

WHO SPECIFICATIONS AND EVALUATIONS FOR PUBLIC HEALTH PESTICIDES

CHLORFENAPYR

4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-
trifluoromethyl-1 *H*-pyrrole-3-carbonitrile



**World Health
Organization**

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DISCLAIMER¹

WHO specifications are developed with the basic objective of promoting, as far as practicable, the manufacture, distribution and use of pesticides that meet basic quality requirements.

Compliance with the specifications does not constitute an endorsement or warranty of the fitness of a particular pesticide for a particular purpose, including its suitability for the control of any given pest or its suitability for use in a particular area. Owing to the complexity of the problems involved, the suitability of pesticides for a particular purpose and the content of the labelling instructions must be decided at the national or provincial level.

Furthermore, pesticides which are manufactured to comply with these specifications are not exempted from any safety regulation or other legal or administrative provision applicable to their manufacture, sale, transportation, storage, handling, preparation and/or use.

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¹ This disclaimer applies to all specifications published by WHO.

INTRODUCTION

WHO establishes and publishes specifications² for technical material and related formulations of public health pesticides with the objective that these specifications may be used to provide an international point of reference against which products can be judged either for regulatory purposes or in commercial dealings.

From 2002, the development of WHO specifications follows the **New Procedure**, described in the "Manual for development and use of FAO and WHO specifications for pesticides." This **New Procedure** follows a formal and transparent evaluation process. It describes the minimum data package, the procedure and evaluation applied by WHO and the experts of the FAO/WHO Joint Meeting on Pesticide Specifications (JMPS).

WHO specifications now only apply to products for which the technical materials have been evaluated. Consequently, from the year 2002 onwards, the publication of WHO specifications under the **New Procedure** has changed. Every specification consists now of two parts, namely the specifications and the evaluation report(s):

Part One: The Specification of the technical material and the related formulations of the pesticide in accordance with chapters 4 to 9 of the above-mentioned manual.

Part Two: The Evaluation Report(s) of the pesticide, reflecting the evaluation of the data package carried out by WHO and the JMPS. The data are provided by the manufacturer(s) according to the requirements of chapter 3 of the above-mentioned manual and supported by other information sources. Evaluation reports include the name(s) of the manufacturer(s) whose technical material has been evaluated. Evaluation reports on specifications developed subsequently to the original set of specifications are added in chronological order to this report.

WHO specifications under the **New Procedure** do not necessarily apply to nominally similar products of other manufacturer(s), nor to those where the active ingredient is produced by other routes of manufacture. WHO has the possibility to extend the scope of the specifications to similar products but only when the JMPS has been satisfied that the additional products are equivalent to that which formed the basis of the reference specification.

Specifications bear the date (month and year) of publication of the current version. Evaluations bear the date (year) of the meeting at which the recommendations were made by the JMPS.

² Publications available on the WHO Prequalification Unit – Vector Control Product Assessment Team (PQT/VCP) website, <https://extranet.who.int/pqweb/vector-control-products>

PART ONE: SPECIFICATIONS

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Chlorfenapyr Information

ISO common name

Chlorfenapyr (ISO 1750 approved)

Synonyms

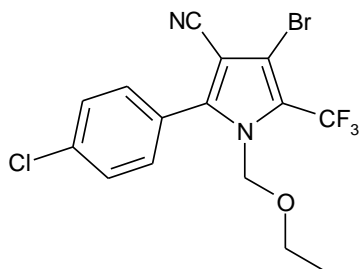
None

Chemical names

IUPAC 4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethyl-1*H*-pyrrole-3-carbonitrile

CA 4-bromo-2-(4-chlorophenyl)-1-(ethoxymethyl)-5-(trifluoromethyl)-1*H*-pyrrole-3-carbonitrile

Structural formula



Molecular formula

C₁₅H₁₁BrClF₃N₂O

Relative molecular mass

407.6

CAS Registry number

122453-73-0

CIPAC number

570

Identity tests

HPLC retention time, IR spectrum

Chlorfenapyr Technical Material

WHO specification 570/TC (December 2017*)

This specification, which is PART ONE of this publication, is based on an evaluation of data submitted by the manufacturer whose name is listed in the evaluation reports (570/2014, 570/2017). This specification should be applicable to TC produced by this manufacturer, but it is not an endorsement of those products nor a guarantee that they comply with the specification. The specification may not be appropriate for TC produced by other manufacturers. The evaluation reports (570/2014, 570/2017), as PART TWO, forms an integral part of this publication.

1 Description

The material shall consist of chlorfenapyr together with related manufacturing impurities and shall be an off-white to tan halide-smelling solid, free from visible extraneous matter and added modifying agents.

2 Active ingredient

2.1 Identity tests (570/TC/M/2, CIPAC Handbook O, p.23, 2017)

The active ingredient shall comply with an identity test and, where the identity remains in doubt, shall comply with at least one additional test.

2.2 Chlorfenapyr content (570/TC/M/3, CIPAC Handbook O, p.23, 2017)

The chlorfenapyr content shall be declared (not less than 940 g/kg), and, when determined, the average measured content shall not be lower than the declared minimum content.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at the WHO Prequalification Unit – Vector Control Product Assessment Team (PQT/VCP) website, <https://extranet.who.int/pqweb/vector-control-products>

Chlorfenapyr Suspension Concentrate

WHO specification 570/SC (January 2022*)

This specification, which is PART ONE of this publication, is based on an evaluation of data submitted by the manufacturers whose names are listed in the evaluation reports (570/2014, 570/2017, 570/2021). This specification should be applicable to relevant products of these manufacturers and those of any other formulators who use only TC from the evaluated sources. The specification is not an endorsement of those products nor a guarantee that they comply with the specification. The specification may not be appropriate for the products of other manufacturers who use TC from other sources. The evaluation reports (570/2014, 570/2017, 570/2021), as PART TWO, form an integral part of this publication.

1 Description

The material shall consist of a suspension of fine particles of technical chlorfenapyr, complying with the requirements of WHO specification 570/TC, in the form of off-white to tan, mildly sweet smelling liquid, in an aqueous phase together with suitable formulants. After gentle agitation, the material shall be homogeneous (Note 1) and suitable for further dilution in water.

2 Active ingredient

2.1 Identity tests (570/SC/M/2, CIPAC Handbook O, p.26, 2017)

The active ingredient shall comply with an identity test, and where the identity remains in doubt, shall comply with at least one additional test.

2.2 Chlorfenapyr content (570/SC/M/3, CIPAC Handbook O, p.26, 2017)

The chlorfenapyr content shall be declared (240 g/l at $20 \pm 2^\circ\text{C}$, Note 2), and when determined, the average measured content shall not differ from that declared by more than $\pm 6\%$.

3 Physical properties

3.1 Pourability (MT 148.1, CIPAC Handbook J, p.133, 2000)

Maximum "residue": 5%.

3.2 Spontaneity of dispersion (MT 160, CIPAC Handbook F, p.391, 1995) (Note 3)

Spontaneity of dispersion: minimum 80% after 5 min in CIPAC Standard Water D at $30 \pm 2^\circ\text{C}$.

3.3 Suspensibility (MT 184.1, CIPAC Handbook P, p.245, 2021 and 570/SC/M/4, CIPAC Handbook O, p.27, 2017) (Note 3)

Suspensibility: minimum 70% after 30 minutes in CIPAC Standard Water D at $25 \pm 5^\circ\text{C}$

3.4 Wet sieve test (MT 185, CIPAC Handbook K, p.149, 2003) (Note 4)

Maximum: 2% of the formulation shall be retained on a 75 μm test sieve.

* Specifications may be revised and/or additional evaluations may be undertaken. Ensure the use of current versions by checking at the WHO Prequalification Unit – Vector Control Product Assessment Team (PQT/VCP) website, <https://extranet.who.int/pqweb/vector-control-products>

3.5 Persistent foam (MT 47.3, CIPAC Handbook O, p.177, 2017) (Note 5)

Maximum: 50 ml after 1 min.

4 Storage stability

4.1 Stability at 0°C (MT 39.3, CIPAC Handbook J, p.126, 2000)

After storage at $0 \pm 2^\circ\text{C}$ for 7 days, the formulation shall continue to comply with the clauses for:

- suspensibility (3.3)
- wet sieve test (3.4).

