FSC Pesticides Policy
Understanding the Intentions & Proposed Changes

Matthew Wenban-Smith

Kathryn Fernholz
Dr. Jeff Howe
Dr. Jim Bowyer

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Dovetail Partners, Inc.

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Introduction
The Forest Stewardship Council (FSC)'s certification standards include requirements regarding the use of pesticides in forest management activities. FSC's pesticides policy aims to provide consistent, international guidance for the implementation of these requirements.

In a nutshell, the policy can be interpreted as giving forest managers guidance to:

1. First, try not to use pesticides.

2. If you have to use pesticides, not to use the most hazardous ones.

3. Whatever pesticides you do use, to use and dispose of them properly.

Over the last 12 months this policy has been the subject of some intense discussion. Much of the discussion has focused around what pesticides are considered "the most hazardous ones" and therefore restricted for use on FSC-certified lands. This article explains the basis of the policy, clarifies the current debate, and suggests some areas where further development may be useful.

Box 1: FSC definitions of 'pests' and 'pesticides'

Pests: Organisms, which are harmful or perceived as harmful and as prejudicing the achievement of management goals. Some pests, especially introduced exotics, may also pose serious ecological threats, and suppression may be recommended. They include animal pests, plant weeds, pathogenic fungi and other micro-organisms.

Pesticide: Any substance or preparation prepared or used in protecting plants, wood or other plant products from pests; in controlling pests; or in rendering such pests harmless.

from *FSC Pesticides Policy (2005)*

Origins
The mission of the FSC is to promote environmentally appropriate, socially beneficial, and economically viable management of the world's forests. A key aspect of the development of FSC policies and standards, and something which adds a degree of differentiation from other certification programs, is FSC's core belief that collaboration between social, environmental and economic stakeholders is the best way to achieve its mission. FSC's governance structure encourages collaboration and cooperation by specifying an equal balance in power between its environmental, social and economic chambers and between interests from the 'economic-north' and 'economic-south'.

FSC's model for achieving its mission requires each of its constituent chambers to listen to and understand the needs of the other chambers, and to seek approaches to forest management that advance their own objectives without unacceptably compromising the needs of other chambers. What this means in practice is that any FSC international policy or standard must be a

compromise between the aims and ambitions of its social and environmental constituents, and the long-term commercial interests of its economic constituents.

This approach is challenging and can lead to a painstakingly slow decision making process, but it was successful in reaching agreement on FSC's 10 Principles and their associated Criteria for responsible forest management - the international standard on which the FSC system is based. Agreement was hard-won, having to balance the practical and achievable with the inspiring and ambitious. There is still plenty of debate on the details of individual Criteria within the FSC standard, but FSC members strongly support the package as a whole. FSC's Criteria relating to the use of pesticides in FSC-certified forests are amongst the most challenging within the standard - but change can only be made with the cross-chamber agreement of the full FSC membership.

FSC Criteria for the use of pesticides
There are three (3) Criteria within the FSC standard that relate specifically to the use of pesticides: Criteria 6.6, 6.7, and (for plantations) 10.7 (see box 2). The aim of FSC policy is to provide guidance on their implementation.

Box 2: The FSC Criteria relating to pesticide use

Criterion 6.6
Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides.

World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, shall be prohibited.

If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks.

Criterion 6.7
Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations.

Criterion 10.7 (applicable to plantations)
Measures shall be taken to prevent and minimize outbreaks of pests, diseases, fire and invasive plant introductions.

Integrated pest management shall form an essential part of the management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides and fertilizers.

Plantation management should make every effort to move away from chemical pesticides and fertilizers, including their use in nurseries. The use of chemicals is also covered in Criteria 6.6 and 6.7.
Source: *The FSC Principles and Criteria for Forest Stewardship, (2002)*

What is so controversial about the pesticides policy?
Clearly the FSC Principles and Criteria do not represent a 'no pesticides' position. Although some individual FSC members would prefer such an approach, this is not the policy or the source of the controversy. Nor is there any fundamental controversy about the requirements for proper use and subsequent disposal of pesticides. There is a very high level of consensus among FSC members and other stakeholders that if forest managers are going to use pesticides they should use them responsibly. There is also recognition that work needs to be done to implement these basic requirements worldwide on a more consistent basis. Supporters of FSC believe that by evaluating compliance with these requirements FSC-accredited certification bodies have been making a major international contribution to improved pesticides use.

