



Forest Stewardship Council®



International Generic Indicators (IGI) addendum IGI for the use of Highly Hazardous Pesticides

FSC-STD-60-004a

DRAFT 2-0

Title: International Generic Indicators for the use of Highly Hazardous Pesticides
Document reference code: FSC-STD-60-004a
Approval body: FSC Board of Directors
Contact for comments: FSC International Center
Performance and Standards Unit
Adenauerallee 134,
53113 Bonn (Germany)

 +49-(0)228-36766-0
 +49-(0)228-36766-30
 psu@fsc.org

© 2021 Forest Stewardship Council, A.C. All rights reserved.
FSC® F000100

No part of this work covered by the publisher's copyright may be reproduced or copied in any form or by any means (graphic, electronic or mechanical, including photocopying, recording, recording taping, or information retrieval systems) without the written permission of the publisher. Printed copies are uncontrolled and for reference only. Please refer to the electronic copy on the FSC website (ic.fsc.org) to ensure you are referring to the latest version.

DRAFT 2-0

The Forest Stewardship Council® (FSC) is an independent, not for profit, non-government organization established to promote environmentally appropriate, socially beneficial, and economically viable management of the world's forests.

FSC's vision is that the world's forests meet the social, ecological, and economic rights and needs of the present generation without compromising those of future generations.

Content

Introduction

A Objective

B Scope

C Effective and validity date

D References

E Terms and definitions

F International generic indicators including adjustments to criterion 10.7 to reflect changes in FSC-POL-30-001 FSC Pesticides Policy

G International generic indicators for the use and risk management of highly hazardous pesticides (HHPs)

H International generic indicators for hazard criteria

Hazard Group Relevant international agreements or conventions

1. Indicators for HHPs that meet Hazard Criterion 1 (Relevant international agreements or conventions)

Hazard Group Acute toxicity

2. Indicators for HHPs that meet Hazard Criterion 2 (Acute toxicity to mammals and birds)

Hazard Group Chronic toxicity

3. Indicators for HHPs that meet Hazard Criterion 3 (Carcinogenicity)
4. Indicators for HHPs that meet Hazard Criterion 4 (Mutagenicity)
5. Indicators for HHPs that meet Hazard Criterion 5 (Developmental and reproductive toxicity)
6. Indicators for HHPs that meet Hazard Criterion 6 (Endocrine disruption)

Hazard Group Environmental toxicity

7. Indicators for HHPs that meet Hazard Criterion 7 (Acute toxicity to aquatic organisms)
8. Indicators for HHPs that meet Hazard Criterion 8 (Persistence in soil and water/ biomagnification and bioaccumulation)

Hazard Group Dioxins

9. Indicators for HHPs that meet Hazard Criterion 9 (Dioxins (residues or emissions))

Hazard Group Heavy metals

10. Indicators for HHPs that meet Hazard Criterion 10 (Heavy metals: arsenic, cadmium, lead, and mercury)

Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References by Hazard Groups

Introduction

The FSC Pesticides Policy builds on a risk-based approach, which recognizes not only the hazard of the active ingredient, but also the circumstances where chemical pesticides can be used.

Before any use of chemical pesticides, the Organization shall practice integrated pest management (IPM) to avoid, or to eliminate, the use of chemical pesticides.

However, in certain circumstances, after having identified and determined likely impacts of a pest, weed or disease and having considered all available pest management strategies, the use of chemical pesticides may remain as the most suitable control. The FSC Pesticides Policy regulates the use of chemical pesticides in these situations.

As part of the Environmental and Social Risk Assessment (ESRA) framework, the revised policy requires that FSC develops International Generic Indicators (IGIs) for the use and risk management of Highly Hazardous Pesticides (HHPs) for the Hazard Groups.

Organizations shall conduct an ESRA as part of their IPM system in accordance with the policy and conform with the applicable international and/or national indicators and thresholds for the use of highly hazardous pesticides.

The IGIs will be the starting point for Standard Development Groups to develop indicators and locally relevant thresholds (conditions) for the use of the relevant FSC Highly Restricted HHPs and FSC Restricted HHPs permitted in a given country.

In countries without Standard Development Groups, certification bodies will adopt the IGIs, or use the national indicators developed in a country with similar forest and pest problems, upon approval of FSC, as indicated in the FSC Pesticides Policy.

This document presents a set of International Generic Indicators, derived from the FSC Pesticide Policy FSC-POL-30-001 V3-0, for its further integration in FSC National Standards.

This set of indicators will be incorporated into the existing FSC-STD-60-004 International Generic Indicators.

A. Objective

The objective of this document is to provide a set of International Generic Indicators (IGIs) for the use and risk management of Highly Hazardous Pesticides (HHPs), which are required for the implementation of FSC-POL-30-001 V3-0 FSC Pesticides Policy.

This set of indicators will be incorporated into the existing FSC-STD-60-004 International Generic Indicators in two different sections:

- a) The International Generic Indicators under Criterion 10.7 in Section F of this document will be placed under Criterion 10.7, replacing the current indicator 10.7.2.
- b) The International Generic Indicators in Annex 'International Generic Indicators for the use and risk management of Highly Hazardous Pesticides (HHPs) in Section F of this document will be incorporated as an Annex to the next version of FSC-STD-60-004 International Generic Indicators

The IGIs have been developed considering:

- The exposure elements and variables described in FSC-POL-30-001 V3-0 FSC Pesticides Policy.
- Research into less hazardous alternatives.
- Engagement with interested and/or affected stakeholders.
- Training requirements (FSC Principles and Criteria V5-2, Criteria 2.5 and 4.3).
- Monitoring requirements (FSC Principles and Criteria V5-2, Criteria 8.2).
- Use of personal protective equipment (FSC Principles and Criteria V5-2, Criteria 2.3).
- Derogation procedure and derogation conditions based on the previous version of the Pesticides Policy.

This document also presents instructions for Standard Developers on how to incorporate the IGIs to National Standards when developing indicators for restricted and highly restricted HHPs in the country.

B. Scope

The IGIs for HHPs will be a mandatory starting point for the Standard Development Groups to develop national indicators for National Forests Stewardship Standards (NFSS). Standard Development Groups shall consider the Instructions for Standard Developers, and all the IGIs, with the option to adopt, adapt, drop or add indicators as appropriate and relevant nationally. Justification for adapting, dropping or adding new indicators shall be presented, as indicated in the generic transfer procedure (FSC-PRO-60-006). The indicators for HHPs in the National Forests Stewardship Standards are developed following FSC-STD-60-006 Process Requirements for the Development and Maintenance of National Forest Stewardship Standards.

Certification Bodies developing Interim National Standards shall adopt these additional IGI into the Interim National Standards or adopt national indicators and locally relevant thresholds to HHPs from a country with similar pest problems and forest conditions, upon approval by FSC IC.

C. Effective and validity date

Approval date	XXX
Publication date	XXX
Effective date	XXX
Period of validity	XXX

D. References

The following referenced documents are relevant for the application of this document.

For references without a version number, the latest edition of the referenced document (including any amendments) applies.

<i>FSC-STD-01-001</i>	<i>FSC Principles and Criteria</i>
<i>FSC-STD-60-004</i>	<i>International Generic Indicators</i>
<i>FSC-STD-01-002</i>	<i>FSC Glossary of Terms</i>
<i>FSC-POL-30-001</i>	<i>FSC Pesticides Policy</i>
<i>FSC-STD-60-006</i>	<i>Process requirements for the development and maintenance of National Forest Stewardship Standards</i>
<i>FSC-PRO-60-006</i>	<i>Development and Transfer of NFSS to FSC P&C V5-1</i>

E. Terms and definitions

Active ingredient: part of the product that provides the pesticidal action (Source: FAO International Code of Conduct on Pesticide Management & <http://www.fao.org/pesticide-registration-toolkit/information-sources/terms-and-definitions/terms-and-definitions-s>).

Acute poisoning: An **acute poisoning** is any illness or health effect resulting from suspected or confirmed **exposure** to a **pesticide** within 48 hours. Warfarins, superwarfarins and coumarins are an exception to this rule as the onset of laboratory findings or symptoms may be delayed greater than 48 hours. (Source: adapted from FAO & WHO International Code of Conduct on Pesticide Management: Rome, 2014).

Affected stakeholder: any person, group of persons or entity that is or is likely to be subject to the effects of the activities of a Management Unit. Examples include but are not restricted to (for example in the case of downstream landowners), persons, groups of persons or entities located in the neighbourhood of the Management Unit.

The following are examples of affected stakeholders: local communities, Indigenous Peoples, workers, forest dwellers, neighbours, downstream landowners, local processors, local businesses, tenure and use rights holders, including landowners, organizations authorized or known to act on behalf of affected stakeholders, for example social and environmental NGOs, labour unions, etc. (Source: FSC-STD-01-001 V5-2 *Principles and Criteria for Forest Stewardship*).

Chemical pesticide: synthetically produced pesticide. (Source: FSC-POL-30-001 V3-0 FSC Pesticides Policy).

Chronic toxicity: Adverse effects that persist over a long period of time whether or not they occur immediately upon exposure or are delayed following continuous or intermittent long-term contact between an agent and a non-target. (Source: Based on FAO & WHO International Code of Conduct on Pesticide Management, 2016).

Critical population density: Maximum acceptable number or density of individuals in a pest population, beyond which the pest threatens the achievement of management objectives. Assessment of the critical population density should take into account historical records from the affected area, the type of pest (insects, weeds, pathogens, etc.), and how the pest population is likely to change in relation to its density, including situations in which small populations show a positive relationship between population density and growth rate (the Allee effect). (Source: International Code of Conduct on the Distribution and use of Pesticides 2006).

