Conclusion regarding the peer review of the pesticide risk assessment of the active substance

methiocarb

finalised: 12 May 2006

SUMMARY

Methiocarb is one of the 52 substances of the second stage of the review programme covered by Commission Regulation (EC) No 451/2000[1], as amended by Commission Regulation (EC) No 1490/2002[2]. 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 methiocarb in accordance with the provisions of Article 8(1) of the amended Regulation (EC) No 451/2000, which was received by the EFSA on 4 March 2004. Following a quality check on the DAR, the peer review was initiated on 15 July 2004 by dispatching the DAR for consultation of the Member States and the sole applicant Bayer AG. 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 in 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 June and July 2005.

A final discussion of the outcome of the consultation of experts took place with representatives from the Member States on 7 April 2006 leading to the conclusions as laid down in this report.

The conclusion was reached on the basis of the evaluation of the representative uses as molluscicide, repellent and insecticide as proposed by the applicant. The use as molluscicide comprises spreading the bait to control slugs and snails in oilseed rape at an application rate of 120 g methiocarb per hectare with maximal 2 applications resulting in a maximum total dose of 240 g/hectare. The use as seed treatment in maize at an application rate of 500 g/dt (≡ 150 g/ha at a seeding rate of 30 kg/ha) is intended to control frit flys and repel pheasants. Methiocarb can be used as molluscicide, insecticide, repellent and acaricide.

[1] OJ No L 53, 29.02.2000, p. 25
[2] OJ No L 224, 21.08.2002, p. 25

The representative formulated products for the evaluation were "Mesurol RB 4", a bait ready for use (RB) and "Mesurol FS 500", a flowable concentrate for seed treatment (FS), both are registered in most of the EU Member States.

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.

Methiocarb is acutely very toxic by oral route and toxic after inhalation in rats. It is not a skin or eye irritant nor a skin sensitiser. The following classification was therefore proposed: T+ Very toxic, R28 Very toxic if swallowed, R23 Toxic on inhalation.
Methiocarb was clastogenic in the chromosomal aberration assay in CHO cells but this was not confirmed in cytological analysis in a micronucleus test. There was no evidence of genotoxicity in other in vitro and in vivo studies. There was no evidence of carcinogenicity in mice and rats. Methiocarb did not affect reproductive and developmental parameters and did not show any potential to cause delayed neurotoxicity. The ADI, ARfD and AOEL of 0.013 mg/kg bw/day were proposed. The operator, worker and bystander exposure is below the AOEL for the use of FS formulation (maize seed treatment), while the AOEL is likely to be exceeded when the RB formulation (oilseed rape) is considered.

The metabolism of methiocarb was investigated in tomato, lettuce, rice and oilseed rape following a soil application or a seed treatment. In tomato, lettuce, rice methiocarb and methiocarb sulphoxid (M01) were identified as major components. Methiocarb phenol (M03) and methiocarb sulfoxide phenol (M04) could be released at significant levels upon hydrolysis of lettuce extracts. In oilseed rape the metabolic pattern at harvest was different. A major part of the radioactivity was associated with fatty acids in the seeds. Methiocarb sulphoxide phenol (M04) and methiocarb sulphone phenol (M05) and their glucose conjugates were identified as main constituents in rape matrices. These compounds were also present at significant levels in crops planted as succeeding crops. The experts' meeting for residues concluded that there is currently insufficient information available to have a firm view on the plant residue definition and proposed that either all phenol metabolites should be included in the plant residue definition and hence more information on suitable methods and appropriate residue trials is needed or alternatively that the toxicity of the phenol metabolites should be further addressed. Consequently a final consumer risk assessment is currently not possible and MRLs cannot be proposed.

Studies were provided on aerobic and anaerobic degradation, photolysis, and adsorption of methiocarb. Data showed that methiocarb is not persistent in soil. Under aerobic conditions at 20 ºC, methiocarb is degraded in soil in less than 2 days and the major degradation products are methiocarb

sulfoxide, (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10). Metabolites M01 and M04 can be classified as low persistent and metabolites M05 and M10 as moderate persistent. Under anaerobic conditions, a new metabolite, methiocarb phenol (M03) was observed. As the use as a pellet formulation in winter oilseed rape post-drilling up to GS 16 could result in anaerobic degradation for the active substance, PECsoil for the anaerobic metabolite M03 was calculated. Photodegradation in soil will contribute to the degradation of methiocarb to M01 and M04 under environmental conditions. Methiocarb is low to medium mobile in soil, whereas the major soil metabolites (M01, M04, M05 and M10) can be classified as medium to very high mobile in soil.

Methiocarb is considered unstable to hydrolysis. Hydrolytic breakdown may be expected to contribute to the degradation of methiocarb in the environment under alkali or pH neutral conditions. Degradation of methiocarb in natural surface water systems may be influenced by sunlight. Results from a non-radiolabelled water/sediment study, with methiocarb applied as pellet formulation, indicated that the active substance degraded quite fast (DT_{50} < 10 days) to methiocarb phenol (M03) and methiocarb sulfoxide phenol (M04) in the water phase. Potential risk for surface water contamination was performed considering drainflow as the main route of entry into the water body, and was considered acceptable. However, a comprehensive surface water risk assessment including runoff will be necessary at Member State level to complete the risk assessment of the pellets formulation and the molluscicidal use. For the representative uses, parent methiocarb and its soil metabolites M01, M04, M05 and M10 would not be expected to leach to groundwater above 0.1 µg/L.

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

The first tier risk assessment for birds and mammals for the use of “Mesurol FS 500” as a seed treatment resulted in a high risk to birds and mammals from uptake of treated maize seeds. Avoidance studies and field studies were conducted to refine the risk to seed-eating birds. The study results suggest that freshly drilled maize fields are not attractive to small seed-eating birds. Due to their inability to ingest whole seeds, small birds may only ingest pieces of methiocarb treated maize seeds. Encounters between small birds and small pieces of treated maize seed on an arable field in spring were considered to be very low. The acceptance studies did not investigate small seed-eating birds but the studies provide some evidence of a general repellency of treated seeds. Therefore the rapporteur Member State considered the risk to small seed eating birds as low. In the avoidance and field studies it was shown that maize treated with “Mesurol FS 500” had a strong repellent effect to larger seed-eating birds potentially feeding on maize. No treatment related mortalities were observed in the tests even under severe feeding pressure. Therefore it was concluded that the risk to birds from the representative use of “Mesurol FS 500” is low. Avoidance studies revealed the repellent effect of “Mesurol FS 500” to mammals. The availability of treated maize seeds on the soil surface is low. Furthermore, field studies showed relatively low abundance of small rodents in maize fields. Therefore it was concluded by the rapporteur Member State that the representative use of “Mesurol FS 500” poses a low risk to small mammals.

The risk to birds from the representative use of “Mesurol RB4” as a slug pellet was assessed as high and further data are needed to quantify the risk to key species of farmland birds and predatory birds. Short-term effects were observed for populations of small mammals in fields treated with “Mesurol RB4”. However populations recovered fast and it was concluded that the risk to wild mammals is low from the representative use in rape. Data/information is needed to address the risk to small earthworm eating mammals such as the common shrew (*Sorex araneus*).

The risk to aquatic organisms was assessed as low based on entry into surface water via drainflow. The exposure of aquatic organisms from run-off was not assessed but should be considered at Member State level. The risk to other non-target arthropods from the use of “Mesurol FS 500” was assessed as low. The in-field risk to certain species of carabid beetles was assessed as high for the representative use of “Mesurol RB4”. The expert meeting concluded that off-field exposure and in- and off-field risk mitigation measures should be considered at Member State level. The risk to earthworms is low for the representative use of “Mesurol FS 500”. The application of “Mesurol RB4”led to a significant reduction in earthworm abundance in a field study on grassland but recovery was observed within one year after application. However, the biomass of large tanylobus earthworm species was still reduced after 12 month. The importance of these species depends on the type of agricultural system (e.g. in low tillage situations). The expert meeting concluded that risk mitigation measures such as restricting the number of applications should be considered at Member State level.
The risk to bees, other soil non target macro-organisms, soil non-target micro-organisms, non-target plants, biological methods of sewage treatment was assessed as low for the representative uses of methiocarb.

Key words: methiocarb, peer review, risk assessment, pesticide, molluscicide, insecticide, repellent and acaricide

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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. Methiocarb 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 methiocarb, hereafter referred to as the draft assessment report, to the EFSA on 4 March 2004. Following an administrative evaluation, the EFSA communicated to the rapporteur Member State some comments regarding the format and/or recommendations for editorial revisions and the rapporteur Member State submitted a revised version of the draft assessment report. In accordance with Article 8(5) of the amended Regulation (EC) No 451/2000 the revised version of the draft assessment report was distributed for consultation on 15 July 2004 to the Member States and the main applicant Bayer AG as identified by the rapporteur Member State.

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 June and July 2005. The reports of these meetings have been made available to the Member States electronically.

A final discussion of the outcome of the consultation of experts took place with representatives from Member States on 7 April 2006 leading to the conclusions as laid down in this report.

