Synopsis report:

Public consultation on the first draft of the international generic indicators for the use and risk management of highly hazardous pesticides

This document contains an analysis of the range of stakeholder groups that submitted comments, as well as a summary of the issues raised, a general response to the comments, and a response on how they were addressed.

Contents

1. Consultation background

The consultation on the 1st draft of the the international generic indicators for the use and risk management of highly hazardous pesticides took place between the 01 February and the 30 April 2020. The deadline of the public consultation on the first draft of the standard FSC International Generic Indicators for the use of Highly Hazardous Pesticides had been extended to 30 April 2020, to address requests received from stakeholders, undergoing difficult circumstances to give their feedbacks within the deadline due to the COVID 19 outbreak.

The draft and the supportive documents, the information about the development process and the consultation were uploaded to the FSC Consultation Platform (https://consultation-platform.fsc.org/) together with a questionnaire. All materials were available in English and Spanish.

The consultation was announced on the FSC website, newsletters, and circulated to certification bodies, FSC membership, consultative forum, standard development groups.

Stakeholders were asked to provide their feedback on the draft overall, including their views on the proposed approach and the associated implementation procedure, as well as for their suggestions on how to improve specific elements of the standard.

During the consultation period, the FSC Forest Management Programme and the Technical Working Group (TWG) conducted three webinars in English for different time zones to present the draft 1-0, to respond to questions and to collect feedback.

The process was paused from 01 May 2020 to 31 July 2020 due to COVID 19 outbreak. The project team re-started the process on 01 August 2020. The TWG analyzed the comments received in the FSC consultation platform, webinars, and via email and identified the core topics to be discussed in the development of the second draft.

During the TWG virtual meetings held in October, November, and December, the TWG members assessed once more the feedback received and agreed on the responses to the comments and on how to incorporate them to the draft standard.

The FSC Forest Programme and the TWG appreciate the high participation and the feedback received.

2. Range of stakeholder consultation participants

A total of 247 stakeholders from 33 countries provided comments through the consultation platform. The respondents identified themselves in the following ranges:

- **Certificate holder (CH)**: 34 %
- **FSC member:** 41 %

The FSC members represented the following chambers:

Economic chamber		**Environmental chamber**		**Social chamber**		**Did not reply**
South	North	South	North	South	North	22%
70%	20%	5%	0%	3%	3.8%	

- **Government:** 2%
- **FSC Network Partner staff**: 7.6%
- **Certification body/auditor (CB)**: 1.6%
- **Standard developer:** 3.2%

The total respondents represented the following interests:

Economic	**Environmental**	**Social**	**Did not reply**
70%	17%	5.2%	7.2%

3. Summary of the general comments and TWG solution by topics

3.1 Terminology and definition

3.1.1 Are the definitions clear?

In total 213 out of 247 participants answered. General quantitative results are below:

Yes	No
164	49

3.1.2 If you have selected 'No', which definitions do you think should be clarified and what is your suggestion?

Stakeholder/Membership main feedback	TWG solution
Critical population density	
Better clarify 'critical population density'. Suggested definition: 'acceptable maximum density or threshold for a pest population beyond which the achievement of silvicultural objectives is threatened'	Please see edited definition of critical population density in the draft 2-0. Allee effect definition and critical population density definition has been combined.
Persistent	
It would be useful to know how long the prolonged period is and please clarify further than a dictionary definition	Please see edited definition in the draft 2-0. World Health Organization (WHO) definition of "persistent" has been added, which provide more information than dictionary definition.
Over exposure	
Redundant words in 'over exposure' & please add example text: over-exposure occurs when the time or quantity limits of exposures that is listed in relevant documents (e.g. GHS), is exceeded	Further clarification of the word 'over exposure' from WHO has been added. Please see edited definition of over exposure in the draft 2-0.
Allee effect	
Should not be included, allee effect is only used in the definition of critical population density, which is only used in the context of IPM indicators.	Allee effect definition has been added to critical population density definition.
Secondary or latent impact	
1) Are the application the workers: If is that true I think the word "Workers"	1) This applies not only to workers but to everyone seriously exposed, as the secondary (excessive

Should be included in this definition. 2) replace the word "dormant" with a clearer word	exposure) and latent effects (after a long period/chronic) are relevant to all. 2) TWG considered the comment and agreed to change 'Secondary or latent impact' to 'Secondary or latent health impact' which can better explain the word 'dormant' as some of the mutatoxic and EDC's impacts are not seen or felt immediately but only years later.
Period of re-entry	
1) similar to the definition of exclusion zone. Exclusion zone should be an area where no pesticides are allowed 2) adding "following application of a pesticide" would reduce any ambiguity to this definition for a lay reader. 3) should refer to an 'unacceptable' risk of contamination	There seems to be a confusion with the different terms. We have now further clarified the definitions of 'exclusion zone' and '"Buffer zone'.
Intervention threshold	
This definition should mention non-chemical methods intervention, and not only chemical interventions	Comment taken. Please see edited definition in the draft 2-0.
Buffer zone	
1) Give specify ranges, units how big, distance, area, radius around. 2) Should probably refer to social values, not cultural values.	1) TWG discussed the proposal, but it concluded these thresholds are better suited to the national indicators. 2) TWG discussed the proposal but agreed to keep both social & cultural values.
Trigger value	
Trigger value definition is too complicated.	TWG has made the definition more user friendly. Please see the edited definition in the draft 2-0.
Sublethal effects	
Sublethal needs a clearer definition	TWG has revised the definition for sublethal. Please see the edited definition in the draft 2-0.

3.1.3 Are there other terms that need to be defined to provide clarity or coherence to the Policy?

Stakeholder/Membership main feedback	TWG solution
What is 'non target species'?	Definition is provided
Add full glossary of terms used included in the	Comment taken. TWG has cross-checked and added glossary from pesticides policy.

pesticide policy documents themselves	
Biomonitoring	Definition added. Please see the draft 2-0.
Mitigation measure	This term is not in the draft.
Local community	This is defined in the FSC Principles and Criteria (FSC-STD-01-001).
Riparian management area	Comment taken, included within 'buffer zone' definition.
Intervention threshold: this definition should mention non-chemical methods intervention, and not only chemical interventions	Comment taken. Please see edited definition in the draft 2-0.
Conflict between definitions within FSC documents should probably refer to social values, not cultural values.	Already clear from the main IGI. Social values mentioned once in Principle 7 Annex E.
LD/LC50	Comment taken. Explanatory note has been added in the indicators. 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.

3.2 IGIs for all HHPs

3.2.1 How much do you agree with the prescribed list?

In total 205 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
10	42	23	120	9

3.2.2 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG solution
Allow flexibility in meeting the requirements, particularly for SLIMF. Some relate to the frequency or spatial scale at which record keeping is required. Some suggestions that not all records are relevant in all contexts. There are suggestions that some factors could be assessed at regional or national levels for SLIMF.	TWG has considered the comment and developed an explanatory annex. Please see the Annex 1 *IPM-ESRA flow chart* and Annex 2 *Records of HHP Usage and IPM Implementation* for a further explanation.
Some of the recording requirements are higher level IPM requirements	TWG found recording requirements are necessary, since IPM does not require 'recording' in its process. Therefore, TWG decided to keep it as it is.
Focus on the economic impact of the pest and exclude the economic impact of the HHP. Motivations for using HHPs might be regulatory, rather than economic, in which case an assessment of the economic impact of the pest may not be relevant.	Comment taken. Indicator 1.2, d) is edited now to: "assessment of the economic impact of the pest and/or other justification for interventions"
Point (g) may require some clarification. Is it referring to volume of product or active ingredient? Suggest that volume is not particularly relevant if not associated with an area.	Comment taken. Point (g) revised to: total annual volume of active ingredient used.

Comments relevant to other draft indicators:

Stakeholder/Membership main feedback	TWG solution
Draft indicator 10.7.3 should be reworded 'to determine the optimal outcome based on an effective risk management framework'. 10.7.3 A decision process and rationale are in place for selecting a pest management	Comment taken. The indicator is now reworded to: "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."

method that considers economic viability* and effectiveness to determine the lowest risk option(s).	

3.2.3 How much do you agree that FPIC should be required for potential impacts of HHP application on rights existing on lands outside of the Management Unit?

In total 126 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
14	14	8	44	46

3.2.4 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG solution
Identify situations in which FPIC is not appropriate; for example, in contexts without Indigenous Peoples, other existing controls may be adequate to protect local communities.	This indicator was developed to address the Pesticides Policy engagement requirement (Clause 4.12.10 states that the company shall "Engage with stakeholders in conformance with the requirements in the applicable National Forest Stewardship Standard or Interim National Standard when conducting ESRA." The use of FPIC is secured in other parts of the national standard, particularly under the Principles 3 and 4. It may be confusing to repeat it here. Note: In the Pesticides Derogation procedure, the engagement requirement was formulated as follows (Clause 5.6): The company shall demonstrate that during a minimum 45-day public consultation period, directly affected parties (e.g. the neighboring communities) and other stakeholders (e.g. social and environmental NGOs, environmental departments/authorities, forest/fisheries departments, National FSC Offices, etc.) were given the opportunity to comment on the derogation application and also how their comments have been taken into account. Take into consideration of all the comments that TWG received, below is the new suggested formulation: **(removed)** ~~*1.9 Free, prior and informed consent** is granted by *Indigenous Peoples** and *local communities** prior to HHPs use that affect their rights, resources*, *lands and territories**, wherever:~~ ~~a) it occurs adjacent to these *lands and territories**, (see definition of *local communities**)~~ ~~b) has a *secondary or latent impact**,~~
They already addressed in the ESRA process, or elsewhere in the Principles and Criteria.	
Appropriately used HHPs will not have impacts outside the MU, and that our emphasis should be on appropriate practices.	
Impacts outside the MU must be mitigated, but not through FPIC. Measures such as buffer zones should allow the application of HHPs without FPIC.	
Recommend waiting for the outcomes of the FPIC working group, to avoid duplication or contradiction.	
FPIC is a high level process, and too slow to be used at an operation level where it would prevent timely pesticide application	
concerns about broadening the scope of FPIC beyond the rights of Indigenous Peoples or communities affected by forest management	
suggest that FPIC should be necessary only for delegation of control within the MU, and that affected stakeholders should be engaged/informed, but there is no need to seek their consent.	

The assessment of impacts outside the MU could become subjective. It may be difficult to determine whether an impact is from HHP use in the MU or from another land use. It is important for Indigenous Peoples to have a say, but cautions that certificate holders must have clarity on the FPIC process. Unless the scope of FPIC is more clearly defined, Indigenous Peoples and local communities will have an 'unjustified position of dominance' The draft indicator would bring no benefits but would reduce uptake of FSC certification.	~~c) has the potential for *sublethal effects** and/or chronic effects.~~ **(new suggestion)** **NEW 10.7.3 (Proposed Instructions and IGIs under 10.7)** Affected and interested stakeholders* are informed about the ESRA process and provided with an opportunity for culturally appropriate* engagement*. **NEW 1.3** ESRA(s), site operational plans, and site-specific risk mitigation and monitoring measures for HHPs take account of secondary or latent impacts*, sublethal effects* and/or chronic effects.

3.2.5 In your experience, are there any situations that would warrant the consideration of FPIC outside the MU?

In total 195 out of 247 participants answered. General quantitative results are below:

Yes	No
27	168

3.2.6 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG response
In national contexts, I do not believe that FPIC is relevant. Not aware of situations where FPIC might apply. HHPs should not have impacts outside the MU if national regulations/best practices are followed FPIC is already adequately addressed in the Principles and Criteria It should only be applied within the MU. Those who support the application of FPIC outside the MU cite a variety of potential reasons, including those listed below. • Adjacent communities • Organization controls a large part of a watershed • Indigenous Peoples have local rights • Communities collect NTFPs within the MU • Adjacent conservation/protection areas	Same solution & rationale as above. **(removed)** ~~*1.9 Free, prior and informed consent** is granted by *Indigenous Peoples** and *local communities** prior to HHPs use that affect their rights, resources, *lands and territories**, wherever:~~ ~~a) it occurs adjacent to these *lands and territories**, (see definition of *local communities**)~~ ~~b) has a *secondary or latent impact**,~~ ~~c) has the potential for *sublethal effects** and/or chronic effects.~~ **(new suggestion)** **NEW 10.7.3 (Proposed Instructions and IGIs under 10.7)** Affected and interested stakeholders* are informed about the ESRA process and provided with an opportunity for culturally appropriate* engagement*. **NEW 1.3** ESRA(s), site operational plans, and site-specific risk mitigation and monitoring measures for HHPs take account of secondary or latent impacts*, sublethal effects* and/or chronic effects.