Despite the consensus around these aspects of FSC's policy, other components have caused much debate. One sticking point relates to the specific meaning of the agreement to 'strive to avoid' pesticide use. The devil here is very much in the detail. How much 'striving' is enough to achieve and retain FSC certification? Although this may seem like a rhetorical question with no conceivable answer, this is the kind of question that the FSC system of stakeholder discussion at the national and international level has been surprisingly effective at answering. The resolution of this and other issues occurs within national and regional standards setting processes and results in slightly different approaches being taken in different countries and regions.

It is the second element of the FSC policy, "if you have to use pesticides, don't use the most hazardous ones", which has proved to be by far the most controversial and difficult element to resolve. This element of policy is derived directly from the requirements of FSC Criterion 6.6.

'FSC-prohibited' or 'highly hazardous' pesticides
FSC Criterion 6.6 includes a list of attributes of pesticides that 'shall be prohibited' in FSC-certified forests and plantations.

The Criterion raises fundamental questions. Is it appropriate or effective in principle to 'prohibit' the use of certain pesticides based only on their inherent attributes? Should the use of a particular pesticide be prohibited even if there were broad agreement that in a specific case the use would be socially or environmentally beneficial, or would be the only commercially viable option? Might putting a pesticide on a 'blacklist' push managers to use a different, less effective pesticide in perhaps greater quantities, with worse environmental or social consequences or negative impacts on the financial viability of forest management?

These are not theoretical issues. In the US it has been convincingly argued that in some cases the use of strychnine bait is the only feasible method for controlling pocket gophers (*Thomomys talpoides*) to the extent necessary to allow commercial establishment of plantations. In the UK warfarin is widely considered to be the 'least worst option' for limiting damage by grey squirrels *(Sciurus carolinensis*) to native hardwoods. But the World Health Organization (WHO) lists warfarin on its 1B list of 'highly hazardous' pesticides. Should the use of warfarin preclude FSC certification of forests in the UK or could this be considered a legitimate exception to a general ban?

The prohibition of specific pesticides is controversial, but is not unique to FSC. An increasing number of pesticides that were once in common use are now banned by governments, either nationally or through international agreements. The decision to ban a pesticide is largely made

when the chemical is found to be unacceptably hazardous to human health and/or the environment. Compliance with FSC standards is voluntary, not statutory. However, a number of FSC members and other stakeholders argue that a blacklist is a blunt instrument, and the longer the list the clumsier it becomes.

To add to the debate, the introduction to the FSC Principles and Criteria explicitly states that there should be flexibility to cope with local circumstances. This is in contrast to the language of Criterion 6.6 which appears to say that particular categories of pesticide are explicitly and universally 'prohibited'. A major challenge for FSC policy has therefore been to define a mechanism of local or national interpretation that could help resolve this conflict.

The key tool developed in response was the concept of the 'derogation' system - a special, temporary approval for the use of a pesticide that would normally be prohibited in FSC-certified forests and plantations. The derogation system is described in more detail below, but the introduction of any system that permits exceptions begs another question: if you can use a 'prohibited' pesticide, is it really prohibited at all? In recognition of this issue, FSC introduced the term 'highly hazardous' in 2005 as a more accurate description of the status of pesticides that had previously been referred to as being 'prohibited' in line with the language of Criterion 6.6.

In conjunction with this change and clarification, the FSC had the remaining challenge of specifically identifying those pesticides which have the attributes listed by Criterion 6.6.

Thresholds and indicators

Criterion 6.6 lists a number of attributes including toxicity, persistence, and chemical class that would normally result in a pesticide being prohibited from use in FSC-certified forests. Many of the attributes are, when considered alone, too loosely defined to be used consistently. For example, is it chronic toxicity or acute toxicity which should be measured - or both? Should FSC consider a pesticide's likeliness to cause cancer or its endocrine disrupting properties to be relevant aspects of toxicity? Should FSC consider toxicity to mammals alone (which mammals?), or should it also consider effects on birds, insects, fish and other organisms?