During the peer review of the draft assessment report and the consultation of technical experts no critical issues were identified for consultation of the Scientific Panel on Plant Health, Plant Protection Products and their Residues (PPR).

In accordance with Article 8(7) of the amended Regulation (EC) No 451/2000, this conclusion summarises the results of the peer review on the active substance and the representative formulation

evaluated as finalised at the end of the examination period provided for by the same Article. 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 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 draft assessment report:

- the comments received
- the resulting reporting table (rev. 1-1 of 4 March 2005)
- the consultation report

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 10 May 2006)

Given the importance of the draft assessment report including its addendum (compiled version of April 2006 containing all individually submitted addenda) and the peer review report with respect to the examination of the active substance, both documents are considered respectively as background documents A and B to this conclusion.

By the time of the presentation of this conclusion to the EU-Commission, the rapporteur Member State has made available amended parts of the draft assessment report which take into account mostly editorial changes. Since these revised documents still contain confidential information, the documents cannot be made publicly available. However, the information given can basically be found in the original draft assessment report together with the peer review report which both is publicly available.

THE ACTIVE SUBSTANCE AND THE FORMULATED PRODUCT

Methiocarb is the ISO common name for 4-methylthio-3,5-xylyl methylcarbamate (IUPAC). The name mercaptodimethur is also approved by ISO for this compound. It should be noted that the name methiocarb is not accepted in Ireland and the name mercaptodimethur is not accepted in the UK.

Methiocarb belongs to the class of phenyl methylcarbamate insecticides such as bufencarb and propoxur and to the class of carbamate acaricides such as benomyl and carbaryl. Furthermore, methiocarb is a molluscicide and a repellent. Methiocarb shows effects by contact and stomach action and inhibits the enzyme acetyl cholinesterase in a similar way as the insecticidal organophosphorous compounds (e.g. dichlorvos).

The representative formulated products for the evaluation were "Mesurol RB 4", a bait ready for use (RB) and "Mesurol FS 500", a flowable concentrate for seed treatment (FS), both are registered in most of the EU Member States.

The evaluation was based on the representative uses as molluscicide, repellent and insecticide as proposed by the applicant. The use as molluscicide comprises spreading the bait to control slugs and snails in oilseed rape at an application rate of 120 g methiocarb per hectare with maximal 2 applications resulting in a maximum total dose of 240 g/hectare. The use as seed treatment in maize at an application rate of 500 g/dt (≡ 150 g/ha at a seeding rate of 30 kg/ha) is intended to control frit flies and repel pheasants. Methiocarb can be used as molluscicide, insecticide, repellent and acaricide.

SPECIFIC CONCLUSIONS OF THE EVALUATION

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

The minimum purity of methiocarb as manufactured should not be less than 980 g/kg, which is higher than the minimum purity given in the FAO specification 165/TC/S/F (1991) of 950 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.

The properties of the representative FS formulation is except for the parameter persistent foaming in line with the FAO Specification 165/FS/S/F (1991). In the case of persisting foaming the determination was carried out with a 50% dilution (value: of 30 mL after 1 minute) instead of using an undiluted sample, as described in the FAO specification. The test was also not carried out according to the FAO/WHO "Manual on development and use of FAO and WHO specifications for pesticides" (First edition, 2002) where it is indicated that the "test should be carried out at the application concentration", which is in the case under consideration the neat formulation and not a dilution of it. However, this was not of any concern during the peer review process.
At the moment no FAO specification exists for RB formulations.

The content of methiocarb in the representative formulations is 40 g/kg (pure) for the RB formulation and 500 g/L (pure) for the FS formulation.

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 methiocarb or the respective formulations.
However, it should be noted that two data gaps were identified with respect to the FS formulation:
Data on the viscosity at 40 °C and
Data on adherence and distribution to seeds.

In the case of the viscosity, the applicant has submitted a new study in September 2005 to address the data gap. This study was assessed by the rapporteur Member State, but the results are given only in

the evaluation table (rev. 2-1 of 10 May 2006) and were neither peer reviewed by other MS nor discussed in an EPCO expert meeting.
In the case of adherence and distribution on seeds, the expert meeting agreed with the assessment of the rapporteur Member State (addendum 2 to the DAR) that the newly submitted data do not address the data gap identified in the DAR. The new data are rather related to the content on methiocarb on treated seed after 6 month storage, but not to the uniformity of methiocarb on the seed.

However, sufficient test methods and data relating to physical, chemical and technical properties are available. Also adequate analytical methods are available for the determination of methiocarb 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.

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

Adequate methods are available to monitor all compounds given in the respective residue definition, i.e.methiocarb and methiocarb-sulfoxide in soil; methiocarb-sulfoxide in surface water; methiocarb in ground water and methiocarb in air.
In the case that methiocarb-sulfoxide-phenol[3] needs to be monitored in surface water, an analytical method is available but needs to be re-assessed, because the applicability was not considered by the meeting of experts (see chapter 6 Residue Definitions).
It was not possible to conclude on the residue definition for food of plant origin (refer to chapter 3.1). Therefore, it is not possible to conduct a final assessment on the respective enforcement methods. However, methods are available to determine methiocarb and its sulfoxide[4] and sulfone[5] metabolites in food of plant origin.
Also a validated method for the determination of methiocarb in blood is available. However, due to the fact that methiocarb metabolises rapidly, it is unlikely that methiocarb will be present at significant levels in blood. Whether or not a metabolite could be used as an appropriate analyte is still under discussion (refer to chapter 2.2).

However, it was agreed at the expert meeting that for transparency reasons the rapporteur Member State should straighten out which are the accepted analytical methods for enforcement/monitoring purposes in particular for water. This clarification is still outstanding.

The methods for soil, water and air are able to determine additional compounds to the one mentioned in the respective residue definitions. In the case that the residue definition for surface water will

[3] methiocarb-sulfoxide-phenol: 3,5-dimethyl-4-(methylsulfinyl)phenol (IUPAC)
[4] methiocarb-sulfoxide: 4-methylsulfinyl-3,5-xylyl-methylcarbamate (IUPAC)
[5] methiocarb-sulfone: 4-methylsulfonyl-3,5-xylyl methylcarbamate (IUPAC)

include methiocarb-sulfoxide-phenol, a method would be available, but must be reviewed, if necessary.

The methodology used is HPLC with MS/MS or fluorescence and GC with FP or MS detection. 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 30, July 2005) on identity, physical and chemical properties and analytical methods was limited to certain physical and chemical properties of the formulation and the ILV for food of plant origin as well as to some further clarifications with respect to analytical methods and physical and chemical properties.

2. Mammalian toxicology

In June 2005 methiocarb was discussed in the EPCO experts' meeting on toxicology (EPCO 28).

2.1 ABSORPTION, DISTRIBUTION, EXCRETION AND METABOLISM (TOXICOKINETICS)

Methiocarb is rapidly and extensively (84 - 90%) absorbed from the gastrointestinal tract into the plasma after oral administration. It is rapidly distributed into organs and tissues. Renal excretion is the major route of elimination and only 5 - 10% is excreted via faeces. Methiocarb is extensively metabolised, through oxidation of the sulphide group, removal of the carbamate group with formation of phenol metabolites and conjugation of phenol hydroxy group with sulphate and glucuronic acid.

2.2 ACUTE TOXICITY

Methiocarb is very toxic by oral route in rats. The oral LD_{50} is 33 mg/kg bw. Toxicity after dermal exposure is low (dermal LD_{50} >5000 mg/kg bw). The inhalation LC_{50} (4-hour exposure) is 0.4 mg/L. Methiocarb is not a skin or eye irritant nor a skin sensitiser. The following classification was therefore proposed: **T+ Very toxic**, **R28 Very toxic if swallowed**, **R23 Toxic by inhalation**.
The experts were unable to determine an appropriate marker for blood samples based on the available information. As methiocarb is metabolised rapidly it is unlikely to be present at significant levels in blood samples. The notifier was invited to propose a marker for blood and animal tissues taking into account of likely levels present and analytical capability. This has not yet been performed.

2.3 SHORT TERM TOXICITY

Short-term toxicity studies were conducted in rats and dogs. Dermal route and inhalation route studies were performed in rabbits and rats, respectively. Target effects are cholinesterase inhibition and reduction of body weight gain. The relevant short term NOAEL of 1.33 mg/kg bw/day is from a 90-day study in dogs, based on clinical signs, reduced body weight gain, erythrocyte cholinesterase

inhibition and retinal cholinesterase inhibition at higher doses. The NOAEL in the subacute inhalation study in the rat was 0.006 mg/L based on significant reduction in plasma and brain cholinesterase activities.

2.4 GENOTOXICITY

Methiocarb was clastogenic in the chromosomal aberration assay in CHO cells but this was not confirmed in cytological analysis in a micronucleus test. There was no evidence of genotoxicity in other *in vitro* and *in vivo* studies.