4.2 Stability at elevated temperature (MT 46.4, CIPAC Handbook P, p.232, 2021)

After storage at $54 \pm 2^\circ\text{C}$ for 14 days, the determined average active ingredient content must not be lower than 95% relative to the determined average content found before storage (Note 6), and the formulation shall continue to comply with the clauses for:

- pourability (3.1)
- spontaneity of dispersion (3.2)
- suspensibility (3.3)
- wet sieve test (3.4).

Note 1 Before sampling to verify the formulation quality, inspect the commercial container carefully. On standing, suspension concentrates usually develop a concentration gradient from the top to the bottom of the container. This may even result in the appearance of a clear liquid on the top and/or of sediment on the bottom. Therefore, before sampling, homogenize the formulation according to the instructions given by the manufacturer or, in the absence of such instructions, by gentle shaking of the commercial container (for example by inverting the closed container several times). Large containers must be opened and stirred adequately. After this procedure, the container should not contain a sticky layer of non-dispersed matter at the bottom. A suitable and simple method of checking for a non-dispersed sticky layer "cake" is by probing with a glass rod or similar device adapted to the size and shape of the container. All the physical and chemical tests must be carried out on a laboratory sample taken after the recommended homogenization procedure.

Note 2 Unless homogenization is carried out carefully, it is possible for the sample to become aerated. This can lead to errors in the determination of the mass per millilitre and in calculation of the active ingredient content (in g/l) if methods other than MT 3.3 are used. If the buyer requires both g/kg and g/l at 20°C , then in case of dispute the analytical results shall be calculated as g/kg.

Note 3 Chemical assay is the only fully reliable method to measure the mass of active ingredient still in suspension. However, the simpler gravimetric method may be used on a routine basis provided that it has been shown to give results equal to those of chemical assay. In case of dispute, chemical assay shall be the referee method.

Note 4 This test detects coarse particles (e.g. caused by crystal growth) or agglomerates (crust formation) or extraneous materials, which could cause blockage of spray nozzles or filters in the spray tank.

Note 5 The mass of sample to be used in the test should correspond to the highest rate of use recommended by the supplier. The test is to be conducted in CIPAC standard water D at $25 \pm 5^\circ$.

Note 6 Samples of the formulation taken before and after the storage stability test may be analyzed concurrently after the test in order to reduce the analytical error.

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2021	FAO/WHO evaluation report based on submission of data from Tianjin Yorkool International Trading Co., Ltd (SC)	11
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FAO/WHO Evaluation Report 570/2021

Recommendations

The Meeting recommended that the existing WHO specification for chlorfenapyr SC should be extended to encompass the corresponding product of Tianjin Yorkool International Trading Co., Ltd.

Appraisal

The Meeting considered data and information submitted in 2021 by Tianjin Yorkool International Trading Co., Ltd (Tianjin Yorkool) to support the extension of the existing WHO specification 570/SC for chlorfenapyr suspension concentrate (SC). The data submitted were in accordance with the requirements of the Manual on development and use of FAO and WHO specifications for pesticides (2016, third revision of the first edition).

FAO specifications for chlorfenapyr TC and SC were developed in 2014 based on submission of data from BASF (FAO/WHO evaluation report 570/2014). The FAO specifications were extended to WHO in 2017 for use of chlorfenapyr in public health (FAO/WHO evaluation report 570/2017).

Tianjin Yorkool provided data on physical-chemical properties of their chlorfenapyr 240 SC formulation, including active ingredient identity and content, persistent foam, wet sieve test, suspensibility, spontaneity of dispersion, pourability, accelerated storage stability testing at $54^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 14 days and storage stability at $0 \pm 2^{\circ}\text{C}$ for 7 days. Tianjin Yorkool indicated that the specification is representative of the quality of their chlorfenapyr 240 SC by providing GLP study reports for all physical-chemical parameters tested for three different batches.

Tianjin Yorkool tested their chlorfenapyr SC for all physical-chemical properties using the most recent CIPAC methods, except for suspensibility where the method MT 184 was used instead of the revised MT 184.1 and the accelerated storage stability test where the MT 46.3 was used instead of the revised MT 46.4. The Meeting agreed that it is acceptable as the updated methods published in Handbook P are considered to provide equivalent results with the previous versions.

Tianjin Yorkool used the official CIPAC method 570/SC/M/3 published in Handbook O for the determination of chlorfenapyr content in the SC formulation (before and after storage at 54°C). According to this method, chlorfenapyr is determined by reversed phase HPLC using UV detection at 300 nm and external standardization.

The stability of the SC in the accelerated storage test was demonstrated to be acceptable, and no significant deterioration was observed in terms of active ingredient content, suspensibility, spontaneity of dispersion, pourability and residues after sieving. After storage at $0 \pm 2^{\circ}\text{C}$ for 7 days (MT 39.3), the formulation continues to comply with the clauses for active ingredient content, suspensibility, and wet sieve test.

The Meeting concluded that Tianjin Yorkool could demonstrate that their chlorfenapyr SC fully comply with the existing WHO specification 570/SC.

Additional actions proposed by the Meeting

The Meeting recommended to update the FAO and WHO SC specifications to align them with the most recent version of the specification template in the Manual, particularly with

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the latest versions of CIPAC MT methods for suspensibility (MT 184.1 instead of MT 184) and stability at elevated temperature (MT 46.4 instead of MT 46.3). These updated methods published in CIPAC Handbook P are considered to provide equivalent results with the previous versions. Therefore, all limits in the concerned clauses remain the same as for the previous versions.

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Annex 1. References

Study number	Author(s)	Year	Study title. Study identification number. Report identification number. GLP [if GLP]. Company conducting the study
20154	S. Pandiselvi	2020	Active ingredient content, physical properties, and storage stability test for 240 g/L Chlorfenapyr Suspension Concentrate. IIBAT study report 20154. GLP. Unpublished.
20201	S. Pandiselvi	2020	Active ingredient content, physical properties, and storage stability test for 240 g/L Chlorfenapyr Suspension Concentrate – 2 nd production. IIBAT study report 20201. GLP. Unpublished.
21044	S. Pandiselvi	2021	Active ingredient content, physical properties, and storage stability test for 240 g/L Chlorfenapyr Suspension Concentrate – 3 rd production. IIBAT study report 20201. GLP. Unpublished.

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FAO/WHO Evaluation Report 570/2017

Recommendations

The Meeting recommended that the specifications for chlorfenapyr TC and SC, proposed by BASF and as amended, should be adopted by WHO.

Appraisal

The FAO specifications for chlorfenapyr TC and SC, based on a data package submitted by BASF, were published in December 2014. BASF had initially requested the development of both FAO and WHO specifications, but WHO specifications could not be published without the successful evaluation of this product by WHOPES. Chlorfenapyr 240 SC was tested and evaluated by WHOPES several times (WHO 2013, WHO 2014, WHO 2017). WHOPES concluded in 2017 that chlorfenapyr 240 SC might have potential for indoor residual spraying in areas with high pyrethroid resistant malaria vectors (i.e. where indoor residual spraying with pyrethroids induced almost no mortality). WHOPES recommended also the use of Interceptor® G2, a polyester net coated with alpha-cypermethrin SC and chlorfenapyr SC, in the prevention and control of malaria (WHO 2017).

The Meeting therefore agreed to publish WHO specifications for chlorfenapyr TC and SC, based on the specifications published by FAO. The WHO specification for the SC was restricted to the formulation containing 240 g/l of chlorfenapyr.

WHO SPECIFICATIONS FOR PUBLIC HEALTH PESTICIDES

Annex 1. References

Study number	Author(s)	Year	Study title. Study identification number. Report identification number. GLP [if GLP]. Company conducting the study
	WHO	2013	Report of the 16 th WHOPES Working Group Meeting, WHO/HQ, Geneva, 22-30 July 2013. WHO, Geneva, document ISBN 978 92 4 150630 4 and WHO/HTM/NTD/WHOPES/2013.6.
	WHO	2014	Report of the 17 th WHOPES Working Group Meeting, WHO/HQ, Geneva, 15-19 September 2014. WHO, Geneva, document ISBN 978 92 4 150803 2 and WHO/HTM/NTD/WHOPES/2014.3
	WHO	2017	Report of the 20 th WHOPES Working Group Meeting, WHO/HQ, Geneva, 20-24 March 2017. Available at : http://www.who.int/whopes/recommendations/wgm/en/

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FAO/WHO Evaluation Report 570/2014

Recommendations

The Meeting recommended that the specifications for chlorfenapyr TC and SC, proposed by BASF Agro B.V. and as amended, should be adopted by FAO.