FSC therefore developed a series of more precise and measurable 'indicators' by which the specified attributes could be evaluated. For each indicator FSC also needed to specify the unit of measurement. For example, 'LD50' (Lethal Dose 50) is the generally accepted measure of a chemical's acute toxicity. This is the predicted dose of a substance at which one half of all individuals in a treated population would be killed, and can be measured for different species.

Next, for each indicator, agreement was needed on a threshold level above or below which an active ingredient would be considered 'highly hazardous'. The choice of such a threshold is socially determined, and in this sense is relatively arbitrary, just as the choice of a particular speed limit (60 miles per hour? 70 miles per hour?) is relatively arbitrary. However, arbitrary does not mean irrational. FSC's choices of indicators and thresholds were benchmarked against existing norms developed by the WHO, US Environmental Protection Agency (EPA) and others, and then broadly consulted with FSC members.

Table 1 gives some examples of the end-result of this rather laborious process, in relation to the attribute of toxicity:

Criterion (derived from FSC Principles and Criteria, 2002)	Indicator	Threshold for inclusion on FSC list of 'highly hazardous pesticides'
Acute toxicity to mammals	World Health Organisation (WHO) toxicity class (active ingredients) Acute toxicity (oral LD50 for rats)	WHO toxicity class 1a, 1b. If acute oral LD50 for rats ≤ 200 mg/kg b.w.
Acute toxicity to aquatic organisms	Aquatic toxicity (LC50)	If LC50 < 50 ug/l (microgrammes per liter)
Chronic toxicity to mammals	Reference dose	If RfD < 0.01 mg/kg day
Carcinogenicity	International Agency for Research on Cancer (IARC) carcinogen; US Environmental Protection Agency (US EPA) carcinogen	If listed in any category below (a) IARC Group 1: 'The agent (mixture) is carcinogenic to humans', or within Group 2A: 'The agent (mixture) is probably carcinogenic to humans' (IARC 2004); (b) US EPA defined as a chemical that is within Group A: 'Human carcinogen' (US EPA 1986); (c) US EPA defined as a chemical that can 'reasonably be expected to be carcinogenic to humans' (chemicals categorised by EPA into Group B2).

Table 1

The identification of 'highly hazardous' pesticides

Having established a series of indicators and thresholds, FSC then used these to evaluate a list of active ingredients of pesticides used in forestry. In 2002 this process resulted in the publication of a list of 38 active ingredients that would be prohibited from use in FSC-certifed forests and plantations, in the absence of a derogation. This list was not considered complete and FSC policy referred both to the list itself and to the underlying indicators and thresholds. It was left to forest managers, certification bodies and FSC to check whether the use of any particular pesticide required derogation, regardless of whether or not it was included on the 2002 list.

Given the genuine difficulty of establishing whether a particular pesticide did or did not fail the specified thresholds, this led inevitably to inconsistency in the implementation of the policy. Following a review of its policy in early 2005, FSC evaluated a more complete list of pesticides. The indicators and thresholds used were the same as in 2002, but the evaluation of a more complete list of the pesticides led to the identification of an *additional* 37 active ingredients that were considered 'highly hazardous' in accordance with the 2002 indicators and

thresholds. At the same time, FSC proposed that this list should be considered definitive in all situations, thereby providing certainty to certification bodies, members, certificate holders and other stakeholders as to whether a given pesticide did or did not require a derogation for its use.

The resulting list of pesticides that FSC considers to be highly hazardous identifies more than 70 active ingredients. Some of these substances have been used only occasionally in forestry, and avoiding their use in the future is not generally considered problematic. Others, however, are currently relied upon by many commercial forest operations, and avoiding their use is very challenging. The FSC derogation system for evaluating requested exceptions is therefore critically important.

The derogation system

The system of derogations to permit the temporary use of 'highly hazardous' pesticides in FSC-certified forests and plantations was introduced in 2002. It was updated following FSC's 2005 policy review, with the aim of streamlining its requirements. The system provides for the temporary use of these pesticides where:

- there is a demonstrated need;

- there are specified controls in place to mitigate the associated hazard, and/or the pesticide's formulation itself reduces the level of hazard;

- there is an ongoing program in place to identify alternatives which do not require the use of a highly hazardous pesticide;

- the requested derogation is supported by stakeholders representing social, environmental and economic interests in the specified area;

FSC policy recognizes that need may be demonstrated when the proposed use is:

- for the protection of native species and forests against damage caused by introduced species, or for protecting human health against dangerous diseases;

- obligatory under national laws or regulations;

- the only economically, environmentally, socially and technically feasible way of controlling specific organisms which are causing severe damage in natural forests or plantations in the specified country.

