Peer review of the pesticide risk assessment of the active substance methomyl[1]

(Question No EFSA-Q-2008-696)

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This conclusion replaces the earlier version published on 8 April 2009[2].

SUMMARY

Methomyl is one of the 52 substances of the second stage of the review programme covered by Commission Regulation (EC) No 451/2000[3], as amended by Commission Regulation (EC) No 1490/2002[4]. This Regulation requires the European Food Safety Authority (EFSA) to organise a peer review of the initial evaluation, i.e. the draft assessment report (DAR), provided by the designated rapporteur Member State and to provide within one year a conclusion on the risk assessment to the EU-Commission.

United Kingdom being the designated rapporteur Member State submitted the DAR on methomyl in accordance with the provisions of Article 8(1) of the amended Regulation (EC) No 451/2000, which was received by the EFSA on 3 May 2004. Following a quality check on the DAR, the peer review was initiated on 28 June 2004 by dispatching the DAR for consultation of the Member States and the main applicant DuPont de Nemours. Makhteshim Agan ICC also submitted a dossier which the rapporteur Member State considered to be substantially incomplete. Subsequently, the comments received on the DAR were examined by the rapporteur Member State and the need for additional data was agreed in an evaluation meeting on 9 February 2005. Remaining issues as well as further data made available by the notifier upon request were evaluated in a series of scientific meetings with Member State experts in September 2005.

A discussion of the outcome of the consultation of experts following the procedure set out in Commission Regulation (EC) 451/2000 took place with representatives from the Member States on 7

[1] For citation purposes: Conclusion on pesticide peer review regarding the risk assessment of the active substance methomyl. *EFSA Scientific Report* (2008) 222, 1-99
[2] The Background section (pages 10-11) has been updated to clarify the status and availability of the documentation developed during both the initial review process and the resubmission procedure.
[3] OJ No L 53, 29.02.2000, p. 25
[4] OJ No L 224, 21.08.2002, p. 25

June 2006 leading to the conclusions set out in the EFSA Conclusion issued on 23 June 2006 (EFSA Scientific Report (2006) 83 refers).

Following the Commission Decision of 19 September 2007 (2007/628/EC)[5] concerning the non-inclusion of methomyl in Annex I to Council Directive 91/414/EEC and the withdrawal of authorisations for plant protection products containing that substance, the notifier DuPont de Nemours made a resubmission application for the inclusion of methomyl in Annex I in accordance with the provisions laid down in Chapter III of Commission Regulation (EC) No. 33/2008. The resubmission dossier included further data in response to the areas of concern identified in the review report as follows: operator, worker and bystander exposure; the risks to birds, mammals, and aquatic organisms; the possible impact on non-target arthropods.

The United Kingdom, being the designated rapporteur Member State, submitted the additional report on methomyl to the EFSA on 15 May 2008. In accordance with Article 19 of Commission Regulation (EC) No. 33/2008, the EFSA dispatched the additional report to Member States and the notifier for consultation. The comments received were subsequently submitted to the Commission for evaluation. In accordance with Article 20 of Commission Regulation (EC) No. 33/2008, the Commission subsequently requested the EFSA, by letter received on 22 September 2008, to arrange a peer review of the evaluation, i.e. the additional report provided by the rapporteur Member State, and to deliver its conclusion on the risk assessment within 90 days.

The peer review was initiated on 23 September 2008 by dispatching the comments received on the additional report to the rapporteur Member State for examination. The rapporteur provided a response to the comments in the reporting table, which was subsequently evaluated by the EFSA to identify the remaining issues to be further considered in a series of scientific teleconferences with Member State experts in November 2008.

A final discussion of the outcome of the consultation of experts took place during a written procedure with the Member States in December 2008. The EFSA conclusion has therefore been re-issued to update the risk assessment in the areas of mammalian toxicology, fate and behaviour, and ecotoxicology.

The original conclusion from the review was reached on the basis of the evaluation of the representative uses presented in the DAR, i.e. use as an insecticide for foliar spraying to control biting and sucking insects in cucumber, courgette, tomato, eggplants and grapes. However, the use on grapes was not supported in the resubmission application, and therefore the conclusion has only been updated in relation to the risk assessment of the representative uses presented in the additional report, i.e. only those uses on cucumber, courgette, tomato, and eggplants. The risk assessment presented for grapes has not been updated.

[5] OJ No L 255, 29.09.2007, p.40

The representative formulated product for the evaluation was ‘Lannate 20 SL’ (also known as ‘Methomyl 20 SL’), a soluble concentrate (SL), registered in some Member States of the EU.

Adequate methods are available to monitor all compounds given in the respective residue definition. Only single methods for the determination of residues are available since a multi-residue-method like the German S19 or the Dutch MM1 is not applicable due to the nature of the residues.
Sufficient analytical methods as well as methods and data relating to physical, chemical and technical properties are available to ensure that quality control measurements of the plant protection product are possible.

Methomyl is highly toxic via the oral, ocular and inhalation routes of exposure, but has a low toxicity via the dermal route. On the basis of the data package available the proposed classification is T+, R26 ‘Very toxic by inhalation’ and R25 ‘Toxic if swallowed’. It is not an eye or skin irritant and does not cause skin sensitisation. The overall short term NOAEL is approximately 10 mg/kg bw/day. Reliable data on effects on cholinesterase activity were not always determined. Based on the available studies, the weight of the evidence indicates that methomyl does not pose a genotoxic, reproductive or developmental concern. There was no evidence of methomyl-induced carcinogenic activity in rats or mice. The NOAEL for acute neurotoxicity is 0.25 mg/kg bw. The ADI, AOEL and ARfD were set at 0.0025 mg/kg bw, based on the acute neurotoxicity NOAEL applying a SF of 100. The operator exposure estimate is below the AOEL only for applications in field crops, with the use of PPE. The worker and bystander exposure is estimated to be below the AOEL for all scenarios considered.

The metabolism of methomyl in fruits is fully elucidated. Four metabolic pathways were identified generally leading to metabolites of no toxicological concern, as formed as a result of hydrolysis of the carbamate ester link and further degradation. However at least 2 metabolites were identified with intact carbamate structure (IN-HUZ57 and IN-G6520) and are considered as toxicologically relevant. In fruits, these metabolites are present at much lower levels than the parent compound and their contribution to the global toxicological burden is expected to be minor. Therefore, only the parent compound is proposed to be included in the residue definition for monitoring and risk assessment in fruit crops. For other commodities dealt with at member state level, the need for inclusion of these metabolites in the residue definition for risk assessment should be carefully considered as it appears that their ratio to the parent compound may be significant on leafy parts of plants, based on information obtained on grape foliage.
A sufficient amount of supervised residue trials were conducted in accordance with the supported representative uses, demonstrating that a MRL of 0.5 mg/kg would be needed for table and wine grapes, while residues in fruiting vegetables are consistently below the Limit Of Quantification (0.02 mg/kg) of the analysis method. In processed commodities (grape juice and wine), residues are lower than in raw grapes, this resulting from a preferential transfer to solid fractions during processing and from a partial degradation of methomyl to methomyl oxime. This degradation product has however no toxicological relevance.
On the basis of the supported representative uses dealt with under this peer review, no livestock exposure to methomyl residues is expected. Due to the low persistency of methomyl in soil, no residue of methomyl is expected in following crops.

Acute and chronic exposure assessments to methomyl residues were performed. A potential acute risk was identified for all considered population subgroups resulting from the consumption of treated table grapes.

Degradation of methomyl under dark aerobic conditions in soil does not produce any major metabolite. Taking into consideration also studies performed with thiodicarb (where methomyl appears as metabolite) methomyl is low or moderate persistent in soil under aerobic conditions. Unextractable residues accounted for up to 32.2 % AR after 30 d and CO_2 for 75.4 % AR after 92 d. New kinetic analysis presented in the resubmission dossier essentially confirmed the results of the first dossier evaluation. No new soil metabolites were identified in the soil photolysis study. Acetonitrile was detected as the major volatile metabolite. The meeting of MS experts considered that the potential environmental contamination by acetonitrile derived from the use of methomyl will be insignificant with respect to other anthropogenic sources. Under normal environmental conditions microbial degradation in soil is likely to predominate over the photolytic one.

In the available field studies for thiodicarb, field degradation half lives of thiodicarb and methomyl were longer than the ones measured under laboratory conditions. The rapporteur Member State normalized the field dissipation rates for methomyl using the average soil temperatures over the period resulting in corrected half lives in the range of those observed in laboratory studies.

Since the half life originally used to calculate PEC in soil was derived from a study finally not considered adequate, new PEC soil were calculated and reported in an addendum. Worst case laboratory half life of 15.2 d was used. Two applications of 450 g/ha with an interval of 14 d were calculated as a worst case representative use. Interception of 60 % (corresponding to leaf development BBCH 50) was assumed for vines and 70 % (corresponding to BBCH 20 onwards for tomatoes) was assumed for vegetables. The proposed representative uses in the initial submission did not restrict the application to any particular growing stage, therefore, EFSA calculated peak PEC soil for tomatoes considering leaf development stages (growing stages BBCH 10-19; 50 % interception) in the updated addendum. In the re-submitted dossier the representative uses have been restricted to growing stages after BBCH-20.

Methomyl is very highly mobile in soil. A column (3 soils) and an aged column (1 soil) leaching study is available for methomyl. In the column leaching study methomyl in leachate represented 6.6 – 55 % AR. Methomyl oxime was observed up to 2.2 % AR in soil and 1.7 % AR in leachate. In the aged column study, the major radioactive component in the leachate (5 % AR) co-chromatographed with methomyl.

Neither hydrolysis nor photolysis are expected to contribute significantly to the degradation of methomyl in the aqueous environment. Methomyl is not ready biodegradable.

In water / sediment systems, methomyl partitions to the sediment to levels up to 11.4 % AR after one day. Degradation occurred with half lives between 2.5 to 4.8 days in the whole systems. Dissipation from the water phase was between 3.5 and 4.5 d. New kinetic analysis presented in the resubmission dossier essentially confirmed the results of the first dossier evaluation. Unextractable residues in the sediment reached a maximum of 20.1 % AR after 14 d declining to 14.7 % AR at the end of the study (102 d). CO_2 reached a maximum of 32.1 – 72.3 % AR at the end of the studies. Acetonitrile appears as a major metabolite in some systems both in the sediment and as a volatile metabolite. The meeting of MS experts considered that the potential environmental contamination by acetonitrile derived from the use of methomyl will be insignificant with respect to other anthropogenic sources.

$PEC_{SW\ /\ SED}$ values for parent methomyl were calculated based only in spray drift loadings and considering two categories. The first category is 'late grapes and listed tall vegetables' (i.e. tomatoes and grapes post-flowering) and the second category is 'listed low vegetables' (i.e. courgettes and aubergines). For cucumber it is necessary for Member States to consider which category cucumbers fit into under their growing regimes. The values were recalculated for a water phase half life of 4.5 d in the addendum. In the resubmission dossier, the applicant presented new $PEC_{SW\ /\ SED}$ calculations based on FOCUS SW scheme. A soil half life of 6.5 d, a water phase half life of 4.1 d and a sediment phase half life of 1000d were assumed for methomyl in these calculations. Only the representative use on fruiting vegetables was intended to be supported in the resubmitted dossier and therefore PEC calculations for the use in grapes have not been updated. RMS estimated FOCUS Step 4 $PEC_{SW\ /\ SED}$ with the maximum mitigations possible according final version FOCUS Landscape and mitigation guidance to be used in the EU risk assessment.

The potential of ground water contamination by methomyl and its minor soil metabolite methomyl oxime was simulated by the applicant and recalculated by the rapporteur Member State for the representative uses in vines and tomatoes with FOCUS PRZM 2.2.1 and FOCUS PEARL 1.1.1 models for all relevant scenarios. None of the crop / scenario combinations exceeded the 0.1 µg / L on the 80^{th} percentile annual average concentrations neither for methomyl nor for methomyl oxime.

Concentration of methomyl in the air compartment and transport through it is not expected to be significant.

Several data gaps were identified during the previous peer review of methomyl for terrestrial vertebrates (EFSA Scientific Report (2006) 83, 1-73, Conclusion on the peer review of methomyl): to provide a first-tier risk assessment for birds and mammals (insectivorous) according to SANCO/4145/2000, to refine the acute risk assessment for birds on the same basis as the PPR Panel Opinion on pirimicarb (the EFSA Journal 2005 240,1-21), to refine the long-term risk assessment for birds, to refine the acute and the long-term risk assessment for mammals, to refine risk assessment for birds and mammals from the consumption of contaminated drinking water.

In the resubmission dossier the supported use was restricted to cucumber/courgette, tomato/eggplant, 2 applications with an application rate of 250-450 g a.s./ha, BBCH≥20. A risk assessment was provided accordingly. A refinement of the acute risk to birds on the basis of the PPR Panel Opinion for pirimicarb was conducted. However a conclusion was not reached since experts agreed that further data would be necessary for the interpretation of the results.

A refinement of the chronic risk to birds was provided, but a potential high risk could not be excluded when using the relevant generic focal species presented in the revised guidance document on the risk assessment for birds and mammals[6] (i.e. TER=4.0 to 4.6 for the generic focal species of 'finch', 'lark' and 'wagtail'). The acute and long term risk for mammals was low for fruiting vegetables due to the limitation of the application window to growing stage BBCH≥20. The risk from consumption of

[6] Scientific Opinion of the Panel on Plant protection products and their Residues (PPR) on the Science behind the Guidance Document on Risk Assessment for birds and mammals, Adopted on 17 June 2008, *The EFSA Journal* (2008) 734: 1-181

contaminated drinking water was addressed by considering that insectivorous birds obtain the water from the food. However EFSA is of the opinion that the available data do not clearly support this.

The risk to aquatic organisms was re-assessed in the resubmission dossier according to FOCUS step 3 and step 4 PEC values for fruiting vegetables with a BBCH≥20. A high risk was identified in all step 4 scenarios except D6 ditch early use with the application of mitigation measures such as a buffer zone of 30 metres.

A high risk to bees was identified. Risk mitigation measures to avoid all contact with bees are considered necessary. No data to establish a withholding period are available.

A high risk to non-target arthropods was identified. The applicant was asked to refine the risk assessment for non-target arthropods for both the in-field and off-field areas. In the resubmission no new data were provided. The potential for recovery was not demonstrated by the available data and risk mitigation measures such as an in-field no-spray buffer zone up to 15 m are necessary to address the off-field risk.

The acute risk to earthworms is considered to be low. In addition the long term risk to earthworms can be considered to be low for the representative uses in cucumber/courgette and tomato/eggplant for growth stages from BBCH 20 onwards.

The risk to soil micro-organisms, other soil non-target macro-organisms, non-target plants and biological methods for sewage treatment is considered to be low.

Key words: methomyl, peer review, risk assessment, pesticide, insecticide

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Background

Commission Regulation (EC) No 451/2000 laying down the detailed rules for the implementation of the second and third stages of the work program referred to in Article 8(2) of Council Directive 91/414/EEC, as amended by Commission Regulation (EC) No 1490/2002, regulates for the European Food Safety Authority (EFSA) the procedure of evaluation of the draft assessment reports provided by the designated rapporteur Member State. Methomyl is one of the 52 substances of the second stage covered by the amended Regulation (EC) No 451/2000 designating United Kingdom as rapporteur Member State.

In accordance with the provisions of Article 8(1) of the amended Regulation (EC) No 451/2000, United Kingdom submitted the report of its initial evaluation of the dossier on methomyl, hereafter referred to as the draft assessment report, to the EFSA on 3 May 2004. In accordance with Article 8(5) of the amended Regulation (EC) No 451/2000 the draft assessment report was distributed for consultation on 28 June 2004 to the Member States and the main applicant DuPont de Nemours as identified by the rapporteur Member State. Makhteshim Agan ICC also submitted a dossier which was found to be substantially incomplete. On this basis the rapporteur Member State has checked only the identity and impurities of methomyl in this latter, incomplete, dossier and taken into consideration the information available where this might indicate a greater risk than that identified by the data in the other dossier submitted.

The comments received on the draft assessment report were evaluated and addressed by the rapporteur Member State. Based on this evaluation, representatives from Member States identified and agreed in an evaluation meeting on 9 February 2005 on data requirements to be addressed by the notifier as well as issues for further detailed discussion at expert level. A representative of the notifier attended this meeting.

Taking into account the information received from the notifier addressing the request for further data, a scientific discussion of the identified data requirements and/or issues took place in expert meetings organised on behalf of the EFSA by the EPCO-Team of the Pesticide Safety Directorate (PSD) in York, United Kingdom in September 2005. The reports of these meetings have been made available to the Member States electronically.

A discussion of the outcome of the consultation of experts following the procedure set out in Commission Regulation (EC) 451/2000 took place with representatives from the Member States on 7 June 2006 leading to the conclusions set out in the EFSA Conclusion issued on 23 June 2006 (EFSA Scientific Report (2006) 83 refers).

Following the Commission Decision of 19 September 2007 (2007/628/EC)[7] concerning the non-inclusion of methomyl in Annex I to Council Directive 91/414/EEC and the withdrawal of authorisations for plant protection products containing that substance, the notifier DuPont de Nemours made a resubmission application for the inclusion of methomyl in Annex I in accordance

[7] OJ No L 255, 29.09.2007, p.40

with the provisions laid down in Chapter III of Commission Regulation (EC) No. 33/2008. The resubmission dossier included further data in response to the areas of concern identified in the review report as follows: operator, worker and bystander exposure; the risks to birds, mammals, and aquatic organisms; the possible impact on non-target arthropods.

The United Kingdom, being the designated rapporteur Member State, submitted the additional report on methomyl to the EFSA on 15 May 2008. In accordance with Article 19 of Commission Regulation (EC) No. 33/2008, the EFSA dispatched the additional report to Member States and the notifier for consultation. The comments received were subsequently submitted to the Commission for evaluation. In accordance with Article 20 of Commission Regulation (EC) No. 33/2008, the Commission subsequently requested the EFSA, by letter received on 22 September 2008, to arrange a peer review of the evaluation, i.e. the additional report provided by the rapporteur Member State, and to deliver its conclusion on the risk assessment within 90 days.

The peer review was initiated on 23 September 2008 by dispatching the comments received on the additional report to the rapporteur Member State for examination. The rapporteur provided a response to the comments in the reporting table, which was subsequently evaluated by the EFSA to identify the remaining issues to be further considered in a series of scientific teleconferences with Member State experts in November 2008.

A final discussion of the outcome of the consultation of experts took place during a written procedure with the Member States in December 2008. The EFSA conclusion has therefore been re-issued to update the risk assessment in the areas of mammalian toxicology, fate and behaviour, and ecotoxicology.

The original conclusion from the review was reached on the basis of the evaluation of the representative uses presented in the DAR, i.e. use as an insecticide for foliar spraying to control biting and sucking insects in cucumber, courgette, tomato, eggplants and grapes. However, the use on grapes was not supported in the resubmission application, and therefore the conclusion has only been updated in relation to the risk assessment of the representative uses presented in the additional report, i.e. only those uses on cucumber, courgette, tomato, and eggplants. The risk assessment presented for grapes has not been updated. A list of the relevant end points for the active substance as well as the formulation is provided in appendix 1.

The documentation developed during the resubsmission peer review was compiled as a **peer review report** comprising of the documents summarising and addressing the comments received on the initial evaluation provided in the rapporteur Member State's additional report:

- the comments received
- the resulting reporting table (rev. 1-1 of 7 October 2008)

as well as the documents summarising the follow-up of the issues identified as finalised at the end of the commenting period:

- the reports of the scientific expert consultation
- the evaluation table (rev. 2-1 of 19 December 2008)

Given the importance of the additional report including its addendum (compiled version of December 2008) and the peer review report with respect to the examination of the active substance, these documents are considered respectively as background documents A and B to this conclusion. The documents of the peer review report and the final addendum prepared during the course of the initial review process are made publicly available as part of the background documentation to the original conclusion, EFSA Scientific Report (2006) 83, issued on 23 June 2006.

THE ACTIVE SUBSTANCE AND THE FORMULATED PRODUCT

Methomyl is the ISO common name for *S*-methyl (*EZ*)-*N*-(methylcarbamoyloxy)thioacetimidate (IUPAC). It should be noted that neither the ISO common name nor the IUPAC identify the configuration but the *Z*- or *cis*-isomer is so strongly favored thermodynamically that the *E*- or *trans*-isomer is not detectable in practice.

Methomyl belongs to the class of oxime carbamate insecticides such as aldicarb, oxamyl and thiodicarb. Methomyl is taken up via the cuticle (contact) or by ingestion and acts by inhibition of the enzyme acetylchlolinesterase.

The representative formulated product for the evaluation was 'Lannate 20 SL' (also known as 'Methomyl 20 SL'), a soluble concentrate (SL), registered in some Member States of the EU.

The evaluated representative uses as insecticide comprise foliar spraying to control biting and sucking insects in cucumber, courgette, tomato, and eggplants. Only the use as insecticide was evaluated. It should be noted that the use in grape was withdrawn during the EU peer review process.

SPECIFIC CONCLUSIONS OF THE EVALUATION

1. Identity, physical/chemical/technical properties and methods of analysis

Methomyl was discussed at the EPCO experts' meeting for physical/chemical properties (EPCO 35) in September 2005. The resubmission application for methomyl did not necessitate an additional peer review in this section.

The minimum purity of methomyl as manufactured should not be less than 985 g/kg, which is higher than the minimum purity given in the FAO specification 264/TC (2002) of 980 g/kg. The higher value relates to the submitted results of current batch analysis and not to any toxicological concern to increase the minimum purity.
The technical material contains no relevant impurities.

Whether or not the second source can be regarded as comparable was discussed by the rapporteur Member State in the supplement to Volume 4 (Report on the Makhteshim-Agan source; Draft June

2004). Due to the fact that additional data on impurities were required (revisions to the specification and supporting information on purity of process reagents), it was not possible to conclude on the comparability. However, the rapporteur Member State has since received the outstanding data and has prepared a revision 1 (July 2005) to the supplement, the rapporteur Member State did not distribute this report to the Commission, the Member States or the EFSA.

The content of methomyl in the representative formulation is 200 g/L (pure).

The assessment of the data package revealed no issues that need to be included as critical areas of concern with respect to the identity, physical, chemical and technical properties of methomyl or the respective formulation.

The main data regarding the identity of methomyl and its physical and chemical properties are given in appendix 1.

Sufficient test methods and data relating to physical, chemical and technical properties are available. Also adequate analytical methods are available for the determination of methomyl in the technical material and in the representative formulation as well as for the determination of the respective impurities in the technical material.
Therefore, enough data are available to ensure that quality control measurements of the plant protection product are possible.

Adequate methods are available to monitor all compounds given in the respective residue definition, i.e. methomyl in food of plant origin, in soil, water and air. Also a method for the determination of residue (methomyl is converted into methomyl oxime[8]) in blood is available.

The methodology used is HPLC with post column derivatisation and fluorescence detection, HPLC with MS detection or GC-MS. A multi-residue method like the Dutch MM1 or the German S19 is not applicable to due the nature of the residues.
An analytical method for food of animal origin is not required due to the fact that no residue definition is proposed (see 3.2).

The discussion in the meeting of experts (EPCO 35, September 2005) on identity, physical and chemical properties and analytical methods was limited to some clarification with respect to the specification of the technical material and certain properties of the plant protection product.

2. Mammalian toxicology

Methomyl was discussed at EPCO and PRAPeR teleconference (TC) experts' meetings for mammalian toxicology, (EPCO 33 in September 2005 and at PRAPeR TC 2 in November 2008, respectively).

[8] methomyl oxime (IN-X1177): N-hydroxyethanimidothioic acid methyl ester

For the resubmission, discussed at PRAPeR TC 2, the RMS prepared an Additional report (May 2008) that included updated information relevant for dermal absorption and exposure assessment.

2.1. ABSORPTION, DISTRIBUTION, EXCRETION AND METABOLISM (TOXICOKINETICS)

Methomyl was readily absorbed from the gastrointestinal tract and rapidly eliminated within 24 hours from dosing (80% in the rat and 63% in the monkey). Urinary excretion accounted for 53% of the administered dose in rats and 29% in monkeys. Expired air accounted for approximately 33% of the administered dose in rats and 39% in monkeys. No specific bioaccumulation was noted with the exception of some radioactivity in red blood cells. In rats the major urine metabolite is the mercapturic acid derivative.[9] Acetonitrile is the major residue in blood and liver. In the monkey, over 18 metabolites were observed, none of which were greater than 4% and included those metabolites common with the rat. The monkey excretes more $^{14}CO_2$ and less ^{14}C-acetonitrile than the rat in expired air, and excretes considerably less of the mercapturic acid derivative of methomyl in urine (0.8% in monkey, 18% in rat); the monkey excreted a greater number of urinary metabolites.