Appraisal

The data for chlorfenapyr were evaluated in support of new FAO and WHO specifications for TC and SC. The supporting data and draft specifications were provided by BASF Agro B.V. (BASF) in 2010 and a revised submission in September 2011. As the recommendation of the 16th WHOPES working group meeting on the use of the chlorfenapyr SC formulation in public health was to further evaluate the potential of the product in indoor residual spraying, the Meeting recommended to publish the FAO specification for chlorfenapyr TC and SC formulation.

Chlorfenapyr has not been evaluated by the FAO/WHO JMPR and WHO/IPCS. The US EPA has completed a review of the toxicological data submitted for this compound [EPA 2001].

Chlorfenapyr was evaluated by the European Commission as a Biocidal Product Type 8 (wood preservative), with Portugal as the Rapporteur Member State, and approved for inclusion into Annex I of the Biocidal Products Directive, 98/8/EC. It is currently under evaluation under the Biocidal Products Regulation No.528/2012 as an insecticide active substance (Biocidal Product Type 18). Chlorfenapyr was not included in Annex I of the Council Directive 91/414/EEC [CD, 2001]

The data submitted were in accordance with the requirements of the revised (revision June 2009) 1st edition of the Manual on development and use of FAO and WHO specifications for pesticides [FAO/WHO Manual] and supported the proposed specifications.

The confidential data provided on the manufacturing process of chlorfenapyr are very similar to the information supplied to EPA OPP. It is however noted that a higher alkylated benzene instead of a related one with lower boiling was specified. The impurities and QC limits for chlorfenapyr TC produced by BASF agree exactly between the information submitted to FAO and to the US EPA, with the exception for the declared minimum content of the active substance which is lower in the US than in the FAO submission (930 g/kg instead of 940 g/kg) [Funk, 2011].

The confidential data submitted by the proposer on the manufacturing process of chlorfenapyr, the data summary in support of the physical-chemical, toxicological and ecotoxicological properties were in accordance with those evaluated by Portugal as part of the European review programme under the Biocide Products Directive 98/8/EC. The only difference is that in the manufacturing process an alkylated aromatic solvent was replaced by a related one with lower boiling point.

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Chlorfenapyr is a white to pale yellow solid. It has a low vapour pressure. The compound does not have ionizable groups - therefore, the low water solubility and the octanol/water partition coefficient are not pH dependent. The active ingredient is stable to hydrolysis at pH 4, 7 and 9 at 50°C. In simulated sunlight there is degradation with half-lives of 5-8 days at pH 5, 7 and 9.

The main formulation types available are aqueous suspension concentrates (SC).

The Meeting was provided with commercially confidential information on the manufacturing process and batch analysis data on all impurities present below or above 1 g/kg and their manufacturing limits in the TC. Mass balances were 98.6 – 99.8 % in the 5-batch data.

Based on JMPS standard estimation of relative toxicity of the impurity and the active ingredient, the impurity CL 303,268 (tralopyril) could be considered as relevant. The Meeting considered, that exposure to even pure chlorfenapyr would actually lead to exposure to tralopyril generated in the metabolism and hence the contribution of tralopyril to the hazard would be covered in the toxicity studies.

The justification was accepted and tralopyril is not considered as a relevant impurity in the technical material.

The identity of chlorfenapyr is confirmed by comparing the retention time in the HPLC method and by IR spectroscopy. The analytical method for the determination of the active ingredient in chlorfenapyr technical and SC formulations is reversed-phase HPLC with UV detection. Impurities were determined by HPLC-UV and HRGC. The LOQs for chlorfenapyr and the impurities were 0.1 g/kg in the TC. Test methods for determination of physical-chemical properties of the technical active ingredient and formulations were OECD, EPA, EC and CIPAC, as indicated in the specifications and supporting data, respectively.

The Meeting recommended amendment of the suspensibility specification clause for chlorfenapyr SC and to replace MT 161 with MT 184 - the harmonization of methods MT 15, MT 161 and MT 168 [CIPAC K].

The Meeting also recommended amendment of the low temperature stability clause for chlorfenapyr SC, and to replace MT 39.2 with MT 39.3 [CIPAC J].

**Supporting Information
for
Evaluation Report 570/2014**

Uses

Chlorfenapyr is a broad-spectrum insecticide and acaricide acting through ingestion and by contact. It is used in agriculture against leafminers, thrips, mites and other pests, and in non-crop and public health against termites, cockroaches, ants, bedbugs, flies, spiders, centipedes and other insect pests.

BASF chlorfenapyr is currently registered in Brazil [since 1997], Australia [since 1998], Japan [since 1996], Mexico [since 1997] and the USA [since 2001], as well as in several other countries, for agricultural and/or non-crop uses.

Identity of the active ingredient*ISO common name*

Chlorfenapyr (ISO 1750 approved)

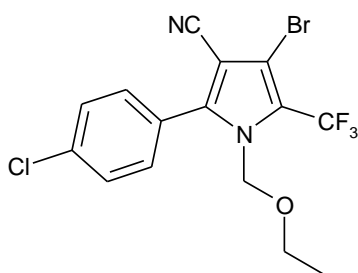
Synonyms

None

Chemical names

IUPAC 4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethyl-1*H*-pyrrole-3-carbonitrile

CA 4-bromo-2-(4-chlorophenyl)-1-(ethoxymethyl)-5-(trifluoromethyl)-1*H*-pyrrole-3-carbonitrile

Structural formula*Molecular formula*

C₁₅H₁₁BrClF₃N₂O

Relative molecular mass

407.6

CAS Registry number

122453-73-0

CIPAC number

570

Identity tests

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HPLC retention time, IR spectrum

Physico-chemical properties of chlorfenapyr

Table 1. Physico-chemical properties of pure chlorfenapyr

Parameter	Values and conditions	Purity % Note ³	Method reference (and technique if the reference gives more than one)	Study number
Vapour pressure	5.40E-6 Pa at 25 °C (extrapolated from measurements at 60, 70 and 80°C)	99.7	OPPTS 830.7950, EC Annex V method A.4	CK-306-003, 1997/7000836
Melting point.	101.4 - 102.3 °C	99.0	EC Annex V Method A.2, OECD 102	CK-303-002, 1994/7000817
Temperature of decomposition	~183°C	93.6	OPPTS 830.6316	CK-334-001, 1993/7001056
Solubility in water	0.11 mg/l at 20°C, pH=5 0.11 mg/l at 20°C, pH=7 0.14 mg/l at 20°C, pH=9 0.11 mg/l at 10°C, unbuffered deionized water 0.14 mg/l at 20°C, unbuffered deionized water 0.20 mg/l at 30°C, unbuffered deionized water	99.0	EC Annex V method A.6, Shake Flask	CK-311-001, 1994/7000775
Octanol/water partition coefficient	log P _{OW} = 5.28 at 20°C , pH=5 log P _{OW} = 5.21 at 20°C , pH=7 log P _{OW} = 5.24 at 20°C , pH=9 log P _{OW} = 5.28 at 20°C , deionized water	99.0	OECD 107	CK-315-002, 1995/7000648
Hydrolysis characteristics	Half-life = stable at 50 °C at pH 4 Half-life = stable at 50 °C at pH 7 Half-life = stable at 50 °C at pH 9	99.0	EC Annex II section 2.9.1, OECD 111	CK-322-005, 1993/7002659
Photolysis characteristics	Half-lives under conditions that approximate a summer day in Princeton, NJ, USA (40.3°N) were 5 to 8 days Predicted half-lives for Central Europe (52°N), using the method of Frank and Klöpffer, were 2.3 hours in June and 1.0 day in December	97.0	US EPA 161-2	CK-630-003, 1994/7000719
		99.7	BBA Guideline IV, 6-1, July 1990	CK-630-006, 1995/7000721
Dissociation characteristics	The active substance does not contain any ionisable groups	-	Waiver	CK-322-001, 1994/7001669
Solubility in organic solvents	Temperature: 20°C (mg/L) hexane: 6850 methanol: 50600 acetonitrile: 394000 toluene: 490000 acetone: 697000 dichloro-methane: 744000 ethyl acetate: 514000	99.0	EC Annex V, A.6	CK-311-001, 1994/7000775

³ Purity is the content of pure active ingredient in the technical material, expressed as a percentage.