If granted, derogations are normally given for a five-year period. They can be renewed if subsequent efforts fail to identify an adequate alternative during this time. Nonetheless FSC policy states that there is a presumption against renewal, and so forest managers using a derogated pesticide are expected to plan to phase out its use during the derogation period.

Applying for a derogation is demanding. The most challenging aspect is generally to seek and receive the support of national and/or local stakeholders. Nevertheless, FSC's experience is that where forest managers have approached social and environmental constituents in an open way, and shown the seriousness of their efforts to avoid using a particular pesticide and to

consider alternatives, social and environmental stakeholders can be persuaded to support the requested derogations. Support is often conditional on stringent application of precautionary measures, ongoing monitoring, and continued efforts to eliminate the use of the pesticide in the future. Examples of derogations that have been approved include the use of strychnine to control gophers in parts of the USA, the use of sodium fluoroacetate (1080) to control European Fox (*vulpes vulpes*) in parts of Australia, and the use of simazine for the residual pre-emergent control of grass and broadleaved weeds in Eucalypt plantation establishment, also in Australia.

Future policy revision

The use of pesticides in forestry, as in other land management activities, remains contentious. The debate on FSC's pesticides policy inevitably reflects this. Over the last 12 years, the policy has evolved from a few, short sentences in the FSC Principles and Criteria, to a fairly detailed set of guidance documents and procedures implemented by FSC and FSC-accredited certification bodies at the international and national levels.

Four areas of policy in particular lend themselves to further review and possible revision at the international level: FSC Criterion 6.6 itself; FSC's thresholds and indicators for the implementation of Criterion 6.6; the development of generic 'decision support systems'; and the analysis and use of data collected from FSC certificate holders worldwide.

Revision of FSC Criterion 6.6

Two basic and controversial elements of FSC policy are derived explicitly from FSC Criterion 6.6: the existence of a 'blacklist' of highly hazardous or 'prohibited' pesticides, and the specification of the attributes that are used to evaluate pesticide active ingredients for inclusion on the list. If FSC members wish to change these aspects of FSC policy then they need to consider revision of Criterion 6.6 itself.

Revision of the Criterion would (rightly) be a fairly intensive piece of work. The wording of Criterion 6.6 represents a delicate balance between differing interests and objectives. It is much easier to open Criteria for revision than it is to reach agreement on an improved wording. Opening the Criterion up for revision would not guarantee that change in a particular direction would be achieved. There are FSC members who would undoubtedly like to see FSC's policy on pesticides tightened up, as well as FSC members who would like to see it made more flexible or less demanding. However, if there are basic concerns about the existence of a list of pesticides that are considered particularly hazardous and which therefore require special provisions for use, and/or about the underlying attributes for inclusion on the list, then debate on the possibility of improving the FSC Criterion is probably the place to start.

Revision of the FSC thresholds and indicators

Notwithstanding concerns about Criterion 6.6 itself, some of the indicators used by FSC to implement the Criterion have been criticised for being simplistic. During 2005 and the early part of 2006 they were reviewed, and it was concluded that a more complicated system taking greater account of soil chemistry and physical properties would be difficult to implement in practice. The current FSC approach has the merit of (relative) simplicity, and the derogation system allows for special cases to be evaluated on their own merits where a real need can be demonstrated at the national or sub-national levels. The flip side is that the specification of thresholds and indicators for the identification of 'highly hazardous' pesticides has not been

settled to everyone's satisfaction, and results in a fairly long list of pesticides that require a derogation for their use.

There is currently a major international effort to develop a Globally Harmonized System (GHS) for the classification and labelling of hazardous chemicals. Once this is fully operational it may provide a more widely accepted basis for evaluating hazard, independent of FSC's own efforts.