2.5 LONG TERM TOXICITY

The experts discussed the types of study that were defined as chronic and concluded that the two year dog study was a chronic study and therefore suitable to define the relevant long term NOAEL of 2.2 mg/kg bw/day, based on impaired feed consumption, vomiting and clinical signs at 8.6 mg/kg bw/day. There was no evidence of carcinogenicity in mice and rats.

The relevance of gavage dosing to human exposures was also discussed and the experts concluded that findings in gavage studies could not be discounted given the typical feeding patterns in humans.

2.6 REPRODUCTIVE TOXICITY

In the main multigeneration study in rats, the parental, reproductive and offspring NOAEL was 4.3 mg/kg bw/day, based on reduced body weights and reduced number of pups per litter and impaired lactation rate at ≥ 12 mg/kg bw/day.

No developmental toxicity was observed in rabbits, with a NOAEL for parental toxicity of 0.5 mg/kg bw/day and foetotoxicity and teratogenicity of 10 mg/kg bw/day (the highest tested dose).

2.7 NEUROTOXICITY

Methiocarb did not show any potential to cause delayed neurotoxicity in hens. The oral LD_{50} in hens was 380 mg/kg bw.

2.8 FURTHER STUDIES

Studies on cholinesterase inhibition and antidotes

- In rats and dogs, the maximum levels of plasma and erythrocyte cholinesterase inhibition were attained at 20 minutes after administration of 10-50 mg/kg bw and in the brain at 2 hours after dosing.
- In the dog, the NOAEL for methiocarb based on plasma cholinesterase inhibition was 0.05 mg/kg bw/day whilst very slight sporadic inhibition was observed for methiocarb sulfoxide indicating a threshold dose level for cholinesterase inhibition. Brain cholinesterase activity was not determined.

Metabolite toxicity studies

- In studies on metabolite toxicity, the oral LD_{50} of methiocarb sulfoxide in rats was 7-9 mg/kg bw. The NOAEL for methiocarb sulfoxide was estimated at 0.1-0.2 mg/kg bw/day in a rat 28-day oral study and 0.05 mg/kg bw/day in a 29 day oral study in dog, based on cholinesterase inhibition.

- In a comparative study of cholinesterase inhibition in the rat by methiocarb and the primary metabolite, methiocarb sulfoxide, the NOAEL for plasma and erythrocyte cholinesterase activity was 0.5 mg/kg bw/day for methiocarb and <0.5 mg/kg bw/day for methiocarb sulfoxide.
- The oral LD_{50} of N-hydroxymethyl methiocarb, N-hydroxymethyl methiocarb sulfone and N-hydroxymethyl sulfoxide were determined to be > 110 mg/kg bw.
- The oral and dermal LD_{50} of methiocarb phenol, methiocarb sulfoxide phenol and methiocarb sulfone phenol in the rat were > 1000 mg/kg bw. The toxicology experts concluded that although these compounds had been shown to be less acutely toxic than methiocarb in studies from 1970, there was insufficient information to discount them entirely.

2.9 MEDICAL DATA

Reports from two manufacturing plants showed that no changes in laboratory parameters or health impairments caused by contact with methiocarb were observed at the medical department including the medical checks which are annually conducted. Poisoning incidents in humans are reported to be limited.

2.10 ACCEPTABLE DAILY INTAKE (ADI), ACCEPTABLE OPERATOR EXPOSURE LEVEL (AOEL) and ACUTE REFERENCE DOSE (ARfD)

In terms of setting reference doses it was agreed that the short-term, maternal toxicity and chronic NOAELs should be integrated to obtain an overall NOAEL.

ADI, ARfD and AOEL

The ADI, ARfD and AOEL of 0.013 mg/kg bw/day were proposed, based on the NOAEL of 1.3 mg/kg bw/day in the 90-day dietary study in dogs, with a safety factor of 100.

2.11 DERMAL ABSORPTION

Methiocarb is intended to be used as a molluscicide in rapes and maize. The representative plant protection products are Mesurol FS 500 and Mesurol RB4 (bait pellets).

Mesurol FS 500

DAR: A dermal absorption value of 2% was proposed by rapporteur Member State, based on *in vivo* and *in vitro* studies.

EPCO: the experts discussed the information presented in the DAR and concluded that the studies were poorly described and provided insufficient information on residues in skin and overall recoveries to conclude on Mesurol FS 500. Thus, the rapporteur Member State was asked to reassess the dermal penetration values (including skin residues if appropriate) and present a more detailed summary in an addendum, which has not been submitted so far (April 2006).

In the evaluation table the rapporteur Member State restated that dermal absorption for the FS 500 formulation is 2 % for the concentrate and diluted product.

Mesurol RB4

DAR: no studies were available for this formulation; a dermal absorption value of 5% was proposed by the rapporteur Member State since it was considered that an RB formulation is unlikely to exceed the seed treatment formulation.

EPCO: the rationale of the 5% value for Mesurol RB4 was unclear. The rapporteur Member State was asked to provide further explanation in an addendum, which was not provided until April 2006.

For Mesurol RB4, two new dermal absorption studies with methiocarb contaminated corn and a position paper have been submitted in October 2005 by the notifier to the rapporteur Member State. These data has not been evaluated and summarised in an addendum by the rapporteur Member State. However, in the evaluation table the rapporteur Member State confirmed that 5% is an appropriate and conservative value to use for the purposes of operator risk assessment for this formulation, without providing any detailed argumentations.

EFSA notes that during the Evaluation Working Group (Parma, April 2006) the issue of dermal absorption values was discussed. The rapporteur Member State was asked to summarise the information already reported in the evaluation table through an addendum; a brief consultation was then launched for the MSs to send written comments on the conclusions drawn by UK.

All the MSs who sent comments agreed on a dermal absorption value of 2% for the FS formulation. As for the RB formulation, some MSs raised concern on the value of 5% proposed by the rapporteur Member State.

As for Mesurol RB4, the absence of specific dermal absorption data would lead to the use of default values (10-100%). Methiocarb MW is 225.3 and log Pow is 3.11. On this basis, a default of 100% is justified. It should be highlighted that 100% is an extremely worst case and that is unlikely to occur but a default approach, according the Guidance Document on dermal absorption (Sanco/222/2000), is considered when there are uncertainties in the studies and especially when studies are lacking.

2.12 EXPOSURE TO OPERATORS, WORKERS AND BYSTANDERS

Mesurol FS500 is a water based dressing liquid formulation containing nominal 500 g/L methiocarb for treatment of maize seed. Mesurol RB4 is a molluscicide pellet bait (40 g/kg) to be applied to oilseed rape using tractor mounted broadcast sprayers and handheld equipment.

Operator exposure

Mesurol FS 500 – Maize seed treatment

2% dermal absorption

- Operator exposure estimates for seed dressing, based on three compound specific field studies comprising seed treatment in professional plants and on farms, indicate levels of total systemic exposure to methiocarb for seed plant workers and workers treating seeds using on-farm equipment

are below the AOEL (5-84% of the AOEL for seed plants and 1% to 10% AOEL for on-farm treatment).

- Based on surrogate exposure data (US Pesticide Handlers Exposure Database - PHED), operator exposure to methiocarb during the loading/sowing of seed treated with 'Mesurol FS 500' is estimated to be 0.009 mg/kg bw/day, equivalent to 70% of the AOEL.

Mesurol RB 4 – Oilseed rape

100% dermal absorption

EFSA notes that when a default value of 100% is applied, estimated exposure is expected to exceed the AOEL. It should be considered that even applying a 10% default value, exposure might be in some cases above the AOEL.

5% dermal absorption (as reported in the DAR, and confirmed by the rapporteur Member State based on the newly submitted studies not peer reviewed).

- *Estimates of exposure for vehicle mounted application of 'Mesurol RB4', using a combination of exposure study data and generic data contained within the PHED indicate levels of total systemic exposure for this task below the AOEL (<1%).*
- *A further exposure assessment, based on exposure data for a similar formulation and work task, indicates levels of exposure below the AOEL (55%).*
- *Total systemic exposure for operators using handheld equipment to apply 'Mesurol RB4' predicted from PHED data indicated levels of total systemic exposure of 38% of the AOEL (75th percentile values).*

Worker exposure

Mesurol FS 500

The meeting agreed that, as the only representative use of 'Mesurol FS 500' is treating seeds prior to sowing, no re-entry scenario is envisaged.

Mesurol RB 4

The experts considered that for crop inspection activities undertaken after treatment, the duration for this task will be short and will not involve direct contact with the broadcast pellets. Exposure to methiocarb for workers performing crop inspections is therefore expected to be negligible.

Bystander exposure

Mesurol FS 500

It is unlikely that bystanders will be present during the dressing of seeds with 'Mesurol FS 500' or during the loading/sowing of treated seed. During the meeting it was concluded that significant levels of bystander exposure are not therefore envisaged. If the case that bystander exposure does occur, levels of bystander exposure are not expected to exceed those of operators involved with sowing treated seed.

Mesurol RB 4

Levels of total systemic exposure to methiocarb for an unprotected bystander arising from dust during loading and broadcast of 'Mesurol RB4 pellets' are expected to be above the AOEL when a dermal absorption value of 100% is considered.