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Table 2. Chemical composition and properties of chlorfenapyr technical material

Manufacturing process, maximum limits for impurities ≥ 1 g/kg, 5 batch analysis data	Confidential information supplied and held on file by FAO. Mass balances were 98.6 – 99.8 % and percentages of unknowns were < 0.1 %.
Declared minimum chlorfenapyr content	940 g/kg
Relevant impurities ≥ 1 g/kg and maximum limits for them	None
Relevant impurities < 1 g/kg and maximum limits for them	None
Stabilisers or other additives and maximum limits for them	None
Melting temperature range of the TC	100 - 101°C (98.8%)

Hazard summary

Chlorfenapyr has not been evaluated by the WHO IPCS or FAO/WHO JMPR.

The IPCS hazard classification of chlorfenapyr is: moderately hazardous, class II. [WHO, 2009]

EU classification of chlorfenapyr according to Regulation No 1272/2008/EC (Annex VI Table 3.2):

T; R23 Toxic by inhalation.

Xn; R22 Harmful if swallowed.

N; R50-53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Hazard class and category codes (Annex VI Table 3.1):

Acute Tox. 3 H331 Toxic if inhaled

Acute Tox. 4 H302 Harmful if swallowed

Aquatic Acute 1 H400 Very toxic to aquatic life

Aquatic Chronic 1 H410 Very toxic to aquatic life with long lasting effects [CLP, 2009]

Formulations

The main formulation type available is SC.

Methods of analysis and testing

The analytical method for the active ingredient in TC and in SC formulations is a full CIPAC method. Chlorfenapyr is determined by reverse phase HPLC chromatography and UV detection [CIPAC 570].

The method for determination of impurities are based on HPLC and HRGC and are adequately validated.

Test methods for determination of physical-chemical properties of the technical active ingredient were OECD, EPA or EC, while those for the formulations are CIPAC.

Test methods for determination of physical-chemical properties of the technical active ingredient were essentially OECD and EPA methods, while those for the formulations were CIPAC MT, as indicated in the specifications.

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Physical properties

The physical properties, the methods for testing them and the limits proposed for the SC formulation, comply with the requirements of the FAO/WHO Manual.

Containers and packaging

No special requirements for containers and packaging have been identified.

Expression of the active ingredient

The active ingredient is expressed as chlorfenapyr.

Annex 1: Hazard Summary Provided by the Proposer

Notes:

- i. The proposer confirmed that the toxicological and ecotoxicological data included in the summary below were derived from chlorfenapyr having impurity profiles similar to those referred to in the table above.
- ii. The conclusions expressed in the summary below are those of the proposer, unless otherwise specified.

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Table 3. Toxicology profile of the chlorfenapyr technical material, based on acute toxicity, irritation and sensitization

Species	Test	Purity % Note ⁴	Guideline, duration, doses and conditions	Result	Study number
Rat (m, f)	oral	94.5	Single exposure. Study conducted according to U.S. EPA Guideline No: 81-1. Doses: 156.25, 312.5, 625, 1250 and 2500 mg/kg b.w.	LD ₅₀ ♂: 441 mg/kg b.w. ♀ 1152 mg/kg b.w.	CK-411-001 1993/7001133
Mouse (m, f)	oral	94.5	Single exposure. Study conducted according to JMAFF Guideline No: 59 NohSan No. 4200. Doses: 35, 70 and 140 mg/kg b.w.	LD ₅₀ ♂ 45 mg/kg b.w. ♀ 78 mg/kg b.w.	CK-411-004 1994/7000707
Rabbit (m, f)	dermal	94.5	Single exposure. Study conducted according to U.S. EPA Guideline No.: 81-2. Dose: 2000 mg/kg b.w.	LD ₅₀ > 2000 mg/kg b.w.	CK-412-001 1992/7001140
Rat (m, f)	inhalation	94.5	Single 4-hour exposure. Study conducted according to U.S. EPA Guideline No.: 81-3 Doses: 0, 0.34, 0.71, 1.8 and 2.7 mg/L.	LC ₅₀ ♂: 0.83 mg/L ♀ > 2.7 mg/L	CK-413-001 1993/7001115
Rabbit (m)	skin irritation	94.5	Single exposure, Study conducted according to U.S. EPA Guideline No.: 81-5. Dose: 0.5 g.	Not irritating	CK-415-004 1993/7001137
Rabbit (m)	eye irritation	94.5	Single exposure, Study conducted according to U.S. EPA Guideline No.: 81-4. Dose: 0.1 mg.	Not irritating	CK-415-003 1993/7001138
Guinea pig (f)	skin sensitisation	95.2	Maximisation test. Study conducted according to JMAFF Guideline No: 59 NohSan No. 4200, OECD guideline No.406, 1992, U.S. EPA Guideline No.: 81-6. Doses: 0.05 mL of 2 w/v% suspension in live oil intradermal and 0.2 mL of 10 w/v% suspension in olive oil topical (induction); 0.5 mL of 0.4 w/v% suspension in olive oil topical (challenge).	Not a skin sensitizer	CK-416-002 1999/7000754

Technical chlorfenapyr is moderately toxic in rats via the oral route and inhalation. Mice were found to be more susceptible towards the acute oral effects of chlorfenapyr technical than the rat. Chlorfenapyr has a low magnitude of toxicity by dermal route of exposure. It is not irritating to the skin or eye in rabbits. It does not cause delayed contact hypersensitivity in guinea pigs by testing according to the maximisation test.

⁴ Purity is the content of pure active ingredient in the technical material, expressed as a percentage.

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Table 4. Toxicology profile of technical chlorfenapyr based on repeated administration (sub-acute to chronic)

Species	Test	Purity % Note ⁵	Guideline, duration, doses and conditions	Result	Study number
Rat (m, f)	Oral dietary	98.4	28-day study conducted according to OECD Method 407. Doses: 0, 600, 900, 1200, 1600, 2000 ppm. (approx. 0, 72, 108, 139, 185, 246 mg/kg b.w./day).	NOAEL < 71.6 mg/kg b.w./day.	CK-420-003, 1991/7001094
Mouse (m, f)	Oral dietary	98.4	28-day study conducted according to OECD Method 407. Doses: 0, 160, 240, 320, 480, 640 ppm. (approx. 0, 32, 51, 67, 112, 144 mg/kg b.w./day).	NOAEL < 32 mg/kg b.w./day.	CK-420-004, 1991/7001093
Rat (m, f)	Oral dietary	93.6	90-day study conducted according to U.S. EPA Guideline No.: 82-1. Doses: 0, 150, 300, 600, 900, 1200 ppm. (approx. 0, 12, 24, 48, 73, 98 mg/kg b.w./day).	NOAEL = 11.7 mg/kg b.w./day.	CK-425-002, 1993/7001148
Mouse (m, f)	Oral dietary	93.6	90-day study conducted according to U.S. EPA Guideline No.: 82-1. Doses: 0, 40, 80, 160, 320 ppm. (approx. 0, 8, 17, 34, 70 mg/kg b.w./day).	NOAEL = 8.2 mg/kg b.w./day.	CK-425-003, 1994/7000836
Dog, Beagle (m, f)	Oral dietary	94.5	90-day study conducted according to U.S. EPA Guideline No.: 82-1. Doses: 60, 120, 300 ppm. (approx. 0, 2, 4, 4/6/7 mg/kg b.w./day for males and 0, 2, 5, 6/6/7 mg/kg b.w./day for females).	NOAEL = 4.2 mg/kg b.m/day	CK-425-001, 1993/7001149
Dog, Beagle (m, f)	One year dietary toxicity	94.5	12-month study conducted according to U.S. EPA Guideline No.: 83-1. Doses: 0, 60, 120, 240 ppm. (approx. 0, 2, 4, 9 mg/kg b.w./day for males and 0, 2, 5, 10 mg/kg b.w./day for females).	NOAEL = ♂: 4.0 mg/kg b.m/day ♀: 4.5 mg/kg b.m/day	CK-427-004, 1994/7000794
Rat (m, f)	Chronic dietary toxicity and carcinogenicity	94.5	24-month study conducted according to U.S. EPA. Guideline No.: 83-5 Doses: 60, 300, 600 ppm in the feed. (approx. 0, 3, 15, 31 mg/kg b.w./day for males and 0, 4, 19, 37 mg/kg b.w./day for females)	<u>organ x, type of tumour</u> incidences were generally low, no significant differences between control and treated groups of animals <u>other effects:</u> At 200 ppm, decreases in body weight and body weight gain, decreases in albumin/globulin ratios, increases in total cholesterol and hepatocellular	CK-427-002, 1994/7000797

⁵ Purity is the content of pure active ingredient in the technical material, expressed as a percentage.

