft to help to minimize the spread of mosquito-borne diseases. The control measures recommended by WHO include the use of chemical insecticides (WHO, 1985). WHO has published generic human health risk assessment models for insecticides used for other public health purposes (WHO, 2011a and 2011b), and a decision was taken by WHO to develop a risk assessment model for aircraft disinsection insecticides, based on the same principles. In order to assist Member States who are required to assess aircraft disinsection insecticides within their jurisdiction, a number of product types currently used or proposed for use have been evaluated according to the risk assessment model.

In this publication, the generic risk assessment model (with worked examples) is presented first, in Part A, along with the description of the process used to develop the model. The evaluation of the different types of aircraft disinsection product against the risk assessment model is presented in Part B.

CONTENTS

PART A

A GENERIC RISK ASSESSMENT MODEL FOR DISINSECTION OF AIRCRAFT WITH CHEMICAL INSECTICIDES

ACKNOWLEDGEMENTS

The first draft of this generic model was prepared at the request of the World Health Organization by the Finnish Institute of Occupational Health, Kuopio, Finland. The work was led by M. Koponen. The first draft was subject to a public review period and comments were received from the following individuals and organizations: A. Aitio, Finland; A. Evans, International Civil Aviation Organization, Montreal, Canada; D. Farr, Ministry for Primary Industries, Auckland, New Zealand; A. Grimes, Callington Haven Pty Ltd, Rydalmere, Australia; R. Kleinpaste, Auckland, New Zealand; J. Leung, Pest Management Regulatory Agency, Ottawa, Canada; T. Phelan, Department of Health and Ageing, Canberra, Australia; J. Sventek, Aerospace Medical Association, Alexandria, VA, USA; C. Thibeault, International Air Transport Association, Montreal, Canada; C. Tomicic, Federal Office of Public Health, Bern, Switzerland; E. Trajber, Produits Sanitaires Aéronefs, Croissy Beaubourg, France; and J. van Engelen, National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands. Technical advice was also provided by Airbus.

The comments received were considered by the Secretariat with the assistance of M. Koponen. A revised draft of the document was then reviewed and presented at a WHO Expert Consultation held at Imperial College London, England, on 11–12 January 2012. The experts appointed by WHO were A. Aitio, Finland; S. Batt, Department of Health and Ageing, Canberra, Australia; A. Boobis, Imperial College London, England; D. Farr, Ministry for Primary Industries, Auckland, New Zealand; M. Koponen, Finnish Institute of Occupational Health, Kuopio, Finland; N. Morgan, Chemicals Regulatory Directorate, York, England; and J. van Engelen, National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands. None of the participating experts declared an interest related to the subject matter of this consultation which could have given rise to a conflict. The Secretariat was provided by WHO, assisted by P. Howe, Peterborough, England.

The WHO Expert Consultation was preceded by a Stakeholder Workshop held on 10 January 2012 at Imperial College London, England, in the presence of the WHO-appointed experts, for the purposes of providing information and the exchange of views. The

Stakeholder Workshop was open to all interested parties. To this end, announcements for the Stakeholder Workshop were sent to a wide range of umbrella organizations and professional associations who represented stakeholders from different sectors (e.g. insecticide manufacturers, airlines, aviation medicine associations, trade unions in the transport sector) plus a number of government departments with an interest in aircraft disinsection. Representatives from the following organizations participated (either in person or making presentations via webinar): Produits Sanitaires Aéronefs; LKC Switzerland Ltd; Sumi Agro France, Sumitomo Corporation Group; Callington Haven Pty Ltd; US Department of Transportation; International Civil Aviation Organization; International Air Transport Association; Association of Flight Attendants/International Transport Workers Federation.

After being finalized by the WHO-appointed experts, the document was prepared for editing by the WHO Secretariat assisted by P. Howe. The document was edited by S. Ballance.

R. Brown, Department of Public Health and Environment, WHO, Geneva, Switzerland, served as the Responsible Officer for this publication in WHO.

The preparation of this report was funded by the European Commission and the Policy Research Programme of the United Kingdom Department of Health. The views expressed in this report do not necessarily reflect the views of these two organizations.

The assistance of the individuals and organizations listed above is gratefully acknowledged.

1. INTRODUCTION

WHO defines "disinsection" as the procedure whereby health measures are taken to control or kill the insect vectors of human diseases present in baggage, cargo, containers, conveyances, goods and postal parcels. Long-standing WHO recommendations cover the use of disinsection techniques in aircraft to help to minimize the spread of mosquito-borne diseases (WHO, 1985). Mosquitoes act as vectors of pathogens and parasites that cause a number of serious diseases, including dengue, yellow fever and malaria (WHO, 2005a). The *International Health Regulations (2005)* (IHR) establish global benchmark standards to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks and that avoid unnecessary interference with international traffic and trade (WHO, 2005a). Control measures for the disinsection of aircraft are referred to in Annex 5 of the IHR, "Specific measures for vector-borne diseases", which states (clause 2) that, where there are methods and materials advised by WHO for disinsection, these should be employed and that (clause 3) States should accept disinsection if methods and materials advised by WHO have been employed.

Residual disinsection provides an insecticidal deposit on inside walls of structures (cargo areas or passenger cabins) to kill target insects that come into contact with the treated surface. Such deposits are intended to remain active for extended periods of time.

Space spraying is the dissemination of small particles (under 30 μm) that will remain airborne sufficiently long (usually not more than 30 minutes) to make contact with flying target species. This type of treatment involves a very low dosage of insecticide as it is not intended to leave a residual deposit.

For aircraft disinsection, WHO currently recommends *d*-phenothrin (2%) for space spraying and permethrin (2%) for residual disinsection (WHO, 2005b).

The WHO recommendations for methods and insecticides to be used for aircraft disinsection were considered in 1995 during an Informal Consultation that described methods, specifications for aerosols

and solvents, and recommended insecticides to be used with particular methods (WHO, 1995). The toxicity of the pyrethroid insecticides recommended by WHO for aircraft disinsection was reviewed (along with other public health uses) in 2005 (WHO, 2005b). The following recommended methods were included in these publications:

- Pre-flight spraying, which involves the aircraft cabin being sprayed with an aerosol containing a residual insecticide while the aircraft is on the ground but before passengers embark. Pre-flight spraying may be combined with blocks-away or top-of-descent spraying.
- Residual spraying, which involves the regular application of a residual insecticide to internal surfaces of the aircraft, except in food preparation areas, at intervals based on the duration of effectiveness. In addition, spot applications are made to surfaces that are frequently cleaned.
- Blocks-away spraying, which involves aerosol spraying of the passenger cabin after the doors have been locked following embarkation but before take-off.
- Top-of-descent spraying, which is in-flight spraying carried out as the aircraft starts its descent to the destination airport.

The WHO recommendations published to date have covered both the efficacy and human health aspects of aircraft disinsection products (based on published studies).

Reports completed by flight attendants or airline personnel have suggested the possibility of the onset of symptoms in passengers and crew members as a consequence of pyrethroid application. The reported symptoms varied from metallic taste, slight and nonspecific irritation of eyes, throat and upper respiratory tract and, in some cases, skin, to severe respiratory symptoms such as dyspnoea, cough and even asthma. In other cases headache and allergic reactions were reported.

According to a WHO report (WHO, 2005b), available data suggest that the most severe symptoms were observed in sensitized subjects (i.e. asthma patients) and were attributed by the affected subjects to aircraft disinsection. However, WHO points out that many of the reports lack details, such as the type of active ingredient or the application method used; moreover, the symptoms observed in most of the