Emergency: a situation that requires immediate action to control the sudden invasion or infestation of a pest, which threatens either long-term stability of the ecosystem, human well-being or economic viability. Events that happen cyclically and scenarios which are predicted through planning, monitoring or the application of an integrated pest management system cannot be considered an emergency. For the purpose of the FSC Pesticides Policy, emergency situations require immediate action and cannot feasibly be controlled by a less hazardous alternative (Source: FAO in Emergencies: Plant Pests and Diseases: www.fao.org/emergencies).

Environmental biomonitoring: is defined as the act of observing and assessing the state and ongoing changes in ecosystems, components of biodiversity and landscape, including the types of natural habitats, populations and species. (Source: Encyclopaedia of Toxicology (Third Edition, 2014)).

Environmental and social risk assessment (ESRA): a process to predict, assess and review the likely or actual environmental and social effects of a well-defined action, evaluate alternatives, and design appropriate mitigation, management and monitoring measures. In the context of the FSC Pesticides Policy, it relates to chemical pesticide use (Source: FAO Environmental and Social Management Guidelines, 2015).

Exclusion zone: Area in which chemical pesticides are used, and which people are prevented from entering during and after pesticide application in order to avoid unacceptable risk of exposure. The exclusion zone remains in force until the risk of exposure has reduced to an acceptable level (the period of re-entry).

Fair compensation: remuneration that is proportionate to the magnitude and type of services rendered by another party or of the harm that is attributable to the first party (Source: *FSC-STD-60-004 V1-0 EN International Generic Indicators*)

Governmental order: the use of a specific chemical pesticide is ordered or carried out by governmental authorities independent of the Organization. (Source: FSC-POL-30-001 V3-0 FSC Pesticides Policy).

Highly hazardous pesticide (HHP): chemical pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health and environment according to internationally accepted classification systems or are listed in relevant binding international agreements or conventions, or contain dioxins, or heavy metals. In addition, pesticides that appear to cause severe or irreversible harm to health or

the environment under conditions of use in a country may be considered to be and treated as highly hazardous (Source: FSC-POL-30-001 V3-0 FSC Pesticides Policy).

FSC distinguishes between FSC prohibited HHPs, FSC highly restricted HHPs and FSC restricted HHPs:

- **FSC prohibited HHPs:** chemical pesticides that: a) are listed or recommended for listing under Annex A (elimination) of the Stockholm Convention on Persistent Organic Pollutants or Annex III of the Rotterdam Convention on the Prior Informed Consent Procedure or listed under the Montreal Protocol on Substances that Deplete the Ozone Layer, or b) are acutely toxic and that can induce cancer (carcinogenic and likely to be carcinogenic), or c) contain dioxins or d) contain heavy metals).
- **FSC highly restricted HHPs:** chemical pesticide presenting two or three out of the following hazards: acute toxicity, chronic toxicity and environmental toxicity.
- **FSC restricted HHPs:** chemical pesticide presenting one out of three of the following hazards: acute toxicity, chronic toxicity and environmental toxicity. (Source: FSC-POL-30-001 V3-0 FSC Pesticides Policy).

Integrated pest management (IPM): careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations, encourage beneficial populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human and animal health and/or the environment. IPM emphasizes the growth of a healthy forest with the least possible disruption to ecosystems and encourages natural pest control mechanisms (Source: Based on *FAO International Code of Conduct on Pesticide Management & <http://www.fao.org/pesticide-registration-toolkit/information-sources/terms-and-definitions/terms-and-definitions-s>).*

Interested stakeholders: any person, group of persons, or entity that has shown an interest, or is known to have an interest, in the activities of a Management Unit. The following are examples of interested stakeholders: conservation organizations, for example environmental NGOs; labour (rights) organizations, for example labour unions; human rights organizations, for example social NGOs; local development projects; local governments; national government departments functioning in the region; FSC National Offices; experts on particular issues, for example High Conservation Values. (Source: FSC-STD-01-001 V5-2 *Principles and Criteria for Forest Stewardship*).

Intervention threshold: Population density level where the controlling measures of the targeted pest should start. It is determined in the IPM system and it is usually lower than the *critical population density** level.

Medical Biomonitoring: Analysis of a chemical pesticide or one of its metabolites in the human body, using samples of substances such as blood, urine or breastmilk. (Source: Based on FAO and WHO (2016). *International Code of Conduct on Pesticide Management: Guidelines on Highly Hazardous Pesticides*. FAO & WHO, Rome.)

Non-target species: those species either directly or indirectly vulnerable to the adverse effects of the pesticide and which are not the target of said pesticide. (Source: Based on FAO & WHO and European Food Safety Authority (EFSA) 2009)

The Organization: the person or entity holding or applying for certification and therefore responsible for demonstrating compliance with the requirements upon which FSC certification is based (Source: *FSC-STD-01-001 V5-2 Principles and Criteria for Forest Stewardship*).

Pest: any species, strain or biotype of plant, animal or pathogenic agent injurious to plants and plant products, materials or environments and includes vectors of parasites or pathogens of human and animal disease and animals causing public health nuisance (Source: *FAO International Code of Conduct on Pesticide Management* & <http://www.fao.org/pesticide-registration-toolkit/information-sources/terms-and-definitions/terms-and-definitions-s>).

Pesticide: any substance, or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth (Source: *FAO International Code of Conduct on Pesticide Management*). This definition includes insecticides, rodenticides, acaricides, molluscicides, larvicides, nematicides, fungicides and herbicides.

Pesticide Buffer zone: the distance between the point of direct pesticide application and the nearest boundary of a sensitive habitat, unless otherwise specified on a product label. (Source: Based on FAO & WHO International Code of Conduct on Pesticide Management, 2016).

Preadolescence: the period of human development just preceding adolescence; specifically: the period between the approximate ages of 9 and 12. (Source: WHO, guidelines to biomonitoring, 2012)

Repair: process of assisting the recovery of environmental values and human health.

Risk: the probability of an unacceptable negative impact arising from any activity in the management unit combined with its seriousness in terms of consequences (Source: *FSC-STD-01-001 V5-2 Principles and Criteria for Forest Stewardship*).

Secondary or latent health impact: Further or dormant effects of the Highly Hazardous Pesticide that may emerge with a time delay (WHO Human Biomonitoring: facts and figures, Copenhagen, 2015)

Sublethal effects: Health effects on individuals who survive being exposed to a Highly Hazardous Pesticide below the acceptable daily intake for an extended period of time (Source: Based on WHO Human Biomonitoring: facts and figures, Copenhagen, 2015 & <http://www.fao.org/pesticide-registration-toolkit/information-sources/terms-and-definitions/terms-and-definitions-s>).

Silviculture: the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the targeted diverse needs and values of landowners and society on a sustainable basis (Source: *Nieuwenhuis, M. 2000. Terminology of Forest Management. IUFRO World Series Vol. 9. IUFRO 4.04.07 SilvaPlan and SilvaVoc*).

Stakeholder: see definitions for 'affected stakeholder' and 'interested stakeholder':

Trigger Value: the value of toxicity exposure ratio (TER) above which exposure is considered to be an unacceptable risk. TER is calculated based on the acute toxicity value and exposure for each pesticide. Its value will be local and based on exposition parameters. (Source: Adapted from Connon, Geist & Werner, 2012).

Verbal forms for the expression of provisions

[Adapted from ISO/IEC Directives Part 2: Rules for the structure and drafting of International Standards]

“shall”: indicates requirements strictly to be followed in order to conform to the document.

“should”: indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.

“may”: indicates a course of action permissible within the limits of the document.

“can”: is used for statements of possibility and capability, whether material, physical or causal.

DRAFT

F. INTERNATIONAL GENERIC INDICATORS INCLUDING ADJUSTMENTS TO CRITERION 10.7 TO REFLECT CHANGES IN FSC-POL-30-001 FSC PESTICIDES POLICY

10.7 The *Organization shall* use integrated pest management and *silviculture** systems which avoid, or aim at eliminating, the use of *chemical pesticides**. The *Organization** shall* not use any *chemical pesticides** prohibited by FSC policy. When *pesticides** are used, The *Organization** shall* prevent, mitigate, and/or repair damage to *environmental values** and human health. (C6.6 and C10.7 P&C V4).**

Note for public consultation

Proposed adjustments to the existing IGI at 10.7 are in presented here in grey text.

Proposed Instructions and IGIs under 10.7



INSTRUCTIONS FOR STANDARD DEVELOPERS: Standard Developers shall* include the relevant aspects of the 'FSC Guide to integrated pest, disease and weed management in FSC certified forests and plantations' (2009) and associated policies, guidelines, advice notes and other FSC normative documents for the development of indicators (Indicator 10.7.1).

Standard Developers shall* either reference or include the relevant aspects of the ILO document "Safety in the use of chemicals at work" (Geneva, ILO, 1993) or any national interpretation of this document in National Standards (Indicator 10.7.4).

Standards Developers shall consider the Annex 'International Generic Indicators for the use and risk management of Highly Hazardous Pesticides (HHP)' and develop national indicators for HHP used or likely to be used in the country.

Standards Developers should consider listing the requirements in FSC-POL-30-001 V3-0 FSC Pesticides Policy Clause 4.12 in National Standards.

10.7.1 Integrated pest management, including selection of *silviculture** systems, is used to avoid, or aim to eliminate, the frequency, extent and amount of chemical *pesticide** applications, and result in non-use or overall reductions in applications.

10.7.2 Prior to using *chemical pesticides**, the requirements of the ESRA framework for Organizations (FSC-POL-30-001 V3-0 FSC Pesticides Policy clause 4.12) are met.