• Seasonal changes and climatic effects • Risk of impacts on HCVs, especially HCVs 4-6 • Impacts of HHPs 'can reach uncontrollable dimensions' • HHPs which have chronic environmental and health risks and are persistent and mobile are used • Risk of impacts on bee-keeping	

3.2.7 Do you agree with addressing IPM and not only the actual use and risk management of the HHPs in this process?

In total 196 out of 247 participants answered. General quantitative results are below:

Yes	No
180	16

3.2.8 If not, where should they be address in the FSC system?

Stakeholder/Membership main feedback	TWG response
Disagree with addressing IPM. It is already adequately addressed elsewhere in the FSC system	TWG does not believe that the fact that IPM is included in national legislation is a reason to exclude it from the HHP IGIs. Nor is the suggestion that IPM resulting in anything other chemical control is already covered by management planning
It should be covered by the FSC IPM guide or, if it is desirable to make specific IPM requirements mandatory, by a revision of the Principles and Criteria and associated IGIs	ESRA is only one tool used in the IPM toolbox. TWG developed an overview flowchart of Overview-IPM-ESRA-IGI for HHP, please see it in Annex 1.

3.2.5 Are the methods for medical biomonitoring suggested for each Hazard Criterion in draft 1 available in your region? (ie. are the required equipments, analytical technology and skills available to conduct the biomonitoring?)

In total 195 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
11	136	48

3.2.6 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG response
Limited availability/accessibility of methods	TWG revised Appendix 1 in the draft 2-0. Please find a further response and guidance from TWG in the Annex 3 *Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion*.
Provide more clarifications	TWG revised Appendix 1 in the draft 2-0. Please find a further response and guidance from TWG in the Annex 3 *Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion*.

3.2.7 Are the methods for medical biomonitoring suggested for each Hazard Criterion in draft 1 feasible in your region? (ie. can the biomonitoring be effectively implemented in the region, or are there significant barriers to implementation such as prohibitive costs, access constraints etc.)

In total 195 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
10	147	38

3.2.8 Please briefly explain your rationale.
Stakeholder/Membership main feedbacks was similar/repeated as the question 3.2.5. Therefore, please refer to 3.2.6.

3.2.9 Are the methods for medical biomonitoring suggested for each Hazard Criterion in draft 1 currently adopted in your region?
In total 194 out of 247 participants answered. General quantitative results are below:

Fully adopted	Partially adopted	I don't know	Not adopted
4	17	37	136

3.2.10 Please briefly explain your rationale

Stakeholder/Membership main feedback	TWG response
Several respondents state that biomonitoring is carried out during the pesticide approval process, rather than when pesticides are in use.	Comment taken. TWG would like to flag that FAO has a biomonitoring guideline for most countries. Please see Annex 4. *Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion (DRAFT)* for further information per country. Please let us know in the second public consultation if such guide is useful. If so, TWG will further develop the draft guide.
Several respondents state that biomonitoring is relevant in a research context, rather than when pesticides are in use.	
Several respondents note the use of biomonitoring in occupational medicine, based on national legislation and/or risk assessment.	

3.3 Hazard Criterion 1

3.3.1 In your experience, are there any emergency situations that warrant the use of an HHP listed under Hazard Criterion1?

In total 192 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
128	25	39

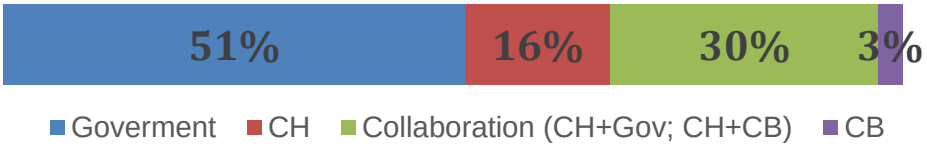
3.3.2 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG response
Emphasizing the importance of emergency mechanisms in FSC system.	TWG understood the importance of emergency mechanisms and found the examples useful.

Some provided examples of the emergency.	

3.3.3 Following a government order for the use of HHPs under Hazard Criterion 1, who do you think should be responsible for monitoring Hazard Criterion 1 HHPs in the environment?

In total 177 out of 247 participants answered, many (more than half) replied government.



3.3.4 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG response
Many respondents believe the government is the main responsible, but CH would be available to help when necessary.	TWG considered the comments in the draft 2-0.
Even agreeing with a partial Government responsibility, CHs should demonstrate a proactive role inside MU for these cases, when economically and technically feasible.	

3.3.5 Is it reasonable to expect certificate holders to engage with government authorities in this way?

In total 193 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
36	143	14

3.3.6 Please briefly explain your rationale.

Stakeholder/Membership main feedback	TWG response
CH should at least inform the Government, who should then consider this in their own risk assessment and if possible. CH should/can offer a support & bring more information about pesticides.	A recommendation is developed to the 20-007 TWG to require CBs to pass information on FSC prohibited HHP use to FSC offices.
Communicate to the government is not effective the request can be viewed negatively by the government.	
We believe that the government already considered the least dangerous/risky option.	

3.3.7 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 1?

In total 188 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	25	115	28	11

3.3.8 Please briefly explain the rationale and provide suggestions for other documents if needed.

Stakeholder/Membership main feedback	TWG response
Many responded that there are too many documents that need to be referred to, need more clarity.	Comment taken. However, to be clear, the reference document list is part of the instruction to SDG, not to CH. TWG developed a guidance table on referenced documents so that it is more user friendly. Please see Annex 5. *Guidance to the most relevant documents for standard developers to guide the development of national indicators for HHP (DRAFT).* Please let us know in the second public consultation if such guide is useful. If so, TWG will further develop the draft guidance.
Some respondents have said they are aware of better documents and that there are National documents (EU pesticide databases/US EPA, UK CoP etc) that are more relevant and maybe the list mentioned should be included as a guide.	TWG considered the comment, please find revised SDG instruction below in red: 'Standard Developers *shall** refer directly to the following documents where relevant to the HHP in question or bring the relevant aspects into National Standards and Interim National Standards. Standard Developers *may** make use of any national interpretations of these documents in laws, regulations, codes of practice, and other governmental guidance.'
Too demanding for smallholders	Comment taken. This will be address and advised in revised *Integrated Pest Management guide -To integrated pest, disease and weed management in FSC certified forests and plantations.*
These documents have been mentioned in the Pesticide Policy so why are we making specific reference to them now?	TWG developed a guidance table on referenced documents so that it is more user friendly. Please see Annex 5. *Guidance to the most relevant documents for standard developers to guide the development of national indicators for HHP (DRAFT).* Several of the documents are not referenced in the Pesticides Policy. TWG agreed to mentioning them again in IGI HHP for validity reason, SDG can use them in specific

	contents, serving a specific purpose. Standard developers need to be thinking about basic health and safety guidance when developing national indicators.

3.3.9 How much do you agree with the indicators for Hazard Criterion 1?

In total 182 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	20	12	52	90

3.3.10 Do you have other comments on the IGIs developed to address Hazard Criterion 1?

Stakeholder/Membership main feedback	TWG response
Biomonitoring requirements are not clear. Need more clarification (eg. frequency of biomonitoring).	Comment taken. Please see added biomonitoring indicator 2.1, c) and revised appendix 1 in the draft 2-0 and the 'NOTE' on frequency and duration. Also, please find a further response and guidance from TWG in the Annex 3 *Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion.*
Textbox is too technical, need more clarification and explanation.	Comment taken. Text boxes are removed in the draft 2-0 and will be provided as a further guidance to biomonitoring. Please see Annex 3 *Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion*.
The proposed techniques are not available in some countries and management use is not feasible.	Comment taken. Please see revised indicator below: Draft 2-0, indicator 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**.
Costs of tests was mentioned and their practicality in developing countries and smallholders. Concerns raised that it will become unaffordable.	Comment taken. TWG is working on a research to identify different scenarios and costs by regions. Appendix 1 in draft 2-0 is revised, the 'medical biomonitoring' column states the least expensive/most accessible options among the FAO recommended methods but that the other methods for a given set of chemicals are equally valid if certificate holder prefer them.
Measures for workers are not same as stakeholders.	Comment taken. TWG do understand the different affect stakeholders vs workers. Please see revised indicator below: Draft 2-0, indicator 2.3:

	Health and safety practices for *workers** and *affected stakeholders** are developed and implemented.
Issues with employee consent to testing (privacy, implementation)	Comment taken. This will be address and advised in revised *Integrated Pest Management guide -To integrated pest, disease and weed management in FSC certified forests and plantations.*
In some situations where we are confident that exposure risk is very low, health monitoring is not warranted – eg. applying occasional rat bait in buildings. The key issue is to avoid exposure through procedures and PPE.	Comment taken. TWG developed a medical biomonitoring guidance triggers summary table. Please see annex 6 *medical biomonitoring guidance triggers summary table*
Compensation mechanism	Compensation mechanism is addressed elsewhere: FSC-STD-60-004 V2-0 *International Generic Indicators* criteria 2.6, FSC-STD-01-001 V5-2 *FSC Principle and Criteria* 4, 4.6.
Who is responsible for the Appendix 1 in the draft 1-0? Need clarification.	Comment taken. TWG developed an explanatory table. Please see annex 7, *General summary of roles and responsibilities regards to appendix 1 in the draft 2-0*.
Many Hazard Criteria indicators are duplicated.	Comment taken. TWG developed a condensed version. Please see annex 8. *Condensed version –FSC-STD-60-004a International generic indicators for the use of highly hazardous pesticides Draft 2-0* and let us know in the 2nd public consultation if you find this version more useful/user friendly than the original version.

3.4 Hazard Criterion 2

3.4.1 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 2?

In total 180 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	24	108	29	11

3.4.2 Please briefly explain the rationale and provide suggestions for other documents if needed.

Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.4.3 How much do you agree with the indicators for Hazard Criterion 2?

In total 179 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	16	13	125	17

3.4.4 Do you have other comments on the IGIs developed to address Hazard Criterion 2?

Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

3.5 Hazard Criterion 3

3.5.1 Although FSC is a voluntary certification system, FSC remains sensitive to negative unintended consequences. Do you have any strong objections to this approach when using known carcinogen(s)?

In total 175 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
105	30	40

3.5.2 Please briefly explain your rationale.

Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

Newly added comment in Hazard Criterion 3 is:

Stakeholder/Membership main feedback	TWG response
At least the use of cholinesterase tests should be stipulated	Comment taken. Use of the cholinesterase tests is stipulated in annex 6 *medical biomonitoring guidance triggers summary table*.

3.5.3 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 3?

In total 171 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	25	99	28	11

3.5.4 Please briefly explain the rationale and provide suggestions for other documents if needed.

Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.5.5 How much do you agree with the indicators for Hazard Criterion 3?

In total 166 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	14	12	38	94

3.5.6 Do you have other comments on the IGIs developed to address Hazard Criterion 3?

Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

3.6 Hazard Criterion 4

3.6.1 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 4?

In total 178 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	24	112	26	9

3.6.2 Please briefly explain the rationale and provide suggestions for other documents if needed.

Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.6.3 How much do you agree with the indicators for Hazard Criterion 4?

In total 176 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	12	12	127	19

3.6.4 Do you have other comments on the IGIs developed to address Hazard Criterion 4?

Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

Newly added comment in Hazard Criterion 4 is:

Stakeholder/Membership main feedback	TWG response
Better justification is needed for pregnant women and children or criterion 4 should be more specific in this topic.	Comment taken. TWG revised draft 2-0, deleting following statement: ~~Women and their offspring are particularly vulnerable to the mutagenic effect of pesticides and need special consideration.~~ Please see revised indicator 5.1, a) below: Health and safety practices for *workers** and *affected stakeholders** are developed and implemented to prevent them from being exposed to Hazard Criterion 1 pesticides.

3.7 Hazard Criterion 5

3.7.1 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 5?

In total 179 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	25	109	27	11

3.7.2 Please briefly explain the rationale and provide suggestions for other documents if needed.
Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.7.3 How much do you agree with the indicators for Hazard Criterion 5?

In total 174 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	12	11	129	16

3.7.4 Do you have other comments on the IGIs developed to address Hazard Criterion 5?
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

Newly added comments in Hazard Criterion 5 are:

Stakeholder/Membership main feedback	TWG response
Indicator 6.2 (*Pregnant women are not exposed to and do not handle HHPs that meets Hazard Criterion 5.)*– could only agree with this indicator if it is in direct control of the organization – inadvertent entry by public disregarding caution signs?	This is already covered under IGI for all HHP, under indicator 1.2
Indicator 6.2 (*Pregnant women are not exposed to and do not handle HHPs that meets Hazard Criterion 5.)* - consider changing to women of childbearing age	Comment taken. TWG revised draft 2-0, deleting following statement: ~~Pregnant women are not exposed to and do not handle HHPs that meets Hazard Criterion 5.~~ Please see revised indicator 6.1 in the draft 2-0.

3.8 Hazard Criterion 6

3.8.1 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 6?

In total 178 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	25	110	26	11

3.8.2 Please briefly explain the rationale and provide suggestions for other documents if needed.

Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.8.3 How much do you agree with the indicators for Hazard Criterion 6?

In total 176 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	11	15	125	18

3.8.4 Do you have other comments on the IGIs developed to address Hazard Criterion 6?
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

3.9 Hazard Criterion 7

3.9.1 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 7?

In total 177 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	24	109	28	11

3.9.2 Please briefly explain the rationale and provide suggestions for other documents if needed.

Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

Newly added comments in Hazard Criterion 7 are:

Stakeholder/Membership main feedback	TWG response
The criterion or the bibliographic source for Table 2 of the hazard criterion 7 was not clearly elaborated.	Comment taken. Please see a NOTE under indicator 7.3 in the draft 2-0. 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.
The objective of including the 'trigger value' is not clear. Trigger Values are not available in the country.	Comment taken. Please find a further response and guidance about trigger value from TWG in the *Annex 3 Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion.* (page 35 of this synopsis report)
Reference documents (below) are not supported as these tools are	Comment taken. TWG agreed to delete those two documents from the reference document list.

developed regionally and may not be appropriate for use globally. • 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.	