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Species	Test	Purity % Note ⁵	Guideline, duration, doses and conditions	Result	Study number
				enlargement. NOAEL 60 ppm, 2.9 and 3.6 mg/kg b.m./day for males and females, respectively	
Mouse (m, f)	Chronic dietary toxicity and carcinogenicity	94.5	24-month study conducted according to U.S. EPA Guideline No.: 83-2. Doses: 20, 120, 240 ppm in the feed. (approx. 0, 3, 17, 35 mg/kg b.w./day for males and 0, 4, 22, 45 mg/kg b.w./day for females).	<u>organ x, type of tumour</u> no significant differences between control and treated groups of animals <u>other effects:</u> At 240 ppm: Increased mortality, not attributable to any neoplastic changes. At 120 ppm, reduced body weight gain and vacuolization of the white matter of the brain at 120 ppm. NOAEL 20 ppm, 2.8 and 3.7 mg/kg b.m./ day for males and females, respectively	CK-428-002, 1994/7000798
Rat (f)	Oral developmental toxicity (embryo-fetal toxicity/teratogenicity)	94.5	Study conducted according to U.S. EPA Guideline No.: 83-3 Doses: 0, 25, 75, 225 mg/kg b.w./day from gestation days 6 to 15.	Ovarian, uterine and fetal observations were unaffected at all dose levels. No external, soft tissue or skeletal malformations or variations were attributed to treatment. NOEL for maternal toxicity: 25 mg/kg b.w./day based on reduced maternal body weight gains, food consumption and water consumption. NOEL for fetal/developmental toxicity: 225 mg/kg b.w./day. Not a developmental toxicant nor a teratogenic agent in the rat.	CK-432-001, 1993/7001107
Rabbit (f)	Oral developmental toxicity (embryo-fetal toxicity/teratogenicity)	94.5	Study conducted according to U.S. EPA Guideline No.: 83-3 Doses: 0, 5, 15, 30 mg/kg b.w./day from gestation days 7 to 19.	NOEL for maternal toxicity: 5 mg/kg b.w./day based on reduced maternal body weight gains nad food consumption. NOEL for fetal/developmental toxicity: 30 mg/kg b.w./day.	CK-432-002, 1993/7001106

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Species	Test	Purity % Note ⁵	Guideline, duration, doses and conditions	Result	Study number
				Not a developmental toxicant nor a teratogenic agent in the rabbit.	
Rat (m, f)	Two-generation (One-Litter) reproduction study in rat	94.5	Study conducted according to U.S. EPA Guideline No.:83-4. Doses: 0, 60, 300, 600 ppm in the feed (approx. 0, 5, 25, 44 mg/kg b.w./day) for two successive generations (P ₁ and F ₁).	Parental toxicity (reduced mean body weights and body weight gains) was noted at the 300 and 600 ppm dietary levels. There was no evidence of any parental toxicity at the 60 ppm dietary level. Reproductive performance was not affected at any dietary dose level. No adverse effects at the 60, 300 or 600 ppm dietary levels were evident from reproductive indices, gestation indices or parturition data during either litter interval. The only neonatal parameters significantly affected by treatment were reductions in pup body weights (at the 300 ppm and 600 ppm) and reductions in pup survival (at 600 ppm in the F2 litters from postnatal day 0 to 4). NOEL for general maternal toxicity and toxicity to the offspring = 60 ppm (equivalent to approximately 5 mg/kg b.w./day)	CK-430-002, 1994/7000839
Rat (m, f)	Acute neurotoxicity	94.9	Single exposure. Study conducted according to U.S. EPA Guideline No.:81-8. Doses: 45, 90, 180 mg/kg b.w.	Increased mortality noted at 180 mg/kg b.w. Clinical signs of toxicity (changes in gait, locomotion and arousal, lethargy) noted at 180 and 90 mg/kg b.w. LOAEL = 90 mg/kg b.w. NOAEL = 45 mg/kg b.w. Not considered to be an acute neurotoxicant.	CK-451-001, 1996/7001081
Rat (m, f)	One-year dietary neurotoxicity	94.5	12-month study conducted according to U.S. EPA Guideline No.: 83-1. Doses: 60, 800, 600 ppm in the feed (approx. 0, 3, 15, 30 mg/kg b.w./day)..	Reduced body weights, body weight gains and feed efficiency. Vacuolation and/or myelin sheath swelling of the brain and spinal cord in males at 300 ppm and above. This process was not	CK-451-002, 1994/7000730

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Species	Test	Purity % Note ⁵	Guideline, duration, doses and conditions	Result	Study number
				associated with any evidence of myelin or axon degeneration and was not evident after the recovery period. LOAEL = 300 ppm NOAEL = 60 ppm (equivalent to daily intake of 2.6 mg/kg b.w./day for males and 3.4 mg/kg b.w./day for females)	

Results observed following long-term dietary administration of chlorfenapyr technical to rats, mice and dogs were similar to those noted following short-term oral administration. The NOAELs for all three species were in the same range, with the lowest NOAEL in rodents: 60 ppm in rats (2.9 and 3.6 mg/kg b.w./ day for males and females, respectively) and 20 ppm in mice (2.8 and 3.7 mg/kg b.w./ day for males and females, respectively). Long-term dietary administration of chlorfenapyr technical resulted in no treatment-related oncogenic findings in either rats or mice.

Results from developmental toxicity studies in rats and rabbits showed that chlorfenapyr technical is neither a teratogen nor a developmental toxicant. The NOAELs for developmental toxicity were the highest doses tested in the respective studies, when tested up to maternally toxic doses (30 and 225 mg/kg b.w./day for rabbits and rats, respectively). The NOAELs for maternal toxicity were 5 and 25 mg/kg b.w./day for rabbits and rats, respectively. Results from a 2-generation reproductive toxicity study in rats showed that chlorfenapyr technical is not selectively toxic to the fertility or the developing offspring. The NOAEL for general maternal toxicity and toxicity to the offspring was 60 ppm (equivalent to approximately 5 mg/kg b.w.).

Results from a one-year neurotoxicity study in rats showed myelin sheath swelling in the spinal nerve roots after 13 weeks of treatment and myelinopathy of the brain and spinal cord after 52 weeks of treatment at doses of 300 and 600 ppm. The NOAEL was 60 ppm (2.6 and 3.4 mg/kg b.w./day for males and females, respectively). The findings were consistent with the neuropathological findings observed in the short-term rodent and long-term mouse studies. The effects were shown to be completely reversible following a 4-month recovery period. The alterations occurred in the absence of direct, degenerative damage to myelin (such as demyelination) or axons (such as axonal degeneration), and were not associated with any clinical behavioral effects (as evidenced by negative findings in the functional observation battery and motor activity tests).

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Table 5. Mutagenicity profile of technical chlorfenapyr based on in vitro and in vivo tests

Species	Test	Purity % Note ⁶	Guideline, duration, doses and conditions	Result	Study number
<i>Salmonella typhimurium</i> and <i>Escherichia coli</i>	Bacterial Reverse Gene Mutation <i>in vitro</i> test	94.5	Study conducted according to U.S. EPA Guideline No.: 84-1 and 84-2. Doses: 0, 0.5, 1, 5, 10, 15, 20 and 25 µg/plate with and without S-9 (3 replicates each).	Does not induce either base-pair substitution or frame-shift mutation in any of the tester bacterial strains. Not mutagenic.	CK-435-001, 1994/7000799
Chinese Hamster lung cell culture	Chromosome aberrations, cytogenic investigation <i>in vitro</i> test	93.8	Study conducted according to OECD 473. Doses: 0, 0.9, 1.8, 3.5, 7.0, 14.1, 28.1, 56.3, 112.5, 225, 450, 900 and 1800 µg/ml with and without S-9.	Not clastogenic or polyploidy-inducing agent.	CK-435-007, 1994/7000803
Chinese Hamster Ovary cell culture	Chromosome aberrations, cytogenic investigation <i>in vitro</i> test	94.5	Study conducted according to EPA Guideline No.: 84-2. Doses: 0, 6.25, 12.5, 25 and 50 µg/ml with S-9; 0, 12.5, 25, 50 and 100 µg/ml without S-9.	Not clastogenic or polyploidy-inducing agent.	CK-435-006, 1994/7000835
Primary rat hepatocytes	Unscheduled DNA Synthesis <i>in vitro</i> test	94.5	Study conducted according to U.S. EPA Guideline No.: 84-4. Doses: 0, 0.05, 0.075, 0.1, 0.125, 0.15 and 0.3 µg/ml.	Because of excessive toxicity at 0.30 µg/ml, the highest dose evaluated was 0.15 µg/ml. No significant increase in the incorporation of tritiated thymidine into nuclear DNA of the cultured cells was found at any dose level. No induction of DNA damage in cultured rat hepatocytes.	1993/7001146, CK-435-003
Chinese Hamster Ovary cell culture	Mammalian Cell CHO/HGPRT Mutagenicity <i>in vitro</i> test	94.5	Study conducted according to U.S. EPA Guideline No.: 84-1 and 84-2. Doses: 0, 5, 10, 50, 100, 250 and 500 µg/ml with metabolic activation; 0, 2.5, 5, 10, 50, 100, and 250 µg/ml without metabolic activation.	Because of excessive toxicity at 500 µg/ml, the highest dose evaluated was 250 µg/ml. No induced mutations at the HGPRT locus in CHO cells. Not mutagenic.	CK-435-004, 1994/7000834