2.2. ACUTE TOXICITY

Methomyl is highly toxic via the oral (LD_{50} 30 mg/kg bw), ocular and inhalation (LC_{50} 0.215 mg/L) routes of exposure, but it has a low toxicity via the dermal route. On the basis of the data package available the proposed classification of methomyl is **T+, R26 'Very toxic by inhalation'** and **R25 'Toxic if swallowed'**. It is not an eye or skin irritant and does not cause skin sensitisation. The adequacy of the local lymph node assay reported in the DAR was discussed in the EPCO meeting. At the top dose, ~2500 mg/kg bw, all animals died. While no deaths occurred in rats after an acute dermal dose of 2000 mg/kg bw, evidence of ChE inhibition was noted. Therefore the mortality was considered to be treatment-related, possibly as a result of oral ingestion through grooming. It was noted that in the surviving animals no sensitisation response was observed. Therefore the study was considered adequate, and confirmed the absence of sensitisation potential.

2.3. SHORT TERM TOXICITY

Short-term feeding studies have been conducted in rats, mice and dogs. The studies showed some drawbacks (not conducted to modern protocols or standards, many of them did not carry out ophthalmologic examinations or reliable determinations of brain cholinesterase activity). The EPCO meeting agreed on a relevant overall NOAEL of approximately 10 mg/kg bw/day from dietary studies in rats, dogs and mice.

2.4. GENOTOXICITY

Negative results were obtained in all the studies submitted (including an *in vivo* clastogenicity assay and a bone marrow micronucleus assay). Positive results have been reported in the literature (two reports); the company evaluated two published papers and submitted a summary of their findings. Based on deficiencies in the study protocols and the route of administration (i.p. injection) in the *in vivo* study, the company considered these publications not suitable for assessing the genotoxic

[9] methomyl mercapturate: *N*-acetyl-*S*-[1-[[[(methylamino)carbonyl]oxy]imino]ethyl]-L-cysteine (CAS)

potential of methomyl. An *in vitro* cytogenicity test was provided and was clearly negative. Based on the available studies, the weight of the evidence indicates that methomyl does not pose a genotoxic concern.

2.5. LONG TERM TOXICITY

In the long-term study in rats, body weight effects and haematological changes were observed (reduced RBC count, haemoglobin and haematocrit). In the long-term study in mice, reduced survival and transient haematological changes (as seen in rats) were observed. The experts during the EPCO meeting agreed on a NOAEL of 3 mg/kg bw/day from the 2 year study in dog, based on liver and spleen histopathology records at higher doses. There was no evidence of methomyl-induced carcinogenic activity in rats or mice.

2.6. REPRODUCTIVE TOXICITY

In the two-generation reproduction toxicity study, the main effects on parental animals were reduced body weight and food consumption, and increased relative spleen weight. There were no effects on reproduction and fertility but the combined mean pup weights were reduced. In the three generation reproduction toxicity study, there were no effects on parents or reproduction and fertility. Pup weight and food consumption were reduced in F3 pups. The parental and offspring NOAEL was 4.6 mg/kg bw/day and the reproductive NOAEL 80 mg/kg bw/day.
Developmental toxicity studies were conducted in rats and rabbits. In the rat developmental study, the maternal effects included reduced body weight and food consumption. There were no effects on the rat foetuses. In the rabbit developmental study, deaths, decreased body weight and clinical signs of cholinesterase activity were observed in the dams. There was no evidence of methomyl-induced teratogenic activity in rats or rabbits. Maternal and developmental NOAELs were 6 mg/kg bw/day and 16 mg/kg bw/day, respectively.

2.7. NEUROTOXICITY

The NOAEL for acute neurotoxicity was 0.25 mg/kg bw based on reversible dose-related brain cholinesterase activity; methomyl did not show any evidence of delayed toxicity.

2.8. FURTHER STUDIES

Several additional studies were performed to assess the reversibility of cholinesterase inhibition in rats, acute oral administration in rats, repeated oral dosing in rats and the *in vitro* activity of human and rat cholinesterase. A human volunteer study was also carried out to evaluate cholinesterase activity and the potential clinical signs of systemic toxicity in humans.
The potential toxicity of the plant metabolite IN HUZ57[10], identified in the grape metabolism study, was discussed during the EPCO meeting. It was considered that it is still of potential toxicological concern (it has the carbamate moiety and insecticidal activity although lower than that of methomyl). In the absence of data however, it was considered to have a potential for higher toxicity than methomyl.

[10] Hydroxy-cysteine derivative of methomyl (IN HUZ57): 9-hydroxy-6-methyl-3-oxo-4-oxa-7-thia-2,5-diazadec-5-en-10-oic acid

The plant metabolite IN G6520[11] retained the carbamate moiety and was potentially more toxic than methomyl. IN NR282[12] was not considered of toxicological concern due to the absence of the carbamate moiety.
Methomyl oxime (IN-X1177) toxicity was discussed in the DAR: they lose their biological activity upon cleavage of the carbamate moiety; therefore they are not expected to induce acetylcholinesterase inhibition as the carbamate moiety is absent.

2.9. Medical data

In a human volunteer study, a statistically significant decrease in RBC cholinesterase activity at doses of 0.2 and 0.3 mg/kg bw was registered within 1.75 hours post dosing; a single occurrence of a mild headache at a dose of 0.3 mg/kg bw and quantitatively increased salivation at 0.2 and 0.3 mg/kg bw were reported. Red blood cholinesterase activity was depressed by 19% at 0.1 mg/kg bw at 1.25 hour post dosing. Plasma cholinesterase activity was depressed at 0.2 mg/kg bw and above.
The EPCO meeting considered the limitations of the human study, including the small group sizes. The meeting additionally discussed the relative sensitivities of RBC and brain ChE in species investigated (equal sensitivity in the acute gavage neurotoxicity study, greater sensitivity in the brain in the rabbit dermal study), and the fact that the relative sensitivity in humans was not known. The data was not considered adequate for the derivation of human reference values.

2.10. Acceptable daily intake (ADI), acceptable operator exposure level (AOEL) and acute reference dose (ARfD)

ADI, AOEL, ARfD
The EPCO meeting considered that the NOAEL of 0.25 mg/kg bw from the rat acute neurotoxicity study was appropriate, with the use of a safety factor of 100 to derive an ARfD and AOEL of 0.0025 mg/kg bw. It was noted that it was not possible to set the ADI using a longer duration study as these had NOAELs of >0.25 mg/kg bw. Therefore the ADI was also set at 0.0025 mg/kg bw/day.

2.11. Dermal absorption

During the teleconference the experts discussed the new dermal absorption values proposed by the RMS in the Additional report (May 2008):
12.1/10= 1.2% (concentrate)
17.8/4.1= ~4.5% (dilution)
The discussion was focused on the available *in vivo* and *in vitro* dermal absorption studies (already presented in the DAR). (It was also noted that an interim report for a new *in vivo* rat dermal penetration study had been submitted to the RMS but had not been circulated).
For the *in vivo* data the meeting agreed not to include the amount found in the skin and considered it as not systemically available. Thus, *in vivo* dermal absorption values were 6.04 and 17.8% for the concentrate and the dilution, respectively. In addition, RMS proposed a correction factor of 2 to be applied to estimate the total *in vivo* absorption in the rat for the concentrate, since no inhalation data

[11] Hydroxy methyl methomyl (IN G6520): methyl *N*-[[[(hydroxymethyl)amino]carbonyl]oxy]ethanimidothioate
[12] IN NR282: 2-methyl-4-thiazolemethanol

were reported and low recovery was observed. This proposal was accepted by MSs. Therefore, *in vivo* rat dermal absorption values of 12 (12.1) and 18% (17.8) for the concentrate and the dilution were set. With regard to *in vitro* data, for the dilution the RMS proposed a correction factor of 4.1 based on rat: human ratio from *in vitro* flux data. Because the flux data was equivocal for the concentrate, the radioactivity absorbed data were used to derive an approximated correction factor of 10 based on radioactivity absorbed in rat, human and rabbits. Some concerns were raised about the use of a different approach for the concentrate and the dilution. The general agreement was to have a common approach for both and since adequate data for the radioactivity absorbed were available (taking into account the skin residues), the meeting decided to establish a correction factor of 10 (mean value rat:human, rabbit:human) and 1.2 (rat:human) for the concentrate and dilution, respectively. Accordingly, new dermal absorption values of 1.2% (12/10) and 15% (18/1.2) were set for the concentrate and the dilution.

2.12. EXPOSURE TO OPERATORS, WORKERS AND BYSTANDERS

Operator exposure

For the resubmission procedure, the RMS supported only the use of 'Lannate 20 SL' (also known as 'Methomyl 20 SL' in field crops (cucumber, courgette, tomato, aubergine) with an application rate of 0.25-0.45 kg a.s./ha (see additional report).
It is noted that in the original review the representative uses also included use on grapes. The exposure assessment performed with the previously agreed dermal absorption values showed that for applications in grapes the AOEL was exceeded for the operator (524% and 8100% of the AOEL for German and UK POEM model, respectively, with use of PPE) and the bystander, whereas it was below the AOEL for re-entry activities.
In the addendum 2 to the additional report, the RMS amended the exposure calculations to reflect new dermal absorption values of 1.2% for the concentrate and 15% for the spray solution.
The RMS also presented calculations reflecting the notifier's proposed reduced application rate of 250 g a.s./ha, together with a proposed work rate of 10 ha/day when using field crop sprayers rather than the default values of 20 ha/day in the German Model and 50 ha/day in the UK POEM. These issues were discussed during the teleconference for the resubmission procedure. According to the table of the intended uses a range for the application rate was presented (0.25-0.45 kg/ha). The meeting noted that the maximum application rate per treatment should be used in the calculations.
In addition, a refinement with 10 ha/day work rate was proposed, based on farm size information for field vegetable enterprises, and considering that several crops may be grown on a farm, and some farms may employ more than one sprayer operator. The meeting noted that the use of the default values is the first step for operator risk assessment and the refinement of the model should be performed at MS level. It was agreed that re-calculations should be submitted with the standard parameters.
The refined calculations are as follows:

Model	Method	% of the AOEL (0.0025 mg/kg bw/day) No PPE	% of the AOEL (0.0025 mg/kg bw/day) With PPE

Model	Method	% of the AOEL (0.0025 mg/kg bw/day) No PPE	% of the AOEL (0.0025 mg/kg bw/day) With PPE
German	Field crop sprayers, 20 ha, 0.45 kg methomyl/ha	1730	121*
UK POEM	Field crop sprayers, 50 ha, 0.45 kg methomyl/ha Knapsack sprayers, 0.8 ha, 0.45 kg methomyl/ha	5596 13572	713° 1976#

*gloves when handling the concentrate, gloves, coverall and sturdy footwear during application

°gloves when handling the concentrate and during the application

#gloves when handling the concentrate, gloves and impermeable coveralls during application

The estimated exposure for operators handling and applying 'Lannate 20 SL' in field crops is above the AOEL with both the German and UK POEM models, even with the use of PPE (according to calculations proposed by the RMS).

EFSA note: it is noted that considering the application of broad-brimmed headwear during application (German model) the operator exposure is below the AOEL (97%, and can be further lowered with the use of hood and visor during application, in place of the broad-brimmed headwear, and in addition to the PPE considered in the re-calculations submitted by the RMS). In addition, it is noted that the RMS also submitted re-calculations taking into account modified input parameters not agreed during the meeting of experts, and therefore not considered for the present assessment.

Worker exposure

Considering the new dermal absorption values agreed during the resubmission procedure, the estimated exposure to methomyl for an unprotected worker is equivalent to 43% of the AOEL for field crops (the only supported use for resubmission).

Bystander exposure

Considering the new dermal absorption values agreed during the resubmission procedure, the estimated bystander exposure to methomyl is equivalent to 13% of the AOEL for field crops (the only supported use for resubmission).

3. Residues

Methomyl was discussed at the EPCO experts' meeting for residues (EPCO 34) in September 2005. The resubmission application for methomyl did not necessitate an additional peer review in this section.

3.1. Nature and magnitude of residues in plant

3.1.1. Primary crops

The metabolism of methomyl has been investigated in grapes. The compound was applied as spray treatment and samples of grapes and leaves were collected 2, 7 and 14 days after application. At 14 days PHI, 88 and 68 % of the TRR in berries and foliage respectively were extractable. Four different metabolic pathways were identified. The primary pathway is supposed to involve the displacement of the S-methyl moiety by glutathione, which in turn is catabolised to its cysteine derivative, being further either hydroxylated to IN-HUZ57 or cleaved to the free thiol. The second pathway involves hydrolysis of the carbamate ester to methomyl oxime (IN-X1177). The third pathway involves oxidation on the methylamino substituent to form IN-G6520. The fourth pathway involves the isomeration of methomyl to its *E*-isomer followed by hydrolysis of the carbamate ester and formation of acetonitrile, which is further either volatilised, derived to IN-NR282 through a cysteine conjugation reaction or ultimately degraded to acetamide, acetic acid and carbon dioxide. Most of the compounds identified can be conjugated to glucose.

The metabolic pattern in fruits and leaves were rather different with methomyl being by far the major compound of the residue in fruits, while it was only a minor component of the residue in foliage samples. In foliage, IN-HUZ57, IN-G6520 and IN-NR282 were present in higher amounts than the parent compound. These metabolites are not present in the rat metabolism and the expert meeting on toxicology (refer to point 2.8) discussed their toxicological relevance. It was concluded that IN-HUZ57 and IN-G6520 should be considered at least as toxic as the parent compound as they still possess the carbamate moiety, while IN-NR282 could be considered as non relevant. The decision as to whether the 2 toxicologically relevant metabolites should or not be included in the residue definition for risk assessment was extensively discussed in the expert meeting. It was finally agreed to consider only methomyl in the residue definition for monitoring and risk assessment given that levels in fruits of IN-HUZ57 and IN-G6520 are one order of magnitude lower than that of methomyl, and their contribution to the global toxicological burden is therefore expected to be minor. Member States should however be aware that this definition is only applicable to the fruit group of commodities.

Further metabolism studies on tobacco, cabbage and maize were also submitted by the notifier, but these studies could not be used as they were not performed according to modern standards, were mainly translocation and uptake studies and gave no qualitative and quantitative information on the metabolic pathway. For crop groups other than fruits, Members States should require relevant and valid information to assess the ratio parent/toxicologically relevant metabolites to establish a residue definition for an adequate protection of consumer's health.

A sufficient number of supervised residue trials were submitted in accordance with the supported representative uses.

For grapevines, a total of 21 valid trials were conducted, 10 in Northern Europe and 11 in Southern Europe. The rapporteur Member State noted that there was no significant difference between both regions. The Highest Residue (HR) and Supervised Trials Median Residue (STMR) were respectively 0.59 and 0.09 mg/kg. For fruiting vegetables, a total of 18 acceptable trials were available (6 on cucumbers, 3 on courgettes and 9 on tomatoes). All these trials lead to residues below the Limit of Quantification (LOQ) of the method of analysis used (0.02 mg/kg). The validity of these results are supported by storage stability studies in grapes, processed grape fractions, broccoli, lettuce, potato, bean seed and peanut, demonstrating that the compound is stable under deep freeze condition for at least 24 months (for processed grape fractions the duration of the study was limited to 9 months, but no sign of degradation was present).

The effects of processing on the nature of the residues were investigated through hydrolysis studies simulating sterilisation, baking, boiling and pasteurisation. These studies showed that, although remaining the major compound present at the end of the simulated process, methomyl is degraded to an extent which depends on the severity of the pH and temperature conditions. The major degradation product was identified as methomyl oxime. This compound resulting from the hydrolysis of the carbamate ester link is less toxic than the parent compound and does not contribute to the inhibition of cholinesterase (refer to point 2.8). Therefore, no specific residue definition is needed for processed commodities. Processing studies were performed on grape samples taken from 4 residue trials to produce wine, grape juice and raisins. A mass balance study was conducted using the data of one trial, demonstrating a slightly preferential transfer to solid (pomace) fractions rather than to liquid fractions (juice and wine). Average transfer factors to grape juice and wine were calculated to be 0.21 and 0.58 respectively. Drying has a reducing effect on the residue level, with a low transfer factor to raisins (0.20 for a drying process of 5-7 days at 60°C). Similarly dry pomace contains generally less residues than wet pomace.

3.1.2. SUCCEEDING AND ROTATIONAL CROPS

No data were submitted to investigate the potential transfer of soil residues to following crops. The reason is the short residual nature of methomyl in soil (DT_{50} ranging from 4 to 8 days and longest DT_{90} value found to be 43 days). In addition to this, the metabolites formed in soil are of no toxicological concern (methomyl oxime being the major hydrolysis product with a DT_{50} of less than 1 day). No MRL or plant-back restriction is needed.

3.2. NATURE AND MAGNITUDE OF RESIDUES IN LIVESTOCK

Given the representative uses supported by the notifier, no exposure of livestock to methomyl residues is expected. However, metabolism studies in lactating goats and laying hens were submitted. These studies indicated that methomyl is extensively metabolised in livestock. No residues of parent compound or structurally related metabolites were present in tissues. Acetonitrile, thiocyanate and acetamide were detected as ultimate degradation products, before incorporation of the administered radioactivity in natural molecular constituents or elimination through expired volatile compounds.
A residue definition for animal products and the establishment of MRLs for these commodities is not required or necessary.

3.3. CONSUMER RISK ASSESSMENT

Chronic exposure.

The chronic dietary exposure assessment has been carried out according to the WHO guidelines for calculating Theoretical Maximum Daily Intakes (TMDI) and National Estimated Daily Intakes (NEDI). Two consumption patterns were considered: the WHO European typical diet for adult consumers, the diets in UK for 10 population subgroups including infants, toddlers, children and adults, which take into consideration high individual consumption levels (at the 97.5^{th} percentile of the distribution of consumptions in the respective populations).
A TMDI calculation was performed for the WHO diet. Methomyl residues were considered to be at the level of the HR found in supervised trials, and the consumer's body weight was 70 kg. In these conditions, the exposure was assessed to reach 6 % of the ADI.
A NEDI calculation was performed for the UK diet. Methomyl residues were considered to be at the level of the STMR found in supervised trials and a processing factor from grapes to wine of 0.58 was

used. The highest exposures among the 10 population subgroups were determined for toddlers and vegetarians, reaching 20 % of the ADI.

In the resubmission with the deletion of grapes as a representative use the chronic risk was further reduced.

Acute exposure.

The acute exposure to residues of methomyl in grapes and fruiting vegetables has been assessed according to the WHO model for conducting National Estimates of Short Term Intakes (NESTI) calculations. Large portion consumption data for 10 population subgroups (including infants, toddlers, children and adults) in UK were used. Calculations were carried out considering residues in composite samples of treated commodities at the level of the HR found in supervised trials (which is slightly higher than the proposed MRL) for grapes and at the level of the LOQ for fruiting vegetables. The variability factor used was 5 for grapes, aubergines and cucumbers and 7 for tomatoes and courgettes. Under these conditions the NESTI were found to be below the ARfD of methomyl for fruiting vegetables, but were largely in excess of the ARfD for table grapes: this exceedence was noted for all population subgroups, and the most critical NESTI value was found for toddlers with a potential acute exposure amounting to 1400 % of the ARfD. No exceedence of the ARfD was noted for wine as it can be considered that the unit to unit variability does not apply for wine production.

3.4. Proposed MRLs

Based on the results of supervised residue trials on grapes and their analysis according to statistical tools recommended by current guidelines a MRL of 0.5 mg/kg for methomyl should be set to accommodate the supported representative use. However, as mentioned in point 3.3, a risk for the consumer has been identified for table grapes.

For tomatoes, aubergines, cucumbers and courgettes the MRL is proposed to be set at the LOQ of the method of analysis (0.02 mg/kg).

4. Environmental fate and behaviour

Methomyl was discussed at the meeting of MS experts on fate and behaviour in the environment EPCO 31 on basis of the information presented in the DAR and Addendum 1 (August 2005). Some end points are derived from studies presented in the thiodicarb dossier. These studies were discussed in the meeting of MS experts EPCO 16.

A dossier was resubmitted to address the use in fruiting vegetables (cucumber, courgette, tomato and aubergine) limiting its application window to growing stage from BBCH 20. The RMS prepared an additional report (May 2008) that included updated information relevant for the fate and behaviour in the environment assessment. MSs and EFSA provided their comments to this additional report and the RMS prepared an addendum 1 to the additional report (November 2008). The resubmission of methomyl was finally discussed at the teleconference meeting of MS experts on fate and behaviour in the environment PRAPeR TC1. After the teleconference meeting the RMS provided additional information in addendum 2 to the additional report.

Use in grapes has not been reassessed in the updated dossier and therefore the peer reviewed assessment of the first submission is retained to address this use. Changes in the fate and behaviour end points derived from the re-submission are considered not to have a major impact on the results for the assessment for grapes.

4.1. FATE AND BEHAVIOUR IN SOIL

4.1.1. ROUTE OF DEGRADATION IN SOIL

The route of degradation of methomyl in soil under dark aerobic conditions at 20 ºC or 25 ºC was investigated in two studies. A total of four soils were investigated covering a range of pH (5.1 – 7.8), clay content (6.0 % - 13.4 %) and organic carbon (0.54 % - 2.1 %). Degradation in one of the soils was also tested at 10 °C. No major metabolite was identified in these studies. Methomyl oxime (max 2.2 % AR after 1d) was identified as a minor soil metabolite. Unextractable residues accounted for up to 32.2 % AR after 30 d and CO_2 for 75.4 % AR after 92 d.

Degradation under dark anaerobic conditions was investigated in one study with one soil (pH 7.8, clay 13.4 %, OC 0.54 %). After 14 d of aerobic incubation the samples were converted to anaerobic conditions. No new metabolites were identified under these conditions. CO_2 amounted up to 53 % AR at the end of the study (14 d aerobic + 60 d anaerobic).

A study was carried out to determine the photolytic degradation of methomyl under natural sunlight in one dry soil under non sterile conditions. No new soil metabolites were identified in this study. Acetonitrile was detected as the major volatile metabolite. The meeting of MS experts considered that the potential environmental contamination by acetonitrile derived from the use of methomyl will be insignificant with respect to other anthropogenic sources.

4.1.2. PERSISTENCE OF THE ACTIVE SUBSTANCE AND THEIR METABOLITES, DEGRADATION OR REACTION PRODUCTS

Additionally to the studies presented under the route sections, rate of degradation of methomyl in soil was also investigated in the studies presented in the thiodicarb dossier where methomyl appears as a metabolite. These studies were summarized by the rapporteur Member State in the methomyl DAR. In general these studies show that methomyl is low or moderate persistent in soil under aerobic laboratory conditions ($DT_{50\ lab\ 20\ ºC}$ = 4 – 15.2 d). However, one of the thiodicarb studies performed in a sandy loam soil (pH 5.6, OM 0.49 % AR) at 25 ºC showed longer halve lives for thiodicarb (DT_{50} = 3.6 d) and methomyl (DT_{50} = 31 d) (Feung and Weisbach, 1991c). Whereas the study was considered initially valid by the rapporteur Member State, the applicant argued that the atypical low water content of this soil made this study not suitable for the use in the risk assessment. These arguments were presented and assessed by the rapporteur Member State in the addendum to thiodicarb and discussed in the experts meeting (EPCO 16). The meeting agreed that these values should not be use for the EU risk assessment.

In the resubmission dossier, the applicant presented a reassessment of the methomyl degradation studies presented in the original dossier following FOCUS Kinetics guidance and using Model Maker^{TM} (v 4.0) software. Good fitting was obtained when the experiments were analyzed by non-linear regression using the SFO (simple first order) kinetic model. Essentially this reassessment confirms the results previously obtained showing that methomyl is low to moderate persistent in soil ($DT_{50\ lab\ 20ºC}$ = 4.6 – 11.5 d).