3. Residues

Methiocarb was discussed in the experts' meeting for residues in June/July 2005 (EPCO 29).

3.1. NATURE AND MAGNITUDE OF RESIDUES IN PLANT

The metabolism, distribution and residue behaviour of methiocarb was investigated in a number of crops. The representative uses for inclusion of methiocarb in Annex I of 91/414/EEC are pelleted bait use on oilseed rape and seed treatment on maize. Therefore, of the studies submitted in the dossier, only studies involving those application methods have been considered by the rapporteur Member State for the evaluation of methiocarb in the Peer Review procedure.

3.1.1. PRIMARY CROPS

The metabolism of methiocarb was investigated in tomato, lettuce, rice and oilseed rape. Phenyl labelled [^{14}C] methiocarb was soil-applied at a rate of 1.12 kg a.s./ha to lettuce, to tomato seedlings, to mature tomato plants and to rice seed simulating a seed treatment. Metabolism of methiocarb following a seed treatment at a rate of 5 and 25 kg a.s./100 kg seed, respectively, was studied in oilseed rape.

Uptake of radioactivity was rapid in both, lettuce and tomatoes. A continued increase in the uptake of radio-labelled material was observed during the study time. Over 40% and 50% of the total [^{14}C] residue (TRR) was recovered in lettuce and tomato plants after 7 and 14 days, respectively. In rice plants, 21% of the applied radioactivity was found 35 days after a treatment of soil and seeds at sowing. Absolute levels of recovered radioactivity in rice plants, lettuce and tomato seedlings were not available from the studies. Total residues (TRR, expressed as parent equivalent) in tomato fruits following methiocarb application to mature tomato plants amounted to 0.066 mg/kg. Following seed treatment of oilseed rape, TRR at harvest in the seed, were 0.05 mg/kg for the low and 0.15mg/kg for the high application rate.

On characterisation of the organic-extractable radioactivity in lettuce, tomato and rice two major components were identified as methiocarb (up to 19% TRR) and methiocarb sulphoxid (M01)(up to 52% TRR) between 1 and 35 days after application. Methiocarb sulfone (M02) residues were minor (max 2% TRR). Following hydrolysis of the aqueous fraction of lettuce extracts methiocarb phenol (M03) (19% TRR) and methiocarb sulfoxide phenol (M04) (27% TRR) were released. In oilseed rape the metabolic pattern at harvest (181 days after application) was different. In the seeds, 38% of the radioactivity was associated with fatty acids. Methiocarb sulphoxide phenol (M04) and methiocarb

sulphone phenol (M05) were the main components identified (*ca* 7 and 8% TRR, respectively) whereas methiocarb and the sulphoxid (M01) and sulfone (M02) metabolites and were not detected in the seeds. In oilseed rape forage and straw the major components of the extracted radioactivity were the glucosides of M04 and M05, i.e. methiocarb sulphoxide phenol glucoside and methiocarb sulphone phenol glucoside, which accounted for 22-57% and 9-21 % of the total radioactivity.

The initial proposal of the rapporteur Member State to define the residue in crops in line with the current CAC definition as sum of methiocarb, methiocarb sulfoxide and methiocarb sulfone expressed as methiocarb was discussed by the residue experts in EPCO 29.
It was noted by the experts that methiocarb phenol (M03), methiocarb sulfoxide phenol (M04) and methiocarb sulfone phenol (M05) (hereafter phenol metabolites) were present in primary crop metabolism studies involving a soil or seed treatment and also in the rotational crop metabolism study (refer to 3.1.2) at significant levels. Phenol metabolites were commonly present as conjugated material but also, usually as lesser proportions, as free metabolites. The potential for release of the free phenol metabolites away from conjugates was noted. However supervised residues trials with oilseed rape and maize were only available determining the methiocarb, methiocarb sulfoxide and methiocarb sulfone components and the actual level of phenol metabolites in these crops at harvest is not known.
Confirming that besides parent methiocarb also methiocarb sulfoxide and methiocarb sulfone are candidate components to be included in the residue definition due to their toxicological properties, EPCO 28 also considered the toxicity of the phenol metabolites. The toxicology experts stated that the only available toxicology information on the phenol metabolites was limited and from the 1970's and therefore it was not possible to be certain of the toxicological profile of these compounds (refer to 2.8). The meeting concluded that there is currently insufficient information available to have a firm view on the residue definition and proposed that two options should be provided to the applicant: To include all phenol metabolites in the residue definition and provide more information on suitable methods and appropriate residue trials or to address the toxicity of the phenol metabolites further.
It is noted that the rapporteur Member State has a differing position on the proposed possible inclusion of the phenol metabolites in the residue definition.

3.1.2. SUCCEEDING AND ROTATIONAL CROPS

In crop rotation studies the potential incorporation of soil residues into succeeding and rotational crops is investigated. In terms of the application mode defined for the representative uses under evaluation (seed and soil treatment), the studies on succeeding crops can be considered valuable to also clarify the residue behaviour of methiocarb in primary crops.

Swiss chard, wheat and sugar beet were grown in soil that had been treated with [^{14}C] methiocarb at a rate of 0.2 kg a.s./ha (0.9N). At harvest total [^{14}C] residues in the mature crops (expressed as parent equivalent) were less than 0.1 mg/kg, with the exception of wheat straw which gave residues of 0.49 mg/kg in the 30 day study falling to 0.11 mg/kg in the 163 day study.

On characterisation of the extractable radioactivity a major component was identified in the crops at harvest as methiocarb sulphoxide phenol glucoside, which accounted for 22-62% of the total radioactivity in the crops, with the exception of wheat grain. Lower amounts of the corresponding free methiocarb sulphoxide phenol were found, however the potential for release of the free phenol metabolites away from conjugates and implications for consumer exposure are not known.

Several other metabolites were identified which individually were present at levels of at or less than 0.01 mg/kg, with the exception of methiocarb sulfone phenol and methiocarb phenol (both free and conjugated) which were present in wheat straw at a level of 0.07 mg/kg and 0.2 mg/kg, respectively.

From the study it could be concluded that methiocarb sulphoxide phenol, methiocarb sulfone phenol, methiocarb phenol and their glucosides may reach significant levels in rotational crops. This result confirms observations made in primary crop studies involving a soil or seed treatment. Concerning the toxicological relevance of the phenol metabolites it is referred to paragraph 2.8 and paragraph 3.1.1 above.

3.2. NATURE AND MAGNITUDE OF RESIDUES IN LIVESTOCK

The metabolism and distribution in livestock was investigated in a dairy cow and chickens, using radio-labelled material. Test animals were dosed with methiocarb only. The studies were conducted during the 1970's and were of limited quality in terms of data presentation to support the reported results. Also data to ensure that samples were stored under acceptable conditions and for appropriate periods are not available. The majority view of EPCO 29 was that the existing old livestock metabolism studies were not acceptable. The meeting agreed that the deficiency should be highlighted in the evaluation for future reference.
In terms of the representative uses it was concluded by EPCO 29 that those uses do not give rise to significant residues in animal products. However, this conclusion is based on the residue trial data in potential feed items currently available (methiocarb, methiocarb sulfone, methiocarb sulfoxid; all below LOQ) and might need reconsideration upon receipt of further information on the phenol compounds.

3.3. CONSUMER RISK ASSESSMENT

A final consumer risk assessment is currently not possible, since a conclusion on the plant residue definition for risk assessment was unable to be reached in the peer review procedure.
No data to further address the potential toxicity of the phenol metabolites or appropriate residue trials to assess consumer exposure to phenol metabolites are currently available.

Based on the initially from the rapporteur Member State proposed residue definition for risk assessment as sum of methiocarb, methiocarb sulfoxide and methiocarb sulfone expressed as methiocarb and national UK-consumption data consumer exposure (NEDI and NESTI) through the representative uses was estimated to be significantly below the ADI (less than 1 %) and ARfD, (less than 4 %) respectively.

It is noted that due to the lack of an agreed plant residue definition the estimates presented above can only be considered as an indicative, provisional assessment to be completed upon receipt of further data regarding the phenol metabolites.

3.4. PROPOSED MRLS

A conclusion on the plant residue definition for monitoring was unable to be reached in the peer review procedure. Thus no finalised MRLs can currently be proposed.

The initially proposed MRLs by the rapporteur Member State of 0.03 mg/kg for rape seed and maize are based on the initially proposed residue definition for monitoring as sum of methiocarb, methiocarb sulfoxide and methiocarb sulfone expressed as methiocarb.
Should this residue definition be confirmed in future, the sensitivity of the proposed enforcement method (0.04 mg/kg per individual compound) needs to be considered for the MRLs proposed.

4. Environmental fate and behaviour

Methiocarb was discussed at the EPCO experts' meeting on environmental fate and behaviour (EPCO 26) in June 2005.