In the meantime, the debate on whether the particular indicators and thresholds specified by FSC for the classification of a pesticide as highly hazardous are 'right' will continue. Some FSC constituents would like to see more pesticides listed, others fewer. The simplest way to review the list (as a first step to possible revision) would be to develop and make publicly available a database listing the active ingredients of all pesticides that are used in forestry, together with the actual data for each of the indicators used by FSC to evaluate hazard. This would provide a shared and transparent tool by which the implications of modifying the indicators or thresholds could easily be checked. It would be possible to see readily the implications of making one or more thresholds higher or lower, in terms of the inclusion or exclusion of particular pesticides on FSC's 'highly hazardous' listing. It would also be possible to see at a glance the list of pesticides that have already been evaluated and are considered 'less hazardous', thereby making clearer the (pesticide based) alternatives to seeking a derogation to use one of the more hazardous pesticides.

Development of generic 'decision support' systems

The debate and controversy in relation to the listing of highly hazardous pesticides has the unfortunate result of diverting attention from other work to improve FSC's pesticides policy.

In 2002 and 2005 FSC noted the potential benefits of developing 'decision support frameworks' for use by forest managers wishing to achieve FSC certification. These would help forest managers show the steps they have taken to identify the safest practical solution to a particular pest problem, taking social, environmental and commercial considerations into account. A decision support framework developed in collaboration between social, environmental and economic members of FSC should provide an effective tool for managers to demonstrate how they are 'striving to avoid' the use of pesticides. The use of such a system would not eliminate the need to use all pesticides, but it should greatly simplify the process of applying for (and building social and environmental stakeholder support for) derogations when they are needed. It should also provide a framework within which non-pesticide based solutions can be proposed and evaluated to determine whether they are as effective (and cost effective) as pesticide-based alternatives, and if so, to spread their use throughout the FSC system.

Data analysis

Finally, and looking further to the future, FSC's 2005 policy clarified the requirements for certification bodies to collect consistent data from certified forest managers on the use of pesticides in FSC-certified forests. It is widely accepted that there is much less use of pesticides in forestry than there is in agriculture. Nonetheless, it is hard to find international data on how much is used, where, and why. By collating information about pesticide use in relation to particular pest problems, implementation of FSC policy could play a useful role in focusing international research efforts on those problems that are currently leading to the widest use of 'highly hazardous' pesticides in forestry.

In conclusion
The use of pesticides in forestry remains controversial both within and beyond the FSC membership. FSC policy cannot escape this controversy. What FSC can do is provide a space within which to look for solutions which are acceptable (with caveats) to most of FSC's social and environmental constituents and acceptable (with caveats) to most of FSC's economic constituents.

There are very few forest managers who like to use pesticides. If the FSC system can lead to innovative and practical solutions which help make their use unnecessary, most forest managers, not to mention social and environmental groups, will be grateful.

End notes.
This article necessarily provides only a summary of a complex issue. For further information about FSC's pesticide policy, and the process leading up to it, please consult the FSC website at: http://www.fsc.org/en/work_in_progress/pesticides/pest_rew.

FSC is currently actively seeking comments on its policy. Comments received will be submitted to an independent panel during August and September 2006, which will determine whether further review and revision of its policy is warranted. Please send any comments to FSC at policy@fsc.org.

Appendix I: Indicators and thresholds for the identification of 'highly hazardous[1]' pesticides, as of 1st January 2006

NB: these indicators and thresholds were scheduled for review during 2006, and may be subject to revision.