An aerobic soil degradation study was conducted with the metabolite methomyl oxime in three soils (pH 5.1 – 7.8, clay 6 – 10 %, OC 0.7 – 2.1 %) at 20 ºC. This metabolite was found to be very low persistent in soil (DT_{50} = 0.7 -0.9 d).

In the resubmission dossier, the applicant presented a reassessment of the methomyl oxime degradation experiments presented in the original dossier following FOCUS Kinetics guidance and using Model Maker™ (v 4.0) software. Good fitting was obtained when the experiments were analyzed by non-linear regression using the SFO (simple first order) kinetic model. Essentially this reassessment confirms the results previously obtained showing that methomyl oxime is low persistent in soil ($DT_{50\ lab\ 20ºC}$ = 1.0 – 1.3 d).

In the photolysis study performed with methomyl, degradation of methomyl was significantly faster under irradiated conditions than in the dark control but slower than in standard aerobic degradation tests. Therefore, it is expected that under normal environmental conditions microbial degradation in soil is likely to predominate over the photolytic one.

Two studies from the open scientific literature on degradation of methomyl in the saturated zone were presented in the dossier as supporting information.

Whereas not triggered by the directive, field dissipation studies are available for thiodicarb formulated either as water flowable or slow release pellets in the thiodicarb dossier. These products were applied as soil or foliar spray (water flowable) or broadcasted in soil surface before planting (pellets). When the substance was sprayed as an aqueous flowable formulation (Norris, 1991a), field degradation half lives of thiodicarb (DT_{50} = 18 d) and methomyl (DT_{50} = 18 – 43 d) were longer than the ones measured under laboratory conditions. A revision of this study presented by the applicant was assessed by the rapporteur Member State in the addendum of thiodicarb (reproduced for transparency in the addendum of methomyl). The applicant argued that this field study was performed at a significantly higher application rate (6 x 1.11 kg/ha) than the EU representative GAP for LARVIN (2 x 375 g /ha). Additionally, the study was designed to address specific weather conditions with application just prior freezing air and soil conditions in North West US. Data were reanalyzed and new approximated lower and upper limits for thiodicarb half life were calculated ($DT_{50\ field} \approx$ 4 – 8.6 d). For methomyl the revised half lifes calculated were comparable to those given in the original report ($DT_{50\ field} \approx$ 19 d – 43 d). However the average soil temperature during the period used to calculate methomyl degradation was reported to be 3 ºC. The rapporteur Member State normalized the field dissipation rates for methomyl using the average soil temperatures over the period resulting in corrected half lives in the range of those observed in laboratory studies ($DT_{50\_field\ norm\ 20\ ºC\ pF\ 2} \approx$ 6.5 – 8.5 d).

Since the half life originally used to calculate PEC in soil was derived from a study finally not considered adequate, new PEC soil were calculated and reported in an addendum. Worst case laboratory half life of 15.2 d was used. Two applications of 450 g/ha with an interval of 14 d were calculated as a worst case representative use. Interception of 60 % (corresponding to leaf development BBCH 50) was assumed for vines and 70 % (corresponding to BBCH 20 onwards was assumed for tomatoes) was assumed for vegetables. However, the proposed representative uses as given do not restrict the application to any particular growing stage. Therefore, EFSA calculated peak PEC soil for tomatoes use considering leaf development stages (growing stages BBCH 10-19; 50 % interception) in the updated addendum.

4.1.3. MOBILITY IN SOIL OF THE ACTIVE SUBSTANCE AND THEIR METABOLITES, DEGRADATION OR REACTION PRODUCTS

Batch adsorption/desorption studies are available for methomyl and its metabolite methomyl oxime. The results for these studies indicate that methomyl (K_{Foc} = 13.3 – 42.8 mL / g) and methomyl oxime (K_{Foc} = 6.6 – 20 mL / g) are very high mobile in soil.
A column (3 soils) and an aged column (1 soil) leaching studies are available for methomyl. In the column leaching study methomyl in leachate represented 6.6 – 55 % AR. Methomyl oxime was observed up to 2.2 % AR in soil and 1.7 % AR in leachate. In the aged column study, the major radioactive component in the leachate (5 % AR) co-chromatographed with methomyl.

4.2. FATE AND BEHAVIOUR IN WATER

4.2.1. SURFACE WATER AND SEDIMENT

In sterile buffer solutions at 25 °C methomyl degradation is pH dependent. Methomyl is stable at pH 5 and pH 7 but degrades at pH 9 with a DT_{50} = 36 d.[13]. Therefore, hydrolysis is not expected to contribute significantly to the degradation of methomyl in the environment.
According aqueous photolysis study available, direct photolysis is not expected to contribute to the environmental degradation of methomyl.
Methomyl is not ready biodegradable according the available study.
Two water sediment studies with a total of four dark aerobic systems incubated at 20 °C are available for methomyl. Methomyl partitions to the sediment, reaching a maximum of 11.4 % AR in the sediment after one day in one of the systems with relatively high organic carbon content (OC 5.8 %). Degradation of methomyl occurred with half lives between 2.5 to 4.8 days in the total systems. Dissipation from the water phase was between 3.5 and 5 d (due to recalculation of some values in the addendum this range changed as 3.5 to 4.5 d). In the resubmission dossier, the applicant presented a reassessment of the methomyl water sediment experiments presented in the original dossier following FOCUS Kinetics guidance and using Model Maker^{TM} (v 4.0) software. Good fitting was obtained when the experiments were analyzed by non-linear regression using the SFO (simple first order) kinetic model. Essentially this reassessment confirms the results previously obtained ($DT_{50\text{ whole water/sediment system}}$ = 3.7 – 4.1 d). No reliable determination of water and sediment degradation half-lives was obtained in this new kinetic analysis. Unextractable residues in the sediment reached a maximum of 20.1 % AR after 14 d declining to 14.7 % AR at the end of the study (102 d). CO_2 reached a maximum of 32.1 – 72.3 % AR at the end of the studies. Acetonitrile was found in the volatiles trap to a maximum of 27 % AR. Acetonitrile also exceeded 10 % AR in the sediment phase (max 10.2 – 10.9 % AR). The higher formation of acetonitrile in some systems seems to be associated to predominance of anaerobic conditions in the sediments of these systems. The meeting of MS experts considered that the potential environmental contamination by acetonitrile derived from the use of methomyl will be insignificant with respect to other anthropogenic sources.
$PEC_{SW\ /\ SED}$ values for parent methomyl were calculated based only in spray drift loadings and considering two categories. The first category is 'late grapes and listed tall vegetables' (i.e. tomatoes and grapes post-flowering) and the second category is 'listed low vegetables' (i.e. courgettes and aubergines). For cucumber it is necessary for Member States to consider which category cucumbers

[13] A half life of 15 d at pH 9 was reported in the thiodicarb DAR from a study performed with this substance.

fit into under their growing regimes. In all simulations a worst case half life of 5 days in water was initially assumed. The values were recalculated for a water phase half life of 4.5 d in the addendum.

In the resubmission dossier, the applicant presented new $PEC_{SW\ /\ SED}$ calculations based on FOCUS SW scheme. A soil half life of 6.5 d, a water phase half life of 4.1 d and a sediment phase half life of 1000d were assumed for methomyl in these calculations. Only the representative use on fruiting vegetables was intended to be supported in the resubmitted dossier and therefore PEC calculations for the use in grapes have not been updated. Two maximum application rates were proposed in the representative uses table (2 x 250 g and 2 x 450 g). For the FOCUS Step 3 and Step 4 calculations the notifier proposed to use an average foliar half life of 3.5 d based on residue decline on fruits (not in the foliage) instead of the default half life of 10 d in leaves proposed by the FOCUS SW guidance document. The teleconference meeting of experts discussed the acceptability of this deviation from FOCUS default values. Further information, including some residue decline trials on grape foliage was tabled by the RMS at this meeting. The experts agreed that in this case the value could be accepted for the EU risk assessment as neither grow dilution or wash off appear to be strong drivers of the decline in this case. After the meeting, the RMS presented the relevant data tabled during the meeting in Addendum 2.

Due to the wide application window allowed for the proposed representative uses, the RMS explored the effect of early and late applications on the simulated PECs by repeating FOCUS Step 3 calculations at a later application window. Additionally the RMS repeated the D6 early application simulation with a single application for which higher PECs are obtained. This is the only scenario for which it was shown that spray drift is the main route of exposure to surface water. In all of the other situations and scenarios simulated, run off and drainage events were responsible for the peaks observed in the calculated PEC_{SW}. The risk assessment based on FOCUS Step 3 PEC $_{SW\ /\ SED}$ showed a high risk for surface water environment in all the scenarios simulated both for higher and lower application patterns. The applicant proposed the consideration of the effect of potential mitigation measures on the exposure to surface water bodies by estimation of FOCUS Step 4 $PEC_{SW\ /\ SED}$. During the peer review it was questioned whether the Step 4 calculation presented in the additional report considered the maximum mitigation values established by the final report on the FOCUS Landscape and mitigation report.[14] New FOCUS Step 4 and clarifications values were provided by the RMS in the addendum 1 to the additional report. During the teleconference meeting of experts, the RMS clarified that FOCUS SW models have not actually been run in order to obtain the corresponding FOCUS Step 4 values but that the mitigation maximum allowed reduction had been directly applied to the FOCUS Step 3 PECs. This approach is not generally acceptable since contributions from run off and drainage may need to be mitigated differently than spray drift. However, the teleconference meeting of experts found this approach acceptable in this case as it was noted that the original applicant's Step 4 calculations (only available for 2 x 450 g a.s. / ha application pattern) indicated that for each scenario there was a single driving route of entry. Therefore, the values presented in Table 8.2 of addendum 1 to the additional report were considered suitable surface water exposure indicators to finalize the EU risk assessment.

[14] **Landscape and mitigation factors in aquatic risk assessment.** Sanco/10422/2005, version 2, September 2007.

Finally, it should be noted that in light of the PPR panel opinion[15] the 90 % run off mitigation is believed to only be attainable for strongly adsorbed pesticides (i.e. Koc ≈ 2000) by vegetative buffer strips, and that this situation does not apply to a highly mobile compound such as methomyl.

4.2.2. POTENTIAL FOR GROUND WATER CONTAMINATION OF THE ACTIVE SUBSTANCE THEIR METABOLITES, DEGRADATION OR REACTION PRODUCTS

The potential of ground water contamination by methomyl and its soil metabolite methomyl oxime was simulated by the applicant for the representative uses in vines and tomatoes with FOCUS PRZM 2.2.1 and FOCUS PEARL 1.1.1 models for all relevant scenarios. The rapporteur Member State recalculated the PEC_{GW} with the end points derived for methomyl using all the available information (including the information derived for methomyl as a metabolite of thiodicarb). A mean soil normalized half life of 7.38 d was used. Two applications of 450 g / ha per year at 14 d interval were simulated assuming 50 % crop interception for tomatoes (corresponding to grow stage BBCH 10-19 for application 30 days after emergence) and 60 % crop interception for vines (corresponding to leaf development for application 65 days after "emergence"). None of the crop / scenario combination exceeded the 0.1 µg / L on the 80th percentile annual average concentrations neither for methomyl nor for methomyl oxime. Values have not been recalculated for the slightly lower mean derived when the Feung and Weisbach (1991c) study is excluded since no change in the ground water risk assessment is expected.

4.3. FATE AND BEHAVIOUR IN AIR.

The Henry law constant of $8.6 \cdot 10^{-10}$ indicate that methomyl is unlikely to volatilize from water or wet soil. This is confirmed by the available soil volatilization study and the water / sediment studies. However, available plant volatilization study indicates that volatilization from leaves surface can occur (27 % within 24 h at 20 ºC with a relative humidity of aprox. 50 %). Photochemical degradation in the upper atmosphere is expected to occur with a half life of 19 h. Therefore, concentration of methomyl in the air compartment and transport through it is not expected to be significant.

5. Ecotoxicology

Methomyl was discussed at the EPCO experts' meeting for ecotoxicology (EPCO 32) in September 2005 in York (UK) (EFSA Scientific Report (2006) 83, 1-73, Conclusion on the peer review of methomyl).

The methomyl resubmission was discussed at a teleconference for ecotoxicology (PRAPeR TC 3) with Member State experts in November 2008 on the basis of the additional report from May 2008.

[15] **Opinion of the Scientific Panel on Plant protection products and their residues (PPR) related on the Final Report of the FOCUS Working Group on Landscape and Mitigation Factors in Ecological Risk Assessment**, EFSA-Q-2006-063. 13 December 2006, *The EFSA Journal* (2006) 437, 1-30

The areas of concern and the data gaps identified in the previous peer review (EFSA Scientific Report (2006) 83, 1-73, Conclusion on the peer review of methomyl) were considered with the resubmission. The risk assessment was provided for the use in cucumber/courgette, tomato/eggplant, 2 applications with an application rate of 250-450 g a.s./ha, BBCH≥20. The peer review focused on the maximum application rate of 450 g a.s /ha.
No new risk assessment was provided for the use in grapes since it was no longer supported by the applicant.

5.1. RISK TO TERRESTRIAL VERTEBRATES

Overall, the following data gaps were identified for terrestrial vertebrates during the previous peer review of methomyl (EFSA Scientific Report (2006) 83, 1-73, Conclusion on the peer review of methomyl):

1. to provide a first-tier risk assessment for birds and mammals (insectivorous) according to SANCO/4145/2000
2. to refine the acute risk assessment for birds on the same basis as the PPR Panel Opinion on pirimicarb (the EFSA Journal 2005 240,1-21)
3. to refine the long-term risk assessment to birds
4. to refine the acute and the long-term risk assessment for mammals
5. to refine the risk assessment for birds and mammals from the consumption of contaminated drinking water

A risk assessment according to SANCO/4145/2000 was provided in the additional report.
A high acute and long-term risk was identified in the first-tier risk assessment (for birds TER_a= 0.99 and TER_{lt} = 1.5, for mammals TER_a= 6.9 and TER_{lt} = 3.2).
The acute and long-term TER for birds were still below the Annex VI triggers when the calculations were made with the minimum application rate of 250 g a.s./ha (TER_a= 1.8 and TER_{lt} = 2.7).

REFINED ACUTE RISK ASSESSMENT FOR BIRDS

The acute risk assessment for birds was refined according to the pirimicarb opinion, as agreed in the previous peer review of methomyl.
The opinion on pirimicarb suggested to take into account the metabolic rate, the influence of avoidance, the effect of ADME (absorption, distribution, metabolism and excretion) and the total time or total food intake from the start of feeding to reach the LD_{50}. Several parameters have to be defined to apply this approach.
The Member States experts discussed step by step the refinement provided in the additional report to agree on the definition of the key parameters and to identify the best and worst case scenarios, as suggested by the opinion on pirimicarb. The outcome of the discussion is reported below.

Estimation of <u>metabolic rate</u> (LD50×*k*) (mg a.s/kg bw/min)

The applicant proposed a 1st order rate constant *k* value of 0.004814 per minute to determine the metabolic rate. The value was derived from the hen metabolism study. Concern was expressed by the experts because the hen was a larger species than the potential focal species and this could potentially overestimate the metabolic rate. Furthermore it was pointed out that there was uncertainty in extrapolating from hen to the focal species, as there would be read across from the NOEC/LOEC from a study with bobwhite quail (*Colinus virginianus*) to the focal species. In conclusion, the meeting agreed to use the 1st order rate constant *k* of 0.004814 per minute (t1/2=144 min). It should be noted that in the RMS 'best case scenario' a metabolic rate of 88 min was used, along with a modelled residue figure of 6.93 mg a.s./kg (see below for further consideration).

Estimation of <u>dose ingestion rate</u> (=FPM×C/bw) (mg a.s/kg bw/min)

<u>Discussion of residue value</u>

The applicant used the residue value of C=6.93 mg a.s./kg small insects to calculate the dose ingestion rate per minute. RMS noted that the residue value of 6.93 mg a.s./kg small insects was derived from a study by Dust, 2001, DuPont 7538 (KIIIA 9.1.3/0) which was provided in the original dossier. Essentially the theoretical maximum insect residue present immediately after two applications at 0.45 kg a.s./ha with a 14-d spray interval was derived. It assumed a RUD of 29 mg a.s./kg small insects (Based on Kenega,1973), 50% deposition based on crop interception, insect residue decline equivalent to foliar residue decay (DT50 3.5d) and first order kinetics.

The RMS considered the value uncertain without supporting data and hence potentially representative of the 'best case scenario'. It should also be noted that this 'best case scenario' used a metabolic rate of 88 minutes compared to 144 minutes for the 'worst case scenario'.

The RMS proposed to use the standard RUD value of 52 mg a.s./kg small insects (from SANCO 4145) for the worst case scenario.

Experts agreed that acute residue decline should not be included in the acute risk assessment and that use of reduced deposition was not acceptable. But refinement with focal species with a more appropriate diet (e.g. either small or large insects or foliar and soil dwelling arthropods) could be considered.

It was proposed during the peer review meeting that the residue data in the revised guidance document on the risk assessment for birds and mammals[16] should be used. According to Appendix 3a, one of the generic focal species for the use on fruiting vegetables with a growth stage BBCH 20 onwards is 'wagtail' and the 90th percentile residue per unit dose is 31.9 mg a.s./kg.

Finally, the experts agreed to conduct the risk assessment on the following best, intermediate and worst case residue values (RUD×application rate):

- worst case: 23.4 mg a.s./kg small insects (RUD of 52 mg a.s/kg insects, upper limit from SANCO4145)
- intermediate case: 14.35 mg a.s./kg small insects (RUD of 31.9 mg a.s/kg insects, from EFSA Journal (2008) 734, 1-181)
- best case: 6.93 mg a.s./kg small insects (modelled residue values provided by applicant)

<u>Discussion of focal species</u>

The applicant had used the skylark (*Alauda arvensis,* body weight 0.037 kg) to calculate the dose ingestion rate, according to the pirimicarb opinion and the related FPM (feeding rate per minute) values of 0.18 – 0.019 g/min. The RMS suggested yellow wagtail (*Motacilla flava,* body weight 0.017

[16] Scientific Opinion of the Panel on Plant protection products and their Residues (PPR) on the Science behind the Guidance Document on Risk Assessment for birds and mammals, Adopted on 17 June 2008, *The EFSA Journal* (2008) 734: 1-181

kg) as the appropriate focal species. Experts supported the RMS proposal and the related FPM values derived from pirimicarb opinion of 0.003 – 0.044 g/min.

Assessment factor (AF)

The Member State experts would accept the AF from the pirimiarb opinion (i.e 5.7) as suggested by the applicant. However, it was noted that the selection of this figure, which was based on an HC_5, involved a risk management decision and also moved away from the *status quo* of 91/414/EEC. Therefore, the experts considered that further support was necessary before using this AF (i.e. to address if there is an appropriate level of protection). The conclusion of the experts was to apply the standard AF of 10.

The estimation of AVT, avoidance threshold dose (derived from a LOEL value)

AVT is not measured in any standard study, however, in the pirimicarb opinion it was considered to be between the NOEC and the LOEC. The acute toxicity study on methomyl only produced a LOEC. The RMS considered the LOEC as a worst case as the bird will reach a higher sub-lethal acute dose at cessation of feeding. The experts agreed with the RMS.

Estimation of AVD, avoidance delay

An AVD of 30 minutes was used. This value was based on the time to effect without metabolism/excretion in the acute bird toxicity study with bobwhite quail, as suggested in the pirimicarb opinion. One expert suggested to base the AVD on the dietary study, however this should be supported with data. Furthermore, it was noted that in the dietary study it is not known when birds feed. The RMS considered that the key output for this assessment was to determine the time to have an immediate response and hence the LD_{50} study had been used, which was also in line with the pirimicarb Opinion.

Finally the meeting accepted 30 minutes as the relevant AVD estimate. However, it was underlined that some uncertainties are related to this value.

In conclusion, the agreed parameters for the application of the pirimicarb approach are reported in the table below.

The ‘intermadiate case scenario’ was based on the 90th percentile residue figure of 31.9 mg a.s./kg taken from Appendix 3a of the revised guidance document on the risk assessment for birds and mammals, whilst the ‘best case scenario’ was based on a modelled residue figure of 6.53 mg a.s./kg and a metabolic rate of 88 minutes. The worst case scenario was based on the residue figure of 52 mg a.s./kg taken from SANCO4145.

Parameters	**Best case**	**Intermediate case**	**Worst case**
Interspecies safety factor (SF)	x10	x10	x10
metabolic t½ (min)	88	144	144
metabolic *k* (min^{-1})	0.00787	0.004814	0.004814
LD_{50} (mg a.s./kg bw) (LD_{50}/SF)	2.42	2.42	2.42
AVT (mg a.s./kg bw) (LOEL/SF)	0.56	0.56	0.56

AVD (min)	30*	30*	30*
FPM (kg food/min)	0.000033	0.000044	0.000044
C (mg a.s./kg insect) (RUD×application rate)	6.93**	14.4 (31.9 x 0.45)***	23.4 (52 x 0.45)
Focal bird spp. yellow wagtail bw (kg)	0.0176	0.0176	0.0176
Calculations (single application rate 450 g a.s/ha)			
Metabolic rate k×LD_{50} (mg a.s./kg bw/min) {%dose ingest. rate}	0.0191 {147%}	0.0116 {32%}	0.0116 {20%}
dose ingestion rate (mg a.s./kg bw/min)	0.0130	0.036	0.0585
acute dose at feeding cessation (mg a.s./kg bw) {%LD_{50}}	0.95 {39%}	1.64 {68%}	2.32 {96%}
net acute dose at feeding cessation (mg a.s./kg bw) {%LD_{50}}	0.79 {33%}	1.49 {62%}	2.12 {88%}
Feeding time to LD_{50} dose (min)	The LD50 is never reached as metabolism exceeds intake hence a time can not be determined.	81	46
Calculations (single application rate 250 g a.s/ha)			
C (mg a.s./kg insect) (RUD×application rate)	6.93**	7.97 (31.9 x 0.25) ***	13.0 (52 x 0.25)
Metabolic rate k×LD50 (mg a.s./kg bw/min) {%dose ingest. rate}	0.0191 {147%}	0.0116 {58%}	0.0116 {36%}
dose ingestion rate (mg a.s./kg bw/min)	0.0130	0.0199	0.0325
acute dose at feeding cessation (mg a.s./kg bw) {%LD50}	0.95 {39%}	1.2 {48%}	1.54 {64%}
net acute dose at feeding cessation (mg a.s./kg bw) {%LD50}	0.79 {33%}	1.3 {54%}	1.39 {57%}
Feeding time to LD50 dose (min)	The LD50 is never reached as metabolism exceeds intake hence a time can not be determined.	182	92

*The experts accepted the 30 minutes as the relevant AVD estimate. However, it was underlined that some uncertainties are related to this value.

**estimated value by applicant

***The RMS noted that according to the EFSA journal 2008, multiple applications should be considered by the application of a Multiple Application Factor (MAF) to insects food item. In such case the calculations of the intermediate case worsen.

Conclusion

The results indicated a potential high acute risk for birds in the worst and intermediate case for the maximum application rate of 450 g a.s./ha and in the worst-case for the 250 g a.s./ha application rate since the metabolic rate was lower than the dose ingestion rate, the acute dose at feeding cessation was close to the lethal dose (96% at 450 g a.s./ha, worst case) or above 50% of the lethal dose (68% at 450 g a.s./ha, intermediate case and 64% at 250 g a.s./ha worst case).

With the maximum application rate of 450 g a.s./ha and initial residue in line with SANCO 4145 (worst case scenario), the feeding time to reach the LD_{50} was 46 minutes. This was considered to be likely for birds and hence realistic. In the intermediate case using residue data from the revised guidance document on the risk assessment for birds and mammals the time was 81 minutes (with an application rate of 250 g a.s./ha and intermediate case the feeding time to reach the $LD_{50}$was determined to be 92 minutes). This figure could be considered acceptable, i.e. it could be unrealistic for a bird to feed continuously for 81 minutes. However, there was much uncertainty as to whether this figure was likely or not (i.e. whether birds would feed continually for 81 minutes).

The experts noted that there were no data available on the feeding periods of birds, which could assist in the interpretation of the outputs, i.e. whether the time taken to reach an LD_{50} was realistic or not. The only figure to compare with was the 143 minutes to reach the LD_{50} reported in the pirimicarb opinion. According to the PPR opinion, it was stated that it 'seems fairly unlikely' that a bird would feed continuously for 143 minutes. The meeting noted that further guidance was needed to assess the "time to reach LD_{50}" (possibly by providing data on normal feeding periods of birds). Due to the lack of information to assist in the interpretation of these results the meeting agreed that it was not possible to derive a conclusion based on the outcome of this risk assessment.