3.9.3 How much do you agree with the indicators for Hazard Criterion 7?

In total 175 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	14	11	52	92

3.9.4 Do you have other comments on the IGIs developed to address Hazard Criterion 7?

Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

Newly added comment in Hazard Criterion 7 is:

Stakeholder/Membership main feedback	TWG response
Indicator 8.1 (*The relevant trigger values* are identified (see Textbox 7) to avoid harm to aquatic organisms.*) should state 'to avoid harm to non-target aquatic organisms'. In addition, there are situations where no harm to non-target organisms is not possible as in the treatment of invasive or exotic fishes.	Comment taken. TWG revised indicator 8.1. Please see it below: 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.

3.10 Hazard Criterion 8

3.10.1 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 8?

In total 175 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	26	108	25	11

3.10.2 Please briefly explain the rationale and provide suggestions for other documents if needed.
Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.10.3 How much do you agree with the indicators for Hazard Criterion 8?

In total 177 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
4	15	12	128	16

3.10.4 Do you have other comments on the IGIs developed to address Hazard Criterion 8?
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10 and 3.9.2. Please refer to 3.3.10 and 3.9.2.

3.11 Hazard Criterion 9

3.11.1 In your experience, are there any emergency situations that warrant the use of an HHP listed under Hazard Criterion 9?

In total 179 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
87	30	62

3.11.2 Please briefly explain your rationale.
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.1. Please refer to 3.3.2.

Newly added comment in Hazard Criterion 9 is:

Stakeholder/Membership main feedback	TWG response
FSC shall provide a derogation for such emergency situation.	There will be no derogation for IGI HHP & there is no scope to ask for derogation

3.11.3 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 9?

In total 177 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	26	108	27	11

3.11.4 Please briefly explain the rationale and provide suggestions for other documents if needed.
Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

3.11.5 How much do you agree with the indicators for Hazard Criterion 9?

In total 173 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	14	14	49	90

3.11.6 Do you have other comments on the IGIs developed to address Hazard Criterion 9?
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

3.12 Hazard Criterion 10

3.12.1 In your experience, are there any emergency situations that warrant the use of an HHP listed under Hazard Criterion 10?

In total 180 out of 247 participants answered. General quantitative results are below:

Yes	No	I don't know
86	32	62

3.12.2 Please briefly explain your rationale.
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.1. Please refer to 3.3.2.

3.12.3 How much do you agree that these are the most relevant documents for standard developers to guide the development of national indicators for HHPs in Hazard Criterion 10?

In total 178 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	24	114	25	10

3.12.4 Please briefly explain the rationale and provide suggestions for other documents if needed.
Stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.7. Please refer to 3.3.8.

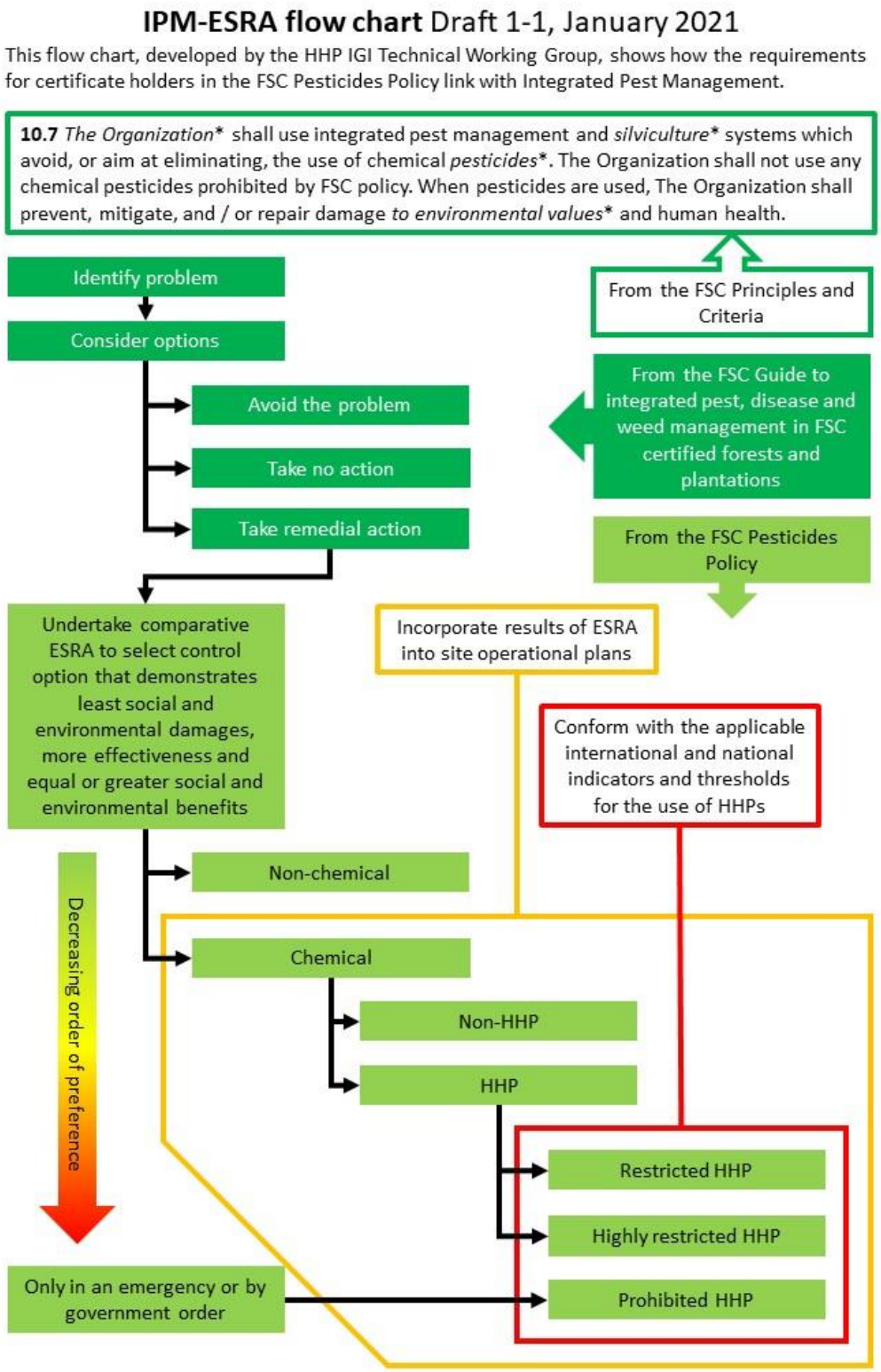
3.12.5 How much do you agree with the indicators for Hazard Criterion 10?

In total 176 out of 247 participants answered. General quantitative results are below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	14	17	124	15

3.12.6 Do you have other comments on the IGIs developed to address Hazard Criterion 10?
Most of the stakeholder/Membership main feedbacks was similar/repeated as the question 3.3.10. Please refer to 3.3.10.

Annex 1. IPM-ESRA flow chart



Annex 2. Records of HHP Usage and IPM Implementation

INSTRUCTIONS FOR STANDARD DEVELOPERS: Standard Developers *may** use this diagram to develop guidance on the record keeping required under indicator 1.2. In some jurisdictions, some or all of the records required under indicator 1.2 will also be regulatory requirements; in these cases, the documentary evidence necessary to demonstrate compliance with regulations might also be suitable to demonstrate compliance with the indicator.
Record keeping *should** be proportionate to *scale, intensity and risk**. Some specific potential adjustments for SIR are suggested below.

Record	**Spatial scale**	**Recording periodicity**	**Potential adjustments for *scale, intensity and risk****	**Notes**
a) level of target pest infestation	*Management Unit** or site	Annual or seasonal	Detailed quantification of infestation might not always be feasible, especially for smallholders. In these cases, visual assessment of signs of damage might be appropriate. Records *shall** be sufficient for the owner/manager to justify their actions.	For widespread and/or highly mobile pests, record keeping at the Management Unit* level might be most appropriate. For more localised outbreaks, site level might be more appropriate.
b) the decision process and rationale for selecting a Highly Restricted or Restricted HHP over a non HHP or *non-chemical pesticide** control method	*Management Unit** or site	When a comparative ESRA is produced or revised, or when site operational plans are produced or revised		Generally this will be determined at the level of the comparative ESRA (FSC-POL-30-001 V3-0 EN, clauses 4.12.2 to 4.12.4), but the decision might be modified by site level factors (FSC-POL-30-001 V3-0 EN, clause 4.12.6).
c) risk assessment for operator safety, detailing the processes to be followed in	Site	When site operational plans are produced or revised		

carrying out the HHP application, following appropriate legislation or guidelines				
d) assessment of economic impact caused by the pest or other justification for intervention	*Management Unit** or site	When a comparative ESRA is produced or revised, or when site operational plans are produced or revised	Any assessment *should** be proportionate to SIR, but records *shall** be sufficient for the owner/manager to justify their actions.	Economic impact might not be the motivation for controlling a pest; control might be necessary to comply with regulations, or to protect human health, for example. Record keeping should be appropriate to the justification for intervention.
e) application methodology	Site	When site operational plans are produced or revised		
f) who made the application	Site	For each operation		These records are important for monitoring worker exposure.
g) total annual volume of active ingredient used	*Management Unit**	Annual		
h) time and date of treatment	Site	For each operation		These records are important for monitoring worker exposure.
i) the weather conditions at time of application	Site	For each operation	Any records *should** be proportionate to SIR. For large scale and high potential impact operations, for example aerial application, detailed records of factors such as wind speed and direction might be appropriate. For small scale	

			manual application by smallholders, a simple note of no/light/strong winds or no/light/heavy rain might be appropriate.	
j) any disposals or spillage, including action taken to prevent contamination and/or harm	*Management Unit** or site	Annual for disposals For each operation for spillage		
k) evaluation and monitoring of the effectiveness of treatment	*Management Unit** or site	Annual or seasonal at the *Management Unit** level Following each operation at the site level	As with recording of the level of target pest infestation, this *should** be proportionate, and might not require detailed quantification, but records *shall** be sufficient for the owner/manager to evaluate the effectiveness of their actions.	For widespread and/or highly mobile pests, record keeping at the Management Unit* level might be most appropriate. For more localised outbreaks, site level might be more appropriate.
l) mapped boundaries of treatment area and pest affected area when relevant	*Management Unit** or site	Annual or seasonal at the *Management Unit** level Following each operation at the site level		

Annex 3. Guide to biomonitoring needed according to FSC Pesticides Policy Hazard Criterion

Guide to biomonitoring needed according to FSC PP Hazard Criterion

The tests listed in the text boxes under each criterion are not an exhaustive list but based on the WHO guidelines for biomonitoring and according to the best available information. The full list of biomonitoring matrices for pesticides include 14 matrices that can be used as indicators and are listed in Table 1, pages 6-8 of the WHO Human Biomonitoring: Facts and figures document (WHO, 2015).
The Biomonitoring is divided into 2 categories; namely, 1. Medical biomonitoring where medical biomonitoring is recommended and 2. Environmental monitoring where environmental parameters can be used to assess the levels of contamination. Biomonitoring is needed for hazard criterion 1-6 and 9, 10 and environmental monitoring can be done for hazard criterion 7 and 8 and the glycine group of herbicides such as glyphosate.

Human Biomonitoring is defined as '*The method of assessing human exposure to chemicals or their effects by measuring these chemicals, their metabolites or reaction products in human specimens*' (CDC, 2005).
The exposome is defined as '*The totality of exposures to environmental chemicals using prospective, comprehensive human biomonitoring surveillance*' (Rappaport, 2011).

WHO (2015) gives a list of biomonitoring equivalent (BE) values for selected pollutants in table 3, pages 15-17 such as DDT and its metabolites, Hexachlorobenzene, dioxins, deltamethrin, cyfluthrin, triclosan, benzene, toluene, cadmium and arsenic.

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'* (Encyclopaedia of Toxicology (Third Edition, 2014)).

A. Medical Biomonitoring

Hazard Criterion 1:

WHO recommended biomonitoring tests for Hazard Criterion 1

1. For organochorines:
   1.1 Whole blood test- 1cc anti-coagulated in sodium hepalin (refrigerated). Taken before and after spraying. Analysed by Comet assay (Yusa *et al*., 2015)
   1.2 Hair test – 50-200mg, cleaned and frozen (Yusa *et al*., 2015)

2. For organochlorines and POPs
   Breast milk test – 1-5cc, prepared and refrigerated. (Sannolo *et al*., 1999)
3. For HCH and methyl bromide
   Blood serum and blood plasma tests – 1cc anti-coagulated in sodium hepalin (refrigerated). Tests for body burden. Determined by LC-MS and analysed by Comet assay (Doganlar *et al*., 2018)

Methods and step-by-step instructions for biomonitoring:

Organochlorines: Whole Blood test

1. Take blood sample from worker before any spraying if done.
2. Ensure consent is given
3. Test blood sample for body burden of organochlorines and keep on file
4. Take blood sample at the end of the worker's contract or once workers leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if organochlorine build-up in the system was identified due to spraying activities.