Criterion (derived from FSC Principles and Criteria, 2002)	Indicator	Threshold for inclusion on FSC list of 'highly hazardous pesticides'
Quantitative or semi-quantitative		
Acute toxicity to mammals	WHO toxicity class (active ingredients) Acute toxicity (oral LD50 for rats) (Acute) reference dose (RfD)	If acute oral LD50 for rats ≤ 200 mg/kg b.w. WHO toxicity class 1a, 1b.
Acute toxicity to aquatic organisms	Aquatic toxicity (LC50)	If LC50 < 50 ug/l (microgrammes per liter)
Chronic toxicity to mammals	Reference dose	If RfD < 0.01 mg/kg day
Persistence in soil or water	Half-life in soil or water (DT50)	If DT50 ≥ 100 d, 'strongly persistent'
Bio-magnification, bio-accumulation	Octanol-water partition coefficient (KOW) or bio-concentration factor (BCF) or bio-accumulation factor (BAF)	If KOW > 1000 i.e. log(KOW) > 3
Carcinogenicity	IARC carcinogen; US EPA carcinogen	If listed in any category below (a) International Agency for Research on Cancer (IARC) within Group 1: 'The agent (mixture) is carcinogenic to humans', or within Group 2A: 'The agent (mixture) is probably carcinogenic to humans' (IARC 2004); (b) US Environmental Protection Agency (EPA) defined as a chemical that is within Group A: 'Human carcinogen' (US EPA 1986); (c) US EPA defined as a chemical that can 'reasonably be expected to be carcinogenic to humans' (chemicals categorised by EPA into Group B2, see below)
Endocrine disrupting chemical (EDC)	EDC listed by the US EPA and NTP	If classified as EDC by US NTP or EPA
Mutagenicity to mammals	(not specified any further)	If mutagenic to any species of mammals
Qualitative		
Specific chemical class	Chlorinated hydrocarbon (definition from Radosevich et al, 2002):	If chemical meets definition from Radosevich et al, 2002.

[1] *Based on explicit FSC indicators and thresholds and not to be confused with the WHO classification of pesticides*

Criterion (derived from FSC Principles and Criteria, 2002)	Indicator	Threshold for inclusion on FSC list of 'highly hazardous pesticides'
	Compounds which contain only carbon, hydrogen and one or more halogen, AND/OR organic molecules with hydrogen and carbon atoms in a linear or ring carbon structure, containing carbon-bonded chlorine, which may also contain oxygen and/or sulphur, but which do not contain phosphorus or nitrogen.	Note: the 2002 policy includes the statement that "not all organochlorines exceed the stated thresholds for toxicity, persistence or bioaccumulation, and they are not included in this list of prohibited pesticides, but they should be avoided". However, the current list of 'highly hazardous' pesticides does not include organochlorines unless they are excluded on the basis of other indicators.
Heavy metals:	Lead (Pb), cadmium (Cd), arsenic (As) and mercury (Hg)	If pesticide contains any heavy metal as listed
Dioxins (residues or emissions)	Equivalents of 2,3,7,8-TCDD	If contaminated with any dioxins at a level of 10 part per trillion (corresponding to10 ng/kg) or greater of tetrachlorodibenzo-p-dioxin (TCDD) equivalent, or if it produces such an amount of] dioxin[s] when burned
International legislation	Banned by international agreement	If banned by international agreement

Appendix II: List of pesticides identified by FSC as 'highly hazardous[2]' and therefore prohibited unless a temporary derogation for use in the applicable territory has previously been approved by the FSC Board of Directors.

NB: FSC will review and revise this list on completion of the review of the associated indicators and thresholds specified in Appendix I.

Name of chemical	Basis for inclusion on FSC 'highly hazardous' list
aldicarb	WHO Table 1, Class Ia.
aldrin	Chlorinated hydrocarbon
Aluminium phosphide	Toxicity similar to sodium cyanide. WHO Table 7.
amitrole	Carcinogenicity (Group B2, US EPA)
benomyl	Persistence: 6 - 12 months. Toxicity: LD50 100 mg/kg. LC50 60 - 140 microg/l. Mutagen
brodifacoum	WHO Table 1, Class Ia.
bromadialone	WHO Table 1, Class Ia.
Carbaryl	Toxicity: LD50 of 100 mg/kg in mice.
chlordane	Organochlorine Persistence: half-life of 4 years. Toxicity: oral LD50 in rabbits approx. 20-300 mg/kg.
chloropicrin	Acute aquatic toxicity (PM) Chlorinated hydrocarbon containing nitrogen but not a pyridine (PM) (no exemption)
chlorothalonil	Acute aquatic toxicity (PM) Chlorinated hydrocarbon (chlorinated aromatic) (PM) [BCF (molluscs, phytoplankton)?]
cyfluthrin	Acute aquatic toxicity (PM) Chlorinated hydrocarbon (PM)
cypermethrin	Acute aquatic toxicity (PM) Chlorinated hydrocarbon (PM) [BCF (aquatic plants, fish, insects, phytoplankton)?]
alpha-cypermethrin	Acute aquatic toxicity (PM) Chlorinated hydrocarbon (PM) [BCF (aquatic plants, fish, insects, phytoplankton)?]
zeta-cypermethrin	Acute toxicity to mammals (WHO) Acute aquatic toxicity (PM) Chlorinated hydrocarbon (PM)