Overall, on the basis of the available information, it was not possible to exclude a high acute risk for insectivorous birds.

REFINED LONG-TERM RISK ASSESSMENT FOR BIRDS

The applicant provided a long-term refinement for insectivorous birds using a F_{twa} value of 0.34 derived from the DT_{50} for foliar residue decline of 3.5d. A further interception factor of 70% for the growing stage BBCH >20 was considered. The RMS was of the opinion that the foliar decline cannot be considered reliable for a quantitative estimate of insect residue decline. The RMS assumed the theoretical level of contamination of small insects of 6.93 mg a.s./kg insects. However, since this value was considered uncertain without supporting data, the experts suggested to revisit the risk assessment based on the revised guidance document on the risk assessment for birds and mammals.

The revised risk assessment used the shortcut values for mean RUD (i.e. values that include food intake rate and RUD and need to be multiplied by the application rate in kg/ha in order to obtain the daily dietary dose) presented in revised guidance document for fruiting vegetable BBCH >20. The corresponding TERs for the generic focal species of 'finch', 'lark' and 'wagtail' ranged from 4.0 to 4.6. These are all less than the Annex VI trigger value of 5, indicating a potential high long-term risk for birds.

REFINED ACUTE AND THE LONG-TERM RISK ASSESSMENT FOR MAMMALS

The Member State experts accepted the refinement based on 50% deposition at BBCH 20 suggested by the RMS in the additional report. The TERs values were 13.8 and 6.4 for the acute and long-term risk respectively, indicating a low risk for mammals.

REFINED RISK ASSESSMENT FOR BIRDS AND MAMMALS FROM THE CONSUMPTION OF CONTAMINATED DRINKING WATER

No refined risk assessment was submitted for birds and mammals from the consumption of contaminated drinking water. As argumentation the RMS stated that the risk for insectivorous birds and mammals drinking from spray-contaminated water is low since the food diet can provide sufficient water content. The RMS mentioned that this is supported by background documentation which showed that only granivorous birds would need to drink. As references the RMS reported in the addendum 2 from December 2008 the section 5.5, appendix 24, of the revised guidance document on the risk assessment for birds and mammals, and a DEFRA research project (Defra, 2007. Improved estimates of food and water intake for risk assessment. PS2330 Research Project Final Report, http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=14845#Description; http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=14245#Description)

Experts agreed with the RMS. Therefore the risk from consumption of contaminated drinking water was considered low. However, EFSA noted that the information reported in the DEFRA Report of 2007 indicated that insectivorous birds could obtain sufficient water from food alone, but only just. Therefore it is EFSA's opinion that it is uncertain to consider the risk from consumption of contaminated drinking water as addressed in this way.

5.2. RISK TO AQUATIC ORGANISMS

A critical area of concern was highlighted in the original review as follows: "a high risk to aquatic organisms was identified for which risk mitigation measures such as a buffer zone of 50 metres for late grapes and listed tall vegetables and a buffer zone of 30 metres for listed low vegetables should be taken into account".

A new risk assessment for aquatic organisms was provided with the resubmission of methomyl. In this update new PEC values were provided according to the FOCUS surface water document.

All the TER values calculated in the Step 3 scenarios (D6 ditch early, D6 ditch late, R2 stream, R3 stream, R4 stream) were below the annex VI triggers, except for algae (all scenarios) and fish (only D6 ditch early).

Step 4 PECs were provided assuming a reduction of 90% for drainage and run-off and 95% for drift (the latter corresponds to a no-spray buffer zone of 30 metres). However the fate experts agreed that for methomyl, which is a poorly adsorbed substance, it may not be possible to reduce inputs of surface runoff by 90%. Moreover, concern was raised whether this level of mitigation might be achieved in practice with for example a vegetative buffer strip (see fate section 4.2).

The TERs calculated with the proposed Step 4 PECs indicated a low risk for fish in all scenarios, however the TERs for *Daphnia* were above the Annex VI triggers only in D6 ditch scenario (early use). The same outcome was derived by considering the minimum application rate of 250 g a.s./ha.

Several options to refine the acute risk assessment for *Daphnia* were provided by RMS with the additional report (i.e. geometric mean value and HC_5). Even if the risk is driven by the chronic endpoint of *Daphnia* (NOEC = 1.6 µg/L), the experts discussed the options proposed i.e the use of the

geometric mean value of 179.6 (and assessment factor of 100) and the use of lower HC_5 of 3.82 µg a.s./L (and assessment factor of 1).
The Member State experts considered both approaches suggested by the RMS to be acceptable, even if the HC_5 approach would be preferred by one Member State expert. Both approaches gave acute Step 4 TERs above the Annex VI triggers for *Daphnia*.

The applicant proposed the use of twa-PEC to refine the chronic risk assessment to invertebrates. However the RMS did not accept such a refinement because no information on the time to the onset of effects was available from the chronic study with *Daphnia*, and initial pulses (as expected for this substance) could give long-term effects. The experts agreed with the RMS.

Overall, a high risk to aquatic organisms was identified. A low risk was demonstrated only for the D6 ditch scenario early use, if a mitigation measure corresponding to 30 m of no-spray buffer zone was applied for the maximum application rate of 450 g a.s./ha.

5.3. RISK TO BEES

Acute contact and oral toxicity studies both with methomyl and the lead formulation are available. The resulting HQ values breach the appropriate Annex VI trigger value indicating a high risk to bees for the representative uses evaluated.
To address the observed mortality in the laboratory, two semi-field tests were submitted. The aim of both studies was to quantify the duration of harmful effects on bees following an application of methomyl at 450 g a.s./ha.
In the first semi-field study ‘Methomyl 20 SL’ (also known as ‘Lannate 20 SL’) was applied to *Phacelia tanacetiflora* and effects on foraging honey bees exposed to spray deposits 2, 6, and 11 days after treatment were recorded. The report concluded that there were no significant effects on mortality when residues were aged for over 2 days. However, the results need to be treated with caution since effects were greater for residues aged for 6 days than those aged for 2 or 11 days. No adverse effects on behaviour, flight activity or incidence of abnormal development were observed.
In the second semi-field study bees were exposed to spray deposits 1, 5, and 10 days after treatment in an apple orchard. Temporary harmful effects on bees were observed, if exposed 1 day after treatment and this effect was the most pronounced in the first 2 days. However, similar effects were observed from residues aged for 10 days and it was considered that the statement, that only effects were observed from 1 day old residues, was not supported. Most mortality occurred in the first 2 days of the evaluation period irrespective of the ageing period of the residues and also in the control thus making results difficult to interpret. It is possible that adverse effects may have been a consequence of the disturbance of the hives due to their introduction in the trial as effects were seen across all treatments including the control. No abnormal behaviour and no incidence for abnormal development of the bee brood were observed, due to Methomyl 20 SL.
In conclusion, a high risk to bees was observed in the laboratory. The information on the effects of aged residues in the 2 semi-field studies is of limited use in refining the risk. The risk to bees was discussed in the EPCO experts’ meeting. Risk mitigation measures to avoid all contact with bees are considered necessary. No data to establish a withholding period is available.

5.4. RISK TO OTHER ARTHROPOD SPECIES

In the previous peer review of methomyl a data gap was identified to further assess the risk to non-target arthropods for both the in-field and off-field areas.

No new data were submitted by the applicant to refine the risk to non-target arthropods.
A refinement of the off-field risk was provided by calculating a multiple application factor (MAF) based on residue decline data (DT50 = 3.5d) to estimate the exposure. Nevertheless, at the 450 g a.s./ha rate (2 applications) a 5m in-field no-spray buffer zone is required for crops <50 cm and a 15m buffer zone for crops >50cm. At the 250 g a.s./ha rate (2 applications) a 5m buffer zone is required for crops <50 cm and a 10m buffer zone for crops >50 cm. It should be noted that EFSA considered the in-field no-spray buffer zone of 15m quite extensive and probably not practicable.
The in-field risk was considered low by the applicant based on the potential for recolonisation observed in field studies with *Typhlodromus pyri,* however the experts expressed concerns with this. *T. pyri* was not the most sensitive species (extended lab test) and full recovery within 1 year was not observed in all field trials submitted. The potential for recolonisation was not considered to be appropriately addressed and no conclusion could be drawn. It was noted that the lack of recovery could be the result of indirect effects, i.e. the removal of prey items. It was also noted that the active substance is short-lived with a foliage DT_{50} of 3.5 d, hence indicating that recovery via in migration should be possible. Whilst these issues are true, it was also noted that the field trials were conducted only with *T. pyri* and there was an overall lack of information on other species, hence there was concern that the "potential for recovery" had not been adequately demonstrated.
Overall the experts concluded that this point was not addressed as there was insufficient information regarding the potential for recolonisation.

5.5. RISK TO EARTHWORMS

In the previous peer review of methomyl a data gap was identified to address the long term risk to earthworms (relevant for the use in grapes and the use in fruiting vegetables before growth stage BBCH 20). With the resubmission the application window is limited to growth stage BBCH≥20, therefore the risk to earthworms is considered to be addressed.

5.6. RISK TO OTHER SOIL NON-TARGET MACRO-ORGANISMS

The DT_{90} for soil in the laboratory equals 50.5 days. Under field conditions the DT_{90} soil might be shorter than this. Therefore no studies on the effects of methomyl on other soil non-target macro-organisms were considered necessary and hence the risk is considered to be low.

No major metabolites were identified in soil.

5.7. RISK TO SOIL NON-TARGET MICRO-ORGANISMS

The effects of methomyl were tested on soil microbial respiration and nitrogen transformation. No deviations of more than 25% after 28 days were observed at 0.45 and 4.5 kg methomyl/ha (i.e. no breaching of the Annex VI trigger value). These dose rates are equal or higher than the dose rates of the representative uses and hence the risk to soil non-target micro-organisms from methomyl is considered to be low for the representative uses evaluated.

No major metabolites were identified in soil.

5.8. RISK TO OTHER NON-TARGET-ORGANISMS (FLORA AND FAUNA)

A greenhouse phytotoxicity study was conducted on six plant species representing 2 families of Monocotyledonae and 3 families of Dicotyledonae. A maximum effect of 6.3% on oats was observed at 2.25 L Methomyl 20 SL/ha. This dose rate is equal to an application rate of 450 g a.s./ha, the maximum application rate of the representative uses. Therefore the risk to non-target plants is considered to be low.

5.9. RISK TO BIOLOGICAL METHODS OF SEWAGE TREATMENT

The 3 hour EC_{50} for methomyl on the activity of activated sludge exceeds 100 mg/L. Based on this study the risk to biological methods of sewage treatment is considered to be low.

6. Residue definitions

Soil
Definitions for risk assessment: methomyl
Definitions for monitoring: methomyl

Water

Ground water
Definitions for exposure assessment: methomyl
Definitions for monitoring: methomyl

Surface water
Definitions for risk assessment: methomyl
Definitions for monitoring: methomyl

Air
Definitions for risk assessment: methomyl
Definitions for monitoring: methomyl

Food of plant origin
Definitions for risk assessment: methomyl
Definitions for monitoring: methomyl

Food of animal origin
Definitions for risk assessment: no residue definition required as no exposure of livestock is expected
Definitions for monitoring: no residue definition required as no exposure of livestock is expected

Overview of the risk assessment of compounds listed in residue definitions for the environmental compartments

Soil

Compound (name and/or code)	Persistence	Ecotoxicology
methomyl	Low to moderate persistent ($DT_{50\ lab\ 20\ °C}$ = 4.6 – 11.5 d)	See points 5.5, 5.6 ad 5.7.

Ground water

Compound (name and/or code)	Mobility in soil	> 0.1 µg / L 1m depth for the representative uses (at least one FOCUS scenario or relevant lysimeter)	Pesticidal activity	Toxicological relevance	Ecotoxicological relevance
methomyl	Very high mobile (K_{foc} = 13.3 – 42.8 mL / g)	FOCUS (PRZM 2.2.1 and PEARL 1.1.1): trigger is not exceeded for any of the simulated uses and scenarios	Yes	Yes	See point 5.2.

Surface water and sediment

Compound (name and/or code)	Ecotoxicology
methomyl (water and sediment)	See point 5.2.

Air

Compound (name and/or code)	Toxicology
methomyl	T+, R26 'Very toxic by inhalation'

LIST OF STUDIES TO BE GENERATED, STILL ONGOING OR AVAILABLE BUT NOT PEER REVIEWED

- A new *in vivo* dermal penetration study in rat (relevant for all representative uses evaluated; interim report already submitted to RMS; refer to point 2.11).
- A refinement of the acute risk to birds (relevant for all representative uses evaluated, submission date not known; refer to point 5.1).
- A refinement of the long-term risk to birds (relevant for all representative uses evaluated, submission date not known; refer to point 5.1).
- The risk to birds and mammals from exposure to contaminated drinking water needs to be addressed (relevant for all representative uses evaluated if the risk is assessed according to the latest guidance document (SANCO/4145/2000); proposed by the EFSA, not discussed at an experts' meeting; submission date not known; refer to point 5.1).
- A refinement of the risk assessment for non-target arthropods for both the in-field and off-field areas (relevant for all representative uses evaluated;; refer to point 5.4).

CONCLUSIONS AND RECOMMENDATIONS

Overall conclusions

The conclusion was reached on the basis of the evaluation of the representative uses as an insecticide for foliar spraying to control biting and sucking insects in cucumber, courgette, tomato and eggplants. Only the use as insecticide was evaluated. It should be noted that the use in grape was withdrawn during the EU peer review process.
The representative formulated product for the evaluation was 'Lannate 20 SL' (also known as 'Methomyl 20 SL'), a soluble concentrate (SL), registered in some Member States of the EU.

Adequate methods are available to monitor all compounds given in the respective residue definition. Only single methods for the determination of residues are available since a multi-residue-method like the German S19 or the Dutch MM1 is not applicable due to the nature of the residues.
Sufficient analytical methods as well as methods and data relating to physical, chemical and technical properties are available to ensure that quality control measurements of the plant protection product are possible.

Methomyl is highly toxic via the oral, ocular and inhalation routes of exposure, but it has a low toxicity via the dermal route. On the basis of the data package available the proposed classification is T+, R26 'Very toxic by inhalation' and R25 'Toxic if swallowed'. It is not an eye or skin irritant and does not cause skin sensitisation. The overall short term NOAEL is approximately 10 mg/kg bw/day. Reliable data on effects on cholinesterase activity were not always determined. Based on the available studies, the weight of the evidence indicates that methomyl does not pose a genotoxic, reproductive or developmental concern. There was no evidence of methomyl-induced carcinogenic activity in rats or mice. The NOAEL for acute neurotoxicity is 0.25 mg/kg bw. The ADI, AOEL and ARfD were set at 0.0025 mg/kg bw, based on the acute neurotoxicity NOAEL applying a SF of 100. The operator exposure estimate is below the AOEL only for applications in field crops, with the use of PPE. The worker and bystander exposure is estimated to be below the AOEL for all scenarios considered.

The metabolism of methomyl in fruits is fully elucidated. Four metabolic pathways were identified generally leading to metabolites of no toxicological concern, as formed as a result of hydrolysis of the carbamate ester link and further degradation. However at least 2 metabolites were identified with intact carbamate structure (IN-HUZ57 and IN-G6520) and are considered as toxicologically relevant. In fruits, these metabolites are present at much lower levels than the parent compound and their contribution to the global toxicological burden is expected to be minor. Therefore, only the parent compound is proposed to be included in the residue definition for monitoring and risk assessment in fruit crops. For other commodities dealt with at member state level, the need for inclusion of these metabolites in the residue definition for risk assessment should be carefully considered as it appears that their ratio to the parent compound may be significant on leafy parts of plants, based on information obtained on grape foliage.

A sufficient amount of supervised residue trials were conducted in accordance with the supported representative uses, demonstrating that a MRL of 0.5 mg/kg would be needed for table and wine grapes, while residues in fruiting vegetables are consistently below the Limit Of Quantification (0.02 mg/kg) of the analysis method. In processed commodities (grape juice and wine), residues are lower than in raw grapes, this resulting from a preferential transfer to solid fractions during processing and from a partial degradation of methomyl to methomyl oxime. This degradation product has however no toxicological relevance.

On the basis of the supported representative uses dealt with under this peer review, no livestock exposure to methomyl residues is expected. Due to the low persistency of methomyl in soil, no residue of methomyl is expected in following crops.

Acute and chronic exposure assessments to methomyl residues were performed. A potential acute risk was identified for all considered population subgroups resulting from the consumption of treated table grapes.

Degradation of methomyl under dark aerobic conditions in soil does not produce any major metabolite. Methomyl oxime was identified as a minor soil metabolite (max 2.2 % AR after 1d). Taking into consideration also studies performed with thiodicarb (where methomyl appears as metabolite) methomyl is low or moderate persistent in soil under aerobic conditions ($DT_{50\ lab\ 20\ ºC}$ = 4 – 15.2 d). Unextractable residues accounted for up to 32.2 % AR after 30 d and CO_2 for 75.4 % AR after 92 d. New kinetic analysis presented in the resubmission dossier essentially confirmed the results of the first dossier evaluation. No new soil metabolites were identified in the soil photolysis study. Acetonitrile was detected as the major volatile metabolite. The meeting of MS experts considered that the potential environmental contamination by acetonitrile derived from the use of methomyl will be insignificant with respect to other anthropogenic sources. Under normal environmental conditions microbial degradation in soil is likely to predominate over the photolytic one.

In the available field studies for thiodicarb, field degradation half lives of thiodicarb and methomyl were longer than the ones measured under laboratory conditions. However the average soil temperature during the period used to calculate methomyl degradation was reported to be 3 ºC. The rapporteur Member State normalized the field dissipation rates for methomyl using the average soil temperatures over the period resulting in corrected half lives in the range of those observed in laboratory studies.

Since the half life originally used to calculate PEC in soil was derived from a study finally not considered adequate, new PEC soil were calculated and reported in an addendum. Worst case laboratory half life of 15.2 d was used. Two applications of 450 g/ha with an interval of 14 d were calculated as a worst case representative use. Interception of 60 % (corresponding to leaf development BBCH 50) was assumed for vines and 70 % (corresponding to BBCH 20 onwards was assumed for tomatoes) was assumed for vegetables. The proposed representative uses in the initial submission did not restrict the application to any particular growing stage, therefore, EFSA calculated peak PEC soil for tomatoes considering leaf development stages (growing stages BBCH 10-19; 50 % interception) in the updated addendum. In the re-submitted dossier the representative uses have been restricted to growing stages after BBCH-20.

According batch adsorption / desorption studies methomyl is very high mobile in soil (K_{foc} = 13.3 – 42.8 mL / g). A column (3 soils) and an aged column (1 soil) leaching studies are available for methomyl. In the column leaching study methomyl in leachate represented 6.6 – 55 % AR. Methomyl oxime was observed up to 2.2 % AR in soil and 1.7 % AR in leachate. In the aged column study, the major radioactive component in the leachate (5 % AR) co-chromatographed with methomyl.

Hydrolysis is not expected to contribute significantly to the degradation of methomyl in the environment (stable at pH 5 and 7, DT_{50} = 36 d at pH 9 in buffered water at 25 °C). Direct photolysis is also not expected to contribute to the environmental degradation of methomyl. Methomyl is not ready biodegradable according the available study.

In water / sediment systems, methomyl partitions to the sediment, reaching a maximum of 11.4 % AR in the sediment after one day in one of the systems. Degradation of methomyl occurred with half lives between 2.5 to 4.8 days in the total systems. Dissipation from the water phase was between 3.5 and 4.5 d. New kinetic analysis presented in the resubmission dossier essentially confirmed the results of the first dossier evaluation. Unextractable residues in the sediment reached a maximum of 20.1 % AR after 14 d declining to 14.7 % AR at the end of the study (102 d). CO_2 reached a maximum of 32.1 – 72.3 % AR at the end of the studies. The higher formation of acetonitrile in some systems seems to be associated to predominance of anaerobic conditions in the sediments of these systems. Acetonitrile was found in the volatiles trap to a maximum of 27 % AR. Acetonitrile also exceeded 10 % AR in the sediment phase (max 10.2 – 10.9 % AR). The meeting of MS experts considered that the potential environmental contamination by acetonitrile derived from the use of methomyl will be insignificant with respect to other anthropogenic sources.

$PEC_{SW\ /\ SED}$ values for parent methomyl were calculated based only in spray drift loadings and considering two categories. The first category is ‘late grapes and listed tall vegetables’ (i.e. tomatoes and grapes post-flowering) and the second category is ‘listed low vegetables’ (i.e. courgettes and aubergines). For cucumber it is necessary for Member States to consider which category cucumbers fit into under their growing regimes. In all simulations a worst case half life of 5 days in water was initially assumed. The values were recalculated for a water phase half life of 4.5 d in the addendum. In the resubmission dossier, the applicant presented new $PEC_{SW\ /\ SED}$ calculations based on FOCUS SW scheme. A soil half life of 6.5 d, a water phase half life of 4.1 d and a sediment phase half life of 1000d were assumed for methomyl in these calculations. Only the representative use on fruiting vegetables was intended to be supported in the resubmitted dossier and therefore PEC calculations for the use in grapes have not been updated. RMS estimated FOCUS Step 4 $PEC_{SW / SED}$ with the maximum mitigations possible according final version FOCUS Landscape and mitigation guidance to be used in the EU risk assessment.

The potential of ground water contamination by methomyl and its minor soil metabolite methomyl oxime was simulated by the applicant and recalculated by the rapporteur Member State for the representative uses in vines and tomatoes with FOCUS PRZM 2.2.1 and FOCUS PEARL 1.1.1 models for all relevant scenarios. None of the crop / scenario combinations exceeded the 0.1 µg / L on the 80th percentile annual average concentrations neither for methomyl nor for methomyl oxime.

Methomyl is unlikely to volatilize from water or wet soil. However, volatilization from leaves surface can occur. Photochemical degradation in the upper atmosphere is expected to occur with a half life of 19 h. Therefore, concentration of methomyl in the air compartment and transport through it is not expected to be significant.

Several data gaps were identified during the previous peer review of methomyl for terrestrial vertebrates (EFSA Scientific Report (2006) 83, 1-73, Conclusion on the peer review of methomyl): to provide a first-tier risk assessment for birds and mammals (insectivorous) according to SANCO/4145/2000, to refine the acute risk assessment for birds on the same basis as the PPR Opinion on pirimicarb (the EFSA Journal 2005 240,1-21), to refine the long-term risk assessment for birds, to refine the acute and the long-term risk assessment for mammals, to the refine risk assessment for birds and mammals from the consumption of contaminated drinking water.

In the resubmission dossier the supported use was restricted to cucumber/courgette, tomato/eggplant, 2 applications with an application rate of 250-450 g a.s./ha, BBCH≥20. A risk assessment was provided accordingly. A refinement of the acute risk to birds on the basis of the opinion of PPR Panel for pirimicarb was conducted. However a conclusion was not achieved since experts agreed that further data would be necessary for the interpretation of results.

A refinement of the chronic risk to birds was provided, but a potential high risk could no be excluded when using the relevant generic focal species presented in the revised guidance document on the risk assessment for birds and mammals (i.e. TER=4.0 to 4.6 for the generic focal species of 'finch', 'lark' and 'wagtail'). Acute and long term risk for mammals was low due to the limitation of the use for fruiting vegetables with a BBCH≥20. The risk from consumption of contaminated drinking water was addressed by considering that insectivorous birds obtain the water from the food. However the opinion of EFSA was that available data do not clearly support this.

Risk to aquatic organisms was re-run in the resubmission dossier according to FOCUS step 3 and step 4 PEC values for fruiting vegetables with a BBCH≥20. A high risk was identified in all step 4 scenarios except D6 ditch early use if a mitigation measures such as a buffer zone of 30 metres was applied.

A high risk to bees was identified. Risk mitigation measures to avoid all contact with bees are considered necessary. No data to establish a withholding period are available.

A high risk to non-target arthropods was identified. The applicant was asked to refine the risk assessment for non-target arthropods for both the in-field and off-field areas. In the resubmission no new data were provided. The potential for recovery was not demonstrated by the available data and risk mitigation measures such as an in-field no-spray buffer zone up to 15 m are necessary to address the off-field risk.