4.1. FATE AND BEHAVIOUR IN SOIL

4.1.1. ROUTE OF DEGRADATION IN SOIL

The aerobic route and rate of degradation of phenyl-^{14}C methiocarb under dark conditions was investigated in two laboratory studies.
The first study used four German soils (20 ºC, 40% MWHC) covering a range of pH values (6.0-8.4), clay contents (5.0-13.8 %) and organic matter contents (1.2–4.5 %). The following compounds were identified as major metabolites (> 10% AR): **methiocarb sulfoxide,** (M01, max 58.8% AR after 3 days), **methiocarb sulfoxide phenol** (M04, max 35.8 %AR after 7 days), **methiocarb sulfone phenol** (M05, max 19.8% AR after 17 days) and **methiocarb methoxy sulfone** (M10, max 13.2% AR after 45 days). Two minor degradation products were observed during the course of the study (methiocarb sulfone, M02, max. 2% AR, and an unidentified metabolite observed in a maximum amount of 6.6% AR). CO_2 was produced up to a maximum of 58% AR at 120 days. Unextracted radioactivity reached a maximum of 57.8% AR after 60 days. No further analyses were performed in order to identify the nature of bound residues.
The degradation of methiocarb was further investigated in the second study under both aerobic and anaerobic conditions at 24 ºC and 75% of the 1/3 bar MWHC (1 sandy loam soil, pH in $CaCl_2$ 6.7, clay 10% and organic carbon 1%). Under aerobic conditions mineralization was lower than in the first study. Major metabolites observed were M01 (max 30% AR at 29d) and M04 (max. 18% AR at 64d).
Under anaerobic conditions there was a little change in the proportion of extractable radioactivity, which decreased from 87% to 76% between day 0 and day 64. A new metabolite **methiocarb phenol** (M03, max. 47% AR at 64 d) was observed. Methiocarb can be applied in oilseed rape post-drilling

up to GS 16, and therefore there is the possibility of exposure to anaerobic conditions. For this reason, PECsoil was calculated also for the anaerobic metabolite M03 to allow a risk assessment for terrestrial organisms (see section 4.1.2). Except for M01 (max. 24% AR on the fist day of anaerobic conditions) no other metabolite exceeded an amount of 10% AR at any time.

Two soil photolysis studies were conducted for 9 days and 30 days respectively. The major degradation product observed in the irradiated soil samples in both studies was methiocarb sulfoxide (M10) accounting for a maximum 57.2% AR (1 d) and 42.8% AR (15 d), whereas in the dark controls M10 accounted for 20.7% AR (9 d) in the first study and 4.5% AR (30 d) in the other one. Methiocarb sulfoxide phenol (M04) was detected as second major metabolite only in the first study in the irradiated samples (max 28.8% AR at 7 d). In conclusion, the results of the studies suggested that photodegradation in soil will contribute to the degradation of methiocarb to a certain extent under environmental conditions.

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

Degradation rate of methiocarb was investigated in the same degradation studies used to establish the soil metabolism. Methiocarb is very low to low persistent in soil under aerobic laboratory conditions (DT_{50} = 0.7 -15 days). Under the same conditions, metabolite M04 is low persistent (DT_{50} = 1.9 – 5.0), and metabolites M01 (DT_{50} = 1.6 -15.1 days), M05 (DT_{50} = 8.3 -14.9 days) and M10 (DT_{50} = 6.5 -26.3 days) are low to moderate persistent.

Field dissipation studies were not submitted as none required.

Originally PECsoil values were calculated by the applicant using FOCUS-PELMO model. The rapporteur Member State recalculated PECsoil values for the active substance and for metabolites methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10) assuming standard soil parameters of 5cm depth and 1.5 g/cm^3 density. As a worst case assumption for acute exposure to the active substance, the initial calculation took no account of pellet degradation. A second calculation was performed where the pellets were assumed to have a DT_{50lab} of 5.7 d, based on the results of modelling from the water/sediment study (see section 4.2.1). During the experts' meeting (EPCO 26) concerns raised whether it was appropriate to base the release rate form pellets on soil on the results of the water/sediment study (new open point 4.5) and whether it was appropriate to use normalised DT_{50} values for PECsoil calculations (new open point 4.8). The approach used was accepted by the meeting. However it was noted that the use of normalised DT_{50} values in PECsoil calculations is not endorsed where the normalisation procedure (i.e. for soil moisture content) results in shorter DT_{50} than would result from not normalising. For the calculation of the metabolites PEC values the two oilseed rape slug pellet treatments were assumed to be applied simultaneously. The anaerobic PECsoil calculations for metabolite methiocarb phenol M03 (see section 4.1.1) were performed based on the maximum formation of M03 from the parent in the anaerobic study (47% formation) corrected for molecular weight.

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

An adsorption/desorption study was carried out on phenyl-^{14}C-methiocarb in four soils. Results indicated that methiocarb is low to medium mobile in soil (K_{oc} = 408 -1000 mL/g) with a calculated mean Freundlich exponent (1/n) of 0.83.

Due to the instability of the compound in $CaCl_2$, a HPLC test with thirteen reference standard substances was conducted to calculate the K_{oc} value for metabolite methiocarb sulfoxide (M01). The estimated K_{oc} value for this metabolite was 31.26 mL/g.

The adsorption/desorption of methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10) was investigated in three separate studies with four soils. The calculated adsorption K_{oc} were in the range 26.7 - 101.0 mL/g (M04), 86.3 - 163.0 mL/g (M05) and 123.2 – 252.0 mL/g (M10), indicating a medium to very high mobility of these degradation products in soils.

An aged column leaching study was available with a slug pellet formulation in two soils. In the leachate from the sand column under the extreme worst case irrigation conditions (6000 mm/year), 0.03 % of the applied active substance represented methiocarb and 0.2 % methiocarb sulfoxide (M01). In the sandy loam column for the experiment simulating the worst case irrigation conditions, very low amounts of methiocarb sulfoxide (M01) were detected representing 0.01% of the applied amount. Residues of methiocarb sulfoxide (M01) (< 0.1 to 2.2% of the applied methiocarb) in the soil columns were exclusively located in the top soil segments for both soil types investigated.

Member States agreed (Evaluation meeting, March 2005) that persistence and adsorption of metabolite methiocarb phenol (M03) formed under anaerobic conditions are not considered necessary. In fact, anaerobic conditions are highly unlikely to occur for this use in those situations considered the most vulnerable for groundwater contamination i.e. freely draining courser textured soils. Therefore, data on adsorption and potential groundwater contamination evaluation are not required for this metabolite.

4.2. FATE AND BEHAVIOUR IN WATER

4.2.1. SURFACE WATER AND SEDIMENT

The fate of phenyl-1-^{14}C labelled methiocarb was studied in buffered aqueous solutions pH 5, 7 and 9, maintained in the dark at 25ºC. The results showed that methiocarb hydrolysis is pH dependent. At pH 5, methiocarb was relatively stable, with 93% AR being present at the end pf the study (51 d). Metabolite methiocarb sulfoxide (M01) was produced at levels < 5.5% AR. More degradation occurred at pH 7, with one major metabolite identified as methiocarb phenol (M03) detected at 46.0 %AR at study end (30 d). The rate of degradation was higher at pH 9 and, again, the metabolite methiocarb phenol (M03) was a major metabolite, detected at maximum levels of 82 %AR (3 d). Methiocarb sulfoxide phenol (M04) also appeared as a major metabolite (max 10.5 %AR at day 1). The calculated first order DT_{50} values of the active substance at pH values of 5, 7 and 9 were 321, 24 and 0.21 days respectively.

Two aqueous photolysis studies indicated that degradation of methiocarb in natural surface water systems may be influenced by sunlight (DT_{50} = 8.2 days corresponding to a predicted environmental half-life of 31 solar summer days at Phoenix, Arizona and 48 solar summer days at Athens, Greece). Methiocarb sulfoxide (M01) was detected as a major metabolite (max. 25.1% AR after 10 days) during the photolysis study.

In the absence of data on readily biodegradability, methiocarb is considered to be not readily biodegradable.

A sediment/water study was conducted using a non-radiolabelled slug pellet formulation in a natural sediment/water system. Initial release of methiocarb into the water was relatively slow due to the degradation of pellets. Major metabolites in water were methiocarb phenol (M03) (max. 22.5% of the applied methiocarb at day 14) and methiocarb sulfoxide phenol (M04) (max. 23.6% at day 56). A proportion of the active substance partitioned to the sediment (max 18.6% at 28 d). No metabolites were detected at >10% in the sediment phase. DT_{50} values for pellet degradation into methiocarb were calculated with the ACSL Optimize Software package and used in the calculation[6] of PEC values (PECsoil, PEC drainflow). As this water/sediment study did not meet the normal requirements, the need for a new water/sediment study in line with the SETAC guidance was discussed by the experts' meeting EPCO 26 (data requirement 4.1). The meeting agreed that even if the study cannot be used to provide endpoints for a PECsw (spray-drift) risk assessment, the representative uses notified for methiocarb as slug pellets in oilseed rape and maize seed treatment do not result in a route of entry to surface waters via spray drift. Therefore it was concluded that these data were no longer required for the intended notified uses, but the data would be needed at Member State level if the applicant seeks authorisation for a spray formulation. The faster DT_{50} for pellet degradation (5.7 days) derived using the results of the sediment/water study can be considered a worse-case in terms of the availability of methiocarb and subsequent transformation into its metabolites.