[2] *Based on explicit FSC indicators and thresholds and not to be confused with the WHO classification of pesticides*

Name of chemical	Basis for inclusion on FSC 'highly hazardous' list
2,4-D, butoxyethanol ester	Chlorinated hydrocarbon (PM) [BCF (aquatic plants, fish)?]
2,4-D, diethanolamine salt	Chlorinated hydrocarbon(PM)
2,4-D, dimethylamine (dma) salt	Chlorinated hydrocarbon(PM) [BCF (aquatic plants, fish)?]
2,4-D, 2-ethylhexyl ester	Chlorinated hydrocarbon(PM)
2,4-D, isopropylamine salt	Chlorinated hydrocarbon(PM)
2,4-D, triisopropanolamine salt	Chlorinated hydrocarbon(PM)
2-(2,4-DP), dma salt (= dichlorprop, dma salt)	Chlorinated hydrocarbon(PM) Endocrine disrupting chemical (TRI Developmental toxin)
DDT	Chlorinated hydrocarbon
diazinon	Toxicity: 0.0009 mg/kg/day. LD50 2.75 - 40.8 mg/kg.
dicamba, dma salt	Chlorinated hydrocarbon(PM) Endocrine disrupting chemical (TRI Developmental toxin)
dichlobenil	Persistence (PM) Chlorinated hydrocarbon (PM) [BCF (aquatic plants, fish, insects, molluscs, phytoplankton, zooplankton)?]
dicofol	Persistence: 60 days. Biomagnification: log Kow 4.28.
dieldrin	Chlorinated hydrocarbon
dienochlor	Organochlorine. Toxicity: LC50 of 50 microg/l in aquatic environments.
difethialone	WHO Table 1, Class Ia.
diflubenzuron	Acute aquatic toxicity (PM) Chlorinated hydrocarbon (PM) [BCF (aquatic plants, terrestrial plants, phytoplankton, zooplankton)?]
dimethoate	Toxicity: RfD 0.0002 mg/kg/day. LD50: 20 mg/kg in pheasants.

Name of chemical	Basis for inclusion on FSC 'highly hazardous' list
diquat dibromide	Reference dose (chronic), as the acceptable daily intake (see 3.1) (WHO 2003) [BCF (aquatic plants, fish, zooplankton)?]
diuron	Persistence (PM) Endocrine disrupting chemical (US EPA, TRI Developmental toxin) Chlorinated hydrocarbon (PM) [BCF (molluscs, phytoplankton, zooplankton)?]
endosulfan	Organochlorine. Toxicity: LD50 much less than 200 mg/kg in several mammals. RfD 0.00005 mg/kg/day.
endrin	Organochlorine. Persistence: half-life >100 days. Toxicity: LD50 <200 mg/kg. Biomagnification high in fish.
esfenvalerate	Acute aquatic toxicity (PM) Persistence (PM) Chlorinated hydrocarbon (PM) [BCF (aquatic plants, fish, molluscs, phytoplankton, zooplankton)?]
gamma-HCH, lindane	Chlorinated hydrocarbon
haloxyfop	Chlorinated hydrocarbon (PM)
heptachlor	organochlorine. Persistence: half-life 250 days. Toxicity: LD50 100-220 mg/kg in rats, 30-68 mg/kg in mice. RfD 0.005 mg/kg/day. Biomagnification: Log Kow 5.44.
hexachlorobenzene	WHO Table 1, Class Ia.
hexazinone	Persistence (PM) [BCF (fish)?]
hydramethylnon	Acute aquatic toxicity (PM) Endocrine disrupting chemical (TRI Developmental toxin, TRI Reproductive Toxin)
imazapyr	Persistence (PM)
imazapyr, isopropylamine salt	Persistence (PM)
mancozeb	Toxicity: RfD 0.003 mg/kg/day.
metam sodium	Carcinogenicity (Group 2B, EPA) Endocrine disrupting chemical (TRI Developmental toxin)