Methyl bromide and CHC's: hair test

1. Take a hair sample from worker before the start of the spraying programme or when the worker starts spraying.
2. Ensure consent is given
3. Test hair sample for body burden of methyl bromide and/or CHC's and keep on file
4. Take hair sample at the end of the worker's contract or once worker leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if Methyl bromide/CHC's build-up in the system was identified due to spraying activities.

POP's, organochlorines and non-dioxin-like PCB's can be measured in breast milk, blood or cord blood.

Hazard Criterion 2:

WHO recommended biomonitoring for Hazard Criterion 2

Exposure of the workers to the pesticides belonging to Hazard Criterion 2 has to be minimized to remain below Acute Toxicity Exposure threshold values (Source: United Nations GHS 8th Edition, 2019 ''purple book'', page 123).

Biomonitoring tests for Hazard Criterion 2 include, amongst others:

1. Urine tests for pyrethroids and neonicotinoids, organophosphate insecticides. <5ml urine sample needed to test for specific metabolite biomarkers as indicates in Yusa *et al*. 2015. The urine matrix is representative of recent exposure as these are non-persistent pesticides that are rapidly metabolized and eliminated. Spot samples are easily collected, stored and transported. Sample preparation using SPE methods. Analysis is done using QuEChERS method.
2. Erythrocyte acetylcholinesterase (AChE) testing before and after applications using Test-mate Model 400 device (EQM Research Inc)

See also Organisation for Economic Co-operation and Development (OECD) guidance document on acute toxicity testing and biomonitoring Standard Operating Procedures.

Methods and step-by-step instructions for biomonitoring;

Urine tests for Neonicotinoids:

Clothianidin and dinotefuran are excreted in the urine (64% and 93%) within 96 hours but acetamiprid (3%) and imidacloprid (13%) in the same period therefore the potential for bioaccumulation is higher.

1. Take a urine sample for all the workers before the start of the spraying programme or when they start spraying the first time or for the first CH
2. Ensure consent is given.
3. Refrigerate the sample or keep cool
4. Test the sample using Nexera liquid chromatography system coupled with Triple Quad 6500 mass spectrometer in the laboratory
5. Test for neonicotinoids and their metabolites
6. Take a urine sample at the intervals as indicated in Annexure 1
7. Keep results on file
8. Take a urine sample at the end of the workers contract or when the worker is no longer active in the spraying programme
9. Compare with the initial test to ascertain if there has been bioaccumulation that could result in DNA damage due to spraying activities

Urine tests for Pyrethroids, Phenoxyalkyl acids & amides:

The pyrethroid metabolites such as *cis*-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid and *trans*-3-(2,2-dichlorovinyl)-2,2-

dimethylcyclopropane carboxylic acid are good indicators of pyrethroid exposure. Stored frozen urine samples remain viable for testing for 1 year.

1. Take a urine sample for all the workers before the start of the spraying programme or when they start spraying the first time
2. Ensure consent is given.
3. Refrigerate the sample or keep cool
4. Test the sample using gas chromatography (Hewlett-Packard MS Engine with GC 5890, auto injector 7673 and 5989 A mass-selective detector in the laboratory
5. Test for pyrethroids and their metabolites – especially *trans*-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid
6. Take a urine sample at the intervals as indicated in Annexure 1
7. Limit of detection of metabolites should be 5µg/l
8. Keep results on file
9. Take a urine sample at the end of the workers contract or when the worker is no longer active in the spraying programme
10. Compare with the initial test to ascertain if there has been bioaccumulation that could result in DNA damage due to spraying activities

Urine tests for Organophosphates & Carbamates:

1. Take urine sample from worker before the spraying starts or at the beginning of the spray programme.
2. Ensure consent is given
3. Test urine sample for metabolite[1] levels in worker's system to determine pre-exposure baseline and keep on file
4. This can be done using field-based dipstick tests
5. The level of carbamates that have accumulated in the system will be shown in the worker's system.
6. Compare the bio accumulated level against the threshold level. This can be calculated as a 15% reduction in erythrocyte AChE levels between the baseline and sample
7. If the reduction is 15% or above, remove the worker from spraying for a period of 14 days and test again. It the reduction is reduced to within 15% of the baseline figure, the worker can resume spraying activities.
8. Take blood sample at the end of the worker's contract or once workers leaves or no longer active in the spraying programme.

Hazard Criterion 3:
Methods and step-by-step instructions for biomonitoring;

WHO recommended biomonitoring for Hazard Criterion 3

Biomonitoring tests for Hazard Criterion 3 include (Yusa et al. 2015):

1. Urine samples taken for carbamates, pyrethroids. <5ml
2. Urine samples taken for organophosphate insecticides. <5ml
3. Hair samples taken for organophosphate insecticides. 50 -200mg
4. Blood samples taken for organophosphate insecticides. 5cc anti-coagulated with sodium heparin (refrigerate)
5. Breast milk samples taken for organophosphate insecticides. <5ml
6. Meconium samples taken for organophosphate insecticides. Measures prenatal exposure. O.5g dry weight needed
7. Sample analysis done using SPE methods. Analysis done using QuEChERS.

Erythrocyte acetylcholinesterase (AChE) testing before and after applications using Test-mate Model 400 device (EQM Research Inc). – for organophosphates and pyrethroids. Before the beginning of the spray programme and when the spray operator is no longer active in the spray programme

Blood tests for Glycines (glyphosates):
1. Take blood sample from worker before any spraying is done or at the start of the spraying programme.
2. Ensure consent is given
3. Test blood sample for body burden of glycines and keep on file
4. Take blood sample at the end of the worker's contract or once workers leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if glycines have built-up in the system was identified due to spraying activities.

Hazard Criterion 4,5 & 6:

WHO recommended biomonitoring for Hazard Criterion 4

Biomonitoring tests for Hazard Criterion 4 include:

1. Erythrocyte acetylcholinesterase (AChE) testing before and after applications using Test-mate Model 400 device (EQM Research Inc)
2. The urine matrix is representative of recent exposure as these are non-persistent pesticides that are rapidly metabolized and eliminated. Spot samples are easily collected, stored and transported. Sample preparation using SPE methods. Analysis is done using QuEChERS method. 5ml fresh samples required and refrigerated. (Yusa et al. 2015)
3. Serum levels of Mullerian hormone in women measured using spot hormone test (Burns & Pastoor, 2018)
4. Urinary metabolite 3-PBA tested using spot test to determine developmental disorders (childhood exposure) (Burns & Pastoor, 2018).

Textbox 5: Biomonitoring for Hazard Criterion 5

Biomonitoring tests for Hazard Criterion 5 include:

1. Hair testing – 50-200mg, cleaned dried and frozen. (Esteban & Castano, 2009.
2. Breast milk test – 1-5cc, prepared and refrigerated.
3. AChE tests done regularly with Test-Mate Model 400 device.
4. Whole blood tests – 1cc anti-coagulated in sodium heparin (refrigerated). (Ungerer, Ewers & Wilhelm, 2007). Taken before and after spraying. Determined by LC-MS and analysed by Comet assay (Doganlar *et al.*, 2018).

Textbox 6: Biomonitoring for Hazard Criterion 6

Biomonitoring for Hazard Criterion 6 includes ((Yusa *et al*, 2015, Estaban & Castano, 2009):

1. Organophosphates, carbamates and pyrethroids: Meconium samples taken from mother. Measures prenatal exposure. 0.5g dry weight needed.
2. Sample analysis done using SPE methods. Analysis done using QuEChERS.
3. AChE tests done with Test-Mate model 400 device before and after spraying (Vikkey et al., 2017). This can be used to test all groups, including pregnant and lactating women.
4. Urine test – 60cc fresh urine sample needed for testing in children as non-invasive. (Calafat et al., 2017). Tested using ELISA test.

Methods and step-by-step instructions for biomonitoring;

Urine tests for carbamates:

1. Take urine sample from worker before any spraying if done.
2. Ensure consent is given
3. Test urine sample for carbamate metabolite[2] levels in worker's system to determine pre-exposure baseline and keep on file
4. This can be done using field-based dipstick tests
5. The level of carbamates that have accumulated in the system will be shown in the worker's system.
6. Compare the bio accumulated level against the threshold level. This can be calculated as a 15% reduction in erythrocyte AChE levels between the baseline and sample
7. If the reduction is 15% or above, remove the worker from spraying for a period of 14 days and test again. It the reduction is reduced to within 15% of the baseline figure, the worker can resume spraying activities.
8. Take blood sample at the end of the worker's contract or once workers leaves or no longer active in the spraying programme.

Urine tests for pyrethroids:

1. Take a urine sample for all the workers before the start of the spraying programme or when they start spraying the first time
2. Ensure consent is given.
3. Refrigerate the sample or keep cool
4. Test the sample using gas chromatography (Hewlett-Packard MS Engine with GC 5890, auto injector 7673 and 5989 A mass-selective detector in the laboratory
5. Test for pyrethroids and their metabolites – especially *trans*-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid
6. Take a urine sample at the intervals as indicated in Annexure 1
7. Limit of detection of metabolites should be 5µg/l
8. Keep results on file
9. Take a urine sample at the end of the workers contract or when the worker is no longer active in the spraying programme
10. Compare with the initial test to ascertain if there has been bioaccumulation that could result in DNA damage due to spraying activities

Hazard Criterion 9:

Blood tests for Dioxins:

1. Take blood sample from worker before any spaying if done.
2. Ensure consent is given
3. Test blood sample for body burden of dioxins and keep on file
4. Take blood sample at the end of the worker's contract or once workers leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if dioxins build-up in the system was identified due to spraying activities.

Hair test for Dioxins:

1. Take a hair sample from worker before the start of the spraying programme or when the worker starts spraying.
2. Ensure consent is given

3. Test hair sample for body burden of dioxins and keep on file
4. Take hair sample at the end of the worker's contract or once worker leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if dioxins build-up in the system was identified due to spraying activities.

Due to their toxicity, endocrine disrupting effects, persistence in the environment and bioaccumulation effects, these compounds are best measured in cord blood (plasma) or breast milk and reflect early life exposure which is linked to long-term health effects.

Hazard Criterion 10:

Blood tests for heavy metals:
1. Take blood sample from worker before any spaying if done.
2. Ensure consent is given
3. Test blood sample for body burden of heavy metals and keep on file
4. Take blood sample at the end of the worker's contract or once workers leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if heavy metals build-up in the system was identified due to spraying activities.

Hair test for heavy metals:
1. Take a hair sample from worker before the start of the spraying programme or when the worker starts spraying.
2. Ensure consent is given
3. Test hair sample for body burden of heavy metals and keep on file
4. Take hair sample at the end of the worker's contract or once worker leaves or no longer active in the spraying programme.
5. Compare with initial test to ascertain if heavy metals build-up in the system was identified due to spraying activities.

Heavy metals are endocrine disruptors linked to gonad dysfunction, adverse effects on the hypothalamus-pituitary-gonads axis resulting in early onset of puberty, testicular injury due to disruption of blood-testis barrier, cancer and sexual function. Arsenic exposure significantly alters the signal transduction mechanisms of the oestrogen receptors impairing pubertal growth and sexual maturation. Maternal scalp hair can be used as a biomarker for prenatal exposure. Arsenic and all pesticides derived from arsenic are known genotoxic carcinogens which can also cause kidney damage and can be easily measured in blood, cord blood, hair and urine samples. The quantities required for chemical analysis are small and costs relatively low and also for chromium based pesticides.

B. Environmental monitoring

Environmental monitoring is assessments for aquatic and terrestrial organisms to ascertain the pesticide residue and metabolite loads in soil and aquatic environments.
Hazard criterion 7 and 8 fall under environmental monitoring and table 1 below has been compiled from numerous documents to indicate what the acute toxicity risks are for hazard criterion 7. This table is used to illustrate the level of risks of the various pesticide groups to the various organisms such as algae, fish, bees etc. For example, the risk to bees is high when using organophosphates, carbamates and pyrethroids but low-high for integrated growth regulators thus when deciding which

category of pesticides to use then this is a guide to choose IGR's over organophosphates, carbamates and pyrethroids.
The texbox provides an explanation of PECs and TERs in table 3 used to evaluate threshold levels of toxicity ratios in the organisms as indicated.

Table 1: Acute toxicity risk of Hazard Criterion 7.

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

If tropical regions use the EU trigger values then consideration needs to be given for the inclusion of an extrapolation factor of 10 (see table 2 in the textbox, the tropical extrapolation has already been calculated to guide you).

Calculating the *trigger values for Hazard Criterion 7 & 8**

The Toxicity Exposure ratio (TER) is a risk indicator for a risk assessment of pesticides and other plant protection products.
The TER indicates the ratio of harmful concentration of a pesticide (acute toxicity value) to the estimated concentration of exposure (PEC) for an organism (acute or chronic). The former generally used the LD_{50}/EC_{50} or NOEC while the latter uses the PEC (predicted environmental exposure).
The predicted no effected concentration (PNEC) indicates the safe concentration of the pesticide for the aquatic environment. The Exposure Toxicity Ratio (ETR) is the inverse of this. The TER is also sometimes referred to as the risk quotient (RQ).