The acute risk to earthworms is considered to be low. In addition the long term risk to earthworms can be considered to be low for the representative uses in cucumber/courgette and tomato/eggplant for growth stages from BBCH 20 onwards.
The risk to soil micro-organisms, other soil non-target macro-organisms, non-target plants and biological methods for sewage treatment is considered to be low.

Particular conditions proposed to be taken into account to manage the risk(s) identified

- The use of PPE is needed to reduce operator exposure below the AOEL
- A low risk to aquatic organisms was identified for D6 drift FOCUS SW scenario (early use) only with the application of risk mitigation measures of 95 % spray drift reduction (i.e 30m no-spray drift buffer zone) (refer to points 4.2 and 5.2).
- Risk mitigation measures to avoid all contact with bees are considered necessary. No data to establish a withholding period are available (refer to point 5.3)
- The risk to non-target arthropods cannot be concluded but risk mitigation measures will possibly be necessary to address the observed toxicity (refer to point 5.4)

Critical areas of concern

- A high risk to aquatic organisms was identified in simulated run off and drainage FOCUS SW scenarios at Step 4.
- The acute risk to birds was not concluded because no data were available to help the interpretation of the outcome of the approach taken on the basis of the PPR Opinion on pirimicarb.
- A high long-term risk for birds could not be excluded.
- A high risk to bees was identified. Risk mitigation measures to avoid all contact with bees are considered necessary. No data to establish a withholding period are available.
- The potential for recovery in-field was not demonstrated for non-target arthropods.

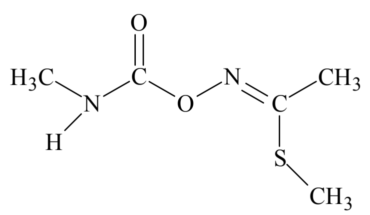
APPENDIX A – LIST OF ENDPOINTS FOR THE ACTIVE SUBSTANCE AND THE REPRESENTATIVE FORMULATION

Identity, Physical and Chemical Properties, Details of Uses, Further Information

Active substance (ISO Common Name) ‡	Methomyl (formerly DPX-X1179)
Function (*e.g.* fungicide)	Insecticide/acaricide

Rapporteur Member State	United Kingdom
Co-rapporteur Member State	--

Identity (Annex IIA, point 1)

Chemical name (IUPAC) ‡	S-methyl (EZ)-N-(methylcarbamoyloxy)thioacetimidate *Note – the cis isomer [see structure below] is so strongly favoured that the trans isomer is not detectable in practice.*
Chemical name (CA) ‡	Methyl N-[[(methylamino)carbonyl]oxy] ethanimidothioate
CIPAC No ‡	264
CAS No ‡	16752-77-5
EC No (EINECS or ELINCS) ‡	240-815-0
FAO Specification (including year of publication) ‡	980 g/kg [264/TC (2002)]
Minimum purity of the active substance as manufactured ‡	Minimum declared 985 g/kg.
Identity of relevant impurities (of toxicological, ecotoxicological and/or environmental concern) in the active substance as manufactured	None.
Molecular formula ‡	$C_5H_{10}N_2O_2S$
Molecular mass ‡	162.2 g/mol
Structural formula ‡	

Physical and chemical properties (Annex IIA, point 2)

Melting point (state purity) ‡	79.6 ± 0.1 °C (98.02% pure)
Boiling point (state purity) ‡	Not applicable; test material is a solid which decomposes after melting
Temperature of decomposition (state purity)	192 ± 3.1°C (98.02% pure)
Appearance (state purity) ‡	Solid, white powder (98.02% pure)
Vapour pressure (state temperature, state purity) ‡	5.4 x 10^{-6} mm Hg (7.2 x 10^{-4} Pa) at 25 °C (99.2% pure)
Henry's law constant ‡	AT 25 °C: 2.1X10^{-11} ATM M^3/MOL 2.1X10^{-6} Pa m^3/mol
Solubility in water (state temperature, state purity and pH) ‡	55 g/l (25 °C) (96.2%) pH 7 only (Methomyl is non-ionising) acceptable
Solubility in organic solvents ‡ (state temperature, state purity)	Solubilities at 20 °C (98.02% pure): Solvent — Solubility (mg/L) Ethyl Acetate — 7.74x10^4 *n*-Heptane — 97.1 1-Octanol — 2.40x10^4 Xylene — 9.58x10^3 Acetone — >250g/kg Acetonitrile — >250g/kg Dichloromethane — >250g/kg Dimethylformamide — >250g/kg *Methanol* — *>250g/kg*
Surface tension ‡ (state concentration and temperature, state purity)	0.0737 N/m (1 mg/mL solution in water at 20.1 ± 0.3 °C) (98.02% pure)
Partition co-efficient ‡ (state temperature, pH and purity)	K_{ow} of methomyl at 25 °C (99.3% pure): = 1.24 (log K_{ow} = 0.09). Mean of results for two concentrations, differing by a factor 10: K_{ow}= 1.14 (at 0.1 mg/mL) and 1.35 (at 1 mg/mL). No data for effect of pH (4 – 10). Case made that methomyl does not ionise in environmental pH range
Dissociation constant (state purity) ‡	Not applicable. Methomyl does not ionise at environmentally relevant pH.

UV/VIS absorption (max.) incl. ε ‡ (state purity, pH)	UV / VIS absorbance maximum for acidic, basic, and neutral solutions of methomyl was 234 nm (25 °C). pH — λ_{max} — ε — log ε 1.74 — 234 — 8.98×10^3 — 3.95 10.92 — 234 — 8.89×10^3 — 3.95 7.02 — 234 — 9.01×10^3 — 3.95 No absorption maxima beyond 290 nm were observed (all pH conditions). Solutions in methanol at higher concentrations measured over a longer cell path length also showed no absorption maxima beyond 290 nm. No effect of pH on absorbance / λmax for time periods up to 30 min.
Flammability ‡ (state purity)	Not classified as highly flammable
Explosive properties ‡ (state purity)	Not classified as explosive
Oxidising properties ‡ (state purity)	Not classified as oxidising

Summary of representative uses evaluated (methomyl)*

Crop and/ or situation (a)	Member State or Country	Product name	F G or I (b)	Pests or Group of pests controlled (c)	Preparation		Application				Application rate per treatment (for explanation see the text in front of this section)			PHI (days) (m)	Remarks
					Type (d-f)	Conc. of as (i)	method kind (f-h)	growth stage & season (j)	number min/ max (k)	interval between applications (min)	kg as/hL min – max (l)	water L/ha min – max	kg as/ha min – max (l)		
Cucumber/ Courgette Tomato/ aubergine (eggplant)	SEU	Lannate 20 SL	F	Biting and sucking insects	SL	200 g/L	MV/HV; foliar	Pre-harvest starting from BBCH 20	1-2	14	0.025 - 0.09	500 - 1000	0.25 - 0.45	7	
Grape (table & wine)	France North and South Europe)	Methomyl 20 SL	F	Biting and sucking insects	SL	200 g/L	HV; foliar	Pre-harvest	1-2	14	0.08-0.12	300-450	0.35	14	[1] [2] [3] [4]
Grape (table & wine)	France North and South Europe	Methomyl 20 SL	F	Biting and sucking insects	SL	200 g/L	HV; foliar	Pre-harvest	1-2	14	0.04-0.10	>450 - 1200	0.45	14	[1] [2] [3] [4]

Crop and/ or situation (a)	Member State or Country	Product name	F G or I (b)	Pests or Group of pests controlled (c)	Preparation		Application				Application rate per treatment (for explanation see the text in front of this section)			PHI (days) (m)	Remarks
					Type (d-f)	Conc. of as (i)	method kind (f-h)	growth stage & season (j)	number min/ max (k)	interval between applications (min)	kg as/hL min – max (l)	water L/ha min – max	kg as/ha min – max (l)		
	)														

[1] The risk assessment has revealed a data gaps and risks (exceedance of relevant threshold) in section 5.

[2] The operator, worker and bystander risk assessment should be regarded as inconclusive due to the lack of a refined calculation according to the EPCO outcomes; however, it is expected to exceed the AOEL

[3] An acute dietary risk for the consumer has been identified.

[4] The risk assessment was not completed since the applicant does not support this use for the review at EU-level.

* For uses where the column "Remarks" is marked in grey further consideration is necessary. Uses should be crossed out when the notifier no longer supports this use(s). (a) For crops, the EU and Codex classifications (both) should be taken into account; where relevant, the use situation should be described (e.g. fumigation of a structure) (b) Outdoor or field use (F), greenhouse application (G) or indoor application (I) (c) *e.g.* biting and suckling insects, soil born insects, foliar fungi, weeds (d) *e.g.* wettable powder (WP), emulsifiable concentrate (EC), granule (GR) (e) GCPF Codes - GIFAP Technical Monograph No 2, 1989 (f) All abbreviations used must be explained (g) Method, e.g. high volume spraying, low volume spraying, spreading, dusting, drench (h) Kind, *e.g.* overall, broadcast, aerial spraying, row, individual plant, between the plant- type of equipment used must be indicated	(i) g/kg or g/L. Normally the rate should be given for the active substance (according to ISO) and not for the variant in order to compare the rate for same active substances used in different variants (e.g. fluoroxypyr). **In certain cases, where only one variant is synthesised, it is more appropriate to give the rate for the variant (e.g. benthiavalicarb-isopropyl).** (j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application (k) Indicate the minimum and maximum number of application possible under practical conditions of use (l) The values should be given in g or kg whatever gives the more manageable number (e.g. 200 kg/ha instead of 200 000 g/ha or 12.5 g/ha instead of 0.0125 kg/ha (m) PHI - minimum pre-harvest interval

Methods of Analysis

Analytical methods for the active substance (Annex IIA, point 4.1)

Technical as (analytical technique)	Reversed-phase HPLC with UV detection (235nm)
Impurities in technical as (analytical technique)	Reversed-phase HPLC with UV detection (230nm)
Plant protection product (analytical technique)	Reversed-phase HPLC with UV detection (235nm)

Analytical methods for residues (Annex IIA, point 4.2)

Residue definitions for monitoring purposes

Food of plant origin		Methomyl (fruit)
Food of animal origin		Not required
Soil		Methomyl
Water	surface	Methomyl
	drinking/ground	Methomyl
Air		Methomyl

Monitoring/Enforcement methods

Unless otherwise stated, residue methods and associated LOQs refer to determination of parent methomyl

Food/feed of plant origin (analytical technique and LOQ for methods for monitoring purposes)	Reversed-phase HPLC with post-column derivatisation (phthalaldehyde/mercaptoethanol reaction) and fluorescence detection (Ex. 330 nm, Em. 466 nm) LOQ: 0.01 mg/kg for wide range of commodities (including wheat grain, grape berries, grape juice, wine, grape raisins, tomato fruit, tomato juice, tomato puree, peanuts (nutmeat), citrus peel, citrus pulp, spinach and beans). Confirmation by reversed-phase HPLC-MS (single ion monitoring) to LOQ of 0.01 mg/kg for acceptable range of crops.
Food/feed of animal origin (analytical technique and LOQ for methods for monitoring purposes)	*Submitted but not required – no residue definition is set for food of animal origin. Not evaluated*

Soil (analytical technique and LOQ)	Reversed-phase HPLC with post-column derivatisation (phthalaldehyde/mercaptoethanol reaction) and fluorescence detection (Ex. 330 nm, Em. 466 nm). LOQ 0.001 mg/kg. ELISA with UV detection also available to validated LOQ of 0.025 mg/kg. The above methods serve interchangeably as monitoring / confirmatory methods
Water (analytical technique and LOQ)	Analytical methods as for soil (HPLC-fluorescence and ELISA-UV detection) but with lower LOQs. Ground w. LOQ 0.1 µg/L Surface w. LOQ 0.25 µg/L
Air (analytical technique and LOQ)	Reversed-phase HPLC with MS detection (single ion *m/z* 163). LOQ 0.58 $\mu g/m^3$ Confirmation by conversion of residues to methomyl oxime and determination by reversed-phase HPLC-MS (single ion, *m/z* 106).
Body fluids and tissues (analytical technique and LOQ)	Residues converted to methomyl oxime and determined by GC/MS (m/z 88 for monitoring; *m/z* 58 and *m/z* 105 for confirmation. LOQ 0.01 mg/kg Additional confirmation by GC-FPD: LOQ 0.01 mg/kg

Classification and proposed labelling with regard to physical and chemical data (Annex IIA, point 10)

	RMS/peer review proposal
Active substance	None for the active substance

Impact on Human and Animal Health

Absorption, distribution, excretion and metabolism (toxicokinetics) (Annex IIA, point 5.1)

Rate and extent of oral absorption ‡	Rapid after gavage administration with peak effects seen 0.5 to 3 hours post dosing. Absorption >90% in the rat and approximately 75% in the monkey (urine and expired air, 5 mg/kg bw).
Distribution ‡	Rat: Widespread (highest levels in the gastro-intestinal tract, liver, blood, and skin).
	Monkey: Widespread (highest levels in fat and muscle).
Potential for accumulation ‡	Although the radioactive tissues residues appear to be high at 168 hours, (8-9% in the rat & approximately 5% in the monkey), methomyl is broken down into small carbon compounds which join the pool of naturally occurring carbon compounds and are incorporated into the tissues.
Rate and extent of excretion ‡	Radiolabel was rapidly excreted in expired air and urine (within 24 hours of dosing (80% in the rat and 63% in the monkey) and extensive elimination in the rat at 168 hours post dosing (approximately 91%). In the monkey, approximately 75% eliminated at 168 hours post dosing.
Metabolism in animals ‡	Three major pathways were proposed: displacement of *S*-methyl from *syn*-methomyl by glutathione followed by transformation to the mercapturic acid derivative (18% of the dose); conversion of methomyl to methomyl oxime (MHTA or IN-X1177) and CO_2 release; and isomerisation of *syn*-methomyl to *anti*-methomyl (IN-B1884), followed by a Beckmann rearrangement and formation of acetonitrile.
Toxicologically relevant compounds ‡ (animals and plants)	Methomyl, INHUZ57, (ING6520)
Toxicologically relevant compounds ‡ (environment)	Methomyl, INHUZ57, (ING6520)

Acute toxicity (Annex IIA, point 5.2)

Rat LD_{50} oral ‡	30 mg/kg bw	**T, R25**
Rat LD_{50} dermal ‡	>2000 mg/kg bw	
Rat LC_{50} inhalation ‡	0.215 mg/l in male & females	**T+, R26**
Skin irritation ‡	Non-irritant (Not classified)	
Eye irritation ‡	Slight-irritant (Not classified)	
Skin sensitisation ‡	Negative in a Buehler (Not classified).	

Short term toxicity (Annex IIA, point 5.3)

Target / critical effect ‡	Decreases in body weight and changes in the haematological parameters.	
Relevant oral NOAEL ‡	Overall NOAEL of approximately 10 mg/kg bw/day from dietary studies in rats, dogs and mice. Reliable data on effects on ChE activity not always determined.	
Relevant dermal NOAEL ‡	90 mg/kg bw/day (rabbit, 21 days).	
Relevant inhalation NOAEL ‡	No data submitted.	

Genotoxicity ‡ (Annex IIA, point 5.4)

	In vitro: negative. *In vivo*: negative.	

Long term toxicity and carcinogenicity (Annex IIA, point 5.5)

Target/critical effect ‡	Histopathology in kidney and spleen.	
Relevant NOAEL ‡	3 mg/kg bw/day (2 year dog study)	
Carcinogenicity ‡	No evidence of carcinogenic activity in rats or mice.	

Reproductive toxicity (Annex IIA, point 5.6)

Reproduction toxicity

Reproduction target / critical effect ‡	Parental: reduced body weight and food consumption Reproductive: no effects Offspring: reduced pup weight	

Relevant parental NOAEL ‡	4.6 mg/kg bw/day	
Relevant reproductive NOAEL ‡	80 mg/kg bw/day	
Relevant offspring NOAEL ‡	4.6 mg/kg bw/day	

Developmental toxicity

Developmental target / critical effect ‡	Maternal: Deaths, reduced body weight and clinical signs of toxicity (rabbit study) Developmental: no effects	
Relevant maternal NOAEL ‡	6 mg/kg bw/day (rabbits)	
Relevant developmental NOAEL ‡	16 mg/kg bw/day (rabbits, highest dose tested)	

Neurotoxicity (Annex IIA, point 5.7)

Acute neurotoxicity ‡	NOAEL: 0.25 for males and females, respectively. Reversible RBC and brain cholinesterase inhibition (≥20%) at the next highest dose	
Repeated neurotoxicity ‡	NOAEL: 9.42 mg/kg bw/day for males and females, respectively. Reduced body weight and food consumption, clinical signs, brain cholinesterase inhibition and effects on FOB parameters at the next highest dose.	
Delayed neurotoxicity ‡	No evidence for this effect was seen in the hen test	

Other toxicological studies (Annex IIA, point 5.8)

Mechanism studies ‡	NOAEL 1 mg/kg bw (30 ppm). RBC cholinesterase inhibition (>20%) and no reaction to tail pinch at 60 ppm, the next highest dose.
Studies performed on metabolites or impurities ‡	No data available on IN-G6520 or IN-HUZ57

Medical data ‡ (Annex IIA, point 5.9)

Worker monitoring data.	The company's acceptable worker exposure limit (AEL) for methomyl is 2.5 mg/m^3 (8-hours time weighted average).
Human volunteer study (acute oral/capsule)	NOAEL: 0.1 mg/kg bw. Reversible RBC and cholinesterase inhibition (≥20%) and increased salivation at 0.2 mg/kg bw, the next highest dose.

Summary (Annex IIA, point 5.10)	Value	Study	Safety factor
ADI ‡	0.0025 mg/kg bw/day	Acute Neurotoxicity in Rat	100
AOEL ‡	0.0025 mg/kg bw/day	Acute Neurotoxicity in Rat	100
ARfD ‡	0.0025 mg/kg bw/day	Acute Neurotoxicity in Rat	100

Dermal absorption ‡ (Annex IIIA, point 7.3)

Formulation: Methomyl 20 SL formulation	Dilution = 15% Concentrate = 1.2%

Exposure scenarios (Annex IIIA, point 7.2)

Operator	**German,** field crop sprayers, 20 ha, 0.45 kg methomyl/ha 1730% AOEL no PPE 121% AOEL (gloves when handling the concentrate, gloves, coverall and sturdy footwear during application) **UK POEM**, field crop sprayers, 50 ha, 0.45 kg methomyl/ha 5596% AOEL no PPE 713% AOEL (gloves when handling the concentrate and during the application) **UK POEM**, Knapsack sprayers, 0.8 ha, 0.45 kg methomyl/ha 13572% AOEL no PPE 1976% AOEL (gloves when handling the concentrate, gloves and impermeable coveralls during application) **EFSA note**: it is noted that considering the application of broad-brimmed headwear during application (German model) the operator exposure is below the AOEL (97%, and can be further lowered with the use of hood and visor during application (in place of the broad-brimmed headwear, and in addition to the PPE considered in the re-calculations submitted by the RMS).

	It is noted that exposure for application in grapes, estimated with previously agreed dermal absorption values, exceeded the AOEL for both the German and UK POEM model, with the use of PPE (524% and 8100% of the AOEL, respectively)
Workers	The estimated exposure to methomyl for an unprotected worker is 43% of the AOEL for field crops. It is noted that exposure for re-entry in grapes, estimated with previously agreed dermal absorption values, was below the AOEL
Bystanders	The estimated bystander exposure to methomyl is 13% of the AOEL for field crops. It is noted that bystander exposure for application in grapes, estimated with previously agreed dermal absorption values, exceeded the AOEL

Classification and proposed labelling with regard to toxicological data (Annex IIA, point 10)

	RMS/peer review proposal	
Substance classified (methomyl)	T+;	Very toxic
	R25,	Toxic if swallowed
	R26	Very toxic by inhalation

Metabolism in plants (Annex IIA, point 6.1 and 6.7, Annex IIIA, point 8.1 and 8.6)

Plant groups covered	Fruit (grapes)
Rotational crops	No data submitted. Significant residues in succeeding crops unlikely due to behaviour of methomyl in soil
Metabolism in rotational crops similar to metabolism in primary crops?	-
Processed commodities	Not required as residues not significant.
Residue pattern in processed commodities similar to residue pattern in raw commodities?	-
Plant residue definition for monitoring	Methomyl (for fruiting crops only)
Plant residue definition for risk assessment	Methomyl (for fruiting crops only)
Conversion factor (monitoring to risk assessment)	Not required

Metabolism in livestock (Annex IIA, point 6.2 and 6.7, Annex IIIA, point 8.1 and 8.6)

Animals covered	Goat, hen.
Time needed to reach a plateau concentration in milk and eggs	> 3 days
Animal residue definition for monitoring	Not applicable (no exposure of livestock expected).
Animal residue definition for risk assessment	Not applicable (no exposure of livestock expected).
Conversion factor (monitoring to risk assessment)	Not applicable (no exposure of livestock expected).
Metabolism in rat and ruminant similar (yes/no)	Yes
Fat soluble residue: (yes/no)	No

Residues in succeeding crops (Annex IIA, point 6.6, Annex IIIA, point 8.5)

	Not required. Significant residues in succeeding crops unlikely due to behaviour of methomyl in soil.

Stability of residues (Annex IIA, point 6 introduction, Annex IIIA, point 8 Introduction)

	Methomyl residues are stable in the following commodities: Grapes: up to 27 months at ≤ -20 °C. Raisin & grape juice: up to 8 months at ≤ -18 °C. Wine: up to 11 months at ≤ -18 °C. Broccoli & lettuce: up to 24 months at ≤ -20 °C. Potato, bean seed & peanut: up to 26 months at ≤ -20 °C. Milk: up to 181 days at ≤ -70 °C. Liver: up to 165 days at ≤ -70 °C. Cow Muscle: up to 181 days at ≤ -70 °C.

Residues from livestock feeding studies (Annex IIA, point 6.4, Annex IIIA, point 8.3)

	Ruminant:	Poultry:	Pig:
	Conditions of requirement of feeding studies		
Expected intakes by livestock ≥ 0.1 mg/kg diet (dry weight basis) (yes/no - If yes, specify the level)	no	no	no
Potential for accumulation (yes/no):	No	No	No
Metabolism studies indicate potential level of residues ≥ 0.01 mg/kg in edible tissues (yes/no)	Yes based on current uses as no intakes	Yes based on current uses as no intakes	Yes based on current uses as no intakes
	Feeding studies (Specify the feeding rate in cattle and poultry studies considered as relevant) N/A as no intakes by animals envisaged for proposed uses Residue levels in matrices : Mean (max) mg/kg		
Muscle Liver Kidney Fat Milk Eggs	Exposure to methomyl residues through consumption by livestock of crops covered by representative uses is negligible. A ruminant feeding study was submitted and evaluated. All residues in all commodities were < 0.01 mg/kg at dose rates of 34 and 86 mg/kg feed DM. A poultry feeding study was not submitted.		