⁶ Purity is the content of pure active ingredient in the technical material, expressed as a percentage.

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Species	Test	Purity % Note ⁶	Guideline, duration, doses and conditions	Result	Study number
Mouse (m, f)	<i>in vivo</i> Micronucleus Assay in Mouse Bone Marrow Cell	94.5	Single exposure. Study conducted according to U.S. EPA Guideline No.: 84-2. Doses: 0, 7.5, 15, 30 mg/kg b.w. (males); 0, 5, 10, 20 mg/kg b.w. (females).	No effect on the number of micronucleated polychromatic erythrocytes in the bone marrow at any dose level at any sacrifice interval for males or females. Does not cause chromosomal damage <i>in vivo</i> . Not genotoxic.	CK-435-002, 1992/7001141

Results from a battery of *in vitro* and *in vivo* genotoxicity studies showed no indication of a mutagenic or genotoxic potential of chlorfenapyr technical material.

Table 6. Ecotoxicology profile of technical chlorfenapyr

Species	Test	Purity % Note	Guideline, duration, doses and conditions	Result	Study number
<i>Lepomis macrochirus</i> (bluegill fish)	Acute toxicity	94.5	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-1. Doses: 0, 5.03, 9.53, 14.7, 26.5, and 43.6 µg/L.	LC ₅₀ = 11.6 µg/L NOEC = 5.03 µg/L	CK-511-001; 1992/7001143
<i>Oncorhynchus mykiss</i> (rainbow trout)	Acute toxicity	94.5	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-1. Doses: 0, 2.61, 4.68, 8.01, 18.4, and 32.4 µg/L.	LC ₅₀ = 7.4 µg/L NOEC = 2.61 µg/L	CK-511-002; 1992/7001128
<i>Ictalurus punctatus</i> (channel catfish)	Acute toxicity	94.9	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-1. Doses: 0, 7.23, 11.7, 24.9, 39.5, and 56.2 µg/L.	LC ₅₀ = 12.3 µg/L NOEC = 7.23 µg/L	CK-511-005; 1996/7000986
<i>Cyprinodon variegatus</i> (sheepshead minnow)	Acute toxicity	94.5	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-1. Doses: 0, 16.2, 30.7, 48.4, 84.9, and 155 µg/L.	LC ₅₀ = 60.2 µg/L NOEC = 30.7 µg/L	CK-511-004; 1993/7001166
<i>Daphnia Magna</i> (water flea)	Acute toxicity: immobility	94.5	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-2. Doses: 0, 1.40, 2.52, 3.86, 6.31, and 10.7 µg/L.	EC ₅₀ = 6.1 µg/L NOEC = 2.52 µg/L	CK-521-001; 1992/7001127

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Species	Test	Purity % Note	Guideline, duration, doses and conditions	Result	Study number
<i>Mysidopsis bahia</i> (mysid shrimp)	Acute toxicity	96.8	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-3 (c). Doses: 0, 0.32, 0.73, 0.89, 1.52, 2.52, and 5.08 µg/L.	LC ₅₀ = 2.0 µg/L NOEC = 0.32 µg/L	CK-521-004; 1994/7000842
<i>Crassostrea virginica</i> (Eastern oyster)	Acute toxicity: shell growth inhibition	94.5	96-h flow-through exposure. Study conducted according to U.S. EPA Guideline 72-3 (b). Doses: 1.81, 4.23, 5.46, 8.17, and 13.2 µg/L.	EC ₅₀ = 9.3 µg/L NOEC = 5.46 µg/L	CK-522-001; 1993/7001153
<i>Selenastrum capricornutum</i> (freshwater green alga)	Algal growth inhibition test	94.9	72-h static exposure. Study conducted according to OECD Method 201. Doses: 0.020, 0.035, 0.074, 0.133, 0.326 and 1.27 mg/L.	E _b C ₅₀ = 132 µg/L NOE _{RC} = 20 µg/L	CK-521-006; 1995/7000716
<i>Lepomis macrochirus</i> (bluegill fish)	Bioconcentration	97.1-97.3	33-day flow-through exposure. 54-day study conducted according to U.S. EPA Guideline 165-4. Dose: 1.0 µg/L (nominal). 2 radiolabels : Phenyl (U)- ¹⁴ C] label or [2-Pyrrole- ¹⁴ C] label.	Bioconcentration factors (BCF): 2084 to 2136 (total radioactivity); <u>83 to 114 (chlorfenapyr active substance)</u> . Uptake rate constant: 356 to 412 µg/Kg fish/µg/L water/day. Depuration rate constant: 0.171 day ⁻¹ . DT ₅₀ for clearance of the total radioactive residue during the depuration phase: 3 to 4 days.	CK-519-001; 1994/7000786
<i>Oncorhynchus mykiss</i> (rainbow trout)	Prolonged toxicity	94.5	28-day flow-through exposure. Study conducted according to OECD Method 204. Doses: 0, 0.86, 1.74, 3.86, 8.91, and 20 µg/L.	NOEC = 0.86 µg/L LOEC = 1.74 µg/L LC ₅₀ = 4.58 µg/L	CK-512-003; 1993/7001102
<i>Oncorhynchus mykiss</i> (rainbow trout)	Fish Early Life Stage toxicity	94.5	94-day flow-through exposure. Study conducted according to U.S. EPA Guideline 72-4(a). Doses: 0, 0.459, 0.907, 1.78, 3.68, and 7.64 µg/L.	NOEC = 3.68 µg/L LOEC = 7.64 µg/L based on post-hatch survival	CK-512-002; 1993/7001103