TER = Acute toxicity (PNEC) /exposure (PEC)
ETR= Exposure (PEC)/Toxicity (PNEC)

If the ETR >100 there is an acute risk (RED),
if the ETR is 100> ETR>1 then there is a medium risk (YELLOW) and
if the ETR is <1 then the ETR is low (GREEN).

Table 2. PEC and TER trigger values.

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

The extrapolation for tropical environments is generally by a factor of 10 for each category (see inserted).

Definitions:

EC_{50}: The **median effective concentration** (**EC_{50}**) is defined as *'The concentration of a substance in an environmental medium expected to produce a certain effect in 50% of test organisms (usually planktonic crustacean Daphnia) in a given population under a defined set of conditions*'.
LD_{50}: The **median lethal dose** (or **LD_{50}**) is defined as *'The dose of a test substance that is lethal for 50% of the animals in a dose group. **LD_{50}** values have been used to compare relative acute hazards of pesticides, especially when no other toxicology data are available for the pesticides*'.
NOEC: **No Observed Effect Concentration** (NOEC) is defined as '*The concentration in an environmental compartment (water, soil, etc) which below an unacceptable effect is unlikely to be observed. It is typically obtained from chronic aquatic toxicity studies and terrestrial toxicity studies*'.
LOEC: **Lowest Observed Effect Concentration** is defined as '*The lowest concentration where an effect has been observed in chronic ecotoxicity studies*'.
Based on ECHA definitions:
https://echa.europa.eu/documents/10162/13632/information_requirements_r10_en.pdf/bb902be7-a503-4ab7-9036-d866b8ddce69

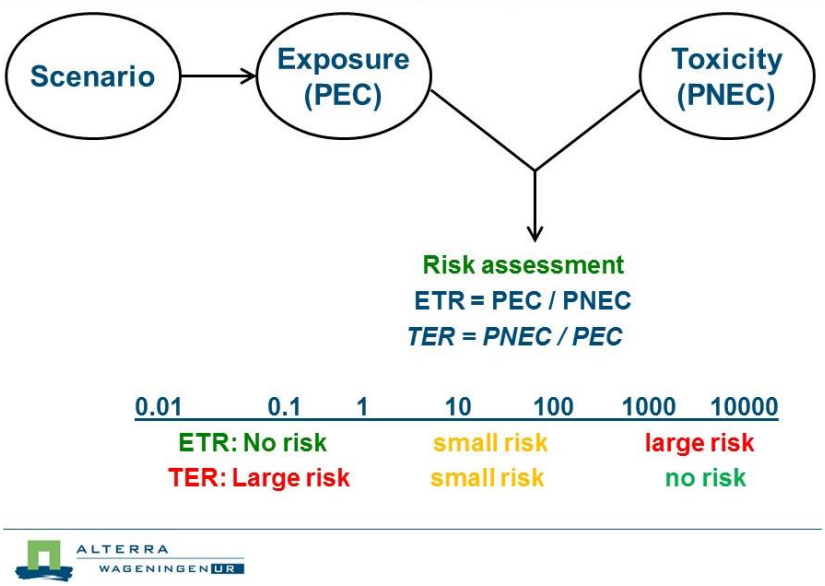


Figure 1. Highlights the limits of the ETR and TER thresholds for when the risks are high, medium or low (*Courtesy Dr J. Everts, Wageningen University*).

Example on how to calculate the PEC and TER:

1. *Scenario:*

   Cuprous oxide (in this case Nordox 75 WG - label attached) is sprayed on Sycamore to control Anthracnose at 2lbs/A (907.18g/0.4ha) applied at bud crack and then 10 days later.

2. To calculate the TER's for fish and daphnia:

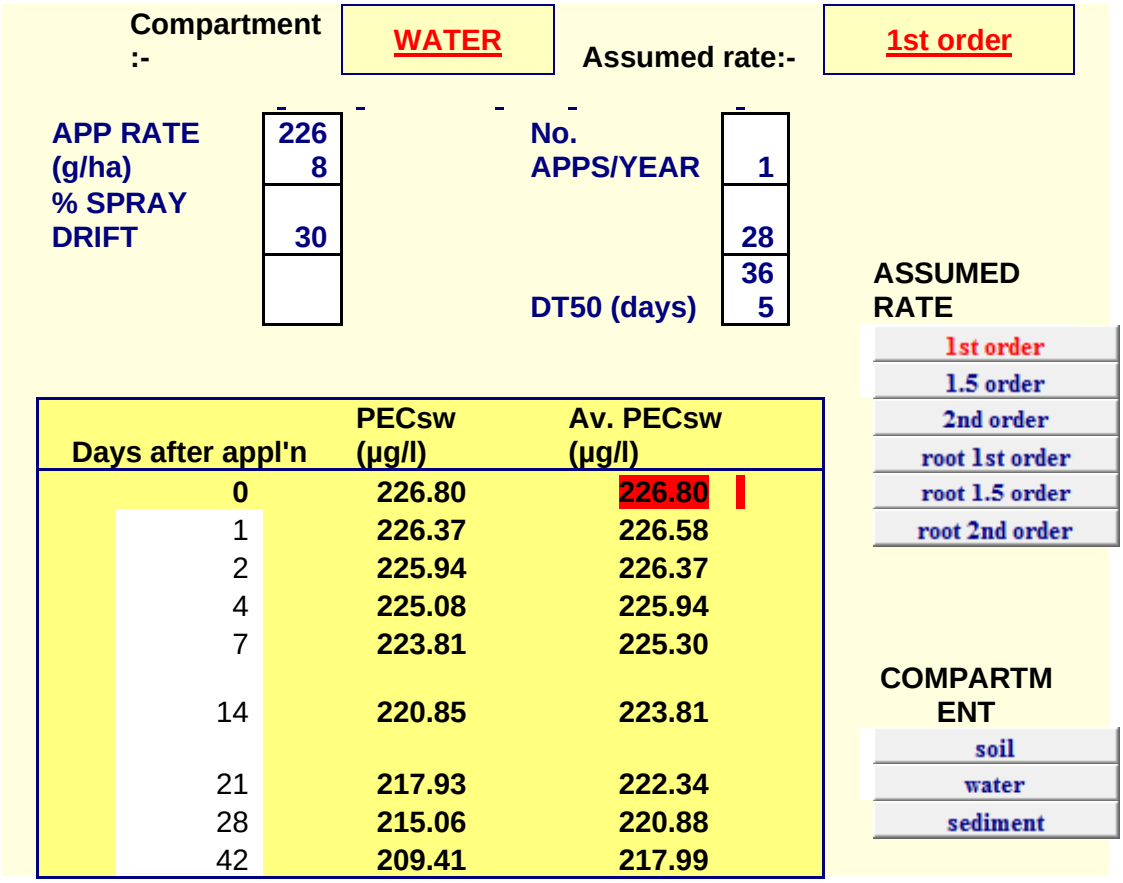
Look on the SDS but if the values are not on the SDS, a good database to use is PPDB (https://sitem.herts.ac.uk/aeru/ppdb/en/Reports/176.htm).
You will need the LC_{50} value for fish and the EC50 value for daphnia. I have included them below for ease of reference.
LC_{50} for fish: not on SDS so 0.207mg/l

EC_{50} for daphnia is 0.45mg/l

IMPORTANT:

Make sure your values reflected are in LD_{50} = mg/kg, LC50 = mg/l, EC_{50} = mg/l otherwise the calculations are incorrect

3. You first need to calculate the PEC value before you can calculate the TER value



Days after appl'n	PECsw (µg/l)	Av. PECsw (µg/l)
0	226.80	226.80
1	226.37	226.58
2	225.94	226.37
4	225.08	225.94
7	223.81	225.30
14	220.85	223.81
21	217.93	222.34
28	215.06	220.88
42	209.41	217.99

Figure 2: PEC calculation for water compartment.
I was inserted the calculation above under figure 2 above for the water compartment. The values needed for the PEC calculation are as follows:

a. rate - 907.18g/0.4 ha - you will need to bring the rate up to g/ha for the calculation = 2268g/ha
b. number of sprays = 1
c. time between sprays = 28 days
d. medium: you need to click on the water button to run the PEC for water
e. if you choose water then you have 2 drift options: 1. 5% if it is a field application (crops) or 2. 30% for top fruit or trees
f. DT_{50} (days): this is not the DT_{50} for the fish and daphnia but the DT_{50} of the pesticide in the water and is listed under "water phase only DT_{50}" on the PPDB indicated above but if there is nothing listed under this then use the DT_{50} typical or general degradation rate = 365

The PEC relates to the toxicity of the pesticide in your chosen medium, in this case, water.

Fill in 1-6 in the spreadsheet under the PEC spreadsheet and it will calculate the PEC for you. Make sure you choose water under compartment, also ensure you run 1st order as this is for acute effects. This will give you a spreadsheet (attached) showing that the P**EC for cuprous oxide is 226.80 microg/l = 0.2268mg/l (0.2mg/l)**

4. Now you can compare the PEC against the trigger value

Fish: PEC tropical trigger value = < 0.01 but temperate value is <0.001
(Aquatic invertebrates) Daphnia: PEC tropical trigger value = < 0.01 but temperate value is <0.001

PEC trigger value for fish = < 0.01 but yours is 0.2
PEC trigger value for daphnia is < 0. 01 but yours is 0.2

This is the PEC value you use for both the TER calculations as follows: The TER calculates the acute toxicity and the ETR calculates the exposure

TER Fish = PNEC/PEC = 0.207/0.2 = 1.035 = MEDIUM risk = YELLOW - this means there is a moderate toxicity risk to fish
ETR Fish = PEC/PNEC = 0.2/0.207 = 1 = MEDIUM risk =YELLOW - this means that there is an exposure risk to fish and a potential for bioaccumulation

TER daphnia = PNEC/PEC = 0.45/0.2 = 2.3 = LOW Risk = GREEN
ETR daphnia = PEC/PNEC = 0.2/0.45 = 0.4 = LOW risk = GREEN

Pesticide Poisoning indicators
Table 2 is a handy table developed by the WHO showing pesticide poisoning indicators and the adverse health effects caused by selected classes of pesticides (WHO, 2015).

Table 2. Adverse health effects caused by selected classes of pesticides[a].

Chemical/chemical class	Examples of pesticides	Clinical presentation	Route of exposure[b]
Arsenicals	Arsenic trioxide, CCA, sodium arsenate	Abdominal pain, nausea, vomiting, garlic odour, metallic taste, bloody diarrhoea, headache, dizziness, drowsiness, weakness, lethargy, delirium, shock, kidney insufficiency, neuropathy	O, R, D (rarely)

Chemical/chemical class	Examples of pesticides	Clinical presentation	Route of exposure[b]
Borates (insecticide)	Boric acid, borax	Upper airway irritation, abdominal pain, nausea, vomiting, diarrhoea, headache, lethargy, tremor, kidney insufficiency	O, R, D (broken skin)
Carbamates (insecticide)	Carbaryl, thiram, aldicarb, mecarbam	Malaise, weakness, dizziness, sweating, headache, salivation, nausea, vomiting, diarrhoea, abdominal pain, confusion, dyspnea, dermatitis, pulmonary oedema	O, D
Chlorphenoxy compounds(herbicides)	Di/tri-chlorophenoxyacetic acid, MCPP	Upper airway and mucous membrane irritation, abdominal pain vomiting, diarrhoea, tachycardia, weakness, muscle spasm, coma, acidosis, hypotension, ataxia, hypertonia, seizures, dermal irritation, headache, confusion, acidosis, tachycardia	O, D
Calciferol (rodenticide)	Cholecalciferol, ergocalciferol	Fatigue, anorexia, weakness, headache, nausea, polyuria, polydipsia, renal injury, hypercalcemia	O
Chloralose	Chloralose	Vomiting, vertigo, tremor, myoclonus, fasciculations,	O

Chemical/chemical class	Examples of pesticides	Clinical presentation	Route of exposure[b]
		confusion, convulsions	
Copper compounds (fungicide)	Copper acetate, copper oleate	Abdominal pain, vomiting, skin/airway/mucous membrane irritation, renal dysfunction, coma	O, R, D
Coumarins (rodenticide)	Brodifacoum, warfarin, pindone	Echymoses, epistaxis, excessive bleeding, haematuria, prolonged prothrombin time, intracranial bleed, anaemia, fatigue, dyspnea	O, D (possible)
Diethyltoluamide (insect repellent)	DEET (N,N-diethyl-meta-toluamide)	Dermatitis, ocular irritation, headache, restlessness, ataxia, confusion, seizures, urticaria	O, D
Dipyridil (herbicide)	Paraquat, diquat	Mucous membrane and airway irritation, abdominal pain, diarrhoea, vomiting, gastrointestinal bleeding, pulmonary oedema, dermatitis, renal and hepatic damage, coma, seizures	O, D (via broken skin)
Phosphonates (herbicide)	Roundup, glyphosate	Airway, skin, and mucous membrane irritation, abdominal, pain, nausea, vomiting, shock,	O, R