Additional results were also available from a study on [phenyl-1-^{14}C]methiocarb conducted on an aerobic water (water without sediment) and anaerobic water-sediment system under non-sterile conditions and from an ecotoxicology study investigating the effects of methiocarb slug pellets on *Daphnia magna* in a water-sediment system.

Potential risk for contamination of surface water was performed considering the two representative uses notified for the review and therefore the only route of entry to surface water was via drainflow. PECsw calculations of methiocarb and its major soil metabolites methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10) were estimated using the model MACRO (version 4.1b) with Brimstone scenario (weather and soil data observed over a period of 7 years and four months). Due to the soil characteristics and the drainage system, this scenario can be regarded as a worst case with respect to pesticide leaching to drains. In addition, as a worst case for the water phase no partitioning between water and sediment in the ditch was taken into account. Therefore, the scenario modelled can be considered as a realistic worst case for leaching losses to drainage water for arable soils in the UK. The PEC_{sw} values were calculated as the 90th percentile of time weighted average concentrations. The

[6] Details of the kinetic scheme used to mathematically evaluate the results of the water/sediment study were provided by RMS in an Addendum dated May 2005.

experts' meeting (EPCO 26) considered that the assessment in the DAR was sufficient to address representative uses in Northern Europe. However, an assessment for run-off for parent and soil metabolites has not been considered. Because this is critical for uses in Southern Europe, assessments of run-off for the parent and soil metabolites should be carried out at the Member State level. It was also concluded that the maximum surface water concentrations from the modelling should be provided in addition with the 90th percentile values. Because the rapporteur Member State was not able to provide the required data, a data gap for peak concentrations in surface water (maximum PECsw) for methiocarb and its major soil metabolites was set after the evaluation meeting in April 2006. Additional calculations, taking into account the higher DT_{50} values for methiocarb (1.4 d) and methiocarb sulfoxide (2.8 d) to derive the geometric mean DT_{50} values, were performed by the rapporteur Member State and included in the DAR.

No PECsed value has been calculated due to there being no route of entry by spray drift (the standard method for calculating PEC in sediment assumes a route of entry to surface waters via spray drift, followed by subsequent partitioning into the sediment). Therefore PECsed values were not required.

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

The leaching behaviour of methiocarb and its metabolites methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10) was simulated with FOCUS-PELMO model. Mean DT_{50} values used in groundwater modelling performed by the applicant did not take into account of the higher DT_{50} values for methiocarb and methiocarb sulfoxide (M01), which were observed in a soil laboratory degradation study (Minor and Freeseman, 1989). Therefore, predicted groundwater concentrations were recalculated by the rapporteur Member State. The assumptions and input parameters were identical to those used by the applicant, with the exception that the geometric mean DT_{50} for methiocarb was increased from 0.8 to 2.8 days, and the geometric mean DT_{50} for methiocarb sulfoxide (M01) was increased form 2.2 to 4.22 days. The experts' meeting (EPCO 26) agreed on the use of the rapporteur Member State calculations to base the risk assessment as they represent a worse case than the applicant modelling. The 6 scenarios identified in FOCUS as relevant to oilseed rape (pellets applications in the autumn) were modelled. The predicted 80th percentile concentrations were < 0.031 µg/L in all the scenarios modelled. It is concluded that the proposed used of methiocarb are unlikely to result in contamination of groundwater at > 0.1 µg/L for the active substance and its metabolites.

4.3. FATE AND BEHAVIOUR IN AIR

Concentration of methiocarb in the air compartment and transport through it is not expected to be significant. Methiocarb does not volatilise appreciably from soil surface and according to Atkinson calculations it may be photochemically degraded in the atmosphere with a half-life of 13.8 hours.

5. Ecotoxicology

Methiocarb was discussed at the EPCO experts' meeting on ecotoxicology (EPCO 27) in June 2006.

5.1. RISK TO TERRESTRIAL VERTEBRATES

The following exposure routes were considered to assess the risk to birds and mammals from the representative use of the slug pellet "Mesurol RB4" in rape:

1. Intentional uptake of slug pellets as food or grit.
2. Exposure via residues in plants.
3. Exposure via residues in earthworms and slugs.
4. Exposure via drinking water.

The first tier TER values indicated a high acute and short-term risk for birds from uptake of pellets and contaminated earthworms/slugs. $1/6^{th}$ of a pellet would be sufficient to reach the LD_{50} dose for a small 15 g bird. The long-term risk from uptake of granules was not assessed assuming that granules are available only for a very limited period of time. The refined risk assessment is mainly based on avoidance studies and field monitoring studies. No consumption of pellets and no mortality were observed if birds were sufficiently supplied with food. Mortality due to uptake of pellets was observed if birds were starved prior to the start of the test and food availability was reduced. The meeting of experts considered the avoidance studies and concluded that the interpretation and use of the studies is difficult because feeding pressure/stress and feeding rates in the laboratory are probably different from the field, the relevance of the tested species is not clear, extrapolation of the behaviour from the lab to the field and a lack of observations during the avoidance study (i.e. what did small birds do when they picked up a pellet). The field studies were considered, however concerns were raised regarding the interpretation of the lack of incidents from a field study. An incident was reported from Denmark which raised concerns that birds could consume pellets in the wild although further information on which to consider the relevance of this incident (i.e whether it involved approved use or mis-use) was not available.

The first tier risk assessment for earthworm-eating birds resulted in TER values of 0.073, 3.87, 0.085 for the acute, short-term and long-term risk. Observations in a field study suggest that small earthworm-eating birds avoided feeding in the open treated area. For larger birds like *Turdus pilaris* and *Turdus viscivorus* the predicted number of earthworms and slugs was 9.5 and 1 to reach the LD_{50} divided by 10. In a field study no mortality of earthworm/slug-eating birds was observed.

The meeting of experts concluded that the risk is lower than predicted by the first tier risk assessment, but some mortality is still likely to occur in the field from the use of "Mesurol RB4". It is not possible from the existing data set to quantify the impact of any lethal (and sub-lethal) effects at a population level. No population modelling had been done. The meeting concluded that the risk to key species of farmland birds from the representative use of "Mesurol RB4" in rape needs to be quantified. Several risk mitigation measures were suggested by the meeting such as restriction of the application to 1 per crop, product stewardship, post-approval monitoring including migratory species, use of bird scarers, admixture and the need for labelling (e.g. to ensure correct application and removal of spillages).

The risk to predatory birds feeding on contaminated mice was assessed in the addendum of May 2005. The majority of dead rodents in treated fields had ingested only one pellet. In some cases mice ingested 5 – 6 pellets (2.2 – 2.64 mg a.s.). The risk assessment focused on these rare encounters between an avian predator and a small rodent with residues caused by the ingestion of 5-6 slug pellets. Based on the LD_{50} of 5 mg a.s./kg bw/d, the ingestion of one prey item would exceed the LD_{50} of 1.07 mg a.s. for a 213 g kestrel. The meeting discussed the assumptions made by the applicant to refine the risk to predatory birds. The meeting agreed that the refinement needs some further justification. No data were provided on the number and percentage of mouse population exposed to predation, dead vs. live prey consumed and the PT (proportion of diet obtained in the treated area) assumption of 0.2. The argument on lower toxicity of food residues compared to bolus application was not supported by metabolism/dissipation data. The lack of reported incidents of secondary poisoning of avian predators by methiocarb slug pellets was not considered to necessarily indicate a lack of actual incidents.
The risk of secondary poisoning to fish eating birds was assessed as low. Most of the metabolites appearing in plant, soil and water were also detected in the hen metabolism studies. Due to the rapid metabolism and excretion of methiocarb and its metabolites in birds, more severe effects from metabolites than for methiocarb are not expected.

The risk to birds and mammals from direct exposure to treated seeds and residues on plants/seedlings was assessed for the representative use of “Mesurol FS 500” as a seed treatment in maize. The risk to birds from residues in plants was assessed as low. The first tier TER values for the uptake of treated seeds were calculated as 0.00263, 0.21 and 0.0024 for the acute, short-term and long-term risk indicating a high risk. Avoidance studies and field studies were conducted to refine the risk to seed-eating birds. The study results suggest that freshly drilled maize fields are not attractive to small seed-eating birds. Due to their inability to ingest whole seeds, small birds may only ingest pieces of methiocarb treated maize seeds. Encounters between small birds and small pieces of treated maize seed on an arable field in spring were considered to be very low. The acceptance studies did not investigate small seed-eating birds but the studies provide some evidence of a general repellency of treated seeds. Therefore the rapporteur Member State considered the risk to small seed eating birds as low. In the avoidance and field studies it was shown that maize treated with “Mesurol FS 500” had a strong repellent effect to larger seed-eating birds potentially feeding on maize. No treatment related mortalities were observed in the tests even under severe feeding pressure. Therefore it was concluded that the risk to birds from the representative use of “Mesurol FS 500” is low. The assessment relates only to the use as a seed treatment in maize if other seed treatment uses are to be requested, then additional crop relevant studies will be required.