10.7.3 ESRA is reviewed and, if necessary, revised within the five-year certificate cycle.

10.7.4 Affected and *interested stakeholders** are informed about the ESRA process and provided with an opportunity for culturally *appropriate** *engagement**.

10.7.5 A decision process and rationale are in place to select the option that demonstrates least social and environmental damages, more effectiveness and equal or greater social and environmental benefits.

- 10.7.6 Records of *pesticide** usages are maintained, including trade name, active ingredient, quantity of active ingredient used, period of use, **number and frequency of applications**, location and area of use and reason for use.
- 10.7.7 The use of *pesticides** complies with the ILO document “Safety in the use of chemicals at work” regarding requirements for the transport, storage, handling, application and emergency procedures for clean-up following accidental spillages.
- 10.7.8 If *pesticides** are used, application methods minimize quantities used, while achieving effective results, and provide effective *protection** to surrounding *landscapes**.
- 10.7.9 Damage to *environmental values** and human health from *pesticide** use is prevented and mitigated or repaired where damage occurs.
- 10.7.10 When pesticides* are used:
- 1) The selected *pesticide**, application method, timing and pattern of use offers the least risk to humans and *non-target species**; and
 - 2) Objective evidence demonstrates that the *pesticide** is the only effective, practical and cost-effective way to control the pest.

G. INTERNATIONAL GENERIC INDICATORS FOR THE USE AND RISK MANAGEMENT OF HIGHLY HAZARDOUS PESTICIDES (HHP)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** follow Annex 4 of FSC-POL-30-001 FSC Pesticide Policy V3-0: Procedure to implement policy requirements for ESRA framework at national level, prior to considering this set of International Generic Indicators. This procedure describes how Standards Developers shall use Annex 2 to establish the conditions for the use of highly restricted and restricted HHPs at national level.

Standard Developers *shall** incorporate the IGIs to the national context and develop locally relevant thresholds or conditions for the use of the relevant FSC Highly Restricted HHPs and FSC Restricted HHPs permitted for use.

Standard Developers *shall** engage with *stakeholders** in this process as per FSC-STD-60-006 Process Requirements for the Development and Maintenance of National Forest Stewardship Standards and FSC-PRO-60-007 Structure, Content and Development of Interim National Standards.

Standard Developers *shall** consider *workers** rights in relation to use of pesticides in accordance with the ILO Code of Practice Safety in the use of chemicals at work, including the right to refuse to use HHPs.

Indicators for the use and risk management of specific HHPs are recommended to be compiled into an annex of the National Standards, but they can be inserted to the body of the National Standard. Also, combining these two options is possible.

In case indicators are inserted to the national standard, the need for the HHP indicators should be considered at least for following criteria: C1.3; C1.6; C2.1; C2.3; C2.5; C2.6; C3.1; C3.2; C4.1; C4.2; C4.5; C4.6; C4.7; C5.1; C6.1; C6.2; C6.3; C6.6; C6.7; C7.4; C7.6; C8.2; C8.3; C8.4; C9.1; C9.3; C10.7; C10.8; C10.12. (The list is based on desk studies conducted in South Africa, New Zealand, UK and Brazil. The studies are available from FSC IC by request to forestmanagement@fsc.org).

INTERNATIONAL GENERIC INDICATORS FOR ALL HHPS



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** determine, using *Best Available Information**, whether *critical population density** is an appropriate measure to determine *intervention threshold** for a particular pest.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** specify research, identify and test alternatives to replace FSC highly restricted HHPs and restricted HHPs with less hazardous alternatives, subject to *scale, intensity and risk**.

-
- 1.1 A documented Integrated Pest Management (IPM) system, consistent with the 'FSC Guide to Integrated Pest, Disease and Weed Management' in FSC certified forests and plantations, is in place to avoid, or aim to eliminate, the

use of chemical pesticides in management units (MU), and minimize risks to human health and the environment while maintaining economically viable management.

- 1.2 In addition to existing IGI 10.7.3 (proposed IGI 10.7.4) requirements, the following records of HHP usage and IPM implementation are maintained, subject to scale, intensity and risk of management activities:

Note for public consultation

FSC is revising and updating the FSC Guide to IPM in 2021 that will include a section on biomonitoring.

- a) level of target pest infestation,
 - b) the decision process and rationale for selecting a Highly Restricted or Restricted HHPs over a non HHP *chemical pesticide** or *non-chemical pesticide** control method,
 - c) risk assessment for operator safety, detailing the processes to be followed in carrying out the HHP application, following appropriate legislation or guidelines,
 - d) assessment of the economic impact of the pest and/or other justification for interventions,
 - e) application methodology,
 - f) who made the application,
 - g) total annual volume of active ingredient used,
 - h) time and date of treatment,
 - i) the weather conditions at time of application,
 - j) any disposals or spillage, including action taken to prevent contamination and/or harm,
 - k) evaluation and monitoring of the effectiveness of treatment,
 - l) mapped boundaries of treatment area and pest affected area when relevant.
- 1.3 ESRA(s), site operational plans, and site-specific risk mitigation and monitoring measures for HHPs take account of *secondary or latent health impacts**, *sublethal effects** and/or *chronic toxicity**.
- 1.4 Control measures are proactively considered and/or implemented before *intervention threshold**, and/or *critical population densities** of the targeted pest are reached.
- 1.5 A trend of replacement, reduction and/or removal of HHPs over time is demonstrated or otherwise justified.
- 1.6 Use of HHPs is limited to the minimum effective dose based on the label and *Best Available Information**

NOTE: In some cases, effective dose range rather than a single dose will need to be determined, depending on the pest.

- 1.7 Directly or potentially *affected stakeholders** are provided with safety information, through *culturally appropriate* engagement**, before HHPs are used.
- a) The safety information for the particular HHP is provided in a culturally appropriate and accessible format.

- b) The information complies with World Health Organization in Guidelines for personal protection in handling the pesticides.
 - c) An *exclusion zone** is established where a HHP and/or application method requires one, as instructed by the label, or other applicable sources, to avoid *workers** and *affected stakeholders** from being exposed to harm.
- 1.8 A *pesticides buffer zone** is established where a HHP and/or application method requires one to ensure the protection of environmental and cultural values.
- 1.9 In the case of an emergency situation or by governmental order the use of Highly Restricted and Restricted HHPs conforms with the use of FSC prohibited HHPs specified in Annex 3 of FSC-POL-30-001 *FSC Pesticides Policy*.
- 1.10 Programmes are in place that have clear actions, timelines, targets and resources allocated to research, identify and test alternatives to replace FSC highly restricted HHPs and restricted HHPs with less hazardous alternatives.
- 1.11 Training programmes for the use of HHPs include informing *workers** of known risks to human health and environmental values; and mitigation measures identified in the ESRA

H. INTERNATIONAL GENERIC INDICATORS FOR HAZARD CRITERIA

Hazard Groups	Number	Hazard Criteria
Relevant International Agreements or conventions	1	Relevant International Agreements or conventions
Acute toxicity	2	Acute toxicity to mammals and birds
Chronic toxicity	3	Carcinogenicity
	4	Mutagenicity to mammals
	5	Developmental and reproductive toxicity
	6	Endocrine disrupting chemical (EDC)
Environmental toxicity	7	Acute toxicity to aquatic organisms
	8	Persistence in soil or water and soil sorption potential and bio-magnification and bioaccumulation
Dioxins	9	Dioxins (residues or emissions)
Heavy metals	10	Heavy metals

Table 1. Hazard Groups and Criteria for the identification of highly hazardous pesticides (Source: *FSC-POL-30-001 FSC Pesticides Policy*).

Hazard Group Relevant international agreements or conventions

1. Indicators for HHPs that meet Hazard Criterion 1 (Relevant international agreements or conventions)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Compliance with IGIs is required in Annex 3 of the FSC Pesticides Policy since these are prohibited HHPs. This instruction is expected to be applied by those Standards Developers that choose to strengthen the requirements for prohibited HHPs.

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- FSC POL-30-001a FSC Lists of highly hazardous pesticides.
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, Chapters 3.1-, 3.5- 3.9 and Part 4 Chapter 4.2.
- The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification, 2009. World Health Organization (WHO), International Programme on Chemical Safety (IPCS) and Inter-Organization Programme for Sound Management of Chemicals (IOMC). Table 1, Table 6, Table 7.
- International tools for preventing local pesticide problems: A consolidated guide to chemical codes and conventions. European Centre on Sustainable Policies for Human and Environmental Rights (ECSPHR), 2008. Section 3, Section 5.2.1.
- International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 9th draft, 2019. FAO & WHO. Part 1, Sections 1.1, 1.3, 1.4 and Annex 6.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

-
- 1.1 When HHPs that meet Hazard Criteria 1 are used, Annex 3. Procedure for the exceptional use of FSC prohibited HHPs in FSC-POL-30-001 FSC Pesticides Policy is applied.
 - 1.2 Medical *biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.
 - 1.3 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
 - 1.4 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.

- 1.5 Harm caused to *workers** and *affected stakeholders** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

Hazard Group Acute Toxicity

2. Indicators for HHPs that meet Hazard Criterion 2 (Acute toxicity to mammals and birds)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- Severely Hazardous Pesticides formulations toolkit (sections 4 and 5) (UNEP FAO).
- Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998. Part III, Chapters 6, 7 and 9.
- The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification. 2009. World Health Organization (WHO), International Programme on Chemical Safety (IPCS) and Inter-Organization Programme for Sound Management of Chemicals (IOMC). Tables 1,2, 3 and 7.
- International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous Pesticides FAO & WHO, 2016. Chapters 2,3 and 6.
- Sound and Sustainable Management of Chemicals. A training manual for workers and trade unions. United Nations Environment Programme (UNEP).2008. Module 2.
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, Chapter 3.1.
- Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Section I Chapter 2, Section VI and Section VII. Cross reference with 2.1.3. These are the biomonitoring indicators and signs and symptoms of acute poisoning.
- International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 9th draft. 2019. FAO & WHO. Part 1, Sections 1.1, 1.3, 1.4 and Annex 6.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

- 2.1 *Medical biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.
- 2.2 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
- 2.3 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.