Chemical/chemical class	Examples of pesticides	Clinical presentation	Route of exposure[b]
		dyspnea, respiratory failure	
Fluoroacetate (rodenticide)	Sodium fluoroacetate	Vomiting, paresthesias, tremors, seizures, hallucinations, coma, confusion, arrhythmias, hypertension, cardiac failure	O, D (possible)
Mercury, organic (fungicide)	Methyl mercury	Metallic taste, paresthesias, tremor, headache, weakness, delirium, ataxia, visual changes, dermatitis, renal dysfunction	O, R, D
Metal phosphides(rodenticide, fumigant)	Zinc-, aluminium-, magnesium-phosphide	Abdominal pain, diarrhoea, acidosis, shock, jaundice, paresthesias, ataxia, tremors, coma, pulmonary oedema, tetany, dermal irritation	O, R, D
Halocarbons (fumigant)	Cellfume, Methyl bromide	Skin/airway/mucous membrane irritant, cough, renal dysfunction, confusion, seizures, coma, pulmonary oedema	O, R, D
Nitrophenolic and nitrocresolic herbicides	Dinitrophenol, dinitrocresol, dinoseb, dinosarn	Sweating, fever, confusion, malaise, restlessness, tachycardia, yellow skin staining, seizures, coma,	O, R, D

Chemical/chemical class	Examples of pesticides	Clinical presentation	Route of exposure[b]
		renal insufficiency, hepatic damage	
Organochlorines (insecticide)	Aldrin, dieldrin HCB, endrin, lindane	Cyanosis, excitability, dizziness, headache, restlessness, tremors, convulsions, coma, paresthesias, nausea, vomiting, confusion, tremor, cardiac arrhythmias, acidosis	O, R, D
Organophosphates (insecticides)	Malathion, parathion, dichlorvos, chlorpyrifos	Headache, dizziness, bradycardia, weakness, anxiety, excessive sweating, fasciculations, vomiting, diarrhoea, abdominal cramps, dyspnea, miosis, paralysis, salivation, tearing, ataxia, pulmonary oedema, confusion, acetylcholinesterase inhibition	O, D
Organotin (fungicide)	Fentin acetate, fentin chloride	Airway, skin, and mucous membrane irritation, dermatitis, salivation, delirium, headache, vomiting, dizziness	O, R, D
Phenol derivatives (Fungicide, wood preservative)	Pentachlorophenol, dinitrophenol	Skin, airway, and mucous membrane irritation, contact dermatitis, dyspnea, diaphoreses,	O, R, D

Chemical/chemical class	Examples of pesticides	Clinical presentation	Route of exposure[b]
		urticaria, tachycardia, headache, abdominal pain, fever, tremor	
Pyrethrins, Pyrethroids	Allethrin, cyfluthrin, permethrin	Allergic reactions, anaphylaxis, dermatitis, paresthesias, wheezing, seizures, coma, pulmonary oedema, diarrhoea, abdominal pain	R, D
Strychnine (rodenticide)	Strychnine	Muscle rigidity, opisthotonus, rhabdomyolysis	O
Thallium (rodenticide)	Thallium sulfate	Abdominal pain, nausea, vomiting, bloody diarrhoea, headache, weakness, liver injury, hair loss, paresthesias, neuropathy, encephalopathy, cardiac failure	O
Triazines (herbicide)	Atrazine, prometryn	Mucous membrane, ocular and dermal irritation	O, R, D

CCA, chromated copper arsenate; HCB, hexachlorobenzene; MCPP, methyl chlorphenoxy propionic acid.[a] This list is an overview and is not meant to be a comprehensive list of all pesticide and pesticide classes. The health worker is encouraged to use other resources and clinical experience in establishing health effect and causality for acute pesticide poisoning.

Route of exposure key: O, oral/ingestion; R, respiratory/inhalation; D, dermal or ocular. Based on references 22–24.

Suggested online references include:
http://www.who.int/whopes/recommendations/IPCSPesticide_ok.pdf

http://npic.orst.edu/npicfact.htm

http://www.epa.gov/pesticides/safety/healthcare/handbook/handbook.pdf

http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-cd2app2v2.pdf,
http://hazard.com/msds/

http://www.epa.gov/pesticides/reregistration/status.htm

http://pesticideinfo.org/

http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

http://www.pesticideinfo.org/Search_Countries.jsp.[b]

Other References:

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Rappaport, SM. 2011. Implications of the exposome for exposure science. *J Expo Sci Environ Epidemiol*. 21(1): 5-9.

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Silva, V., Mol, H.G.J., Zomer, P., Tienstra, M., Ritsema, C.J. & Geissen, V. 2019. Pesticide residues in European agricultural soils – A hidden reality unfolded. *Science of the Environment*, 653: 1532-1545. Https://doi.org/10/1016.j.sciotenv.2018.10.441

SANCO, 2002. Guidance Document on Risk Assessment for Birds and Mammals Under Council Directive 91/414/EEC. European Commission Health & Consumer Protection Directorate Directorate-General. Directorate E – Food Safety: Plant

health, animal health and welfare, international questions. E1 – Plant health. SANCO/4145/2000/final. 25 September 2002.

SANCO, 2002. Guidance Document on Terrestrial Ecotoxicology Under Council Directive 91/414/EEC. European Commission Health & Consumer Protection Directorate Directorate-General. Directorate E – Food Safety: Plant health, animal health and welfare, international questions. E1 – Plant health. SANCO/414510329/2002 rev 2 final. 17 October 2002.

EFSA, 2013. EFSA Guidance document on the risk assessment of plant protection products on bees (Apis mellifera, Bombus spp. and solitary bees). European Food Safty Authority (EFSA) Parma, Italy. EFSA Journal 2013, 11(7): 3295, 268 pp. http://doi.org/10.2903/j.efsa.2013.3295

Suggested online references include:
http://www.who.int/whopes/recommendations/IPCSPesticide_ok.pdf

http://npic.orst.edu/npicfact.htm

http://www.epa.gov/pesticides/safety/healthcare/handbook/handbook.pdf

http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-cd2app2v2.pdf , http://hazard.com/msds/

http://www.epa.gov/pesticides/reregistration/status.htm

http://pesticideinfo.org/

http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

http://www.pesticideinfo.org/Search_Countries.jsp.[b]

Other References:

CDC, 2005. Third national Report on Human Exposure to Environmental Chemicals. Centres for Disease Control and Prevention. Atlanta, Georgia.

Rappaport, SM. 2011. Implications of the exposome for exposure science. *J Expo Sci Environ Epidemiol*. 21(1): 5-9.

WHO, 2015. Human biomonitoring: facts and figures. World Health Organization, European Environment and Health Process.WHO Regional Office for Europe, Copenhagen.

Annex 4. Human biomonitoring in various countries and the associated legislation (DRAFT)

Human biomonitoring in various countries and the associated legislation

EU member states have adopted the Parma Declaration on Environment and Health in 2010 emphasizing the need for better health requirements when it comes to pesticides use and the need for biomonitoring and protection of children and vulnerable communities[1]. The European Human Biomonitoring Initiative (HBM4EU 2017-2021) has taken the lead to ensure biomonitoring is included in all member states' legislation and comply to the WHO Biomonitoring principles.

6 major uses of biomonitoring of pesticides in human populations (adapted from Sexton *et al*., 2004)[4]:

1. Identifying the priority exposures

   Out of thousands of pesticides, which are the most dangerous? Biomarkers can help set priorities for health and regulatory set-up
2. Recognising time trends in exposure
   Periodic measurement of biomarkers in the population shows how body burdens of pesticides vary from season to season, year to year and decade to decade

3. Identifying at-risk populations
   Large biomarker studies can distinguish exposure differences among racial, geographic or socioeconomic groups

4. Establishing reference ranges for comparison
   A blood test/ urine test shows that you've been exposed to some pesticide. Should you be worried? Your doctor can't tell without data from people with little to no exposure.

5. Providing integrated dose measurements
   Biomarker analysis provides a direct assay of body burden that integrates exposure from all sources, even ones that are hard to measure

6. Evaluating exposure prevention efforts
   Goverments are entrusted with reducing people's exposure to environmental pesticides. Do they succeed? Before-and-after biomarker tests can tell.

Country	Biomonitoring (Y/N)	Lead agency (ies)	Legislation/Regulation/Plan	Tests
EUROPE[2]				
Germany	Y	German Environment Agency (UBA): Human Biomonitoring Commission (HBC)	The National Implementation Plan of the Federal Republic of Germany[3] German Biomonitoring Plan Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	Breast milk Blood Urine (WHO, 2012)
Austria	Y	Environment Agency Austria (EAA)	Agenda 21 Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Belgium	Y	The Scientific Institute of Public Health (WIV-ISP) Flemish Institute for Technological research (VITO)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Flemish Human Biomonitoring Programme (FLEHS) Environmental Health Policy	Breast milk Blood Urine (WHO, 2012)
Croatia	y	Croatian Institute of Public Health	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Cyprus	y	State General laboratory, Ministry of Health, Republic of Cyprus	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Czech Republic	Y	Masaryk University (MU), research Centre for Toxic Compounds in the Environment (RECETOX)	Regulation (EC) No 1907/2006 on the Registration, Evaluation,	

Country	Biomonitoring (Y/N)	Lead agency (ies)	Legislation/Regulation/Plan	Tests
			Authorization and Restriction of Chemicals (REACH)	
Denmark	Y	The Capital Region of Denmark Technical University of Denmark – DTU Food-National Food Institute National Research Centre for the Working Environment	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Exposome Initiative Danish DEMOCOPHES survey	Maternal blood Umbilical cord blood (WHO, 2012) Serum
European Union	Y	European Environment Agency (EEA)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Finland	Y	National Institute of Health and Welfare Finnish Institute of Occupational Health	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
France	Y	The French National Institute of Health and Medical Research (INSERM)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) The French National Biomonitoring Programme	51 groups of biomarkers (WHO, 2012).
Greece	Y	EnvE-Lab, Aristotle University of Thessaloniki (AUTH) National and Kapodistrian University of Athens (UoA) The Cross-Mediterranean Environment and Health Network (CROME)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Hungary	Y	National Public Health Institute	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	Blood Cord blood (WHO, 2015)

Country	Biomonitoring (Y/N)	Lead agency (ies)	Legislation/Regulation/Plan	Tests
Iceland	Y	University of Iceland (UI)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Ireland	Y	Health Service Executive (HSE)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Israel	Y	Public Health Services, Israel Ministry of Health (MoH-IL)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) European HBM programme	Blood Breast milk Cord blood Urine (
Italy	Y	The Italian National Institute of Health (ISS) Ministry of Health of Italy (MoH-IT) The Cross-Mediterranean Environment and Health Network (CROME)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Japan	Y	Japanese Food Safety Commission Kyoto University Human Specimen Bank		
Latvia	Y	State Education Development Agency of the Republic of Latvia (VIAA)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Lithuania	Y	Lithuanian national Public Health Surveillance Laboratory Lithuanian Agency of Science, Innovation and Technology	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Luxembourg	Y	Luxembourg national Health Laboratory Luxembourg Institute for Health	Regulation (EC) No 1907/2006 on the Registration, Evaluation,	

Country	Biomonitoring (Y/N)	Lead agency (ies)	Legislation/Regulation/Plan	Tests
			Authorization and Restriction of Chemicals (REACH)	
The Netherlands	Y	Netherlands National Institute of Public Health and the Environment (RIVM)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Norway	Y	Norwegian Institute of Public Health (NIPH)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Poland	Y	Nofer institute of Occupational Medicine (NIOM)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Portugal	Y	Foundation for Science and Technology (FCT), Ministry of Science, Technology and Higher Education National Institute of Health Dr Ricardo Jorge (INSA)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Sicily	Y	Consortium to Perform Human Biomonitoring on European Scale (COPHES).	WHO European Environment and Health Information System (ENHIS) Sicilian Environmental Health Policy European Environment and Health Action plan	Blood Urine Breast milk (WHO, 2012)
Slovakia	Y	Slovak Medical University in Bratislava Public Health Authority of the Slovak Republic	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Slovenia	Y	National Institute of Public Health (NIJZ) Jožef Stefan Institute	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	Blood Urine Milk Hair sampling (WHO, 2012)

Country	Biomonitoring (Y/N)	Lead agency (ies)	Legislation/Regulation/Plan	Tests
		The Cross-Mediterranean Environment and Health Network (CROME)		
Spain	Y	Institute of Health Carlos III (ISCIII) The Cross-Mediterranean Environment and Health Network (CROME)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) National HBM plan Ministry of Agriculture, Food and Environment	Urine Blood Serum Scalp hair (WHO, 2012; WHO, 2015)
Sweden	Y	Swedish Environmental Protection Agency	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
Switzerland	Y	Swiss Tropical and Public Health Institute (SWISS TPH)	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
United Kingdom	Y	UK Department of Health (DH) – Public Health England	Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	
THE AMERICA'S				
North America	Y	Centre for Disease Control (CDC) National Institute for Occupational Safety and Health (NIOHS) National Centre for Health Statistics (NCHS) American Public health Association (APHA) US Environmental protection Agency (EPA)	US National Health and Nutrition Survey (NHANES) Federal Insecticide Fungicide and Rodenticide Act of 1972 (FIFRA) overseen by EPA for worker safety OHSA requires employers to conduct medical biomonitoring of workers	Blood Urine (WHO, 2012)
AFRICA				

Country	Biomonitoring (Y/N)	Lead agency (ies)	Legislation/Regulation/Plan	Tests
South Africa	Y	National Department of Health (HDoH) National Institute of Occupational Health (NIOH)	National Health Act, no 61 of 2003 National Environmental Health Policy, 2013 National Environmental Health Norms and Standards for Premises and acceptable Monitoring Standards for Environmental Health Practitioners, Notice No. 1229 of 2015	Urine tests for acute poisoning and Blood tests for chronic poisoning

References:

1. WHO, 2010. Parma Declaration on Environment and Health. EUR/55934/5.1 Rev.2, 11 March 2010. WHO Europe, Denmark. https://www.euro.who.int/__data/assets/pdf_file/0011/78608/E93618.pdf
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3. Germany. 85/2017. National Implementation plan. Available from: https://www.umweltbundesamt.de/en/publikationen/national-implementation-plan-of-the-federal
4. Sexton, K., Needham, L.L. and Pirkle, L.L. 2004. Huamn biomonitoring of environmental chemicals. American Scientist, Volume 92: 38-45.