Ingestion of slug pellets and contaminated earthworms were identified in the first tier risk assessment as routes of exposure posing a high potential risk to mammals from the representative use of “Mesurol RB4”. Higher tier studies showed that pellets are usually avoided but wood mice fed on pellets if alternative feed was scarce. Significant mortality was observed in these trials. Short-term effects on populations of small rodents were observed in field studies. However, the recovery was

rapid either from the remaining population itself or through immigration from neighbouring habitat. Therefore the risk to small herbivorous mammals was considered to be low from the representative use in rape. The higher tier studies together with the submitted ecological data provided sufficient evidence to conclude that the risk to medium herbivorous mammals and to hedgehog (*Erinaceus europaeus*) as a representative of earthworm/slug-eating mammals is low. No data/information was provided whether the risk to small earthworm-eating mammals such as common shrew (*Sorex araneus*) are covered by the refined risk assessment. The EFSA therefore proposes that this issue should be addressed.

The risk of secondary poisoning by uptake of contaminated fish was assessed as low for the representative uses of "Mesurol RB4" and Mesurol FS 500". The risk to mammalian predators and scavengers was assumed to be low by the rapporteur Member State because weasels and stoat do not swallow a mouse whole and they prefer living prey. Larger mammalian predators such as a fox consume a whole living or dead mouse but due to their large body size effects are assumed to be sub-lethal.

The first tier risk assessment for "Mesurol FS 500" indicated a high acute and long-term risk to mammals from ingestion of treated seeds while the risk from residues in seedlings was assessed as low. Avoidance studies revealed the repellent effect of "Mesurol FS 500". The availability of treated maize seeds on the soil surface is low. Furthermore, field studies showed relatively low abundance of small rodents in maize fields. Therefore it was concluded by the rapporteur Member State that the representative use of "Mesurol FS 500" poses a low risk to small mammals. The residue levels measured in earthworms exposed to "Mesurol FS 500" were lower compared to residues measured after exposure to "Mesurol RB4". Therefore the risk from uptake of contaminated earthworms is considered to be covered by the risk assessment for "Mesurol RB4".

Overall it is concluded that the risk to birds and mammals from the representative use of "Mesurol FS 500" as a seed treatment in maize is low. Labelling at Member State level (e.g. in line with Annex V of Directive 91/414/EEC) is proposed to ensure removal of spills of treated seeds in order to minimise the risk to birds and mammals. The risk to birds from the representative use of "Mesurol RB4" was assessed as high and further data are needed to quantify the risk to key species of farmland birds. Short-term effects were observed for populations of small mammals in fields treated with "Mesurol RB4". However, populations recovered fast and it was concluded that the risk to wild mammals is low from the representative use in rape. Some uncertainty remains regarding the risk to small earthworm-eating mammals such as the common shrew.

5.2. RISK TO AQUATIC ORGANISMS

Daphnids were the most sensitive tested organisms. A 48 h EC_{50} of 0.004 mg a.s./L was observed for daphnids. The major metabolites in water M03, M04 and the soil metabolites M01, M05 and M10 were markedly less acutely toxic to aquatic organisms than methiocarb. The risk assessment was based on PECsw calculations for the use of "Mesurol RB4". The PECsw were calculated with Macro for "Brimestone" drainage scenario (see fate and behaviour, point 4.2.)

The TER values for the acute and chronic risk from methiocarb were above the relevant Annex VI trigger. The acute TER values for the metabolites M03, M04, M05 and M10 indicated a low acute risk to aquatic organisms. The acute TER value for the metabolite M01 was calculated as 119. This calculation is based on a PECsw of 0.00047 mg M01/L. This PECsw is the 90th percentile of the daily time weighted average values calculated for a simulation period of 8 years. The drainflow assessment provided by the applicant showed that peak concentrations of M01 exceeding the acute LD_{50} for daphnids could occur at some days of the 8 years simulation period. However, based on the conclusion of the meeting on fate and behaviour that the PECsw values used for the risk assessment were worst case, the meeting on ecotoxicology regarded the risk to aquatic invertebrates as sufficiently addressed for the suggested scenario. The rapporteur Member State was asked to provide the peak concentrations for the modelling period of 8 years for methiocarb and its major metabolites (see fate and behaviour, point 4.2.). The peak values were not provided. Therefore some uncertainty remains on the actual peak concentrations.

Methiocarb reached levels of >10 % of the AR in the sediment phase of the water-sediment degradation study after > 14 days and the chronic NOEC for daphnids is below 0.1 mg a.s./L. Therefore a risk assessment for sediment-dwelling organisms would be required. However, a risk assessment for sediment dwelling organisms was considered as not necessary given the very low levels of methiocarb predicted to reach surface water via drainflow.
Since the risk to aquatic organisms was assessed only for entry into surface water via drainflow, the meeting on fate and behaviour suggested that the PECsw for run-off should be calculated for the parent and the soil metabolites and a risk assessment should be conducted at MS level during product authorization.

The metabolite M03 was formed only under anaerobic conditions in the sediment phase in amounts of > 10 % of AR. However, the metabolite was not predicted to appear in sediment for the calculated drainage scenario and given the lower toxicity to aquatic organisms compared to methiocarb a risk assessment for sediment dwelling organisms is considered as not required.

5.3. RISK TO BEES

The most likely route of exposure of bees is via residues in pollen from systemic uptake of methiocarb. At the time when bees are likely to be attracted to flowering oilseed rape any residues of methiocarb in plants should be at very low levels. The residues in maize pollen from seeds treated with “Mesurol 500 FS” were below the limit of detection of 0.001 mg/kg. Therefore it is concluded that the risk to bees from the representative use of “Mesurol RB4” and “Mesurol FS 500” is low.

5.4. RISK TO OTHER ARTHROPOD SPECIES

Exposure of other non-target arthropods is expected to occur only in-field. Ground dwelling arthropods (*Pardosa spp.*, *Aleochara bilineata*, *Poecilus cupreus*, *Calathus fuscipes* and *Pterostichus melanarius*) were exposed to “Mesurol RB4” and “Mesurol FS 500” in extended laboratory studies. The results indicate that ground dwelling spiders and rove beetles are unlikely to be affected by the

representative uses. Some effects were observed on carabid beetles from the use of "Mesurol RB4 pellets" and further investigated in a long-term 4 year field study with repeated annual autumn applications of 5.5 kg product/ha. The winter active species *Bembidion obtusum* did not recover within one year and there was some evidence of a cumulative effect. *B. obtusum* is a univoltine species with low powers of dispersion. Spring active species were less affected. The meeting concluded that *B. obtusum* although limited in its geographical distribution may well be representative for other similar species in different regions/habitats. It was noted that a single application was made in the autumn only; therefore the situation in the field study was still not worst case. Overall it was concluded by the meeting that the representative use of "Mesurol RB4" poses a high in-crop risk to certain species of surface active carabid beetles present at the time of application. Off-crop risk has not been assessed and will be dependent upon the method of application. Due to insufficient information on pellet "drift" from such machinery this should be assessed at Member State level. Restriction to one application and admixing of the pellets to the seed were discussed by the meeting as potential risk mitigation measures. Appropriate risk mitigation measures to protect sensitive in- and off-field non-target arthropods should be considered at Member State level.

5.5. RISK TO EARTHWORMS

The risk from the representative use of "Mesurol FS 500" to earthworms was assessed as low. The acute TER was well above the Annex VI trigger. To assess the long-term risk, earthworms were exposed to treated seeds sown at rates up to a dose of 500 g a.s./ha. No effects (including reproduction and number of juveniles) were observed up to the highest rate of 500 g a.s./ha. If the highest tested dose rate of 500 g a.s./ha is used as a NOEC and divided by the proposed use rate of 150 g a.s./ha this would result in a TER of 3.3. However, the risk was considered to be low because of the realism of the exposure regime and no effects were observed at an exposure rate of 3 times the proposed rate. The acute risk from soil metabolites to earthworms was assessed as low for both representative uses.

The standard risk assessment for "Mesurol RB4" slug pellet resulted in acute TER values above the relevant Annex VI trigger of 10. However sublethal effects were observed at very low dose levels. The risk was further investigated in field studies on grassland. Significant reduced abundance of earthworms was found 6 months after the treatment but numbers had recovered to around control levels after 12 months. At a treatment of 2 x 120 g a.s./ha the biomass of tanylobus species was still statistically reduced at 12 months. The meeting agreed that the ecological relevance of the observed reduction in adult biomass cannot be determined. The applicant proposed that the tanylobous species would be less relevant in arable fields, however the meeting noted that in low tillage situations such species are normally present and would be important. The meeting agreed that the risk was closely related to the number of applications and the type of agricultural system (crop rotation, low vs. conventional tillage). It was therefore concluded by the meeting that risk mitigation measures such as restricting the number of applications should be left to Member States.

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

A risk assessment for other soil non-target macro-organisms is not triggered since the soil DT_{90} for methiocarb and its soil metabolites is < 100 days. However, studies with the metabolites M01, M04, M05, M10 and *Folsomia candida* were submitted. The risk assessment resulted in TER values well above 10, indicating a low risk to other soil-non target macro-organisms.