Summary of residues data according to the representative uses on raw agricultural commodities and feedingstuffs (Annex IIA, point 6.3, Annex IIIA, point 8.2)

Crop	Northern or Mediterranean Region, field or glasshouse, and any other useful information	Trials results relevant to the representative uses (a)	Recommendation/comments	MRL estimated from trials according to the representative use	HR (c)	STMR (b)
Grapevine	N and S EU	1 x 0.02, 2 x 0.03, 3 x 0.05, 2 x 0.06, 2 x 0.07, 1 x 0.09, 1 x 0.10, 1 x 0.11, 1 x 0.13, 1 x 0.18, 1 x 0.20, 1 x 0.21, 1 x 0.26, 1 x 0.28, 1 x 0.33, 1 x 0.59		0.5	0.59	0.09
Cucumber	S. EU	6 < 0.02.	Sufficient trials to propose MRL when considered with courgette data	0.02*	0.02*	0.02
Courgette	S. EU	3 < 0.02.	Sufficient trials to propose MRL when considered with cucumber data	0.02*	0.02*	0.02
Tomato	S. EU	9 < 0.02.	Extrapolation to aubergine acceptable.	0.02*	0.02*	0.02

(a) Numbers of trials in which particular residue levels were reported *e.g.* 3 x <0.01, 1 x 0.01, 6 x 0.02, 1 x 0.04, 1 x 0.08, 2 x 0.1, 2 x 0.15, 1 x 0.17
(b) Supervised Trials Median Residue *i.e.* the median residue level estimated on the basis of supervised trials relating to the representative use
(c) Highest residue

Consumer risk assessment (Annex IIA, point 6.9, Annex IIIA, point 8.8)

ADI	0.0025 mg/kg
TMDI (% ADI) according to WHO European diet	Calculated for cluster diets B, D, E and F. In all cases cluster diet B represents worst case values, these are presented below: Grapes 0.000116 mg/kg bw/day (5%) – not included in the total TMDI Tomato 0.000049 mg/kg bw/day (1.95%), Aubergine - 0.000005 mg/kg bw/day (<1%) Cucumber & gherkin - 0.000003 mg/kg bw day (<1%) Fruiting veg., cucurbits - 0.000028 mg/kg bw/day (1.13%) Total: 0.000088 mg/kg bw/day (3.53%)
TMDI (% ADI) according to national (to be specified) diets	See NEDI calculation
IEDI (WHO European Diet) (% ADI)	Maximum 3.53% for cluster B, all other diets (clusters D, E and F) below this.
NEDI (according to diet of 10 consumer sub-populations in UK) (% ADI)	Critical consumers = vegetarians: 0.000511 mg/kg bw/day (20%).
Factors included in IEDI and NEDI	None
ARfD	0.0025 mg/kg
IESTI (% ARfD)	See NESTI
NESTI (% ARfD) according to national (to be specified) large portion consumption data	Table grape: critical consumer (UK diet) = toddler: 0.0360 mg/kg bw/day (1400%). Wine: critical consumer (UK diet) = vegetarian: 0.0012 mg/kg bw/day (48%). Tomato: critical consumer (UK diet) = infant: 0.0010 mg/kg bw/day (40%). Aubergine: critical consumer (UK diet) = 4 – 6yr old child: 0.0005 mg/kg bw/day (20%). Cucumber: critical consumer (UK diet) = toddler: 0.0006 mg/kg bw/day (24%). Courgette: critical consumer (UK diet) = toddler: 0.0009 mg/kg bw/day (36%).
Factors included in IESTI and NESTI	NESTI – Table grapes: HR (which is above the proposed MRL), variability factor 5; Wine: STMR, no variability factor Fruiting vegetables: MRL, variability factor 7 for tomatoes and courgette and 5 for aubergines and cucumbers

Processing factors (Annex IIA, point 6.5, Annex IIIA, point 8.4)

Crop/processed crop	Number of studies	Transfer factor	% Transference *
Grape/ grape juice	4	0.21	Not calculated
Grape/ young wine	4	0.71	Not calculated
Grape/ mature wine	4	0.58	Not calculated
Grape/ raisin	4	0.20	Not calculated

* Calculated on the basis of distribution in the different portions, parts or products as determined through balance studies

Proposed MRLs (Annex IIA, point 6.7, Annex IIIA, point 8.6)

Wine grapes	0.5 mg/kg
Cucumber	0.02* mg/kg
Courgette	0.02* mg/kg
Tomato	0.02* mg/kg
Aubergine	0.02* mg/kg

When the MRL is proposed at the LOQ, this should be annotated by an asterisk after the figure.

Route of degradation (aerobic) in soil (Annex IIA, point 7.1.1.1.1)

Mineralization after 100 days ‡	75% at 92 days [14C-1]-label n=1
Non-extractable residues after 100 days ‡	14% at 92 days [14C-1]-label n=1
Metabolites requiring further consideration ‡ - name and/or code, % of applied (range and maximum)	None major >10%AR

Route of degradation in soil - Supplemental studies (Annex IIA, point 7.1.1.1.2)

Anaerobic degradation ‡	
Mineralization after 100 days	Mineralisation 23.4% of applied 60 days after conversion to anaerobic conditions (excludes the 29% CO2 produced in the first 14 days under aerobic conditions).
Non-extractable residues after 100 days	Non-extractable residues 24.5% 60 days after conversion.
Metabolites that may require further consideration for risk assessment - name and/or code, % of applied (range and maximum)	No major soil metabolites formed.
Soil photolysis ‡	
Metabolites that may require further consideration for risk assessment - name and/or code, % of applied (range and maximum)	Mineralisation and non-extracted residues minimal. No major soil metabolites. The major breakdown product identified was the volatile acetonitrile representing up to 40% AR at 30 days (study end).

Rate of degradation in soil (Annex IIA, point 7.1.1.2, Annex IIIA, point 9.1.1)

Laboratory studies ‡

Methomyl	Aerobic conditions				
Soil type	Moisture content %	DT_{50} (d)	DT_{90} (d)	r^2	Normalised 1st order DT_{50} (d)
Flint Hall	31.21	4.6	15.4	0.99	4.60
Wilsons Farm	8.28	4.9	16.2	0.97	4.90
Boarded Barns Farm	11.57	9.9	33.0	0.98	8.60
Shelley Field (clay loam, pH 7.3)	29.3	9.7	32.2	0.99	8.44
Madera (loam, pH 7.8) (25 ºC)	75% FMC (37.6%) 0.33 bar	11.5	38.2	4 (chi^2)	16.7
Speyer 2.2 (sandy loam, pH 6.4)	50% MWHC (45.9%)	5.1	16.8	3 (chi^2)	5.1
Mattapex (loam, pH 5.1)	50% MWHC (35.2%)	8.1	26.9	3 (chi^2)	6.34
Nambsheim (sandy loam, pH 7.8)	50% MWHC (32.3%)	7.1	23.4	3 (chi^2)	6.34
Methomyl geometric mean 1st order DT_{50} (days) **Methomyl median 1st order DT_{50} (days)**					**6.97** **6.34**

Note that the results for the Flint Hall, Wilsons Farm, Boarded Barns Farm and Shelley Field soils come from studies performed with thiodicarb as parent material

Methomyl oxime[17]	Aerobic conditions						
Soil type	pH (water)	t. °C / % MWHC	DT_{50}/ DT_{90} (d)	f. f. k_{dp}/k_f	DT_{50} (d) 20 °C pF2/10kPa	St. (χ^2)	Method of calculation
Speyer 2.2	6.4	20°C / 50% MWHC	1 / 3.3	-	1	9	SFO, non linear regression

[17] Methomyl oxime =Z-methyl N-hydroxyethanimidothioate, INX1177 (max. 2.5 % AR in soil).

Methomyl oxime[17]	Aerobic conditions						
Soil type	pH (water)	t. °C / % MWHC	DT_{50}/ DT_{90} (d)	f. f. k_{dp}/k_f	DT_{50} (d) 20 °C pF2/10kPa	St. (χ^2)	Method of calculation
Mattapex	5.1	20°C / 50% MWHC	1.2 / 3.9	-	0.94	11	SFO, non linear regression
Nambsheim	7.8	20°C / 50% MWHC	1.3 / 4.4	-	1.15	6	SFO, non linear regression
Geometric mean					1.03	-	

Kinetic data derived from zero to day 4 data (no. of data points = 6)

Degradation in the saturated zone: laboratory incubations using subsoils under anaerobic conditions at 10°C gave 1st order DT50 ≤ 8 hours (n=5, r^2 not reported)

Field studies ‡

DT_{50f}: None submitted, none required. Field studies are available for thiodicarb where methomyl appears as metabolite. See thiodicarb DAR and EFSA conclusion (list of end points).
DT_{90f}: None submitted, none required

pH dependence ‡ (yes / no) (if yes type of dependence)	no
Soil accumulation and plateau concentration ‡	Requirement not triggered. Data not required

Laboratory Anaerobic

Methomyl DT_{50lab} (25°C, anaerobic): (total system) 14 days (n=1, r^2 = 0.98).

Soil adsorption/desorption (Annex IIA, point 7.1.2)

Methomyl ‡							
Soil origin	Soil type	Soil pH	OC %	Kf (mL/g)	Kfoc (mL/g)	1/n	r^2
Speyer, Germany	Sandy loam	6.2	2.09	0.277	13.3	0.86	0.982
Rock Hall, MD USA	Loam	5.1	0.99	0.201	20.3	0.88	0.987
Rochelle, IL USA	Silty clay loam	6.0	2.27	0.809	35.6	0.82	0.991
Nambsheim, France	Sandy loam	8.1	1.05	0.145	13.8	0.83	0.981
Flakkebjerg, Denmark	Loam	6.6	1.10	0.471	42.8	0.89	0.993
Arithmetic mean				0.381	25.2	0.86	
pH dependence, Yes or No			No				

Methomyl oxime ‡							
Soil Origin	Soil Type[a]	Soil pH	% Organic Carbon[b]	Kf (mL/g)	Kfoc (mL/g)	1/n	r^{2c}
Speyer, Germany	Sandy loam	6.2	2.09	0.186	8.9	0.73	0.992
Rock Hall, MD USA	Loam	5.1	0.99	0.090	9.1	0.95	0.976
Rochelle, IL USA	Silty clay loam	6.0	2.27	0.454	20.0	0.84	0.996
Nambsheim, France	Sandy loam	8.1	1.05	0.070	6.6	0.71	0.964
Flakkebjerg, Denmark	Loam	6.6	1.10	0.139	12.6	0.68	0.941
Arithmetic mean				0.188	11.4	0.78	
pH dependence (yes or no)			No				
[a]USDA Classification system, [b]organic carbon = organic matter/1.72, [c]R^2 values calculated from data presented in original reports							

Mobility in soil (Annex IIA, point 7.1.3, Annex IIIA, point 9.1.2)

Column leaching ‡	Guideline: BBA part IV, 4-2 Precipitation (mm): 200 Time period (days): 2 n=3 Leachate:2-57%AR, 5.4-55%AR as methomyl 0.8-1.7%AR methomyl oxime
Aged residues leaching ‡	Guideline: BBA part IV, 4-2 Aged for (days) 13 days Precipitation (mm): 200 Time period (days): 2 n=1 Leachate:6.7%AR, 4.7-5.3%AR as methomyl 0.8-0.9%AR methomyl oxime.

Lysimeter/ field leaching studies ‡	None submitted. None required.

PEC (soil) (Annex IIIA, point 9.1.3)

Method of calculation	DT_{50}: 15.2* days, simple 1st order kinetics longest lab value. Soil depth 5cm, soil bulk density 1.5g/cm^3
Application rate	2 x 450g methomyl/ha with 14 days interval assuming 60% crop interception (vines).*

PEC$_{(s)}$ (mg/kg)	Single application Actual	Single application Time weighted average	Multiple application Actual	Multiple application Time weighted average
Initial	-	-	0.367	0.367
Short term 24h			0.350	0.359
2d			0.335	0.351
4d			0.306	0.335
Long term 7d			0.267	0.314
28d			0.102	0.207
50d			0.038	0.144
100d			0.004	0.080

For applications at growth stages after flowering in grapes 70% crop interception is appropriate. In this situation the initial PEC is 0.275 mg/kg.
* Application in vines has not been reassessed in the resubmitted dossier: therefore end points and environmental assessment presents the results of the original submission peer review.

Parent Method of calculation	DT_{50}: 15.2 days, simple 1st order kinetics longest lab value. Soil depth 5cm, soil bulk density 1.5g/cm^3
Application data	2 x 450g methomyl/ha with 14 days interval assuming 70% crop interception (vegetables).

PEC$_{(s)}$ (mg/kg)	Single application Actual	Single application Time weighted average	Multiple application Actual	Multiple application Time weighted average
Initial			0.275	0.275
Short term 24h			0.263	0.269
2d			0.251	0.263
4d			0.229	0.251
Long term 7d			0.200	0.253
28d			0.077	0.155

PEC$_{(s)}$ (mg/kg)	Single application Actual	Single application Time weighted average	Multiple application Actual	Multiple application Time weighted average
50d			0.028	0.108
100d			0.003	0.060

For fruiting vegetables uses, 70% crop interception would correspond to applications at growing stages BBCH 20 onwards and 50 % for growing stages BBCH 10-19. For the 450g/ha use pattern on fruiting vegetables an initial PEC is 0.458 mg/kg for BBCH 10-19.

Route and rate of degradation in water (Annex IIA, point 7.2.1)

Hydrolytic degradation of the active substance and metabolites > 10 % ‡	pH5__: 25°C stable pH7__: 25°C stable pH9__: 25°C 1st order DT50 36 days (graphical estimate) After 30 days methomyl oxime accounted for ca. 42%AR
Photolytic degradation of active substance and metabolites above 10 % ‡	No direct aqueous photolysis (no adsorption maxima > 290nm)
Quantum yield of direct phototransformation in water at Σ > 290 nm	No direct aqueous photolysis (no adsorption maxima > 290nm)
Readily biodegradable ‡ (yes/no)	No
Degradation in water/sediment - DT50 water ‡	No reliable degradation half life in the water phase available
- DT90 water ‡	See above
- DT50 whole system ‡	3.7 – 4.1 days
- DT90 whole system ‡	12.2 – 13.5 days (1st order r2=0.95-0.99, n=4)

Mineralization	32&46% AR at 102 days (n=2) 72%AR at 31 days (n=1) and 60%AR at 44 days (n=1) all values at study end.
Non-extractable residues	10&15% AR at 102 days (n=2) 15.5%AR at 31 days (n=1) and 15.2%AR at 44 days (n=1) all values at study end.

Distribution in water / sediment systems (active substance) ‡	Concentrations of extractable methomyl in sediment were minimal in 3 of the systems studied (<6.2%AR at all time points). In the 5.8%oc silty clay loam system methomyl was 11.4%AR 2 days after application declining rapidly to <0.4%AR by day 14.
Distribution in water / sediment systems (metabolites) ‡	No major metabolites accumulated in the water or sediment of the systems (acetonitrile is a transient sediment component only). In addition to CO_2, the predominant breakdown products identified (acetonitrile and acetamide) are volatile.

PEC (surface water) and PEC sediment (Annex IIIA, point 9.2.3)

Grapes[18]

Parent

Method of calculation	DT_{50}:4.5 days, 1st order, longest water phase dissipation DT50 from dark 20°C lab. Sediment water study.
Application rate	Crop: 1.late applications to grapes and tall growing vegetables 2 applications at 14 day intervals at 450g a.s./ha to 30cm deep static water body
Main routes of entry	7.23% drift from 3m for 2 applications 2.77% drift from 1m for 1 application (as concentration is higher than from 2 applications and 2.38% drift)

PEC$_{(sw)}$ (µg / L)	1. Grapevines late and tall vegetables Actual	1. Grapevines late and tall vegetables Time weighted average
Initial	12.1	12.1
Short term 24h	10.4	11.2
2d	8.90	10.4
4d	6.53	9.03

[2] Application in vines has not been reassessed in the resubmitted dossier: therefore end points and environmental assessment presents the results of the original submission peer review.

Long term 7d	4.12	7.40
14d	1.40	4.96
21d	0.16	2.77
28d	0.01	1.57
42d	0.00	0.79

Applications as above but with lower drift inputs with no spray zones required to demonstrate acceptable aquatic risk.	1. 0.1% drift from 50m for 1 application 2. 0.1% drift from 30m for 1 application (as concentrations are higher than from 2 applications and 0.08% drift)

PEC$_{(sw)}$ (µg / L)	1. Grapevines late and tall vegetables Actual	1. Grapevines late and tall vegetables Time weighted average
Initial	0.15	0.15
Short term 24h	0.13	0.14
2d	0.11	0.13
4d	0.08	0.11
Long term 7d	0.08	0.09
14d	0.02	0.06
21d	0.00	0.03
28d	0.00	0.02
42d	0.00	0.01

PEC (sediment)

Parent

Method of calculation	11.4% partitioning to top 5cm layer of sediment, entry route as for surface water, pattern of decline reflecting that measured in the sediment/water study
Application rate	Crop: 1.late applications to grapes and tall growing vegetables 2 applications at 14 day intervals at 450g a.s./ha to 30cm deep static water body with 5cm underlying sediment with density 1.3g/cm^3 with baseline distances of 3 and 1m respectively.

PEC$_{(sed)}$ (µg / kg)	1. Grapevines late and tall vegetables Actual	1. Grapevines late and tall vegetables Time weighted average
Initial	-	-
Short term	Peak 6.3 at 2 days	-
Long term	< 0.22, 12 days after peak	-

Fruiting vegetables[19]

	Value	**Remarks**
Molecular weight [g/mol]	Methomyl: 162.2 Acetonitrile: 41.1	Phys.-chem. Properties
Water solubility [mg/L]	Methomyl: 54,700 Acetonitrile: 1 x 10^6	Phys.-chem. Properties Conservative default value
Vapour pressure [Pa]	Methomyl: 7.2 x 10^{-4}	Phys.-chem. Properties
DEGRADATION IN SOIL		
DT_{50} (soil) [d]	Methomyl: 6.5[a]	Geometric mean of laboratory values at reference conditions of pF2 and 20°C (n = 5)
Temperature correction function Reference temperature [°C] MACRO: gamma exponent [1/K] PRZM: Q-10 [-]	 20 0.079 2.2	 FOCUS recommendations
Moisture correction function Reference moisture [-] PRZM / MACRO: moisture exponent [-]	 pF 2 0.7	 FOCUS recommendations
SORPTION TO SOIL		
K_{OC} [L/kg]	Methomyl: 25.1	Arithmetic mean value (n=5)
1/n [-]	Methomyl: 0.86	Arithmetic mean value (n=5)
DEGRADATION IN AQUATIC SYSTEMS		
DT_{50} whole system [d](Step 1)	Methomyl: 4.1	Worst case of two systems
DT_{50} water [d] (Steps 2 to 4)	Methomyl: 4.1	Worst case system DT50 value from two systems
DT_{50} sediment [d] (Steps 2 to 4)	Methomyl: 1000	Conservative default value
Temperature correction function Reference temperature [°C] TOXSWA: activation energy [J/mol]	 20 54000	 FOCUS recommendations

[19] Only fruiting vegetables have been reassessed in the resubmitted dossier.

	Value	Remarks
MANAGEMENT RELATED PARAMETERS		
Crop uptake factor [-]	0.5	FOCUS recommendations
Washoff coefficient [1/cm]	0.5	FOCUS recommendations
Foliar half-life	3.5 d	Derived from supervised residue trials

[a]: note that a median value of 6.3 d was derived by the RMS following normalisation and could be used for future exposure assessments at MS level

Degradation in water / sediment			
System	FOCUS Step	Value(s)	Kinetic level and type
Auchingilsie	Step 1	$DegT_{50}$ = 3.7	P-I Total system, SFO
	Step 2	$DegT_{50}$ = 3.7	P-I Total system, SFO
	Step 3	Water: 3.7 Sediment: 1000	Default approach, See discussion
Hichingbrooke	Step 1	$DegT_{50}$ = 4.1	P-I Total system, SFO
	Step 2	$DegT_{50}$ = 4.1	P-I Total system, SFO
	Step 3	Water: 4.1 Sediment: 1000	Default approach, See discussion
Manningtree*	Step 1	$DegT_{50}$ = 2.5	P-I Total system, SFO
	Step 2	$DegT_{50}$ = 2.5	P-I Total system, SFO
	Step 3	Water: 2.5 Sediment: 1000	Default approach, See discussion
Ongar*	Step 1	$DegT_{50}$ = 4.5	P-I Total system, SFO
	Step 2	$DegT_{50}$ = 4.5	P-I Total system, SFO
	Step 3	Water: 4.5 Sediment: 1000	Default approach, See discussion
*reported as water degradation DT50 in the original DAR, but as methomyl residues were negligible in sediment in these systems these can also be considered valid total system DT50 values. Note the DT50 of 4.1 days used in FOCUS modelling is conservative relative to the geomean value of 3.6 days that FOCUSsw guidance recommends should have been used.			

Application rate	Crop: Fruiting vegetables (cucumber, courgette, tomato, aubergine) Crop interception: Applications may be made from BBCH 20 onwards Number of applications: 2 x 450 g a.s./ha or 2 x 250 g a.s./ha Interval (d): 14 d Application rate(s): 250 or 450 g as/ha Application window: 30 Apr – 31 Oct (whole application period) plus additional simulations

from 17-Sept to 31-Oct (late application window)

FOCUS STEP 1 Scenario	Day after overall maximum	PEC_{SW} (µg/L)		PEC_{SED} (µg/kg)	
		Actual	TWA	Actual	TWA
	0	149.29		36.43	

FOCUS STEP 2 Scenario	Day after overall maximum	PEC_{SW} (µg/L)		PEC_{SED} (µg/kg DS*)	
		Actual	TWA	Actual	TWA
Northern EU March – May	0	13.63		3.41	
Northern EU June - September	0	13.63		3.41	
Northern EU October – February	0	31.03		7.78	
Southern EU March – May	0	25.23		6.32	
Southern EU June - September	0	19.43		4.87	
Southern EU October - February	0	25.23		6.32	

* DS = dry weight sediment

FOCUS **Step 3** PECsw for **methomyl (early** application of 2 x 450 g a.s./ha to fruiting vegetables)

Scenario	Methomyl PEC_{sw} (µg/L)	
	Global maximum	Day – 21 TWA
D6 Ditch	2.479	0.0748
R2 Stream	7.691	0.247
R3 Stream	13.690	0.480
R4 Stream	15.377	0.568

D6 single early application PECsw = 2.838µg/l

FOCUS **Step 3** PECsed for **methomyl (early** application of 2 x 450 g a.s./ha to fruiting vegetables)

Scenario	Methomyl PEC_{sed} (µg/L)	
	Global maximum	Day – 21 TWA
D6 Ditch	0.295	0.0953
R2 Stream	1.041	0.233
R3 Stream	1.526	0.419
R4 Stream	2.166	0.512

D6 single early application PEC_{sed} = 0.308 (µg/kg)

RMS FOCUSsw Step 3 simulation for **late** applications of 2 x 450 g a.s./ha to fruiting vegetables

Scenario	**Application window**	**PAT application dates**	**Global maximum PECsw µg/l (date of peak)**	**Global maximum PECsed (date of peak)**
D6 ditch	17-Sept to 31-Oct	06-Oct/22-Oct	15.872 (29-Oct)	3.234 (30-Oct)
R2 stream	17-Sept to 31-Oct	09-Oct/25-Oct	14.129 (28-Oct)	1.424 (28-Oct)
R3 stream	17-Sept to 31-Oct	23-Sept/22-Oct	12.926 (2-Nov)	1.297 (02-Nov)
R4 stream	17-Sept to 31-Oct	23-Sept/15-Oct	7.022 (04-Oct)	1.148 (04-Oct)

Step 4 PECsw for D6 (late applications with

FOCUS **Step 3** PECsw for **methomyl (early** application of 2 x **250** g a.s./ha to fruiting vegetables)

Scenario	**PECsw (µg/l) Global maximum**	**PECsed (µg/kg dw) Global maximum**
D6 ditch	1.377	0.169
R2 stream	4.236	0.593
R3 stream	7.132	0.825
R4 stream	8.667	1.259

D6 single early application PECsw = 1.576µg/l

FOCUS **Step 3** PECsw for **methomyl** (**late** application of 2 x **250** g a.s./ha to fruiting vegetables)

Scenario	PECsw (µg/l) Global maximum	PECsed (µg/kg dw) Global maximum
D6 ditch	8.980	1.882
R2 stream	7.606	0.801
R3 stream	7.106	0.737
R4 stream	3.881	0.657

FOCUS **Step 4** PECsw (30m no spray zone) for **methomyl** (**early** application of 2 x **450** g a.s./ha to fruiting vegetables) (RMS calculations)

Scenario	PECsw (µg/l) Global maximum	PECsed (µg/kg dw) Global maximum
D6 ditch	0.144*	0.019*

*maximum PEC values derived from single application pattern

Step 3 and estimated Step 4 PECsw values for use of methomyl on fruiting vegetables at either 2 x 450 g a.s./ha or 2 x 250 g a.s./ha. Maximum Step 4 mitigation reduction factors have been applied as recommended by the FOCUS Landscape and Mitigation Factors report

Scenario (2 x 450 g a.s./ha)	Step 3 PECsw (µg/l)	Notes	Step 4 PECsw (µg/l)	Mitigation assumed
D6 ditch early	2.838	Single application GAP	See table above	drift mitigated by 95%
D6 ditch late	15.872	Double application GAP	1.5872	drainage mitigated by 90%
R2 stream	14.129	Late application	1.4129	runoff mitigated by 90%
R3 stream	13.69	Early application	1.369	runoff mitigated by 90%
R4 stream	15.377	Early application	1.5377	runoff mitigated by 90%
Scenario (2 x 250 g a.s./ha)	**Step 3 PECsw (µg/l)**	**Notes**	**Step 4 PECsw (µg/l)**	**Mitigation assumed**
D6 ditch early	1.576	Single application GAP	0.0788	drift mitigated by 95%
D6 ditch late	8.98	Double application GAP	0.898	drainage mitigated by 90%
R2 stream	7.606	Late application	0.7606	runoff mitigated by 90%
R3 stream	7.132	Early application	0.7132	runoff mitigated by 90%
R4 stream	8.667	Early application	0.8667	runoff mitigated by 90%

Step 3 and estimated Step 4 PECsed values for use of methomyl on fruiting vegetables at either 2 x 450 g a.s./ha or 2 x 250 g a.s./ha. Maximum Step 4mitigation reduction factors have been applied as recommended by the FOCUS Landscape and Mitigation Factors report

Scenario (2 x 450 g a.s./ha)	**Step 3 PECsed (µg/kg dw)**	**Notes**	**Step 4 PECsed (µg/kg dw)**	**Mitigation assumed**
D6 ditch early	0.308	Single application GAP	See table above	drift mitigated by 95%
D6 ditch late	3.234	Double application GAP	0.3234	drainage mitigated by 90%
R2 stream	1.424	Late application	0.1424	runoff mitigated by 90%
R3 stream	1.526	Early application	0.1526	runoff mitigated by 90%
R4 stream	2.166	Early application	0.2166	runoff mitigated by 90%
Scenario (2 x 250 g a.s./ha)	**Step 3 PECsed (µg/kg dw)**	**Notes**	**Step 4 PECsed (µg/kg dw)**	**Mitigation assumed**
D6 ditch early	0.169	Single application GAP	0.00845	drift mitigated by 95%
D6 ditch late	1.882	Double application GAP	0.1882	drainage mitigated by 90%
R2 stream	0.801	Late application	0.0801	runoff mitigated by 90%
R3 stream	0.825	Early application	0.0825	runoff mitigated by 90%
R4 stream	1.259	Early application	0.1259	runoff mitigated by 90%

PEC (ground water) (Annex IIIA, point 9.2.1)

Method of calculation and type of study (*e.g.* modelling, monitoring, lysimeter)	For FOCUS gw modelling, values used- [data derived from studies conducted with thiodicarb also used] Modelling using FOCUS PRZM 2.4.1 and FOCUS PEARL 1.1.1 with appropriate FOCUS scenarios, according to FOCUS guidance on Grapes and Tomatoes Geometric mean DT50 lab: methomyl 7.38d (NB: a median value of 6.3 d was derived by the RMS following normalisation and could be used for future exposure assessments at MS level) methomyl oxime 0.67d normalised to –10kPa, 20°C with Q10 2.2, 100% formation of methomyl from methomyl oxime. Kfoc mean: methomyl 25.2mL/g 1/n=0.86 methomyl oxime 11.4mL/g 1/n=0.78
Application rate	2x450g a.s./ha 14 day application intervals with 60% crop interception for grapes and 50% crop interception for tomatoes 1st applications 65 days after ‘emergence’ for grapes and 30 days after ‘emergence’ for tomatoes

PEC$_{(gw)}$

Maximum concentration	-
Average annual concentration (Results quoted for modelling with FOCUS gw scenarios, according to FOCUS guidance)	Annual average concentrations (80th % year) according to FOCUS guidance, see results in table below.