NOTE: For Hazard Criterion 2, a *preadolescent** is particularly at risk from the effects of these HHPs.

- 2.4 Harm caused to *workers** and *affected stakeholders** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at the Management Unit level.

Hazard Group Chronic Toxicity

3. Indicators for HHPs that meet Hazard Criterion 3 (Carcinogenicity)



Instructions for Standard Developers:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance:

- Severely Hazardous Pesticides formulations toolkit (sections 4 and 5) (UNEP FAO).
- FAO HHP protection of children in low to middle income countries (FAO 2015).
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, chapter 3.6.
- International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 9th draft. 2019. FAO & WHO. Part 1, sections 1.1, 1.3, 1.4 and Annex 6.
- Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998. Part III, Chapters 6, 7 and 9.
- The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification. 2009. World Health Organization (WHO), International Programme on Chemical Safety (IPCS) and Inter-Organization

Programme for Sound Management of Chemicals (IOMC). Tables 1,2, 3 and 7.

- Understanding the Impacts of Pesticides on Children: A discussion paper. 2018. UNICEF.
- Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Chapter 1 deals with special populations and environmental justice (page 9) covering children's risk.
- An NGO Guide to SAICM (The Strategic Approach to International Chemicals Management) 2008. Chapters 5.1.4 and 5.1.5 and 5.1.7
- International tools for preventing local pesticide problems: A consolidated guide to chemical codes and conventions. European Centre on Sustainable Policies for Human and Environmental Rights (ECSPHR), 2008. Chapter 3, section 4.2.5, 4.3.5 and Chapter 6.
- Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Section I chapter 2, section VI and section VII
- Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998. Part III, Chapters 6, 7 and 9.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

-
- 3.1 Medical *biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.
 - 3.2 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
 - 3.3 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
 - 3.4 Harm caused to *workers** and affected stakeholder by over-exposure to a HHP in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

4. Indicators for HHPs that meet Hazard Criterion 4 (Mutagenicity)



Instructions for Standard Developers:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- Severely Hazardous Pesticides formulations toolkit (sections 4 and 5) (UNEP FAO).
- International tools for preventing local pesticide problems: A consolidated guide to chemical codes and conventions. European Centre on Sustainable Policies for Human and Environmental Rights (ECSPHR), 2008. Chapter 3, section 4.2.5, 4.3.5 and Chapter 6.
- Recognition and management of pesticide Poisonings. 6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Section I chapter 2, section VI and section VII.
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, chapter 3.5.
- International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 9th draft. 2019. FAO & WHO. Part 1, sections 1.1, 1.3, 1.4 and Annex 6.
- Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998. Part III, Chapters 6, 7 and 9.
- The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification. 2009. World Health Organization (WHO). International Programme on Chemical Safety (IPCS) and Inter-Organization Programme for Sound Management of Chemicals (IOMC). Tables 1,2,3 and 7.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

-
- 4.1 *Medical biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.
 - 4.2 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
 - 4.3 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
 - 4.4 Harm caused to *workers** and *affected stakeholders** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

5. Indicators for HHPs that meet Hazard Criterion 5 (Developmental and reproductive toxicity)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

Note: Post 2018 product label will conform to GHS harmonized system of classification and labelling of chemicals (2019)

- Severely Hazardous Pesticides formulations toolkit (sections 4 and 5) (UNEP FAO).
- Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998. Part III, Chapters 6, 7 and 9.
- The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification. 2009. World Health Organization (WHO), International Programme on Chemical Safety (IPCS) and Inter-Organization Programme for Sound Management of Chemicals (IOMC). Tables 1,2, 3 and 7.
- International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 9th draft. 2019. FAO & WHO. Part 1, sections 1.1, 1.3, 1.4 and Annex 6.
- International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous f Pesticides FAO &WHO, 2016. Chapters 2,3 and 6.
- Sound and Sustainable Management of Chemicals. A training manual for workers and trade unions. United Nations Environment Programme (UNEP).2008. Module 2.
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, Chapter 3.7.
- Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Section I chapter 2, section VI and section VII.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

- 5.1 *Medical biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.
- 5.2 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
- 5.3 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
- 5.4 Harm caused to *workers** and *affected stakeholder** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.
- 5.5 NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

6. Indicators for HHPs that meet Hazard Criterion 6 (Endocrine disruption)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- Severely Hazardous Pesticides formulations toolkit (sections 4 and 5) (UNEP FAO).
- Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998. Part III, Chapters 6, 7 and 9.
- Sound and Sustainable Management of Chemicals. A training manual for workers and trade unions. United Nations Environment Programme (UNEP).2008. Module 2.
- The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification. 2009. World Health Organization (WHO), International Programme on Chemical Safety (IPCS) and Inter-Organization Programme for Sound Management of Chemicals (IOMC). Tables 1,2, 3, 4 and 7.
- International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 9th draft. 2019. FAO & WHO. Part 1, sections 1.1, 1.3, 1.4 and Annex 6.
- International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous Pesticides FAO &WHO, 2016. Chapters 2,3 and 6.
- OECD work on Endocrine Disrupting Chemicals. OECD, 2018. <http://oe.cd/endocrine-disrupters>

- IPCS International Program of Chemical Safety (WHO) -Integrated Risk Assessment document.
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, Chapter 3.9.
- Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Chapter 21.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

-
- 6.1 Medical *biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.
 - 6.2 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
 - 6.3 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
 - 6.4 Harm caused to *workers** and *affected stakeholders** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

Hazard Group Environmental toxicity

7. Indicators for HHPs that meet Hazard Criterion 7 (Acute toxicity to aquatic organisms)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- Considerations of assessing the risks of combined exposure to multiple chemicals. Series on testing and assessment. No 296. OECD.2018. Chapter 7.
- WHO IPCS Integrated Risk Assessment 2001.
- Acute toxicity risk of pesticides in Hazard Criterion 7, as indicated in the table below:

Category	Insecticides	Organophosphate	Carbamate	Pyrethroid	Phenyl pyrazoles	Herbicide	Integrated Growth Regulators	Fungicide
Algae	High	High	High	High	High	Mod	High	Low
Aquatic invertebrates	High	High	High	High	High	Mod	High	Low
Aquatic plants	High	High	High	High	High	High	High	Low
Fish	Mod	High	High	High	Mod-high	High	Low	Low-high
Non target arthropods	Mod	Mod-high	No-mod	Mod-high	Mod-high	Low-mod	Low-high	Low-mod
Earthworms	Low-high	High	High	High	Low-high	Mod	Low-high	Mod
Birds	Low-mod	Low-high	No-high	No-low	No-high	No-low	No	No-mod
Mammals	Mod	Low-high	No-high	Low	No-high	No-low	No	No-mod
Bees	Low-high	High	High	High	Low-high	Mod	Low-high	Mod

Table 2. Acute toxicity risk of pesticides in Hazard Criterion 7

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

7.1 The relevant *trigger values** are identified (see Table 3) that minimize harm to non-target species in aquatic ecosystems for HHPs under Hazard Criterion 7.

Category	EU Acute PEC trigger values	Tropical Acute PEC trigger values	EU TER trigger value	Tropical TER trigger value
Algae	<0.1	<0.01	100	1000
Aquatic plants	<0.01	<0.001	10	100
Aquatic invertebrates	<0.01	<0.001	10	100
Fish	<0.01	<0.001	100	1000
Non-target arthropods	<0.001	<0.0001	2	20
Earthworms	<0.001	<0.0001	10	100
Birds	<0.001	<0.0001	10	100
Mammals	<0.001	<0.0001	10	100
Bees	<0.076	<0.0076	50	500

Table 3. Relevant trigger values for Hazard Criterion 7 & 8.

- 7.2 Protection measures are implemented to avoid exceeding *trigger values**.
- 7.3 ESRA results are taken into account to implement an environmental biomonitoring program to ensure *trigger values** are not exceeded and has sufficient scope, detail and frequency to detect changes, relative to the initial assessment and status of the *trigger values**.

NOTE: If your country/region/climate has not developed a *trigger value** (temperate and boreal versus tropical), use LD/LC50 of the relevant pesticides to determine exposure thresholds.

NOTE: LD50 = The **median lethal dose** (or **LD50**) is defined as the dose of a test substance that is lethal for 50% of the animals in a dose group. **LD50** values have been used to compare relative acute hazards of pesticides, especially when no other toxicology data are available for the pesticides.

8. Indicators for HHPs that meet Hazard Criterion 8 (Persistence in soil and water/ biomagnification and bioaccumulation)



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- Metabolites impact on non – target arthropods and pollinators
- Ecological monitoring methods for the assessment of pesticides impacts (Grant and Tingle, DFID).
- Considerations of assessing the risks of combined exposures to multiple chemicals. Series on testing and assessment. No 296. OECD, 2018
- WHO IPCS Integrated Risk Assessment, 2001 Chapter 7.
- FOCUS (the forum for co-ordination of pesticide fate models and their use) database – environmental fate – surface and ground water- <https://esdac.jrc.ec.europa.eu/projects/focus-dg-sante>
- The European soil database v2.0.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

NOTE: For the Boreal zone refer to the same advice as for the Temperate zone

-
- 8.1 The relevant *trigger values** are identified (see Table 3).to detect persistence in soil and water/ biomagnification and bioaccumulation for HHPs under Hazard Criterion 8.
- 8.2 Protection measures are implemented to avoid exceeding *trigger values**.
- 8.3 ESRA results are taken into account to implement an environmental biomonitoring program to ensure *trigger values** are not exceeded and

has sufficient scope, detail and frequency to detect changes, relative to the initial assessment and status of the *trigger values**.