Annex 5. Guidance to the most relevant documents for standard developers to guide the development of national indicators for HHP (DRAFT)

HAZARD CRITERION 1 – Relevant international agreements or conventions			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
FSC POL-30-001a FSC Lists of highly hazardous pesticides	-	List of prohibited pesticides (active ingredients) by FSC	Certificate holders (and applicants for certification and FSC-accredited certification bodies
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 and 3.9 Part 4 Chapter 4.2.	Provide information about the classification of pesticides considering: acute toxicity, mutagenicity, reproductive toxicity, and hazard to the ozone layer.	Designated to government authorities in charge for classification of pesticides
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, 6 and 7	Provide information and guidelines about the classification of pesticides by hazard.	Designated to government authorities in charge for classification of pesticides
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.	Provide information about international agreements involving pesticides	Designated to government authorities in charge for classification of pesticides, pesticide industry, and other relevant entities
International Code of Conduct on Pesticide Management. Guidelines for personal protection	Part 1, Sections 1.1, 1.3, 1.4	Provide information about Protective Personal Equipment (PPE) use	Designated to government authorities in charge of pesticide management,

when handling and applying pesticides. 2020. FAO & WHO.			pesticide risk reduction (main) and also pesticide industry, and other relevant entities

HAZARD CRITERION 2 – Acute toxicity			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Severely Hazardous Pesticides formulations toolkit (UNEP FAO), 2017.	Sections 4 and 5	Provide information about collecting data about pesticides incidents and aspects to reduce the risk of pesticides poisonings	Designated to government authorities in charge pesticides management
Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO Code of Practice. 1998.	Part III, Chapters 6, 7 and 9.	Provide information about safety requirements for hazardous chemicals, PPE use, first aid, and occupational health services.	Designated to government authorities in charge of the safety, health, and welfare of persons engaged in forestry work, organizations, and contractors.
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.	Provide information and guidelines to the classification of pesticides by hazard.	Designated to government authorities in charge for classification of pesticides
International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous Pesticides FAO &WHO, 2016.	Chapters 2, 3 and 6.	Provide information about identification of HHPs, risk assessment, and prevention of pesticides' negative effects.	Designated to government authorities in charge for classification and regulation of pesticide use.
Sound and Sustainable Management of Chemicals. A training manual for workers and	Module 2	Provide general information about safe of chemicals in workplace	Trade unions and workers

trade unions. United Nations Environment Programme (UNEP).2008.			
Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019.	Part 3, Chapter 3.1.	Information about the classification of pesticides considering acute toxicity	Designated to government authorities in charge for classification of pesticides
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; Section VII. Cross reference with 2.1.3.	Provide information about symptoms of pesticide poisoning and treatment recommendations.	Healthcare professionals
International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 2020. FAO & WHO.	Part 1, Sections 1.1, 1.3, 1.4	Provide information about Protective Personal Equipment (PPE) use	Designated to government authorities in charge of pesticide management, pesticide risk reduction (main) and also pesticide industry, and other relevant entities

HAZARD CRITERION 3 – Carcinogenicity			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Severely Hazardous Pesticides formulations toolkit (UNEP FAO), 2017	Sections 4 and 5	Provide information about collecting data about pesticides incidents and aspects to reduce the risk of pesticides poisonings	Designated to government authorities in charge pesticides management
FAO HHP protection of children in low to middle income countries (FAO 2015).	-		
Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th	Part 3, chapter 3.6.	Provide information about the classification of pesticides considering carcinogenicity properties	Designated to government authorities in charge for classification of pesticides

Edition. United Nations (UN), New York & Geneva, 2019.			
International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 2020. FAO & WHO.	Part 1, sections 1.1, 1.3, 1.4	Provide information about Protective Personal Equipment (PPE) use	Designated to government authorities in charge of pesticide management, pesticide risk reduction (main) and also pesticide industry, and other relevant entities
Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998	Part III, Chapters 6, 7 and 9	Provide information about safety requirements for hazardous chemicals, PPE use, first aid, and occupational health services.	Designated to government authorities in charge of the safety, health, and welfare of persons engaged in forestry work, organizations, and contractors.
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.	Information and guidelines to the classification of pesticides by hazard.	Designated to government authorities in charge for classification of pesticides
Understanding the Impacts of Pesticides on Children: A discussion paper. 2018. UNICEF.	-	Highlights the various pathways of exposure of pesticides and outlines the associated effects on children's health.	As a discussion paper, it's addressed to all interested public.
Recognition and management of pesticide Poisonings. 6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes.	Chapter 1	Information about special populations and environmental justice covering children's risk.	Healthcare professionals
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	Information about civil society contributions to implementation of SAICM.	Civil society (main), public health and environmental advocacy organizations;

		SAICM is a global policy and strategy to protect human health and ecosystems from the harms caused by exposure of toxic chemical substances.	organizations of medical and healthcare professionals; organizations representing communities or constituencies potentially impacted by toxic chemical exposure; trade unions; and others.
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.	Provide information about international agreements involving pesticides	Designated to government authorities in charge for classification of pesticides, pesticide industry, and other relevant entities
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	Provide information about symptoms of pesticide poisoning and treatment recommendations.	Healthcare professionals

HAZARD CRITERION 4 – Mutagenicity			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Severely Hazardous Pesticides formulations toolkit (UNEP FAO), 2017.	Sections 4 and 5	Provide information about collecting data about pesticides incidents and aspects to reduce the risk of pesticides poisonings	Designated to government authorities in charge pesticides management
International tools for preventing local pesticide problems: A consolidated guide to chemical codes and conventions. European	Chapter 3, section 4.2.5, 4.3.5 and Chapter 6.	Provide information about international agreements involving pesticides	Designated to government authorities in charge for classification of pesticides, pesticide industry, and other relevant entities

Centre on Sustainable Policies for Human and Environmental Rights (ECSPHR), 2008.			
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.	Provide information about symptoms of pesticide poisoning and treatment recommendations.	Healthcare professionals
Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019	Part 3, chapter 3.5	Provide information about the classification of pesticides considering mutagenicity	Designated to government authorities in charge for classification of pesticides
International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 2020. FAO & WHO.	Part 1, sections 1.1, 1.3, 1.4	Provide information about Protective Personal Equipment (PPE) use	Designated to government authorities in charge of pesticide management, pesticide risk reduction (main) and also pesticide industry, and other relevant entities
Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998.	Part III, Chapters 6, 7 and 9.	Information about safety requirements for hazardous chemicals, PPE use, first aid, and occupational health services.	Designated to government authorities in charge of the safety, health, and welfare of persons engaged in forestry work, organizations, and contractors.
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.	Information and guidelines to the classification of pesticides by hazard.	Designated to government authorities in charge for classification of pesticides

HAZARD CRITERION 5 – Developmental and reproductive toxicity			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Severely Hazardous Pesticides formulations toolkit (UNEP FAO).	Sections 4 and 5	Provide information about collecting data about pesticides incidents and aspects to reduce the risk of pesticides poisonings	Designated to government authorities in charge pesticides management
Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998.	Part III, Chapters 6, 7 and 9	Provide information about safety requirements for hazardous chemicals, PPE use, first aid, and occupational health services.	Designated to government authorities in charge of the safety, health, and welfare of persons engaged in forestry work, organizations, and contractors.
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.	Provide information and guidelines to the classification of pesticides by hazard.	Designated to government authorities in charge for classification of pesticides
International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 2020. FAO & WHO.	Part 1, sections 1.1, 1.3, 1.4	Provide information about Protective Personal Equipment (PPE) use	Designated to government authorities in charge of pesticide management, pesticide risk reduction (main) and also pesticide industry, and other relevant entities
International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous f Pesticides FAO &WHO, 2016.	Chapters 2,3 and 6.	Provide information about identification of HHPs, risk assessment, and prevention of pesticides' negative effects.	Designated to government authorities in charge for classification and regulation of pesticide use.
Sound and Sustainable Management of Chemicals. A training manual for workers and trade unions. United Nations Environment Programme (UNEP).2008.	Module 2	Provide general information about safe of chemicals in workplace	Trade unions and workers

Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019.	Part 3, Chapter 3.7.	Information about the classification of pesticides considering reproductive toxicity	Designated to government authorities in charge for classification of pesticides
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.	Information about signs and symptoms regarding pesticide poisoning.	Healthcare professionals

HAZARD CRITERION 6 – Endocrine disruption			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Severely Hazardous Pesticides formulations toolkit (UNEP FAO), 2017.	Sections 4 and 5	Provide information about collecting data about pesticides incidents and aspects to reduce the risk of pesticides poisonings	Designated to government authorities in charge pesticides management
Safety and Health in Forestry work. International Labour Office (ILO), Geneva. ILO code of practice. 1998.	Part III, Chapters 6, 7 and 9.	Provide information about safety requirements for hazardous chemicals, PPE use, first aid, and occupational health services.	Designated to government authorities in charge of the safety, health, and welfare of persons engaged in forestry work, organizations, and contractors.
Sound and Sustainable Management of Chemicals. A training manual for workers and trade unions. United Nations Environment Programme (UNEP).2008.	Module 2	Provide general information about safe of chemicals in workplace	Trade unions and workers
The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification. 2009. World Health Organization (WHO), International Programme on Chemical Safety (IPCS) and	Tables 1,2, 3, 4 and 7.	Provide information and guidelines to the classification of pesticides by hazard.	Designated to government authorities in charge for classification of pesticides

Inter-Organization Programme for Sound Management of Chemicals (IOMC).			
International Code of Conduct on Pesticide Management. Guidelines for personal protection when handling and applying pesticides. 2020. FAO & WHO.	Part 1, sections 1.1, 1.3, 1.4	Provide information about Protective Personal Equipment (PPE) use	Designated to government authorities in charge of pesticide management, pesticide risk reduction (main) and also pesticide industry, and other relevant entities
International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous Pesticides FAO &WHO, 2016.	Chapters 2, 3 and 6.	Provide information about identification of HHPs, risk assessment, and prevention of pesticides' negative effects.	Designated to government authorities in charge for classification and regulation of pesticide use.
OECD work on Endocrine Disrupting Chemicals. OECD, 2018	http://oe.cd/endocrine-disrupters	Provide information for classification of substances as an endocrine disruptor	Designated to government authorities in charge for classification of pesticides
IPCS International Program of Chemical Safety (WHO) - Integrated Risk Assessment document, 2004.	-	Provide information about generic and technical terms used in chemical hazard/risk assessment	Designated to government authorities in charge for classification of pesticides and health and environmental professionals
Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019.	Part 3, Chapter 3.9.	Information about the classification of pesticides considering repeated exposure.	Designated to government authorities in charge for classification of pesticides
Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes.	Chapter 21.	Provide information about symptoms regarding chronic effects of pesticides.	Healthcare professionals

HAZARD CRITERION 7 – Acute toxicity to aquatic organisms			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Ecological monitoring methods for the assessment of pesticides impacts in the tropics. handbook (Grant and Tingle, DFID, CTA, NRI, 2002).	~~Chapters 5-13~~ Chapters 9, 10 and 11	Provide aid about methods and techniques for ecological monitoring that involve significant pesticide usage.	Designated to government authorities, NGOs, academics and students of ecotoxicology.
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	https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0546&from=EN	Uniform principles for evaluation and authorization of chemical plant protection products in the EU	Member States from European Union
Considerations of assessing the risks of combined exposure to multiple chemicals. Series on testing and assessment. No 296. OECD.2018	Chapter 7	Approaches for the risk characterization stage of combined exposure to multiple chemicals.	Designated to government authorities in charge for classification of pesticides
IPCS - International Program of Chemical Safety (WHO) - Integrated Risk Assessment Terminology, 2004	-	Provide information about generic and technical terms used in chemical hazard/risk assessment	Designated to government authorities in charge for classification of pesticides and health and environmental professionals