PEC(gw) - FOCUS modelling results (80th percentile annual average concentration at 1m)

	Scenario	Parent (µg/L)	Metabolite Methomyl oxime (µg/L)
PRZM 2.4.1/ Vines	Chateaudun	<0.001	<0.001
	Hamburg	0.003	<0.001
	Kremsmunster	0.001	<0.001
	Piacenza	<0.001	<0.001
	Porto	<0.001	<0.001
	Sevilla	<0.001	<0.001
	Thiva	<0.001	<0.001

	Scenario	Parent (µg/L)	Metabolite methomyl oxime (µg/L)
PEARL 1.1.1 / Vines	Chateaudun	0.003	<0.001
	Hamburg	0.001	<0.001
	Kremsmunster	0.001	<0.001
	Piacenza	0.084	0.005
	Porto	<0.001	<0.001
	Sevilla	<0.001	<0.001
	Thiva	<0.001	<0.001

	Scenario	Parent (µg/L)	Metabolite Methomyl oxime (µg/L)
PRZM 2.4.1/ Tomatoes	Chateaudun	<0.001	<0.001
	Piacenza	<0.001	<0.001
	Porto	<0.001	<0.001
	Sevilla	<0.001	<0.001
	Thiva	<0.001	<0.001

PEARL 1.1.1 / Tomatoes	Scenario	Parent (µg/L)	Metabolite methomyl oxime (µg/L)
	Chateaudun	0.003	<0.001
	Piacenza	0.042	0.002
	Porto	<0.001	<0.001
	Sevilla	<0.001	<0.001
	Thiva	<0.001	<0.001

NOTE: The revised median methomyl DT_{50} value would be 5.81d based on addendum 1. Since an acceptable groundwater assessment was produced with the longer DT_{50} of 7.38d in the original DAR the figures above have not been amended here to reflect the agreed shorter DT_{50}.

Fate and behaviour in air (Annex IIA, point 7.2.2, Annex III, point 9.3)

Direct photolysis in air ‡	Not studied-no data requested Latitude: .... Season: .... DT_{50} ....
Quantum yield of direct phototransformation	Methomyl has no absorption maxima >290nm
Photochemical oxidative degradation in air ‡	Tropospheric half life of 19 hours derived by the Atkinson method of calculation for reaction with OH radicals
Volatilisation ‡	From plant surfaces: up to 27%AR volatilised from bean leaves within 24 hours (20°C, 50% relative humidity)
	from soil: only 3%AR volatilised from soil within 24 hours

PEC (air)

Method of calculation	Expert judgement, based on vapour pressure, dimensionless Henry's Law coefficient and information on volatilisation from plants and soil and effect of mixing and diffusion.

$PEC_{(a)}$

Maximum concentration	Negligible

Residues requiring further assessment

Environmental occurring metabolite requiring further assessment by other disciplines (toxicology and ecotoxicology).	Soil Definitions for risk assessment: methomyl Definitions for monitoring: methomyl Water

	Ground water Definitions for exposure assessment: methomyl Definitions for monitoring: methomyl Surface water Definitions for risk assessment: methomyl Definitions for monitoring: methomyl Air Definitions for risk assessment: methomyl Definitions for monitoring: methomyl

Monitoring data, if available (Annex IIA, point 7.4)

Soil (indicate location and type of study)	No pertinent information available by the notifier or in published literature
Surface water (indicate location and type of study)	No pertinent information available by the notifier or in published literature
Ground water (indicate location and type of study)	No pertinent information available by the notifier or in published literature
Air (indicate location and type of study)	No pertinent information available by the notifier or in published literature

Points pertinent to the classification and proposed labelling with regard to fate and behaviour data

Candidate for R53: May cause long-term adverse effects to the aquatic environment

The risk assessment was provided for the use in cucumber/courgette, tomato/eggplant, 2 applications with an application rate of 250-450 g a.s./ha, BBCH≥20. The peer review focused on the maximum application rate of 450 g a.s /ha.
No new risk assessment was provided for the use in grapes since it was no longer supported by the applicant.

Effects on terrestrial vertebrates (Annex IIA, point 8.1, Annex IIIA, points 10.1 and 10.3)

Species	Test substance	Time scale	End point (mg/kg bw/day)	End point (mg/kg feed)
Birds ‡				
Colinus virginianus	methomyl	Acute	24.2	-
Colinus virginianus	methomyl	Short-term	>518.8[1]	>5620
Colinus virginianus	methomyl	Long-term	20.3[2]	150
Mammals ‡				
Rat	methomyl	Acute	27.4	-
Rat	methomyl	Long term	4.6	-
Additional higher tier studies ‡ none				

[1] based on mean bw = 32.5g; mean food consumption = 3.0g/bird/d
[2] based on mean bw = 200g; mean food consumption = 27g/bird/d

Toxicity/exposure ratios for terrestrial vertebrates (Annex IIIA, points 10.1 and 10.3)

BIRDS dietary exposure – drinking water

Indicator species/Category	Time scale	ETE	TER	Annex VI Trigger
Methomyl 20SL: SEU fruiting veg; 14d spray interval; >BBCH 20				
Tier I (Bird) - (2 x 0.45 kg methomyl/ha)				
Small insectivore	Acute	48.5[1]	***0.5***	10
Tier I (Bird) - (2 x 0.25 kg methomyl/ha)				
Small insectivore	Acute	27.0[2]	***0.9***	10
Tier II refinement (Birds) **Acute:** The daily food diet of a small insectivorous bird (most at dietary risk via food) contains 7.5mL water which exceeds (2.5x) the estimated daily water requirement for such birds, hence supplementary water would not be sought. Significant canopy water accumulations are unlikely to occur due to the crop leaf architecture and theoretical considerations predict large dilution (200x) in contaminated puddles. Hence overall avian dietary drinking water risk is considered to be low.				

based on max. spray conc. from a single application ([1]0.45 & [2] 0.25 kg a.s./500L) with 20 % dilution factor SANCO4145/2000

BIRDS dietary exposure - food

Indicator species/Category	Time scale	ETE	TER	Annex VI Trigger
Methomyl 20SL: SEU fruiting veg; 14d spray interval; >BBCH 20				
Tier I (Bird) - (2[1] x 0.45 kg methomyl/ha)				
Small insectivore[2]	Acute[6]	24.4	***1.0***	10
	Short-term	13.6	38.2	10
	Long-term	13.6 7.2[5]	***1.5*** ***2.7***[5]	5
Tier I (Bird) - (2[1] x 0.25 kg methomyl/ha)				
Small insectivore[2]	Acute[6]	13.5	***1.8***	10
	Short-term	7.5	68.8	10
	Long-term	7.5 4.0[5]	***2.7*** 5.1[5]	5
Tier II refinement (Bird) **Acute:** Higher tier refinement was based on the EFSA Journal, 2005, 240, 1-21, PPR pirimicarb decision since methomyl is also a carbamate insecticide with similar toxicokinetic and metabolic properties. Best, intemediate and worse case dose ingestion, metabolic rate at LD50, net acute dose at cessation of feeding and time to reach LD50 dose were estimated for the yellow wagtail (focal species) using parameters (with appropriate interspecies correction) and equations as described in EFSA J. 2005. Following the Peer Review meeting of 20 November 2008, it was agreed to rerun the risk assessment using information from the EFSA (2008) opinion on the science behind the guidance document[20].				

Parameters	Best case	Intermediate case	Worst case
Interspecies safety factor (SF)	x10	x10	x10
metabolic t½ (min)	88	144	144
metabolic k (min^{-1})	0.00787	0.004814	0.004814
LD_{50} (mg a.s./kg bw) (LD_{50}/SF)	2.42	2.42	2.42
AVT (mg a.s./kg bw) (LOEL/SF)	0.56	0.56	0.56
AVD (min)	30*	30*	30*
FPM (kg food/min)	0.000033	0.000044	0.000044
C (mg a.s./kg insect) (RUD×application rate)	6.93**	14.4 (31.9 x 0.45)***	23.4 (52 x 0.45)
Focal bird spp. yellow wagtail bw (kg)	0.0176	0.0176	0.0176
Calculations **(single application rate 450 g a.s/ha)**			
Metabolic rate k×LD_{50} (mg a.s./kg bw/min) {%dose ingest. rate}	0.0191 {147%}	0.0116 {32%}	0.0116 {20%}
dose ingestion rate	0.0130	0.036	0.0585

[20] Scientific Opinion of the Panel on Plant protection products and their residues on a request from the EFSA PRAPeR Unit on risk assessment for birds and mammals. *The EFSA Journal (2008) 734, 1-181*

(mg a.s./kg bw/min)			
acute dose at feeding cessation (mg a.s./kg bw) {%LD_{50}}	0.95 {39%}	1.64 {68%}	2.32 {96%}
net acute dose at feeding cessation (mg a.s./kg bw) {%LD_{50}}	0.79 {33%}	1.49 {62%}	2.12 {88%}
Feeding time to LD_{50} dose (min)	The LD50 is never reached as metabolism exceeds intake hence a time can not be determined.	81	46

*The experts accepted the 30 mins as the relevant AVD estimate. However, it was underlined that some uncertainties are related to this value.
**estimated value by applicant
***The RMS noted that according to the EFSA journal 2008, multiple applications should be considered by the application of a Multiple Application Factor (MAF) to insects food item. In such case the calculations of the intermediate case worsen.

Tier II Higher tier refinement (Birds)
Long term:
Following the Peer Review meeting of 20-11-08, it was agreed to re-run the avian long-term risk assessment using information on dietary composition and residue levels using the EFSA (2008) opinion[21].

Using the mean short-cut values for the mean RUD for the 'finch', 'lark' and 'wagtail' of 11.4, 9.9 and 9.7, daily dietary doses of 5.1, 4.5 and 4.4 for single applications are determined.

Focal species	**Short-cut value**	**Daily Dietary Dose assuming single application (i.e. 0.45 x RUD)**	**TER**
Finch	11.4	5.1	4.0
Lark	9.9	4.5	4.5
Wagtail	9.7	4.4	4.6

[21] Scientific Opinion of the Panel on Plant protection products and their residues on a request from the EFSA PRAPeR Unit on risk assessment for birds and mammals. *The EFSA Journal (2008) 734, 1-181*

MAMMALS dietary exposure – drinking water

Indicator species/Category	Time scale	ETE	TER	Annex VI Trigger
Methomyl 20SL: SEU fruiting veg; 14d spray interval; >BBCH 20				
Tier I (Mammal) - (2 x 0.45 kg methomyl/ha)				
Small insectivore	Acute	28.2[1]	***1.0***	10
Tier I (Mammal) - (2 x 0.25 kg methomyl/ha)				
Small insectivore	Acute	15.7[2]	***1.7***	10
Tier II refinement (Birds) **Acute:** The daily food diet of a small insectivorous mammal (most at dietary risk via food) contains 4.4mL water which exceeds (2.5x) the estimated daily water requirement for such mammals, hence supplementary water would not be sought. Significant canopy water accumulations are unlikely to occur due to the crop leaf architecture and theoretical considerations predict large dilution (200x) in contaminated puddles. Hence overall avian dietary drinking water risk is considered to be low.				

based on max. spray conc. from a single application ([1]0.45 & [2] 0.25 kg a.s./500L) with 20 % dilution factor SANCO4145/2000

MAMMALS dietary exposure - food

Indicator species/Category	Time scale	ETE	TER	Annex VI Trigger
Methomyl 20SL: SEU fruiting veg; 14d spray interval; >BBCH 20				
Tier I (Mammal) - (2[1] x 0.45 kg methomyl/ha)				
Small insectivore[2]	Acute	4.0 2.0[3]	**6.9** 13.8[3]	10
	Long-term	1.5 0.7[3]	**3.2** 6.4[3]	5
Tier I (Mammal) - (2[1] x 0.25 kg methomyl/ha)				
Small insectivore[2]	Acute	2.2	12.4	10
	Long-term	0.8	5.8	5
Tier II refinement (Mammal)) **Acute & Long term:** The RMS considered that small mammals will likely feed exclusively on ground/soil dwelling insects hence canopy interception refinement is appropriate. Using a precautionary canopy interception of 50% (at >BBCH 20 canopy interception of fruiting field vegetable can be70%) ETEs were revised at the higher application rate from which TERa and TERlt values of 13.8 and 6.4 were derived, indicating low acute and long term risk to mammals also the higher application rate.				

[1]due to 14d spray interval & rapid residue decline, risk assessment based on 1x application (SANCO 4145/2000)
[2] herbivorous birds considered unlikely to graze foliage at >BBCH20,
[3] with Tier II refinement based on 50% canopy interception

Toxicity data for aquatic species (most sensitive species of each group) (Annex IIA, point 8.2, Annex IIIA, point

Group	Test substance	Time-scale	Endpoint	Toxicity (mg/L)
Laboratory tests ‡				
Acute, static – bluegill sunfish (Report No. SPL 282/571)	Methomyl	96-hour	LC_{50}	**0.63**
Acute, static – bluegill sunfish (Report No. HLR 30-91)	Methomyl 20SL	96-hour	LC_{50}	1.1
Fish early life stage – fathead minnow (Report No. HLO 702-91)	Methomyl	-	NOEC	**0.073**
Fish life cycle – fathead minnow (Report No. HLO 47-93)	Methomyl	-	NOEC	0.076
Acute, static-renewal *D. magna* (Report No. SPL 282/572)	Methomyl	48-hour	EC_{50}	**0.017**
Acute, static-renewal *D. magna*, neonates and adults (Report No. DuPont-3726)	Methomyl 20SL	48-hour	EC_{50}	0.0193 (<24-hour old *D. magna*) 0.0362 (12-day old *D. magna*)
Daphnia magna	Methomyl 20SL	48 hr	EC_{50}	28-day old adult > 0.123
Daphnia magna	Methomyl 20SL	96 hr	EC_{50}	27-day old adults = 0.098; neonate = 0.084
			NOEC	0.026
Gammarus italicus	Methomyl	96 hr	EC_{50}	0.047
Echinogammarus tibaldii	Methomyl	96 hr	EC_{50}	0.250
Daphnia longispina	Methomyl	96 hr	EC_{50}	0.220
Cyclops strenuous	Methomyl	96 hr	EC_{50}	0.190
Gammarus pulex	Methomyl	96 hr	EC_{50}	0.760
Biomphalaria alexandrina	Methomyl	96 hr	EC_{50}	1.10
Bulinus truncatus	Methomyl	96 hr	EC_{50}	0.870
Pteronarcella badia	Methomyl	96 hr	EC_{50}	0.060
Skwala sp.	Methomyl	96 hr	EC_{50}	0.029
Gammarus pseudolimnaeus	Methomyl	96 hr	EC_{50}	1.050
Isogenus sp.	Methomyl	96 hr	EC_{50}	0.343
Chironomus sp.	Methomyl	96 hr	EC_{50}	0.032

Group	Test substance	Time-scale	Endpoint	Toxicity (mg/L)
Chironomus plumosus	Methomyl	96 hr	EC_{50}	0.088
Life-cycle, static-renewal *D. magna* (Report No. HLR 46-82)	Methomyl	21-day	NOEC	**0.0016**
Aquatic algae, *S. capricornutum* (Report No. SPL 282/573)	Methomyl	72-hour	EC_{50}	**>100**
			NOEC	100
Aquatic algal inhibition, *S. subspicatus* (Report No. SPL 282/594)	Methomyl	72-hour	EC_{50}	**>100**
			NOEC	100
Microcosm or mesocosm tests				
None				

Toxicity/exposure ratios for the most sensitive aquatic organisms (Annex IIIA, point 10.2)

FOCUS Step1

2 x 450 g a.s./ha (cucumber, courgette, tomato, aubergine)

Test substance	Organism	Toxicity end point (mg/L)	Time scale	PEC_i	PEC_{twa}	TER	Annex VI Trigger[1]
a.s.	Fish	0.63	Acute	0.14929		**4.22**	100
a.s.	Fish	0.073	Chronic	0.14929		**0.49**	10
a.s.	Aquatic invertebrates	0.017	Acute	0.14929		**0.11**	100
a.s.	Aquatic invertebrates	0.0016	Chronic	0.14929		**0.01**	10
a.s.	Algae	>100	Chronic	0.14929		>669.84	10

[1]If the Annex VI Trigger value has been adjusted during the risk assessment of the active substance, it should appear in this column. E.g. if it is agreed during the risk assessment of mesocosm, that a trigger value of 5 is required, it should appear as a minimum requirement to MS in relation to product approval.
[2] only required for herbicides
[3]consider the need for PEC_{sw} and PEC_{sed} and indicate which has been used

FOCUS Step 2

2 x 450 g a.s./ha (cucumber, courgette, tomato, aubergine), Northern Europe, October-February

Test substance	N/S[1]	Organism[2]	Toxicity end point (mg/L)	Time scale	PEC[3]	TER	Annex VI Trigger[4]
a.s.	N	Fish	0.63	Acute	0.03103	**20.30**	100
a.s.	N	Fish	0.073	Chronic	0.03103	**2.35**	10

Test substance	N/S[1]	Organism[2]	Toxicity end point (mg/L)	Time scale	PEC[3]	TER	Annex VI Trigger[4]
a.s.	N	Aquatic invertebrates	0.017	Acute	0.03103	**0.55**	100
a.s.	N	Aquatic invertebrates	0.0016	Chronic	0.03103	**0.05**	10
a.s.	N	Algae	>100	Chronic	0.03103	>3222.69	10

[1] indicate whether Northern of Southern
[2] include critical groups which fail at Step 1.
[3] indicate whether maximum or twa values have been used.
[4] If the Annex VI Trigger value has been adjusted during the risk assessment of the active substance, it should appear in this column. E.g. if it is agreed during the risk assessment of mesocosm, that a trigger value of 5 is required, it should appear as a minimum requirement to MS in relation to product approval.

Refined aquatic risk assessment using higher tier FOCUS modelling.

FOCUS Step 3

2 x 450 g a.s./ha (cucumber, courgette, tomato, aubergine)

Test substance	Scenario[1]	Water body type[2]	Test organism[3]	Time scale	Toxicity end point (mg/L)	PEC[4]	TER	Annex VI trigger[5]
a.s.	D6	ditch early	Fish	0.63	Acute	0.002838	221.99	100
	D6	ditch early	Fish	0.073	Chronic	0.002838	25.72	10
	D6	ditch early	Aquatic invertebrates	0.017	Acute	0.002838	**5.99**	100
	D6	ditch early	Aquatic invertebrates	0.0016	Chronic	0.002838	**0.56**	10
	D6	ditch early	Aquatic invertebrates	0.1796	Acute (geometric mean)	0.002838	**63.28**	100
	D6	ditch early	Aquatic invertebrates	0.00382	Acute (SSD)	0.002838	1.35	1
a.s.	D6	ditch late	Fish	0.63	Acute	0.015872	**39.69**	100
	D6	ditch late	Fish	0.073	Chronic	0.015872	**4.60**	10
	D6	ditch late	Aquatic invertebrates	0.017	Acute	0.015872	**1.07**	100
	D6	ditch late	Aquatic invertebrates	0.0016	Chronic	0.015872	**0.10**	10
	D6	ditch late	Aquatic invertebrates	0.1796	Acute (geometric mean)	0.015872	11.32	100
	D6	ditch late	Aquatic invertebrates	0.00382	Acute (SSD)	0.015872	**0.24**	1
a.s.	R2	Stream late	Fish	0.63	Acute	0.014129	**44.59**	100
	R2	Stream late	Fish	0.073	Chronic	0.014129	**5.17**	10

Test substance	Scenario[1]	Water body type[2]	Test organism[3]	Time scale	Toxicity end point (mg/L)	PEC[4]	TER	Annex VI trigger[5]
	R2	Stream late	Aquatic invertebrates	0.017	Acute	0.014129	**1.20**	100
	R2	Stream late	Aquatic invertebrates	0.0016	Chronic	0.014129	**0.11**	10
	R2	Stream late	Aquatic invertebrates	0.1796	Acute (geometric mean)	0.014129	**12.71**	100
	R2	Stream late	Aquatic invertebrates	0.00382	Acute (SSD)	0.014129	**0.27**	1
a.s.	R3	Stream early	Fish	0.63	Acute	0.01369	**46.02**	100
	R3	Stream early	Fish	0.073	Chronic	0.01369	**5.33**	10
	R3	Stream early	Aquatic invertebrates	0.017	Acute	0.01369	**1.24**	100
	R3	Stream early	Aquatic invertebrates	0.0016	Chronic	0.01369	**0.12**	10
	R2	Stream late	Aquatic invertebrates	0.1796	Acute (geometric mean)	0.01369	**13.12**	100
	R2	Stream late	Aquatic invertebrates	0.00382	Acute (SSD)	0.01369	**0.28**	1
	R4	Stream early	Fish	0.63	Acute	0.015377	**40.97**	100
	R4	Stream early	Fish	0.073	Chronic	0.015377	**4.75**	10
	R4	Stream early	Aquatic invertebrates	0.017	Acute	0.015377	**1.11**	100
	R4	Stream early	Aquatic invertebrates	0.0016	Chronic	0.015377	**0.10**	10
	R4	Stream early	Aquatic invertebrates	0.1796	Acute (geometric mean)	0.015377	**11.68**	100
	R4	Stream early	Aquatic invertebrates	0.00382	Acute (SSD)	0.015377	**0.25**	1

[1] drainage (D1-D6) and run-off (R1-R4)
[2] ditch/stream/pond
[3] include critical groups which fail at Step 2.
[4] indicate whether PEC_{sw}, or PEC_{sed} and whether maximum or twa values used
[5] If the Annex VI Trigger value has been adjusted during the risk assessment of the active substance, it should appear in this column. E.g. if it is agreed during the risk assessment of mesocosm, that a Trigger value of 5 is required, it should appear as a minimum requirement to MS in relation to product approval.