Name of chemical	Basis for inclusion on FSC 'highly hazardous' list
methoxychlor	Persistence: half-life 60 days. Toxicity: RfD 0.005 mg/kg/day. LC50 <0.020 mg/l for trout.
methylarsonic acid (monosodium methanearsenate, MSMA)	Chemical class (heavy metals) [BCF (aquatic plants, crustaceans, fish, molluscs, phytoplankton, zooplankton)?]
methylbromide	reference dose (US EPA 1993)
metolachlor	Biomagnification: log Kow 3.45.
mirex	Organochlorine. Persistence: half-life > 100 days. Toxicity: LD50 50-5000 mg/kg. Carcinogen. Bioaccumulation high.
naled	Acute aquatic toxicity (PM) Endocrine disrupting chemical (TRI Developmental toxin)
oryzalin	Persistence: Half-life 20-128 days. Toxicity: LD50 100 mg/kg in birds.
oxydemeton-methyl, Metasystox	WHO Table 2, Class Ib.
oxyfluorfen	Toxicity: RfD 0.003 mg/kg/day Log Kow 4.47
paraquat	Persistence: > 1000 days. Toxicity: RfD 0.0045 mg/kg/day. Log Kow 4.47. Reference dose (US EPA 1993) [BCF (aquatic plants, fish, phytoplankton)?]
parathion	WHO Table 1, Class Ia.
pendimethalin	Persistence (PM) The log K_{ow} of pendimethalin is 5.2, above the threshold, although it is a root-contact herbicide and thus has no systemic activity, bio-magnification is likely to be small, however, the potential for bio-accumulation of a pesticide is assessed independently of persistence. Persistent chemicals may be transferred to plants, to ground water and surface waters where they can be absorbed by other organisms. The US EPA rates Pendimethalin as a persistent, bio-accumulative and toxic (PBT) chemical[3].

[3] US Environmental Protection Agency (EPA) 2004: Toxics Release Inventory (TRI) Program, TRI PBT chemical list, http://www.epa.gov/tri/chemical/pbt_chem_list.htm

Name of chemical	Basis for inclusion on FSC 'highly hazardous' list
pentachlorophenol	WHO Table 2, Class Ib.
permethrin	Toxicity: Log Kow 6.10. LC50 0.0125 mg/litre in rainbow trout.
quintozene	Organochlorine. Persistence: 1 - 18 months. Toxicity: high. Biomagnification: Log Kow 4.46.
simazine	Toxicity: RfD 0.005 mg/kg/day
sodium cyanide	WHO Table 2, Class Ib. Acute toxicity to mammals (WHO) Acute aquatic toxicity (PANNA 2002) [BCF (fish)?]
sodium fluoroacetate, 1080	WHO Table 1, Class Ia.
2,4,5-T	Organochlorine Toxicity: medium to high in mammals. Often contaminated with dioxin.
tebufenozide	Persistence (PM)
terbumeton	Persistence (PM) Reference dose (US EPA 1993)
terbuthylazine	Reference dose (US EPA, Reregistration Eligibility Decision, p. 13, 1995) Chlorinated triazine: exemption [BCF (phytoplankton, zooplankton)?]
terbutryn	Reference dose (US EPA 1993) [BCF (aquatic plants, insects, phytoplankton)?]
trifluralin	Toxicity: RfD 0.0075 mg/kg/day. Log Kow 5.07. LC50 0.02 mg/litre. (under review, to be clarified)
toxaphene (camphechlor)	Organochlorine. Persistence: > 100 days, high. Bioaccumulation high.
warfarin	WHO Table 2, Class Ib.
zinc phosphide	Acute toxicity to mammals (PM) Reference dose (US EPA, Reregistration Eligibility Decision, 1998):

This report was prepared by

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FOR MORE INFORMATION OR TO REQUEST ADDITIONAL COPIES OF THIS REPORT, CONTACT US AT:

INFO@DOVETAILINC.ORG

WWW.DOVETAILINC.ORG

651-762-4007

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DOVETAIL PARTNERS, INC.
4801 N. Highway 61, Suite 108
White Bear Lake, MN 55110
Phone: 651-762-4007
Fax: 651-762-9642
www.dovetailinc.org