NOTE: If your country/region/climate has not developed a *trigger value** (temperate and boreal versus tropical), use LD/LC50 of the relevant pesticides to determine exposure thresholds.

NOTE: LD50 = The **median lethal dose** (or **LD50**) is defined as the dose of a test substance that is lethal for 50% of the animals in a dose group. **LD50** values have been used to compare relative acute hazards of pesticides, especially when no other toxicology data are available for the pesticides.

DRAFT

Hazard Group Dioxins

9. Indicators for HHPs that meet Hazard Criterion 9 (Dioxins (residues or emissions))



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- Severely Hazardous Pesticides formulations toolkit (sections 4 and 5) (UNEP FAO).
- ILO Safety in the use of chemicals at work
- IPCS International Program of Chemical Safety (WHO) -Integrated Risk Assessment document
- International Code of Practice for use of pesticides (WHO)
- Strategic Approach to International Chemicals management (UNEP)
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, Chapter 3.8
- Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Chapter 21

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

-
- 9.1 When HHPs that meet Hazard Criteria 9 are used, Annex 3. Procedure for the exceptional use of FSC prohibited HHPs in FSC-POL-30-001 FSC Pesticides Policy is applied.
 - 9.2 *Medical biomonitoring** of *workers** exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current Best Available Information*.
 - 9.3 Appropriate actions are taken to avoid harm, as identified through the application of the identified *medical biomonitoring** methodology.
 - 9.4 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
 - 9.5 Harm caused to *workers** and *affected stakeholders** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

Hazard Group Heavy Metals

10. Indicators for HHPs that meet Hazard Criterion 10 (Heavy metals (arsenic, cadmium, lead, and mercury))



INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHPs in question or bring the relevant aspects into National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.

- ILO Safety in the use of chemicals at work
- IPCS International Program of Chemical Safety (WHO) Integrated Risk Assessment document
- International Code of Practice for use of pesticides (WHO)
- Strategic Approach to International Chemicals management (UNEP)
- Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019. Part 3, Part 4
- Recognition and management of pesticide Poisonings. 6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes. Section I and Chapter 21.
- FOCUS (the forum for co-ordination of pesticide fate models and their use) database – environmental fate – surface and ground water- <https://esdac.jrc.ec.europa.eu/projects/focus-dg-sante>
- The European soil database v2.0.

Standard Developers *shall** consider total formulations including active ingredient and inert or co-formulants (e.g. surfactant, wetter, adjuvant, additive).

Standard Developers *shall** prioritize the development of indicators for the identification of harm and identify the required treatment before looking at compensation when it comes to human health.

-
- 10.1 When HHPs that meet Hazard Criteria 10 are used, Annex 3. Procedure for the exceptional use of FSC prohibited HHPs in FSC-POL-30-001 FSC Pesticides Policy is applied.
 - 10.2 *Medical biomonitoring** of workers exposed to HHPs that meet these Hazard Criteria is conducted following a methodology based on an analysis of current *Best Available Information**.

- 10.3 Appropriate actions are taken to avoid harm, as identified through the application of the identified medical biomonitoring* methodology.
- 10.4 Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
- 10.5 Harm caused to *workers** and *affected stakeholders** by over-exposure to HHPs in these Hazard Criteria is treated and/or *fair compensation** is provided.

NOTE: Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, and References By Hazard Groups where current international *Best Available Information** for each of the relevant indicators can be found.

Note for public consultation

The Synopsis, Annex 6. Medical Biomonitoring Guidance Triggers Summary Table may be referenced for use at Management Unit level.

Appendix 1: PERSONAL PROTECTIVE EQUIPMENT (PPE), MEDICAL BIOMONITORING, AND REFERENCES BY HAZARD GROUPS

This table provides summary information by Hazard Group/Criterion and is intended to be a “Quick Reference” for determining PPE needs for chemical use. Standard Development Groups shall use this information for developing the national indicators to the target HHPs. Medical Biomonitoring information is also provided for that purpose.

Note for public consultation

The TWG is providing additional guidance to Biomonitoring for Standard Development Group. Please see page 29 of synopsis report, Annex 3. *Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion.*

Column titles and explanations: “Sub-set of Chemicals in Hazard Group” is a partial listing of chemical in a Hazard Group. For a full and complete list of chemicals in any Hazard Group see the most current version of FSC-POL-30-001a. Hazard Group and Criterion are as described in FSC-POL-30-001. Personal Protective Equipment (PPE) is compiled from literature cited in the “References” column. Classification is from FAO & WHO International Code of Conduct on Pesticide Management: Guidelines for Personal Protection when Handling and Applying Pesticides, 2020. “Medical Biomonitoring” and “Frequency and Duration” are from “WHO Human Biomonitoring Guide for Exposure in the Workplace, Vol.1, 1996” and various others including the listed references.

NOTE: Frequency and Duration

1. How the hours worked are calculated.







The hours are based on a 5-day working week (averaging 8 hours per day) and an average of 21 working days a month resulting in approximately 220 working days per year. The hours worked are based on working those hours consistently in those categories to facilitate the ADI to be exceeded, only then the exposure to the pesticide will need to be tested and monitored to ensure human health is protected.









2. Before and after spraying.



Before spraying means when the spray operator is new to the spray programme and before they apply the first pesticide for any CH, they need to be tested to calculate a baseline of what pesticide load already exists in their body. These results need to be kept on file to compare any future results to. If the spray operator works for multiple CH's, they need to keep their biomonitoring file with them so that they can notify each CH that they have been tested. They need to keep track of their hours sprayed and notify and








relevant CH of the hours they have already sprayed. They do not need to get initial testing at the CH, only the first CH. Once they get to the next threshold where they need to be tested, they need to notify the relevant CH that they need to be tested prior to starting the spray programme at the relevant CH. For example, they are spraying an organophosphate and they are reaching 115 hours in one month, they will need to go for an additional test.








After spraying means once the spray operator has decided that they no longer want to be active in any spray operations (they retire, change job categories or work opportunities) they need to be tested so that their closing pesticide load is measured. These records/tests need to be kept on file for 5-10 years.







Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References	
Organochlorines/ chlorinated hydrocarbons (DDT, Endosulfan, Atrazine, Vinclozolin, TBT, Aldrin, Chlordane, Endrin, Heptachlor, Chlordecone, Lindane, Toxaphene, Hexachlorobenzene, Mirex)	1	<p><u>Relevant International Agreements or Conventions</u></p> <p>GHS06 DANGER</p>  <p>H300, H301 H310, H311, H330, H331,</p> <p>GHS05 DANGER</p>	<p>1. Butyl rubber gloves</p>  <p>2. Type 3 protective clothing (liquid tight)</p>  <p>Type 4 protective clothing (spray tight)</p> 	 	<p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 14605:2005</p>	<p>Whole blood tests 1cc blood anti-coagulated in sodium heparin (refrigerated)</p> <p>Analyse with Comet Assay</p>	<p>Organochlorines, CHC's & PICS: Using whole blood</p> <p>1. Before the beginning of the spraying for all groups a blood sample needs to be taken :</p> <p>a. If the worker sprays less than 40 hours per month – additional testing not necessary</p>	<p>Yusa <i>et al.</i>, 2015 (https://dx.doi.org/10.1016/j.aca.2015.05.032)</p> <p>Sannolo <i>et al.</i>, 1999 (https://doi.org/10.1002/(SICI)1096-9888(199910)34:10%3c1028::AID-JMS861%3e3.0.CO;2-H)</p>





Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
PICS (Annexure III) (2,4,5-T, Aldrin, Benomyl, Binapacryl, Captafol, Carbofuran, Chlordane, Chlorobenzilate, DDT, Dieldrin, Dinoseb, DNOC, DNOC ammonium salt, DNOC potassium salt, DNOC sodium salt, Ethylene dibromide, Ethylene dichloride, Ethylene oxide, Fluoroacetamide, Heptachlor, Hexachlorobenz	1	 H290, H314, H318 GHS07 WARNING  Ozone depleting H420	Type 5 protective clothing (airborne particles)   Type 6 protective clothing (chemical splash)   3. Safety boots  4. Full face respirators 	BS EN ISO 13982:2004 EN 13034 EN 345:1993 EN ISO 20345 EN 136 EN 141:2000	Or use field-based test kit Hair test 50-200mg hair sample, cleaned and frozen Analyse with GC-LS	b. If the worker sprays between 40 and 115 hours per month (1h/d) – additional testing not necessary c. If the worker sprays between 115 and 575 hours per month (5h/d) then additional testing is required once per year d. If the worker sprays between 575 and 920 hours per month (8h/d) then additional testing is required every 3-6 months 2. All workers active in the spraying programme need test	Doganlar <i>et al.</i> , 2018 (https://doi.org/10.1007/s00244-018-0545-7) WHO, 1996. Biological monitoring of chemical exposure in the workplace. Guidelines, volume 1, Chapter 5.1. https://apps.who.int/iris/bitstream/handle/10665/41856/WHO_HPR_OCH_96.1.pdf?sequence=1&isAllowed=y WHO, 2012. <i>Biomonitoring-based indicators of exposure to chemical pollutants.</i> Pg 20, 22,









Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
ene, Hexachlorocyclohexane, Lindane, Mercury, Methamidophos, Monocrotophos, Paraquat dichloride, Parathion-methyl, PCP, Phosphamidon, Thiram, Toxaphene, Z-Phosphamidon)			Full face respirators for vapours and gases. 5. Particulate air filters for respirators. 6. Apron	 P95, P99, P100 EN 467:1995	NOTE: These are the least expensive/most accessible options.	once they leave the spray programme or are no longer active in the spray programme Methyl bromide: 1.Hair sample to be taken before spraying commences- before the worker is active in the spray programme 2.Hair sample to be taken when the worker leaves or is no longer active in the spray programme	
Methyl bromide	1						
Bupyrindyls (Paraquat, Paraquat dibromide,	2	<u>Acute toxicity to mammals and birds</u> GHS06 DANGER	1.Chemically resistant nitrile gloves 2.Type 3 and type 4	 EN 374:2016	Urine tests 5cc fresh urine sample, refrigerated. Tested using ELIZA test. –	Urine tests: 1.Before the spraying a urine test needs to be taken for all groups:	Yusa <i>et al.</i> , 2015 (https://dx.doi.org/10.1016/j.aca.2015.05.032)



Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
Diquat, Diquat dibromide)		 <p>H330, H301 H310, H311 H330, H331</p> <p>GHS07 WARNING</p>  <p>H302, H312 H332, H315 H317, H319</p> <p>GHS05 DANGER</p>  <p>H314, H318</p>	<p>protective clothing</p>   <p>3.Safety boots</p>  <p>4.Face and Eye protection (safety goggles)</p>  <p>5.Half face respirators</p> <p>6.Particulate air filters for respirators</p>	<p>EN14605:2005</p> <p>EN 345:1993 N ISO 20345</p> <p>EN 166: 2001 EN 140, EN 149 EN 143: 2000</p> <p>R95, R99, R100</p>	<p>dipstick test (field-tests available)</p> <p>AChE tests (done on urine) Test done as indicated with unit - mobile field unit- AChE check Control unit from Securetec : www.securetec.net</p> <p>Testmate-400</p>	<p>a. If the worker sprays less than 40 hours per month – an additional test is not necessary</p> <p>b. If the worker sprays between 40 and 115 hours per month (1h/d) – an additional test is not necessary</p> <p>c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional test is not necessary</p> <p>d. If a worker sprays between 575 and 920 hours per month (8h/d) – an additional</p>	<p>WHO, 1996. Biological monitoring of chemical exposure in the workplace. Guidelines, volume 1, Chapter 5.1. https://apps.who.int/iris/bitstream/handle/10665/41856/WHO_HPR_OCH_96.1.pdf?sequence=1&isAllowed=y</p> <p>WHO, 2012. Biomonitoring-based indicators of exposure to chemical pollutants. Pg 20, 22.</p>








Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
			7. Apron 	EN 467: 1995	NOTE: These are the least expensive/most accessible options.	test is needed once a year 2. All workers active in the spraying programme need test once they leave the spray programme or are	
Neonicotinoids (Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Desmethyl acetamiprid, Nitenpyram, Thiacloprid, Thiamethoxam)	2	<u>Acute toxicity to mammals and birds</u> GHS05 DANGER  H314, H318 GHS06 DANGER  H300, H301	1. Neoprene glove  2. Type 3 & Type 4 protective clothing   Type 5 protective clothing 	EN 374:2016 EN14605:2005 BS EN ISO 13982: 2004	Urine tests 5cc fresh urine sample refrigerated. Tested in laboratory using Nexera liquid chromatography system coupled with Triple Quad	Urine tests: 1. Before the spraying a urine test needs to be taken for all groups: a. If the worker sprays less than 40 hours per month – an additional test is not necessary b. If the worker sprays between 40 and 115	Calderon-Segura et al., 2011. (https://dx.doi.org/10.1155/2012/612647) Yusa et al., 2015 (https://dx.doi.org/10.1016/j.aca.2015.05.032) Vikkey et al., 2017 (http://doi.org/10.1177/11778630217704659)




Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		H310,H311 H330, H331	3.Safety boots				
	4	GHS07 WARNING  H302, H312 H332, H315 H317, H319 <u>Mutagenicity to mammals</u>	4.Face & eye protection	  EN 345:1993 EN ISO 20345	6500 mass spectrometer	hours per month (1h/d) – an additional test is not necessary	Jakubowski 2012 (https://dx.doi.org/10.1039/c1em10706b)
	8	GHS08 DANGER  H340, H341 <u>Persistence in soil/water and</u>	5.Half respirator 6.Particulate filters for respirators 7.Apron	  EN 166:2001 EN 140 EN149 EN143: 2000 R95, R99, R100 EN 467: 1995		c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional test is not necessary d. If a worker sprays between 575 and 920 hours per month (8h/d) – an additional test is needed once a year 2. All workers active in the spraying programme need test once they leave the spray programme or are	Harada <i>et al.</i> , 2016. (https://dx.doi.org/10.1371/journal.pone.0146335) WHO, 1996. Biological monitoring of chemical exposure in the workplace. Guidelines, volume 1, Chapter 5.1. https://apps.who.int/iris/bitstream/handle/10665/41856/WHO_HPR_OCH_96.1.pdf?sequence=1&isAllowed=y WHO, 2012. <u>Biomonitoring-based</u>










Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		<p>soil absorption potential & biomagnification & bioaccumulation</p> <p>GHS09 WARNING</p>  <p>H410, H411 H412, 4413 Environment</p>			<p>NOTE: These are the least expensive/most accessible options.</p>	<p>*if acetamiprid or imidacloprid are used, then testing will be needed for c. as the excretion rate is very slow thus bioaccumulation may occur</p>	<p>indicators of exposure to chemical pollutants. Pg 20, 22.</p>
<p>Pyrethroids (Cyfluthrin, Cypermethrin, Deltamethrin, Permethrin,</p> <p>Phenoxyalkyl acids</p> <p>Amides (Acetachlor, Alachlor, Amicarbazone,</p>	2	<p>Acute toxicity to mammals and birds</p> <p>GHS06 DANGER</p>  <p>H300, H301, H310, H311,</p>	<p>1. Neoprene gloves/chemically resistant gloves</p> <p>2. Type 3 & 4 protective clothing</p>	  <p>EN 374:2016</p> <p>EN 14605:2005</p> <p>EN 345:1993</p> <p>EN ISO 20345</p>	<p>Urine tests</p> <p>5cc fresh urine sample refrigerated. Tested using ELISA test (dipstick test)</p> <p>60cc needed for testing in</p>	<p>Urine tests for Pyrethroids, Phenoxyalkyl acids & amides:</p> <p>1. Before the spraying a urine test needs to be taken for all groups:</p>	<p>Ungerer, Ewers & Wilhelm, 2007 (https://doi.org/10.1016/j.ijheh.2007.01.024)</p> <p>Calafat <i>et al.</i>, 2017 (http://dx.doi.org/10.1016/j.ijheh.2016.10.008)</p>





Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
Asulam, beflubutamid, Butachlor, Chlorthiamid, Diflufenicam, Dimetachlor, Dimethenamid, Etabenzanid, Fentrazamide, Flufenacet, Metazachlor, Metolachlor, Propachlor, Propanid, Tebutam)	3	<p>H330, H331</p> <p>GHS07 WARNING</p>  <p>H302, H312, H332, H315, H317, H319</p> <p>GHS05 DANGER</p>  <p>H314, H318</p> <p><u>Carcinogenicity</u></p> <p>GHS07 WARNING</p> 	 <p>3.Safety boots</p>  <p>4.Face & eye protection (safety goggles)</p>  <p>5.Half-face respirators</p>  <p>6.Particulate air filters for respirators</p>  <p>7.Apron</p>	<p>EN 166:2001</p> <p>EN 140 EN 149</p> <p>EN 143:2000</p> <p>R95, R99, R100</p> <p>EN 467: 1995</p>	<p>children. (dip stick)</p> <p>AChE tests AChE tests done when necessary with Test-Mate model 400 device or field testing with AChE check Control device from Securetec obtainable from www.securetec.net</p>	<p>a.If the worker sprays less than 40 hours per month – an additional test is not necessary</p> <p>b. If the worker sprays between 40 and 115 hours per month (1h/d) – an additional test is not necessary</p> <p>c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional test is needed every 2 years</p> <p>d. If a worker sprays between 575 and 920 hours per month (8h/d) – an additional</p>	<p>Yusa <i>et al.</i>, 2015 (https://dx.doi.org/10.1016/j.aca.2015.05.032)</p> <p>Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003)</p> <p>CDC National Biomonitoring Programme https://www.cdc.gov/biomonitoring/Cyfluthrin_Cypermethrin_Permethrin_BiomonitoringSummary.html#</p> <p>Leng <i>et al.</i>, 1997. (PII S0048-9697(97)05493-4)</p>



Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
	4	H335, H336 GHS08 DANGER  H334, H350 H350i, H350I <u>Mutagenicity to humans</u>			NOTE: These are the least expensive/most accessible options.	test is needed once a year 2. All workers active in the spraying programme need to be tested once they leave the spray programme or are no longer active in the spraying programme	
	6	GHS08 DANGER  H340, H341 <u>Endocrine Disrupting Chemicals (EDC)</u> GHS08 DANGER					




Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References	
		 H370, H371 H372, H373			NOTE: These are the least expensive/most accessible options.			
Carbamates 1.Thiocarbamates	3 7	Carcinogenicity GHS07 WARNING  H335, H336 GHS08 DANGER  H334, H350 H350i, H350I Acute toxicity to aquatic organisms	1.Neoprene gloves/chemically resistant gloves 2.Type 3 & 4 protective clothing 3.Safety boots	   	EN 374:2016 EN 14605:2005 EN 345:1993 EN ISO 20345 EN 166:2001 EN 140 EN 149	Urine tests 5cc fresh urine sample refrigerated. Tested using ELISA test – dipstick test 60cc needed for testing in children. (dip stick) AChE tests AChE tests done when needed with Test-Mate model 400 device or	Urine tests for Carbamates: 1.Before the spraying a urine test needs to be taken for all groups: a.If the worker sprays less than 40 hours per month – an additional test is not necessary b. If the worker sprays between 40 and 115 hours per month (1h/d) – an additional test is not necessary	Calderon-Segura et al., 2011. (https://dx.doi.org/10.1155/2012/612647) Ungerer, Ewers & Wilhelm, 2007 (https://doi.org/10.1016/j.ijheh.2007.01.024) Calafat et al., 2017 (http://dx.doi.org/10.1016/j.ijheh.2016.10.008) Yusa et al., 2015 (https://dx.doi.org/10.1016/j.aca.2015.05.032)













Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		GHS09 WARNING  H400 Environment	4.Face & eye protection (safety goggles) 5.Half-face respirators 6.Particulate air filters for respirators 7.Apron	 	EN 143:2000 R95, R99, R100 EN 467: 1995	field testing with AChE check Control device from Securetec obtainable from www.securetec.net c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional test is needed every year d. If a worker sprays between 575 and 920 hours per month (8h/d) – an additional test is needed every 3-6 months 2. All workers active in the spraying programme need to be tested once they leave the spray programme or are no longer active in the spraying programme	Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003) Vikkey et al., 2017 (http://doi.org/10.1177/11778630217704659) WHO, 1996. Biological monitoring of chemical exposure in the workplace. Guidelines, volume 1, Chapter 5.1. https://apps.who.int/iris/bitstream/handle/10665/41856/WHO_HPR_OCH_96.1.pdf?sequence=1&isAllowed=y




Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
Organophosphates	2	<p><u>Acute toxicity to mammals and birds</u></p> <p>GHS05 DANGER</p>  <p>H314, H318</p> <p>GHS06 DANGER</p>  <p>H300, H301 H310, H311 H330, H331</p> <p>GHS07 WARNING</p> 	<p>1. Neoprene gloves / chemically resistant nitrile gloves</p>  <p>2. Type 3 & Type 4 protective clothing</p>   <p>Type 5 protective clothing</p>  <p>3. Safety boots</p>  <p>4. Face & eye protection</p> 	<p>EN 374:2016</p> <p>EN 14605: 2005 EN 345:1993</p> <p>EN ISO 20345</p> <p>EN 166:2001</p> <p>EN 140 EN 149</p>	<p>NOTE: These are the least expensive/most accessible options.</p> <p>Urine tests 5cc fresh urine sample refrigerated. Tested using ELISA test. – dipstick test</p> <p>60cc needed for testing in children. (dip stick)</p> <p>AChE tests for blood samples AChE tests done when necessary with Test-Mate model 400 device or field testing with AChE</p>	<p>Urine tests for Organophosphates:</p> <p>1. Before the spraying a urine test needs to be taken for all groups:</p> <p>a. If the worker sprays less than 40 hours per month – an additional test is not necessary</p> <p>b. If the worker sprays between 40 and 115 hours per month (1h/d) – an additional test is not necessary</p> <p>c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional</p>	<p>Yusa <i>et al.</i>, 2015 (https://dx.doi.org/10.1016/j.aca.2015.05.032)</p> <p>Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003)</p> <p>Ungerer, Ewers & Wilhelm, 2007 (https://doi.org/10.1016/j.ijheh.2007.01.024)</p> <p>Doganlar <i>et al.</i>, 2018 (https://doi.org/10.1007/s00244-018-0545-7)</p>





Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
	3	H302, H312 H332, H315 H317, H319 <u>Carcinogenicity</u> GHS07 WARNING  H335, H336 GHS08 DANGER  H334, H350, H350i, H350I <u>Mutagenicity to mammals</u> GHS08 DANGER	5. Half respirator 6. Particulate filters for respirators 7. Apron	  EN 143:2000 R95, R99, R100 EN 467: 1995	check Control device from Securetec obtainable from www.securetec.net	test is needed every year d. If a worker sprays between 575 and 920 hours per month (8h/d) – an additional test is needed every 3-6 months 2. All workers active in the spraying programme need to be tested once they leave the spray programme or are no longer active in the spraying programme	Calafat <i>et al.</i> , 2017 (http://dx.doi.org/10.1016/j.ijheh.2016.10.008) (https://doi.org/10.116/j.ijheh.2016.10.008) Calderon-Segura <i>et al.</i> , 2011. (https://dx.doi.org/10.1155/2012/612647) Vikkey <i>et al.</i> , 2017 (http://doi.org/10.1177/11778630217704659) WHO, 1996. Biological monitoring of chemical exposure in the workplace.
	4						











Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)		Classification	Medical Biomonitoring*	Frequency and Duration	References
	5	 <p>H340,H341</p> <p><u>Developmental and Reproductive toxicity</u></p> <p><u>GHS08 DANGER</u></p>				<p>NOTE: These are the least expensive/most accessible options.</p>		<p>Guidelines, volume 1, Chapter 5.1. https://apps.who.int/iris/bitstream/handle/10665/41856/WHO_HPR_OCH_96.1.pdf?sequence=1&isAllowed=y</p>
	6	 <p>H360, H360F H360D, H360FD H361, H361f, H361d, H361fd H362</p> <p><u>Endocrine Disrupting Chemicals (EDC)</u></p>						





Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)		Classification	Medical Biomonitoring*	Frequency and Duration	References
	7	GHS08 DANGER  H370, H371 H372, H373 <u>Acute toxicity to aquatic organisms</u> GHS09 WARNING  H400 Environment				NOTE: These are the least expensive/most accessible options.		
Carbamates 2.Dithiocarbamates	2	<u>Acute toxicity to mammals and birds</u> GHS05 DANGER	1.Neoprene gloves / chemically resistant nitrile gloves		EN 374:2016	Urine tests 5cc fresh urine sample refrigerated. Tested using	Urine tests for carbamates: 1.Before the spraying a urine test needs to	Yusa <i>et al.</i> , 2015 https://dx.doi.org/10.1016/j.aca.2015.05.032






Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
	5	 H314, H318 GHS06 DANGER  H300, H301 H310, H311 H330, H331 GHS07 WARNING  H302, H312 H332, H315 H317, H319	2.Type 3 & Type 4 protective clothing  Type 5 protective clothing  3.Safety boots  4.Face & eye protection 	 EN 14605: 2005 EN 345:1993  EN ISO 20345  EN 166:2001  EN 140 EN 149  EN 143:2000	ELISA test. – dipstick test 60cc needed for testing in children. (dip stick) AChE tests AChE tests done when necessary with Test-Mate model 400 device or field testing with AChE check Control device from Securetec obtainable from	be taken for all groups: a.If the worker sprays less than 40 hours per month – an additional test is not necessary b. If the worker sprays between 40 and 115 hours per month (1h/d) – an additional test is not necessary c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional test is needed every year d. If a worker sprays between 575 and 920	Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003) Ungerer, Ewers & Wilhelm, 2007 (https://doi.org/10.1016/j.ijheh.2007.01.024) Doganlar et al., 2018 (https://doi.org/10.1007/s00244-018-0545-7) Calafat et al., 2017 (http://dx.doi.org/10.1016/j.ijheh.2016.10.008)





Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
					<p>NOTE: These are the least expensive/most accessible options.</p>		
	6	<p><u>Developmental and Reproductive toxicity</u></p> <p>GHS08 DANGER</p>  <p>H360, H360F H360D, H360FD H361, H361f, H361d, H361d H362</p> <p><u>Endocrine Disrupting Chemicals (EDC)</u></p> <p>GHS08 DANGER</p>	<p>5. Half respirator</p> <p>6. Particulate filters for respirators</p> <p>7. Apron</p>	 <p>R95, R99, R100</p> <p>EN 467: 1995</p>	<p>www.securetec.net</p>	<p>hours per month (8h/d) – an additional test is needed every 3-6 months</p> <p>2. All workers active in the spraying programme need to be tested once they leave the spray programme or are no longer active in the spraying programme</p>	<p>Calderon-Segura et al., 2011. (https://dx.doi.org/10.1155/2012/612647)</p> <p>Vikkey et al., 2017 (http://doi.org/10.1177/11778630217704659)</p> <p>WHO, 1996. Biological monitoring of chemical exposure in the workplace. Guidelines, volume 1, Chapter 5.1. https://apps.who.int/iris/bitstream/handle/10665/41856/WHO_HPR_OCH_96.1.pdf?sequence=1&isAllowed=y</p>
	7						



Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		H370, H371 H372, H373 <u>Acute toxicity to aquatic organisms</u> GHS09 WARNING  H400 Environment			NOTE: These are the least expensive/most accessible options.		
Di-nitro anilines (Benfluralin, Butralin, Chlornidine, Dipropalin, Ethalfluralin, Fluchloralin, Isopropalin, Methalpropalin,	3	<u>Carcinogenicity</u> GHS07 WARNING  H335, H336	1. Neoprene gloves / chemically resistant nitrile gloves 2. Type 3 & Type 4	  EN 374:2016 EN 14605:2005 EN 345:1993	Urine tests 5cc fresh urine sample refrigerated. ELIZA dipstick test 60cc needed for testing in	Urine tests for Di-nitro anilines: 1. Before the spraying a urine test needs to be taken for all groups:	Ungerer, Ewers & Wilhelm, 2007 https://doi.org/10.1016/j.ijheh.2007.01.024 Doganlar et al., 2018