HAZARD CRITERION 8 – Persistence in soil and water, biomagnification and bioaccumulation			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
IPCS - International Program of Chemical Safety (WHO) - Integrated Risk Assessment Terminology, 2004	-	Provide information about generic and technical terms used in chemical hazard/risk assessment	Designated to government authorities in charge for classification of pesticides and health and environmental professionals
FOCUS (The European Forum for co-ordination of pesticide fate models and their use)	https://esdac.jrc.ec.europa.eu/projects/focus-dg-sante	Information about pesticide fate models and their use regarding groundwater and surface water.	Designated to EU government authorities in charge for pesticides management and researchers.
The European soil database v2.0	https://esdac.jrc.ec.europa.eu/content/european-soil-database-v20-vector-and-attribute-data	Soil attributes database for Europe	EU government authorities, researchers and general public
Ecological monitoring methods for the assessment of pesticides impacts in the tropics. Handbook (Grant and Tingle, DFID, CTA, NRI, 2002).	Chapters 5-13	Information about methods and techniques for ecological monitoring	Designated to government authorities, NGOs, academics and students of ecotoxicology.
Considerations of assessing the risks of combined exposures to multiple chemicals. Series on testing and assessment. No 296. OECD, 2018	Chapter 7	Approaches for the risk characterization stage of combined exposure to multiple chemicals.	Designated to government authorities in charge for classification of pesticides

HAZARD CRITERION 9 – Dioxins			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Severely Hazardous Pesticides formulations toolkit) (UNEP FAO).	Sections 4 and 5	Provide information about collecting data about pesticides incidents and aspects to reduce the risk of pesticides poisonings	Designated to government authorities in charge pesticides management
Safety in the use of chemicals at work (ILO), 2014	-	Report about reduction of the incidence of illnesses and injuries resulting from the use of chemicals at work	Designated to government authorities in charge of the safety, health, and welfare of persons using chemicals at work.
IPCS - International Program of Chemical Safety (WHO) - Integrated Risk Assessment Terminology, 2004	-	Provide information about generic and technical terms used in chemical hazard/risk assessment	Designated to government authorities in charge for classification of pesticides and health and environmental professionals
International Code of Conduct on Pesticide Management. FAO & WHO, 2014.	-	Information about the establishment of voluntary standards related to the management of pesticides, particularly where there is inadequate or no national legislation to regulate pesticides.	Designated to government authorities in charge of pesticide management
Strategic Approach to International Chemicals management (UNEP)	https://www.saicm.org/	A global multi-sectoral and multi-stakeholder policy framework working to promote the sound management of chemicals across the lifecycle.	Designated to government authorities in charge of the safety of using chemicals at work.
Global Harmonized System of Classification and Labelling of Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019	Part 3, Chapter 3.8	Information about the classification of pesticides considering single exposure.	Designated to government authorities in charge for classification of pesticides
Recognition and management of pesticide Poisonings. 6th Edition. 2013. United	Chapter 21	Provide information about symptoms regarding chronic effects of pesticides.	Healthcare professionals

States Environmental Protection Agency (EPA), Office of Pesticide Programmes			

HAZARD CRITERION 10 – Heavy Metals			
Sources	**Relevant content**	**Brief content description**	**Addressed to**
Safety in the use of chemicals at work (ILO), 2014	-	Report about reduction of the incidence of illnesses and injuries resulting from the use of chemicals at work	Designated to government authorities in charge of the safety, health, and welfare of persons using chemicals at work.
IPCS - International Program of Chemical Safety (WHO) - Integrated Risk Assessment Terminology, 2004	-	Provide information about generic and technical terms used in chemical hazard/risk assessment	Designated to government authorities in charge for classification of pesticides and health and environmental professionals
International Code of Conduct on Pesticide Management. FAO & WHO, 2014.	-	Information about the establishment of voluntary standards related to the management of pesticides, particularly where there is inadequate or no national legislation to regulate pesticides.	Designated to government authorities in charge of pesticide management
Strategic Approach to International Chemicals management (UNEP)	https://www.saicm.org/	A global multi-sectoral and multi-stakeholder policy framework working to promote the sound management of chemicals across the lifecycle.	Designated to government authorities in charge of the safety of using chemicals at work.
Global Harmonized System of Classification and Labelling of	Part 3, Part 4	Information about the classification of pesticides	Designated to government authorities in charge for classification of pesticides

Chemicals (GHS) 8th Edition. United Nations (UN), New York & Geneva, 2019.		considering health and environmental hazards.	
Recognition and management of pesticide Poisonings.6th Edition. 2013. United States Environmental Protection Agency (EPA), Office of Pesticide Programmes.	Section I and Chapter 21	Information about signs and symptoms regarding pesticide acute and chronic effects.	Healthcare professionals
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	Information about pesticide fate models and their use regarding groundwater and surface water.	Designated to EU government authorities in charge for pesticides management and researchers.
The European soil database v2.0.	https://esdac.jrc.ec.europa.eu/content/european-soil-database-v20-vector-and-attribute-data	Soil attributes database for Europe	EU government authorities, researchers and general public

Annex 6. Medical biomonitoring guidance triggers summary table

To be used as a guide to determine if medical biomonitoring is necessary. If yes, then please refer to Appendix 1 in draft 2-0 for further guidance. If no, then medical biomonitoring is not necessary.

Notes on use:

1. Triggers are applied over a year (i.e. 40hrs per month is averaged across a calendar year). At the beginning of the year or spray program the certificate holder shall estimate the amount of exposure for each worker to determine if "before" testing is necessary. As the year progresses the certificate holder will monitor worker exposure hours and update the annual estimate. Should the average monthly hours exceed any of the triggers in the table, then the relevant medical monitoring is initiated.
2. Hours are those exposed to pesticide, for example wearing PPE and manually applying pesticide Where the application method when the worker isn't directly exposed, ie (helicopter, air-conditioned tractors, etc.).
3. "Before and after spray program" are defined by Hazard Group in Appendix 1. Generally, "before" means "prior to beginning any spray application" and is to be kept on file as baseline or reference; "after" means "at the end of the workers contract or when the worker is no longer active in the spraying programme".
4. Refer to Appendix 1 (big table) for more detail on pesticides, type of test, PPE and other controls and the **Guide to biomonitoring needed according to FSC PP Hazard Criterion**.

Hazard Group	**Chemical groups and known Forestry Pesticide Examples**	**Type of Test**	**>20 hrs/mth**	**20-40 hrs/mth**	**40-115 hrs/mth**	**115-575 hrs/mth**	**>575 hrs/mth**
1: International Agreements / Conventions	DDT Dibromide Paraquat dichloride	Blood	Nil	Before and after spray program	Before and after spray program	Before and after spray program and once per year	Before and after spray program and 2 to 4 times per year
	Methyl bromide	Hair	Before and after spray program	Before and after spray program	Before and after spray program	Before and after spray program	Before and after spray program
2: Acute toxicity to mammals and birds	1080 2,4-D Alpha-cypermethrin Brodifacoum Bromadilone Chlorpyrifos Cypermethrin	Urine AChE	Nil	Before and after spray program	Before and after spray program	Before and after spray program and 1 test every 2 years	Before and after spray program and once per year

	Deltamethrin Dibromide Difenacoum Diquat Fipronil Lambda-cyhalothrin Paraquat dichloride Pindone Sulfluramid Sodium cyanide Warfarin Zinc Phosphide						
3: Carcinogenicity	Organophosphates Pyrethroids Phenoxyalkyl acids Amides Carbaryl Glyphosate Oxyfluorfen Permethrin	Blood	Nil	Before and after spray program	Before and after spray program	Before and after spray program and once per year for Carbamates and Organophosphates or 1 test every 2 years for Pyrethroids, Phenoxyalkyl acids and Amides	Before and after spray program and once per year
4: Mutagenicity to mammals	Organophosphates Ziram Pyrethroids Phenoxyalkyl acids Amides Brodifacoum	Urine AChE	Nil	Before and after spray program	Before and after spray program	Before and after spray program and once per year for Carbamates and Organophosphates or 1 test every 2 years for Pyrethroids, Phenoxyalkyl acids and Amides	Before and after spray program and once per year
5: Developmental and reproductive toxicity	Organophosphates Bromadilone Difenacoum Warfarin	Urine AChE	Nil	Before and after spray program	Before and after spray program	Before and after spray program once per year for Organophosphates	Before and after spray program and once per year

6: Endocrine disrupting	Amitrole Atrazine Carbaryl Deltamethrin Lambda-cyhalothrin Picloram	Urine AChE	Nil	Before and after spray program	Before and after spray program	Before and after spray program and 1 test every 2 years	Before and after spray program and once per year
7: Acute toxicity to aquatic organisms	Alpha-cypermethrin Captan Copper oxychloride Cuprous oxide Diflubenzuron	NA	NA	NA	NA	NA	NA
8: Persistence in soil and water/ biomagnification & bioaccumulation	Terbutryn	NA	NA	NA	NA	NA	NA
9: Dioxins	Quintozene (PCNB)	Hair Blood	Before and after spray program	Before and after spray program	Before and after spray program	Before and after spray program and once per year	Before and after spray program and 2 to 4 times per year
10: Heavy metals	Arsenic, Cadmium Mercury: and their compounds	Hair Blood	Before and after spray program	Before and after spray program	Before and after spray program	Before and after spray program and once per year	Before and after spray program and 2 to 4 times per year

Annex 7. General summary of roles and responsibilities regards to appendix 1 in the draft 2-0.

Explanatory document regarding Roles and Responsibilities of Certificate Holders (CH), National Standard Developers (NSD) and Certification Bodies (CB) with regards to Appendix 1.

Entity	General Summary of Roles and Responsibilities
NSD	Ensure all references and best available documents (including national policies and regulations if available) are used to develop indicators and locally relevant thresholds for HPP use at the national level.
CB	Ensure compliance with IGIs or national indicators (when available); Ensure compliance and consistency between ESRA results and site operational plans; Ensure the best available information is being used by CH.
CH	Implement the IGIs or national indicators (when available) incorporating them into the ESRA; Incorporate the ESRA results to site operational plans following the best available information for that region/country.

Annex 8. Condensed version –FSC-STD-60-004a *International generic indicators for the use of highly hazardous pesticides* Draft 2-0

Condensed version of IGI for each Hazard Criterion.

Note for public consultation

The IGI below shows IGI that are repeated for the same issues within each Hazard Criterion, with key considerations for specific indicators noted. This option reduces the length of the draft by eliminating repetition. This would be inserted at p18 to 31, replacing the current structure.

Indicators and Instructions to Standards Developers are substantively unchanged, with minor edits to fit this revised format.

However, there are concerns that the longer version with indicators repeated for each Hazard Criterion may be easier to follow. Comments are welcome. See question XX in consultation platform. (link)

INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standards Developers shall refer to Appendix 1: Personal Protective Equipment (PPE), Medical Biomonitoring, And References By Hazard Groups, for GHS EDC toxicity category PPE.

Standard Developers shall* either reference or include the relevant aspects of the documents listed in Appendix 2: Specific References for Each Hazard Criterion or any national interpretation of these documents in National Standards.

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

Standard Developers shall* prioritize indicators for the identification of the harm and required treatment before looking at compensation when it comes to human health in Hazard Criteria 1, 2, 3, 4, 5, 6, 9 and 10.

Standard Developers *shall** consider the exposure elements and exposure variables described in Annex 2 of the FSC Pesticides Policy, when adapting these IGIs for specific HHPs.

1. IGI on Prohibited HHPs for Hazard Criteria 1, 9 and 10

1.1 When HHPs that meet Hazard Criteria 1,9 or 10 are used Annex 3. Procedure for the exceptional use of FSC prohibited HHPs in FSC-POL-30-001 FSC Pesticides Policy is applied.

2. IGI on human health risks associated with the use of HHPs for Hazard Criteria 1, 2, 3, 4, 5, 6, 9 and 10:

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 worker and affected stakeholder by over-exposure* to a HHPs in these Hazard Criteria is treated and\or fair compensation* is provided.

Note for public consultation

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

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.

3. IGI for Hazard Criterion 7 (Acute toxicity to aquatic organisms) and Hazard Criterion 8 (Persistence in soil and water/ biomagnification and bioaccumulation):

2.5 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.

2.6 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.

2.7 Protection measures are implemented to avoid exceeding trigger values*.

2.8 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 hasn't developed a trigger value* (temperate and boreal versus tropical), use LD/LC50 of the relevant pesticides to determine exposure thresholds.

NOTE: LC 50 refers to the lethal dose or lethal concentration. The amount of active ingredient that will kill 50% of the population. Lethal dose is for pesticides in soil that effect the NTA's etc and LC relates to effect on aquatic organisms.

APPENDIX 2: Specific References for Each Hazard Criterion or any national interpretation of these documents in National Standards.

INSTRUCTIONS FOR STANDARD DEVELOPERS:

Standard Developers *shall** refer directly to the following documents where relevant to the HHP 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.

Hazard Criterion 1:

- 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.
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Hazard Criterion 2:

- 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.

Hazard Criterion 3:

- 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.

Hazard Criterion 4:

- 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.
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Hazard Criterion 5:

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.
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Hazard Criterion 6:

- 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.

Hazard Criterion 7:

- 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 parazoles	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 arthro-pods	Mod	Mod-high	No-mod	Mod-high	Mod-high	Low-mod	Low-high	Low-mod
Earth-worms	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

Hazard Criterion 8:

- 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.

Hazard Criterion 9:

- 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

Hazard Criterion 10:

- 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.