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Species	Test	Purity % Note	Guideline, duration, doses and conditions	Result	Study number
<i>Daphnia magna</i> (water flea)	Chronic Toxicity Full Life-Cycle	94.5	21-day flow-through exposure. Study conducted according to U.S. EPA Guideline 72-4(b) and OECD 202, Part B. Doses: 0, 0.278, 0.448, 0.987, 1.88, 3.57 and 7.70 µg/L.	NOEC = 3.57 µg/L LOEC = 7.70 µg/L	CK-523-001; 1994/7000840
<i>Mysidopsis bahia</i> (mysid shrimp)	Chronic Toxicity Full Life-Cycle	94.5	28-day flow-through exposure. Study conducted according to U.S. EPA Guideline 72-4. Doses: 0, 0.172, 0.385, 0.966, 1.89 and 3.86 µg/L.	NOEC = 0.17 µg/L LOEC = 0.39 µg/L	CK-523-002; 1994/7000791
<i>Hyalella azteca</i>	Acute toxicity to freshwater sediment-dwelling organisms	94.9	Single application to sediment. 10-day study conducted according to U.S. EPA Guideline 73-1. Doses: 0, 6.25, 12.5, 25.0, 50.0, and 100 mg ai/kg of dry sediment (nominal).	NOEC = 10.9 mg/kg in the sediment LC ₅₀ = 21.2 mg/kg in the sediment	CK-521-007; 1997/7000878
<i>Leptocheirus plumulosus</i>	Acute toxicity to saltwater sediment-dwelling organisms	94.5	Single application to sediment. Static 10-day study conducted according to U.S. EPA Guideline 73-1. Doses: 0, 0.05, 0.10, 0.20, 0.40, and 0.80 mg ai/kg of dry sediment (nominal).	NOEC = 0.09 mg/kg in the sediment LC ₅₀ = 0.19 mg/kg in the sediment	CK-521-008; 1998/7000835
<i>Chironomus riparius</i> (midge)	Toxicity to freshwater sediment-dwelling organisms	94.9	Single application to water. Static 28-day study conducted according to EEC Annex II Series 8.2.7. Doses: 0, 18.8, 37.5, 75, 150, and 300 µg ai/L (nominal).	NOEC = 18.8 µg/L LC ₅₀ = 49.5 µg/L	CK-549-007; 1997/7000799
Soil microbes	Inhibition of respiration and nitrification of soil microflora	94.5	Single application in 2 soils. 28/91-day study conducted according to BBA Part VI 1.1. Doses: 400 and 4000 µg a.i. per kg dry soil (nominal).	No significant effect on carbon fixation, NOEC ≥ 4.0 mg/kg. More than 25% inhibition of nitrogen fixation after 56 days in 1 soil.	CK-625-001; 1995/7000712
<i>Eisenia foetida</i> (earthworm)	Acute toxicity	94.5	Single application to soil. 14-day study conducted according to OECD 207. Doses: 0, 5.0, 10, 20, 40, and 80 mg/kg dry soil (nominal).	LC ₅₀ = 23 mg a.i./kg soil	CK-531-003; 1994/7000855
<i>Eisenia foetida</i> (earthworm)	Chronic toxicity, growth & reproduction	94.5	Single application to soil. 156-day study conducted according to Draft International Standard ISO/DIS 11268-2, Soil quality.	No significant effects on mortality, reproduction, morphology, or change in body weight at 0.84 and 4.2 mg ai per kg dry soil.	CK-534-001; 1995/7000765

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Species	Test	Purity % Note	Guideline, duration, doses and conditions	Result	Study number
			Doses: 0.84 mg and 4.2 mg ai per kg dry soil (nominal).		
Various Crop Plants and Weeds	Acute toxicity to non-target plants	N/A	Herbicide Screening Procedure. Pre- and/or post-emergence exposure at doses ranging from 63 to 2000 g/ha.	Low herbicidal activity post-emergence and no herbicidal activity when applied pre-emergence to over 30 species of plants.	CK-549-016; 1930/7000989
<i>Anas platyrhynchos</i> (mallard duck)	Acute toxicity LD ₅₀	94.5	Single exposure. 21-day study conducted according to U.S. EPA Guideline No: 71-1. Doses: 0, 1, 2, 4, 8, 16, 32, 64, and 128 mg/kg b.w. (nominal).	LD ₅₀ = 10.3 mg/kg b.w. NOEL = 1 mg/kg b.w.	CK-505-001; 1993/7001095
<i>Colinus virginianus</i> (Northern bobwhite)	Acute toxicity LD ₅₀	94.5	Single exposure. 21-day study conducted according to U.S. EPA Guideline No: 71-1. Doses: 0, 1, 2, 4, 8, 16, 32, 64, and 128 mg/kg b.w. (nominal).	LD ₅₀ = 34 mg/kg b.w. NOEL = 8 mg/kg b.w.	CK-505-002; 1993/7001094
<i>Anas platyrhynchos</i> (mallard duck)	Acute toxicity LC ₅₀	94.5	5-day exposure. 8-day study conducted according to U.S. EPA Guideline No: 71-2. Doses: 0, 4, 6, 9, 13.5, and 20.3 mg/kg diet. (nominal).	LC ₅₀ = 8.6 mg/kg diet NOEC < 4 mg/kg diet	CK-505-003; 1993/7001093
<i>Colinus virginianus</i> (Northern bobwhite)	Acute toxicity LC ₅₀	94.5	5-day exposure. 8-day study conducted according to U.S. EPA Guideline No: 71-2. Doses: 0, 10, 20, 40, 80, 160, and 320 mg/kg diet. (nominal).	LC ₅₀ = 132 mg/kg diet NOEC = 10 mg/kg diet	CK-505-004; 1993/7001158
<i>Anas platyrhynchos</i> (mallard duck)	Effects on bird reproduction	94.5	20-week exposure. Study conducted according to U.S. EPA Guideline No: 71-4 and OECD Method 206. Doses: 0, 0.5, 1.5, and 2.5 mg/kg diet (nominal).	NOEC for reproductive effects = 0.5 mg/kg diet	CK-505-008; 1994/7000889
<i>Colinus virginianus</i> (Northern bobwhite)	Effects on bird reproduction	94.5	20-week exposure. Study conducted according to U.S. EPA Guideline No: 71-4 and OECD Method 206. Doses: 0, 0.5, 1.5, and 4.5 mg/kg diet (nominal).	NOEC for reproductive effects = 1.5 mg/kg diet	CK-505-007; 1994/7000890
<i>Apis mellifera</i> (honey bee)	Acute contact and oral toxicity	94.5	Single exposure.	LD ₅₀ contact = 0.45 µg/bee LD ₅₀ oral = 1.7 µg/bee	CK-541-004; 1995/7001534

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Species	Test	Purity % Note	Guideline, duration, doses and conditions	Result	Study number
			96-h study conducted according to U.S. EPA Guideline No: 141-1 and EPPO 170. Doses: 0.031, 0.063, 0.1, 0.25 , 0.50 and 1.0 µg a.s./bee (nominal) for the contact test and 0.13, 0.25, 0.50, 1.0, 2.0, and 4.0 µg a.s./bee (nominal) for the oral test.		

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Annex 2: References

Study number	Author(s)	year	Study title. Study identification number. Report identification number. GLP [if GLP]. Company conducting the study.
EC, 2013		2013	COMMISSION DIRECTIVE 2013/27/EU of 17 May 2013 amending Directive 98/8/EC of the European Parliament and of the Council to include chlorfenapyr as an active substance in Annex I thereto
EPA 2001		2001	Pesticide Fact Sheet, Chlorfenapyr, EPA-730-F-00-001, January, 2001 http://www.epa.gov/opprd001/factsheets/chlorfenapyr.pdf
CD, 2001		2001	2001/697/EC: Commission Decision of 5 September 2001 concerning the non-inclusion of chlorfenapyr in Annex I to Council Directive 91/414/EEC (Text with EEA relevance) (notified under document number C(2001) 2617) Official Journal L 249 , 19/09/2001 P. 0019 - 0020
FAO/WHO Manual		2009	Manual on development and use of FAO and WHO specifications for pesticides, June 2009 revision of the First edition http://www.fao.org/agriculture/crops/core-themes/theme/pests/pm/jmps/manual/en/ www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm and http://whqlibdoc.who.int/publications/2006/9251048576_eng_update2.pdf
Funk, 2011		2011	E-mail from Steven Funk, EPA, Sent on 4 April 2011 13:17 [From: Funk.Steve@epamail.epa.gov to laszlo.bura@efsa.europa.eu]
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CK-306-003		1997	AC 303630: Determination of the vapor pressure American Cyanamid Co.; Ewing NJ; United States of America CK-306-003; 1997/7000836 GLP, Unpublished
CK-303-002		1994	AC 303,630: Determination of the melting point American Cyanamid Co.; Princeton NJ; United States of America CK-303-002; 1994/7000817 GLP, Unpublished
CK-334-001		1993	Pirate technical (AC 303,630) – Explodability American Cyanamid Co.; Princeton NJ; United States of America CK-334-001; 1993/7001056 GLP, Unpublished
CK-311-001		1994	AC 303,630: The determination of the solubility American Cyanamid Co.; Princeton NJ; United States of America CK-311-001; 1994/7000775 GLP, Unpublished
CK-315-002		1995	AC 303,630: n-octanol/water partition American Cyanamid Co.; Princeton NJ; United States of America CK-315-002; 1995/7000648 GLP Unpublished