FOCUS Step 4

2 x 450 g a.s./ha (cucumber, courgette, tomato, aubergine)

Scenario[1]	Water body type[2]	Test organism[3]	Time scale	Toxicity end point	Buffer zone distance	PEC[4]	TER	Annex VI trigger[5]

Scenario[1]	Water body type[2]	Test organism[3]	Time scale	Toxicity end point	Buffer zone distance	PEC[4]	TER	Annex VI trigger[5]
D6	ditch early	Aquatic invertebrates	Acute	0.017	Drift mitigated by 95% (i.e. 30 m)	0.000144	118.80	100
D6	ditch early	Aquatic invertebrates	Chronic	0.0016	Drift mitigated by 95% (i.e. 30 m)	0.000144	11.11	10
D6	ditch early	Aquatic invertebrates	Acute (geometric mean)	0.1796	Drift mitigated by 95% (i.e. 30 m)	0.000144	1247.22	100
D6	ditch early	Aquatic invertebrates	Acute (SSD)	0.00382	Drift mitigated by 95% (i.e. 30 m)	0.000144	26.53	1
D6	ditch late	Fish	Acute	0.63	Drainage mitigated by 90%	0.001587	396.93	100
D6	ditch late	Fish	Chronic	0.073	Drainage mitigated by 90%	0.001587	45.99	10
D6	ditch late	Aquatic invertebrates	Acute	0.017	Drainage mitigated by 90%	0.001587	**10.71**	100
D6	ditch late	Aquatic invertebrates	Chronic	0.0016	Drainage mitigated by 90%	0.001587	**1.01**	10
D6	ditch late	Aquatic invertebrates	Acute (geometric mean)	0.1796	Drainage mitigated by 90%	0.001587	113.16	100
D6	ditch late	Aquatic invertebrates	Acute (SSD)	0.00382	Drainage mitigated by 90%	0.001587	2.41	1
R2	Stream late	Fish	Acute	0.63	Runoff mitigated by 90%	0.001413	445.89	100
R2	Stream late	Fish	Chronic	0.073	Runoff mitigated by 90%	0.001413	51.67	10
R2	Stream late	Aquatic invertebrates	Acute	0.017	Runoff mitigated by 90%	0.001413	**12.03**	100
R2	Stream late	Aquatic invertebrates	Chronic	0.0016	Runoff mitigated by 90%	0.001413	**1.13**	10

Scenario[1]	Water body type[2]	Test organism[3]	Time scale	Toxicity end point	Buffer zone distance	PEC[4]	TER	Annex VI trigger[5]
R2	Stream late	Aquatic invertebrates	Acute (geometric mean)	0.1796	Runoff mitigated by 90%	0.001413	127.11	100
R2	Stream late	Aquatic invertebrates	Acute (SSD)	0.00382	Runoff mitigated by 90%	0.001413	2.70	1
R3	Stream early	Fish	Acute	0.63	Runoff mitigated by 90%	0.001369	460.19	100
R3	Stream early	Fish	Chronic	0.073	Runoff mitigated by 90%	0.001369	53.32	10
R3	Stream early	Aquatic invertebrates	Acute	0.017	Runoff mitigated by 90%	0.001369	**12.42**	100
R3	Stream early	Aquatic invertebrates	Chronic	0.0016	Runoff mitigated by 90%	0.001369	**1.17**	10
R3	Stream early	Aquatic invertebrates	Acute (geometric mean)	0.1796	Runoff mitigated by 90%	0.001369	131.19	100
R3	Stream early	Aquatic invertebrates	Acute (SSD)	0.00382	Runoff mitigated by 90%	0.001369	2.79	1
R4	Stream early	Fish	Acute	0.63	Runoff mitigated by 90%	0.001538	409.70	100
R4	Stream early	Fish	Chronic	0.073	Runoff mitigated by 90%	0.001538	47.47	10
R4	Stream early	Aquatic invertebrates	Acute	0.017	Runoff mitigated by 90%	0.001538	**11.06**	100
R4	Stream early	Aquatic invertebrates	Chronic	0.0016	Runoff mitigated by 90%	0.001538	**1.04**	10
R4	Stream early	Aquatic invertebrates	Acute (geometric mean)	0.1796	Runoff mitigated by 90%	0.001538	116.80	100
R4	Stream early	Aquatic invertebrates	Acute (SSD)	0.00382	Runoff mitigated by 90%	0.001538	2.48	1

[1] drainage (D1-D6) and run-off (R1-R4)
[2] ditch/stream/pond
[3] include critical groups which fail at Step 3.
[4] indicate whether PEC_{sw}, or PEC_{sed} and whether maximum or twa values used
[5] If the Annex VI Trigger value has been adjusted during the risk assessment of the active substance, it should appear in this column. E.g. if it is agreed during the risk assessment of mesocosm, that a Trigger value of 5 is required, it should appear as a minimum requirement to MS in relation to product approval.

Bioconcentration	Active substance	Metabolite1
$logP_{O/W}$	$logP_{O/W}$ = 0.09 at 25 ºC << $logP_{O/W}$ ≥3 (Report No. AMR-1234-88)	Metabolite 1
Bioconcentration factor (BCF)[1] ‡	Not applicable	Not applicable
Annex VI Trigger for the bioconcentration factor	Not applicable	Not applicable
Clearance time (days) (CT_{50})	Not applicable	Not applicable
(CT_{90})	Not applicable	Not applicable
Level and nature of residues (%) in organisms after the 14 day depuration phase	Not applicable	Not applicable

[1] only required if log $P_{O/W}$ >3.
* based on total ^{14}C or on specific compounds

Effects on honeybees (Annex IIA, point 8.3.1, Annex IIIA, point 10.4)

Test substance	Acute oral toxicity (LD_{50} µg a.s./bee)	Acute contact toxicity (LD_{50} µg a.s. /bee)
a.s. ‡	48hr: 0.28 µg/bee Report No. Du Pont - 2738	48hr: 0.16 µg/bee Report No. Du Pont - 2738
Preparation[1] Methomyl 20 SL (expressed as a.s./bee)	48hr: 0.20 µg/bee Report No. Du Pont - 2739	48hr: 0.17 µg/bee Report No. Du Pont - 2739
Field or semi –field tests <u>Semi-field test</u>: Methomyl 20SL was applied at 450-g a.s./ha to *Phacelia tanacetiflora* and effects on foraging honey bees exposed to spray deposits 2, 6, and 11 days after treatment were recorded. The report concluded that there was no significant effect on mortality when residues were aged for over 2 days. However, the results need to be treated with caution since effects were greater for residues aged for 6 days than those aged for 2 or 11 days. No adverse effects on behaviour, flight activity or incidence of abnormal development were observed (Report No. DuPont-4446). <u>Semi-field:</u> In a similar trial bees were exposed to spray deposits 1, 5, and 10 days after treatment. The report stated that Methomyl 20SL applied at 450-g a.s./ha to apple trees had temporary harmful effects on honey bees, if exposed 1 day after treatment and that this effect persisted for 2 days. However, similar effects were observed from residues aged for 10 days and it was considered that this statement was not supported. Most mortality occurred in the first 2 days of the evaluation period irrespective of the ageing period of the residues thus making results difficult to interpret. No abnormal behaviour and no incidence for abnormal development of the bee brood was observed, due to Methomyl 20SL (Report No. DuPont-5470).		

Test substance	Acute oral toxicity (LD_{50} µg a.s./bee)	Acute contact toxicity (LD_{50} µg a.s. /bee)
On the basis of the information submitted it was considered that there was a potential risk to bees. The information from the aged residue trials was considered to be of only limited use. Member States need to consider appropriate risk management measures for bees.		

Hazard quotients for honey bees (Annex IIIA, point 10.4)

Crop and application rate : fruiting vegetables (2 x 450 g a.s./ha)

Test substance	Route	Hazard quotient	Annex VI Trigger
a.s.	Contact	2.813	50
a.s.	oral	1.607	50
Preparation	Contact	2.647	50
Preparation	oral	2.250	50

The risk to bees should be managed at Member State level.

Effects on other arthropod species (Annex IIA, point 8.3.2, Annex IIIA, point 10.5)

Laboratory tests with standard sensitive species + extended laboratory studies

Species	Stage	Test Substance	Dose (kg as/ha)	Endpoint	Effect	Annex VI Trigger
Laboratory tests ‡						
Tier 1 (glass) – dose response (Report No. DuPont-2668)	*Typhlodromus pyri* – protonymphys	Methomyl 20SL	1, 3, 9, 27, and 81 g/ha	7-day LR_{30} LR_{50}	9.1 g/ha 12.8 g/ha	30%
Tier 2 - extended dose/response (Report No. DuPont-3766)	*Typhlodromus pyri* - protonymphys	Methomyl 20SL	6.25, 12.5, 25, 50, and 100 g/ha	7-day LR_{25} LR_{50}	22.1 g/ha 34.5 g/ha	30%
Tier 2 - field-aged residues (Report No. DuPont-4427)	*Typhlodromus pyri* - protonymphys	Methomyl 20SL	22.5, 33.75, and 450 g/ha	7-day mortality (%) at 33.75 g/ha fresh residues	5.4%	30%
				7-day mortality at 450 g/ha 7-day aged deposits	3.3%	30%

Species	Stage	Test Substance	Dose (kg as/ha)	Endpoint	Effect	Annex VI Trigger
Tier 1 (glass) – dose response (Report No. DuPont-2669)	*Aphidius rhopalosiphi* - adults	Methomyl 20SL	0.006, 0.019, 0.056, 0.167, 0.500 g/ha	48-hr LR_{30} LR_{50}	0.20 g/ha 0.25 g/ha	30%
Tier 2 - dose/response (Report No. DuPont-3764)	*Aphidius rhopalosiphi* - adults	Methomyl 20SL	1, 3, 9, 27, 81 g/ha	48-hr LR_{25} LR_{50} reproduction	8.33 g/ha 14.7 g/ha 35% at 27 g/ha	30%
Tier 2 - extended field-aged residues (Report No. DuPont-2563)	*Aphidius rhopalosiphi* - adults	Methomyl 20SL	1.25 kg/ha	14-day field-aged-residue: mortality (%) 14-day reproduction (result from 1520 g/ha)	2.8% 27.8%	30%
Tier 1 – spraying over mummified aphids (DuPont-4630)	*Aphidius rhopalosiphi – protected life stage*	Methomyl 20SL	450 g/ha	7-day mortality (%) at 450 g/ha emergence (% decrease) at 450 g/ha	6.81% 3.93%	30%
Tier 2 – field-aged spray deposits on natural soil (Report No. DuPont-3337)	*Poecilus cupreus - adults*	Methomyl 20SL	720 g/ha	1-day field aged residue: mortality, and food consumption (%)	0%, -2.6%	30%
Tier 2 – extended field-aged residues (DuPont-2562)	*Chrysoperla carnea - larvae*	Methomyl 20SL	1250 g/ha	7-day field-aged spray deposits: mortality and reproduction (%)	Mortality 22.2%; Reproduction: 11.5%	30%
Tier 2 lab. Aged residues (Du Pont 3336)	*Aleochara bilineata*	Methomyl 20SL	720 g/ha	1-day aged residues: mortality and reproduction	21.3% 5.3%	30%

Species	Stage	Test Substance	Dose (kg as/ha)	Endpoint	Effect	Annex VI Trigger
Tier 2- extended field aged residues (Du Pont 5514)	*Orius laevigatus*	Methomyl 20SL	450 g/ha	5-day aged residues mortality: reproductive reduction	29% 9%	30%

Trigger values are indicated as 30% as per Directive 97/57/EC however it should be noted that Escort 2 (2000) refers to a value of 50% for extended laboratory studies.

Hazard quotients
Crop and application rate: **2 x 450 g a.s./ha fruiting vegetables** (cucumber, courgette, tomato, egg plant)

Table T1: Hazard quotients for 450 g a.s./ha rate

Species	LR50 (g a.s./ha)	Max single application rate (g a.s./ha)	MAF[1]	Drift value	Vegetative distribution factor : off-field only	Correction factor : off field only	Hazard quotient -in-field	Hazard quotient-off--field
Veg crops <50 cm high (cucumbers + courgettes)								
A. rhopalosiphi	0.25	450	1.1	1m: 0.0238	10	10	1980	47
T.pyri	12.8	450	1.1	1m: 0.0238	10	10	39	0.9
Veg crops >50 cm at 3m (tomato/ aubergine)								
A. rhopalosiphi	0.25	450	1.1	3m: 0.0723	10	10	1980	143
T.pyri	12.8	450	1.1	3m: 0.0723	10	10	39	3

[1]Based on a foliage DT50 of 3.5 days.

Field or semi-field tests*
Methomyl 20SL applied twice at an interval of 14 days at a rate of 2250 mL/ha (i.e., 450-g methomyl/ha) to grapevine in the field resulted in a maximum of 64% reduction in the population of *Typhlodromus pyri* 28 days after the 2nd application. The population reduction was below 50% (37%) at 81 days after the 2nd application of Methomyl 20SL (Report No. DuPont-3883). Methomyl 20SL applied twice at an interval of 14 days at a rate of 2250 mL/ha (i.e., 450-g methomyl/ha) to grapevine in the field resulted in a maximum effect of 71% reduction compared to controls 28 days after the 2nd application on a mixed population off predatory mites. The population reduction was below 50% (34%) at 338 days after the 2nd application of Methomyl 20SL (Report No. DuPont-4327). Methomyl 20SL applied twice at an interval of 13 days at a rate of 2250 mL/ha (i.e., 450-g methomyl/ha) to grapevine in the field had a maximum effect of 93% reduction compared to controls observed 56 days after the 2nd application on a mixed population off predatory mites. The population reduction was below 50% (23%) at 371 days after the 2nd application of Methomyl 20SL (Report No. DuPont-4326). Methomyl 20SL applied twice at an interval of 14 days at a rate of 2250 mL/ha (i.e., 450-g methomyl/ha) to a mixed predatory mite population had a maximum effect of 87% reduction compared to controls at 27 days after the 2nd application. The population reduction was below 50% (25%) at 56 days after the 2nd application of Methomyl 20SL (Report No. DuPont-5469). Methomyl 20SL applied twice at an interval of 14 days at a rate of 2250 mL/ha (i.e., 450-g methomyl/ha) to grapevine in the field had a maximum effect of 98.7% reduction compared to controls on *Typhlodromus pyri* at 27 days after the 2nd application. The population reduction was below 50% (36%) at 83 days after the 2nd application of Methomyl 20SL (Report No. DuPont-5659). Methomyl 20SL applied at a potential drift rate of 22.5-g methomyl/ha to grapevines in the field had no statistically significant effects on *Typhlodromus pyri* on day 8 (-5%) after application (Report No. 4330). Methomyl 20SL applied at a potential drift rate of 33.75-g methomyl/ha to grapevines in the field had no statistically significant effects on *Typhlodromus pyri* on day 8 (9%) and on day 27 (22%) after application(Report No. DuPont-4329).

*Data presented on grapevine, this represents the worst case scenario from the original evaluation and hence is sufficient to cover the vegetables crops.

Table T2: Higher tier test concentrations required for methomyl spray drift based on ESCORT2

Crop	Max single application rate (g a.s./ha)	MAF	Drift value	Vegetative distribution factor : off-field only	Correction factor : off field only	Higher tier test concentration for spray drift (g a.s./ha)
Maximum rate						
Veg crops <50 cm high (cucumbers + courgettes)	450	1.1	0.0238 at 1m	1	5	59 (for 3m)
‘’	450	1.1	0.0047 at 5m	1	5	11.6 (for 5m)
Veg crops >50 cm (tomato/ aubergine)	450	1.1	0.0723 at 3m	1	5	179(for 3m)
‘’	450	1.1	0.0322 at 5m	1	5	79.6 (for 5m)
‘’	450	1.1	0.0056 at 15m	1	5	13.9 (for 15 m)

The lowest end points in the higher tier studies for *A.rhopalosiphi* and *T.pyri* are as follows:

Table T3: Summary of the results of higher tier laboratory testing for the standard sensitive species

Study type and reference	Species	Effects (g a.s./ha)
Extended testing (Du-Pont 3766)	*Typhlodromus pyri*	LR50: 34.5 ER50: >50.0
Extended testing (Du-Pont 3764)	*Aphidius rhopalosiphi*	LR50: 14.7 ER50:>27.0

i) Crop: fruiting vegetables 2 x 450 g a.s./ha

In field: potential for re-colonisation

Off-field: the situation is summarised by the following table.

Table T4 : Comparison of ESCORT2 higher tier extended laboratory rates with effects end points from extended laboratory studies (2 x 450 g a.s./ha)

Crop	Higher tier test concentration for spray drift at distance from crop in meters (g a.s./ha)	Higher tier test concentration for spray drift at 5m or > (g a.s./ha)	Effects end points from extended laboratory studies
Veg crops <50 cm high (cucumbers + courgettes)	59 (for 1m)	11.6 (for 5m)	*T. pyri* LR50: 34.5 ER50: >50.0 *A. rhopalosiphi* LR50: 14.7 ER50:>27.0
Veg crops >50 cm at 3m (tomato/ aubergine)	179(for 3m)	79.6 (for 5m) 13.9 (for 15 m)	

Off-field: Mitigation measures are required to manage the off-field risk.

Effects on earthworms, other soil macro-organisms and soil micro-organisms (Annex IIA points 8.4 and 8.5. Annex IIIA, points, 10.6 and 10.7)

Test organism	Test substance	Time scale	End point[1]
Earthworms			
	a.s. ‡	Acute 14 days	Methomyl: LC_{50} = 19 mg/kg soil dry weight (Report No. DuPont-3926)
	Preparation	Chronic	Methomyl 20SL: NOEL = 7.5 mg formulation /kg artificial soil (1.5 mg a.s./kg) (Report No. DuPont-5503)
Other soil macro-organisms : Not applicable			
Soil micro-organisms			
Nitrogen mineralisation	Methomyl 20 SL		Methomyl 20SL: No significant effect (<25% effect) after 28 days at a rate equivalent to 4.5 kg a.s./ha. (Report No. DuPont-4113)
Carbon mineralisation	Methomyl 20 SL		Methomyl 20SL: No significant effect (<25% effect) after 28 days at a rate equivalent to 4.5 kg a.s./ha. (Report No. DuPont-4113)

[1] indicate where end point has been corrected due to log Pow >2.0 (e.g. LC_{50corr}): Not applicable for methomyl.

Toxicity/exposure ratios for soil organisms

Crop and application rate: **2 x 450 g a.s./ha fruiting vegetables (covers lower rate)**

Test organism	Test substance	Time scale	End point mg a.s./kg dw soil	Soil PEC[1]	TER	Trigger
Earthworms						
	a.s.	Acute	19	0.275	69	10
	Preparation (end point presented in terms of active substance)	Chronic	1.5	0.275	5.5	5

[1] Maximum soil PEC (70% crop interception)

Effects on non target plants (Annex IIA, point 8.6, Annex IIIA, point 10.8)

Preliminary screening data

Insecticide: Screening data showed that Methomyl 20SL applied at 2.25 l/ha resulted in a maximum effect of 6.3% relative to the control on 6 test crop species.

Effects on biological methods for sewage treatment (Annex IIA 8.7)

Test type/organism	end point
Activated sludge	3 hr EC20: 86.7 mg a.s./l 3 hr EC50: 100 mg a.s./l
Pseudomonas sp	Not applicable

Ecotoxicologically relevant compounds (consider parent and all relevant metabolites requiring further assessment from the fate section)

Compartment	
soil	methomyl
water	methomyl
sediment	methomyl
groundwater	-

Classification and proposed labelling with regard to ecotoxicological data (Annex IIA, point 10 and Annex IIIA, point 12.3)

	RMS/peer review proposal

Active substance	N; Harmful R50/R53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

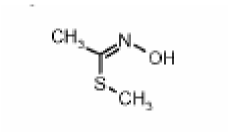
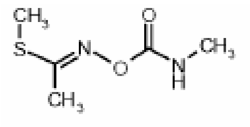
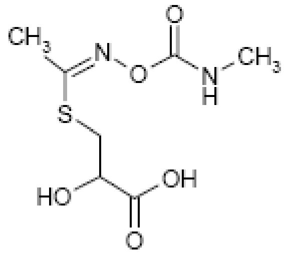
	RMS/peer review proposal
Preparation	N: Harmful R50/53: Very toxic to the aquatic organisms, may cause long term adverse effects in the aquatic environment

APPENDIX B – ABBREVIATIONS USED IN THE LIST OF ENDPOINTS

ADI	acceptable daily intake
AOEL	acceptable operator exposure level
ARfD	acute reference dose
a.s.	active substance
bw	body weight
CA	Chemical Abstract
CAS	Chemical Abstract Service
CIPAC	Collaborative International Pesticide Analytical Council Limited
d	day
DAR	draft assessment report
DM	dry matter
DT_{50}	period required for 50 percent dissipation (define method of estimation)
DT_{90}	period required for 90 percent dissipation (define method of estimation)
ε	decadic molar extinction coefficient
EC_{50}	effective concentration
EEC	European Economic Community
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINKS	European List of New Chemical Substances
EMDI	estimated maximum daily intake
ER50	emergence rate, median
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FOCUS	Forum for the Co-ordination of Pesticide Fate Models and their Use
GAP	good agricultural practice
GCPF	Global Crop Protection Federation (formerly known as GIFAP)
GS	growth stage
h	hour(s)
ha	hectare
hL	hectolitre
HPLC	high pressure liquid chromatography or high performance liquid chromatography
ISO	International Organisation for Standardisation
IUPAC	International Union of Pure and Applied Chemistry
K_{oc}	organic carbon adsorption coefficient
L	litre
LC	liquid chromatography
LC-MS	liquid chromatography-mass spectrometry
LC-MS-MS	liquid chromatography with tandem mass spectrometry
LC_{50}	lethal concentration, median
LD_{50}	lethal dose, median; dosis letalis media
LOAEL	lowest observable adverse effect level

LOD	limit of detection
LOQ	limit of quantification (determination)
µg	microgram
mN	milli-Newton
MRL	maximum residue limit or level
MS	mass spectrometry
NESTI	national estimated short term intake
NIR	near-infrared-(spectroscopy)
nm	nanometer
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
PEC	predicted environmental concentration
PEC_A	predicted environmental concentration in air
PEC_S	predicted environmental concentration in soil
PEC_{SW}	predicted environmental concentration in surface water
PEC_{GW}	predicted environmental concentration in ground water
PHI	pre-harvest interval
pK_a	negative logarithm (to the base 10) of the dissociation constant
PPE	personal protective equipment
ppm	parts per million (10^{-6})
ppp	plant protection product
r^2	coefficient of determination
RPE	respiratory protective equipment
STMR	supervised trials median residue
TER	toxicity exposure ratio
TMDI	theoretical maximum daily intake
UV	ultraviolet
WHO	World Health Organisation
WG	water dispersible granule
yr	year

APPENDIX C – USED COMPOUND CODE(S)

Code/Trivial name	Chemical name	Structural formula
IN-X1177/MHTA, methomyl oxime	*Z*-methyl *N*-hydroxyethanimidothioate	
IN-B1884/ Anti-methomyl	*E*-methyl *N*-[[(methylamino)carbonyl]oxy]ethanimidothioate	
IN-HUZ57/Hydroxy-cysteine derivative of methomyl	9-hydroxy-6-methyl-3-oxo-4-oxa-7-thia-2,5-diazadec-5-en-10-oic acid	
IN-G6520/ Hydroxy methyl methomyl	Methyl-*N*-[[[(hydroxymethyl)amino]carbonyl]oxy] ethanimidothioate