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References	
Nitralin, Oryzalin, Pendimethalin, Profluralin, Trifluralin)	6	GHS08 DANGER  H334, H350 H350i, H350I <u>Endocrine Disrupting Chemicals (EDC)</u>	protective clothing   Type 5 protective clothing 	 	EN ISO 20345 EN 166:2001	children. (dip stick) AChE tests AChE tests done when necessary with Test-Mate model 400 device or field testing with AChE check Control device from Securetec obtainable from www.securetec.net	a.If the worker sprays less than 40 hours per month – an additional test is not necessary b. If the worker sprays between 40 and 115 hours per month (1h/d) – an additional test is not necessary c. If a worker sprays between 115 and 575 hours per month (5h/d) an additional test is needed every 2 years d. If a worker sprays between 575 and 920 hours per month (8h/d) – an additional	https://doi.org/10.1007/s00244-018-0545-7 Calafat <i>et al.</i> , 2017 (http://dx.doi.org/10.1016/j.ijheh.2016.10.008) Calderon-Segura <i>et al.</i> , 2011. (https://dx.doi.org/10.1155/2012/612647) Vikkey <i>et al.</i> , 2017 (http://doi.org/10.1177/11778630217704659) Yusa <i>et al.</i> , 2015
	8	GHS08 DANGER  H370, H371 H372, H373 <u>Persistence in soil/water and soil absorption potential &</u>	3.Safety boots  4.Face & eye protection  5.Half respirator 	EN 140 EN 149 EN 143:2000 R95, R99, R100				







Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		<u>biomagnification & bioaccumulation</u> GHS09 WARNING  H410, H411 H412, 4413 Environment	6.Particulate filters for respirators  7.Apron	EN 467: 1995	NOTE: These are the least expensive/most accessible options.	test is needed once a year 2. All workers active in the spraying programme need to be tested once they leave the spray programme or are no longer active in the spraying programme	https://dx.doi.org/10.1016/j.aca.2015.05.032 Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003) Ungerer, Ewers & Wilhelm, 2007 (https://doi.org/10.1016/j.ijheh.2007.01.024)
Glycines (Glyphosate)	3	<u>Carcinogenicity</u> GHS07 WARNING 	1.Neoprene gloves / chemically resistant nitrile gloves 	EN 374:2016	Whole blood tests 1cc blood anti-coagulated in sodium	1.Before the beginning of the spraying for all groups a blood sample needs to be taken :	CDC National Biomonitoring Programme (https://www.cdc.gov/biomonitoring/biomo)

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		H335, H336 GHS08 DANGER  H334, H350 H350i, H350I	2.Type 3 & Type 4 protective clothing  3.Safety boots  4.Face & eye protection  5.FPP3 masks 6.Apron 	EN 14605: 2005 EN 345:1993 EN 166:2001 EN 140 EN 149 EN 149:2001 EN 467: 1995	hepalin (refrigerated) Analyse with Comet Assay Or use field-based test kit	a. If the worker sprays less than 40 hours per month – additional testing not necessary b. If the worker sprays between 40 and 115 hours per month (1h/d) – additional testing not necessary c. If the worker sprays between 115 and 575 hours per month (5h/d) then additional testing not necessary d. If the worker sprays between 575 and 920 hours per month (8h/d) then additional testing is required every year	nitroing_summaries_3.html

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
					<p>NOTE: These are the least expensive/most accessible options.</p>		
						2. All workers active in the spraying programme need test once they leave the spray programme or are no longer active in the spray programme	
Dioxins	9	<p><u>Dioxins (residues/emissions)</u></p> <p>GHS06 DANGER</p>  <p>H300, H301, H310, H311 H330, H331</p> <p>GHS08 DANGER</p>	<p>1. Butyl rubber gloves</p> <p>2. Type 3 & Type 4 protective clothing</p>   <p>Type 5 protective clothing</p> 	<p>EN 374:2016</p> <p>EN 14605: 2005</p> <p>BS EN ISO 13982: 2004</p>	<p>Hair tests 50-200g cleaned, dried and frozen. Tests done once off.</p> <p>Whole blood tests 1cc anti-coagulated in sodium heparin</p>	<p>Hair tests for Dioxins:</p> <p>1. Hair sample to be taken before spraying commences- before the worker is active in the spray programme</p> <p>2. Hair sample to be taken when the worker leaves or is no longer active in the spray programme</p>	<p>Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003)</p> <p>Ungerer, Ewers & Wilhelm, 2007 (https://doi.org/10.1016/j.ijheh.2007.01.024)</p>

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)		Classification	Medical Biomonitoring*	Frequency and Duration	References
		 H304, H334, H370, H371, H372, H373 GHS09 WARNING  H400, H410, H411, H412, H413 Environment	3.Safety boots 4.Full face respirators for gases and vapours 5.Particulate filters for respirators 6.Apron		EN 345:1993 EN ISO 20345 EN 136 EN 141:2000 P95, P99, P100 EN 467: 1995	(refrigerated) . Analysed by Comet assay.	Blood tests for Dioxins: 1.Before the beginning of the spraying for all groups a blood sample needs to be taken : a. If the worker sprays less than 40 hours per month – additional testing not necessary b. If the worker sprays between 40 and 115 hours per month (1h/d) – additional testing not necessary c. If the worker sprays between 115 and 575 hours per month	CDC National Biomonitoring Programme https://www.cdc.gov/biomonitoring/biomonitoring_summaries_3.html

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
					<p>NOTE: These are the least expensive/most accessible options.</p>		
						<p>(5h/d) then additional testing is required once per year</p> <p>d. If the worker sprays between 575 and 920 hours per month (8h/d) then additional testing is required every 3-6 months</p> <p>2. All workers active in the spraying programme need test once they leave the spray programme or are no longer active in the spray programme</p>	
Heavy metals	10	<p><u>Heavy Metals</u></p> <p>GHS06 DANGER</p>	<p>1. Butyl rubber gloves</p> <p>2. Type 3 & Type 4</p>	<p>EN 374:2016</p> <p>EN 14605:2005</p>	<p>Hair tests 50-200g cleaned, dried and frozen. Tests</p>	<p>Hair tests for Heavy metals:</p> <p>1. Hair sample to be taken before spraying</p>	<p>Esteban & Castano, 2009 (https://doi.org/10.1016/j.envint.2008.09.003)</p>

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
		 H300, H310, H330, H331 GHS08 DANGER  H304, H334, H340, H341, H350, H351, H360, H361, H362, H370, H371, H372 GHS09 WARNING 	protective clothing   Type 5 protective clothing  3.Safety boots 4.Full face respirators for gases and vapours 5.Particulate filters for respirators		done once off. Urine tests 5cc fresh urine sample refrigerated. Regularly taken. Tested using ELISA test. 60cc needed for testing in children. (dip stick) Regularly taken. BS EN ISO 13982: 2004 EN 345:1993 EN ISO 20345 EN 136 EN 141:2000 P95, P99, P100 EN 467: 1995	commences- before the worker is active in the spray programme 2.Hair sample to be taken when the worker leaves or is no longer active in the spray programme Blood tests for heavy metals: 1.Before the beginning of the spraying for all groups a blood sample needs to be taken : a. If the worker sprays less than 40 hours per month – additional testing not necessary	CDC National Biomonitoring Programme https://www.cdc.gov/biomonitoring/biomonitoring_summaries_3.html

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)		Classification	Medical Biomonitoring*	Frequency and Duration	References
		H400, H410, H411, H412, H413 Environment	6. Apron			<p>NOTE: These are the least expensive/most accessible options.</p>	<p>b. If the worker sprays between 40 and 115 hours per month (1h/d) – additional testing not necessary</p> <p>c. If the worker sprays between 115 and 575 hours per month (5h/d) then additional testing is required once per year</p> <p>d. If the worker sprays between 575 and 920 hours per month (8h/d) then additional testing is required every 3-6 months</p> <p>2. All workers active in the spraying programme need test</p>	

Sub-set of Chemicals in Hazard Group	Hazard Group	Hazard Criterion	Personal Protective Equipment (PPE)	Classification	Medical Biomonitoring*	Frequency and Duration	References
					NOTE: These are the least expensive/most accessible options.	once they leave the spray programme or are no longer active in the spray programme	

Ecological monitoring methods for the assessment of pesticides impacts in the tropics. handbook (Grant and Tingle, DFID, CTA, NRI, 2002). Chapters 5-13.

EU commission regulation number 546/2011: Implementing regulation EC No 1107/2009 of the European Parliament and of the Council as regards uniform principles of evaluation and authorization of plant protection products. 2011.

POPS – Heptachlor, Aldrin, Dieldrin, DDT, Endrin, Chlordane, Toxaphene, Hexachlorobenzene, Mirex.

PICS – 2,4,5-T, Aldrin, Benomyl, Binapacryl, Captafol, Carbofuran, Chlordane, Chlorobenzilate, DDT, Dieldrin, Dinoseb, DNOC, DNOC ammonium salt, DNOC potassium salt, DNOC sodium salt, Ethylene dibromide, Ethylene dichloride, Ethylene oxide, Fluoroacetamide, Heptachlor, Hexachlorobenzene, Hexachlorocyclohexane, Lindane, Mercury, Methamidaphos, Monocrotophos, Paraquat dichloride, Parathion-methyl, PCP, Phosphamidon, Thiram, Toxaphene, Z-Phosphamidon

1. Dimethylphosphate (DMP), Diethylphosphate (DEP), O,O-dimethylphosphorothiate (DMPT), O,O-diethylphosphorothiate (DEPT), O,O-dimethylphosphorodithioate (DMPDT) and O,O-diethylphosphorodithioate (DEPDT).

Environmental monitoring: https://www.who.int/water_sanitation_health/resourcesquality/wqmchap11.pdf?ua=1