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CK-303-001		1991	AC 303,630: Determination of the melting point of technical American Cyanamid Co.; Princeton NJ; United States of America CK-303-001; GLP, Unpublished
K-322-005		1993	CL 303,630: Hydrolysis American Cyanamid Co.; Princeton NJ; United States of America CK-322-005; 1993/70002659 GLP, Unpublished
CK-630-003		1994	AC 303,630: Photodegradation in water American Cyanamid Co.; Princeton NJ; United States of America CK-630-003; 1995/7000719 GLP, Unpublished
CK-630-006		1995	Determination of the quantum yield of AC 303,630 in water CK-630-006; 1995/7000721 GLP, Unpublished
CK-322-001		1994	The dissociation constant of AC 303,630 American Cyanamid Co.; Princeton NJ; United States of America CK-322-001; 1994/7001669 Not subject to GLP regulations, unpublished
WHO, 2009		2009	The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009, p. 67. www.who.int/entity/ipcs/publications/pesticides_hazard_2009.pdf
CLP, 2009		2009	http://ecb.jrc.ec.europa.eu/classification-labelling/clp/ghs/index.php?indexNum=608-034-00-3&subLang=EN
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CK-411-001		1993	Oral LD50 study in albino rats with AC 303,630 technical CK-411-001; 1993/7001133 GLP, Unpublished
CK-411-004		1994	Oral LD50 study in albino mice with AC 303,630 technical CK-411-004; 1994/7000707 GLP, Unpublished
CK-412-001		1992	Dermal LD50 study in albino rabbits with AC 303,630 technical CK-412-001; 1992/7001140 GLP, Unpublished
CK-413-001		1993	Acute inhalation toxicity study with AC 303,630 in rats CK-413-001; 1993/7001115 GLP, Unpublished
CK-415-004		1993	Skin irritation study in albino rabbits with AC 303,630 technical CK-415-004; 1993/7001137 GLP, Unpublished
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CK-416-002	1995	Dermal sensitization study of Chlorfenapyr technical in guinea pigs (Maximization test) CK-416-002; 1999/7000754 GLP, Unpublished
CK-420-003	1991	AC 303,630: A 28-day rat feeding study CK-420-003; 1991/7001094 GLP, Unpublished
CK-420-004	1991	AC 303,630: A 28-day mouse feeding study CK-420-004; 1991/7001093 GLP, Unpublished
CK-425-002	1993	AC 303,630: A 13-week dietary toxicity study in the albino rat CK-425-002; 1993/7001148 GLP, Unpublished
CK-425-003	1994	AC 303,630: A 13-week dietary toxicity study in the albino mouse CK-425-003; 1994/7000836 GLP, Unpublished
CK-425-001	1993	90-day dietary toxicity study with AC 303,630 in purebred Beagle dogs CK-425-001; 1993/7001149 GLP Unpublished
CK-427-002	1994	A chronic dietary toxicity and oncogenicity study with AC 303,630 in rats CK-427-002; 1994/7000797 GLP, Unpublished
CK-427-004	1994	One year dietary toxicity study with AC 303,630 in purebred Beagle dogs CK-427-004; 1994/7000794 GLP, Unpublished
CK-428-002	1994	A chronic dietary toxicity and oncogenicity study with AC 303,630 in mice CK-428-002; 1994/7000798 Non-GLP, study initiated in 1991 prior to the implementation of GLP, but scientifically valid, Unpublished
CK-432-001	1993	An oral developmental toxicity (embryo-fetal toxicity / teratogenicity) definitive study with AC 303,630 in rats CK-432-001; 1993/7001107 GLP, Unpublished
CK-432-002	1993	An oral developmental toxicity (embryo-fetal toxicity / teratogenicity) definitive study with AC 303,630 in rabbits CK-432-002; 1993/7001106 GLP, Unpublished
CK-430-002	1994	A two-generation (one-litter) reproduction study with AC 303,630 in rats CK-430-002; 1994/7000839 GLP, Unpublished
CK-435-007	1994	MK-242 technical: Analysis of metaphase chromosomes obtained from CHL cells cultured in vitro CK-435-007; 1994/7000803 GLP, Unpublished
CK-435-006	1994c	Evaluation of CL 303,630 in the in vitro chromosome aberration assay in chinese hamster ovary (CHO) cells CK-435-006; 1994/7000835 GLP, Unpublished

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CK-435-003	1993	Unscheduled DNA synthesis in rat primary hepatocytes with AC 303,630 CK-435-003; 1993/7001146 GLP, Unpublished
CK-435-004	1994b	Evaluation of CL 303,630 in the in mammalian cell CHO/GHPR T mutagenicity assay: Additional Data CK-435-004; 1994/7000834 GLP, Unpublished
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CK-511-001	1992	Acute toxicity of AC 303,630 to bluegill sunfish (<i>Lepomis macrochirus</i>) under flow-through test conditions CK-511-001; 1992/7001143 GLP, Unpublished
CK-511-002	1992	Acute toxicity of AC 303,630 to rainbow trout (<i>Oncorhynchus mykiss</i>) under flow-through test conditions CK-511-002; 1992/7001128 GLP, Unpublished
CK-511-005	1996	Acute toxicity of AC 303,630 to the channel catfish (<i>Ictalurus punctatus</i>) under flow-through test conditions CK-511-005; 1996/7000986 GLP Unpublished
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CK-521-001	1992	Acute toxicity of AC 303,630 to <i>Daphnia magna</i> under flow-through test conditions CK-521-001; 1992/7001127 GLP, Unpublished
CK-521-004	1994	Acute toxicity of AC 303,630 to the Mysid (<i>Mysidopsis bahia</i>) under flow-through conditions CK-521-004; 1994/7000842 GLP, Unpublished
CK-522-001	1993a	Effect of AC 303,630 on new shell growth in the eastern oyster (<i>Crassostrea virginica</i>) under flow-through test conditions CK-522-001; 1993/7001153 GLP, Unpublished
CK-521-006	1995	Effect of AC 303,630 on the growth of <i>Selenastrum capricornutum</i> 1995/7000716 GLP, OECD, Unpublished
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CK-512-003	1993	Toxicity of AC 303,630 in rainbow trout (<i>Oncorhynchus mykiss</i>) after 28 days of exposure under flow-through test conditions CK-512-003; 1993/7001102 GLP, Unpublished

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CK-512-002	1993	Early life-stage toxicity of AC 303,630 in rainbow trout (<i>Oncorhynchus mykiss</i>) CK-512-002; 1993/7001103 GLP, Unpublished
CK-523-001	1994	Chronic toxicity of 14C-AC 303,630 during the complete life-cycle of <i>Daphnia magna</i> under flow-through test conditions CK-523-001; 1994/7000840 GLP, Unpublished
CK-523-002	1994	Chronic toxicity of AC 303,630 to the mysid (<i>Mysidopsis bahia</i>) under flow-through test conditions CK-523-002; 1994/7000791 GLP, Unpublished
CK-521-007	1997	Evaluation of the acute toxicity of whole sediment-associated AC 303630 to the freshwater amphipod, <i>Hyallela azteca</i> , under flow-through conditions CK-521-007; 1997/7000878 GLP, Unpublished
CK-521-008	1998	Evaluation of the acute toxicity of whole sediment-associated AC 303630 (Chlorfenapyr) to the saltwater amphipod, <i>Leptocheirus plumulosus</i> , under static test conditions CK-521-008; 1998/7000835 GLP, Unpublished
CK-549-007	1997	Evaluation of the toxicity of AC 303,630 to the sediment dwelling larvae of the midge, <i>Chironomus riparius</i> (report amendment # 1) CK-549-007; 1997/7000799 GLP, Unpublished
CK-625-001	1995	The effects of AC 303,630 on the respiration and nitrification of soil microflora CK-625-001; 1995/7000712 GLP, Unpublished
CK-531-003	1994	14-day acute toxicity study with AC 303,630 in the earthworm (<i>Eisenia foetida</i>) CK-531-003; 1994/7000855 GLP, Unpublished
CK-549-016	1992	Evaluation of CL 303630 (Chlorfenapyr) for herbicidal activity American Cyanamid Co.; Princeton NJ; United States of America CK-549-016; 1930/7000989 Non-GLP, Unpublished
CK-505-001	1993b	21-day acute toxicity test with AC 303,630 technical in the mallard duck (<i>Anas platyrhynchos</i>) CK-505-001; 1993/7001095 GLP, Unpublished
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CK-505-007		1994	Reproduction study with AC 303,630 technical in the northern bobwhite (<i>Colinus virginianus</i>) CK-505-007; 1994/7000890 GLP, Unpublished
CK-541-004		1995	An acute contact and oral toxicity study with AC 303,630 on the honey bee (<i>Apis mellifera</i> L.) CK-541-004; 1995/7001534 GLP, Unpublished
CK-534-001		1995	Determination of the effects of sublethal concentrations of AC 303,630 active ingredient on earthworm (<i>Eisenia fetida</i>) growth and reproduction CK-534-001; 1995/7000765 GLP, Unpublished
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