5.7. RISK TO SOIL NON-TARGET MICRO-ORGANISMS

No effects exceeding ±25% on soil nitrification and respiration were observed in tests with the formulation "Mesurol FS 500" up to a concentration of 20 times the initial PECs of the representative uses of methiocarb. The studies with "Mesurol FS 500" are considered adequate to assess also the risk of "Mesurol RB4". The effects on soil nitrification were tested for the metabolites M01, M04, M05 and M10. No effects of ±25% on soil nitrification were observed at dose rates exceeding the peak PECs for the representative use of "Mesurol RB4". The risk to soil non-target micro-organisms is considered to be low.

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

No effects of the formulation "Mesurol FS 500" on non-target plants were observed in pre- and post emergence tests with 6 different dicotyledonae and 5 monocotyledonae plant species up to a use rate of 240 g a.s./ha. The test with "Mesurol FS 500" is considered as adequate to assess also the risk of "Mesurol RB4" to non-target plants. Non-target plants may potentially be exposed through "Mesurol RB4" slug pellets which may occasionally be broadcast into field margins. Since no effects were observed up to 240 g a.s./ha the risk to non-target plants is considered to be low.

5.9. RISK TO BIOLOGICAL METHODS OF SEWAGE TREATMENT

The EC_{50} for effects on respiration of activated sludge was determined as > 10000 mg a.s./L. Therefore the risk to biological methods of sewage treatment is considered to be low for the representative uses of methiocarb.

6. Residue definitions

Soil

Definitions for risk assessment: methiocarb, methiocarb sulfoxide, (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) methiocarb methoxy sulfone (M10), methiocarb phenol (M03) (anaerobic degradation)

Definitions for monitoring: methiocarb, methiocarb sulfoxide, (M01)

Water

Ground water

Definitions for exposure assessment: methiocarb, methiocarb sulfoxide, (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) methiocarb methoxy sulfone (M10)

Definitions for monitoring: methiocarb

Surface water[7]

Definitions for risk assessment: methiocarb, methiocarb sulfoxide, (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) methiocarb methoxy sulfone (M10)

Definitions for monitoring: methiocarb sulfoxide, (M01), (in the case of accident or spillage of the plant protection product, as methiocarb DT_{90} < 3 days at alkaline pH, methiocarb sulfoxide phenol (M04) may be a more appropriate indicator)

Air

Definitions for risk assessment: methiocarb

Definitions for monitoring: methiocarb

Food of plant origin

Definitions for risk assessment: A conclusion was unable to be reached in the peer review procedure.

Definitions for monitoring: A conclusion was unable to be reached in the peer review procedure.

Food of animal origin

Definitions for risk assessment: not proposed, no acceptable studies submitted

Definitions for monitoring: not proposed, not required

[7] [7] Residue definitions in water and sediment would need to be updated if approval for a spray formulation is sought in the future.

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

Soil

Compound (name and/or code)	Persistence	Ecotoxicology
methiocarb	Very low to low persistence ($DT_{50\ lab}$ = 0.7-1.5 d, 20°C, 40% MWHC)	The risk to earthworms was assessed as low taking into account a field study which showed recovery of earthworms within one year after treatement with "Mesurol RB4". Field tests showed a potential high in-field risk to certain surface dwelling carabid beetles. The risk to other soil non-target macro and micro organisms was assessed as low.
methiocarb sulfoxide (M01)	Low persistence ($DT_{50\ lab}$ = 1.6-6.1 d, 20°C, 40% MWHC)	The toxicity of M01 to earthworms is higher than that of methicarb. The acute TER of 443.2 is lower than that of methiocarb but is still well above the Annex VI trigger indicating a low acute risk. The long-term risk to earthworms is covered by the field study with "Mesurol RB4". The risk to soil non-target micro organisms is considered to be low.
methiocarb sulfoxide phenol (M04)	Low persistence ($DT_{50\ lab}$ = 1.9-5.0 d, 20°C, 40% MWHC)	The risk to soil dwelling organisms was assessed as low.
methiocarb sulfone phenol (M05)	Low to moderate persistence ($DT_{50\ lab}$ = 8.3-14.9 d, 20°C, 40% MWHC)	The risk to soil dwelling organisms was assessed as low.
methiocarb methoxy sulfone (M10)	Low to moderate persistence ($DT_{50\ lab}$ = 6.5-26.3 d, 20°C, 40% MWHC)	The risk to soil dwelling organisms was assessed as low.

methiocarb phenol (M03) (anaerobic conditions)	No data on half life in soil. Maximum PECsoil estimated 0.1123 mg/kg soil	No data are available to conduct a risk assessment for soil dwelling organisms.

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**
methiocarb	Low to medium mobility (K_{foc} = 408-1000 mL/g)	6 FOCUS scenarios relevant to oilseed rape < 0.1 µg/L	yes	Yes	Yes
methiocarb sulfoxide (M01)	Very high mobility (K_{oc} = 31.26 mL/g estimated by HPLC)	6 FOCUS scenarios relevant to oilseed rape < 0.1 µg/L	No data available No data required	LD_{50} 7 mg/kg bw (Very toxic) Short term NOAEL 0.1 mg/kg bw/day and 0.05 mg/kg bw/day (rat and dog, respectively)	The acute toxicity of M01 to aquatic organisms is lower compared to methiocarb.
methiocarb sulfoxide phenol (M04)	High to very high mobility (K_{foc} = 26.7-101.0 mL/g)	6 FOCUS scenarios relevant to oilseed rape < 0.1 µg/L	No data available No data required	Oral and dermal LD_{50}>1000 mg/kg bw	The acute toxicity of M04 to aquatic organisms is lower compared to methiocarb.

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
methiocarb sulfone phenol (M05)	High mobility (K_{foc} = 86.3-163.0 mL/g)	6 FOCUS scenarios relevant to oilseed rape < 0.1 µg/L	No data available No data required	Oral and dermal LD_{50}>1000 mg/kg bw	The acute toxicity of M05 to aquatic organisms is lower compared to methiocarb.
methiocarb methoxy sulfone (M10)	Medium to high mobility (K_{foc} = 123.2-252.0 mL/g)	6 FOCUS scenarios relevant to oilseed rape < 0.1 µg/L	No data available No data required	No data available	The acute toxicity of M10 to aquatic organisms is lower compared to methiocarb.
methiocarb phenol (M03) (anaerobic conditions)	No data, none required	No data, none required	No data	Oral and dermal LD_{50}>1000 mg/kg bw	The acute toxicity of M03 to aquatic organisms is lower compared to methiocarb.

Surface water and sediment

Compound (name and/or code)	Ecotoxicology
methiocarb	See 5.1.
methiocarb sulfoxide (M01)	The acute toxicity of M01 to aquatic organisms is lower compared to methiocarb. The TER values based on drainflow PECsw values are lower than those for methiocarb but for daphnids (the most sensitive tested organism) still above the Annex VI trigger.

Compound (name and/or code)	Ecotoxicology
methiocarb sulfoxide phenol (M04)	The acute toxicity to aquatic organisms is lower compared to methiocarb. The risk to aquatic organisms was assessed as low.
methiocarb sulfone phenol (M05)	The acute toxicity to aquatic organisms is lower compared to methiocarb. The risk to aquatic organisms was assessed as low.
methiocarb methoxy sulfone (M10)	The acute toxicity to aquatic organisms is lower compared to methiocarb. The risk to aquatic organisms was assessed as low.

Air

Compound (name and/or code)	Toxicology
methiocarb	R23 Toxic on inhalation (LC_{50} 0.4 mg/L)

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

- A study for the determination of the viscosity at 40 °C of the representative FS formulation (study submitted to the rapporteur Member State, September 2005; The outcome of the rapporteur Member State assessment is given only in the evaluation table of (rev. 2-1 of 10 May 2006) and not peer reviewed; refer to chapter 1).
- Data on adherence and distribution to seeds for the representative FS formulation (date of submission unknown, data gap identified at the expert meeting, due to the fact that the submitted study described in addendum 2 does not address the requirement already identified in the DAR; refer to chapter 1).
- Depending on the final residues definition in food of plant origin, it could be necessary to require further data (refer to chapter 1 and point 3.1).
- Depending on the final assessment on the residues in blood, it could be necessary to require further data (refer to chapter 1 and point 2.2).
- Two newly submitted *in vivo* and the comparative *in vitro* dermal absorption studies with Mesurol RB4 (studies submitted only to the rapporteur Member State in October 2005; no evaluation available; refer to point 2.11).
- Optional more information on suitable methods and appropriate residue trials covering the phenol metabolites of methiocarb or data to address the toxicity of the phenol metabolites further are required (data gap identified at the EPCO experts' meeting in June/July 2005, relevant for all uses; no submission date proposed by the applicant; refer to point 3.1).
- PECsw calculations to address the runoff route of entry to surface water for methiocarb and for soil metabolites in Southern European conditions need to be considered at Member State level (refer to point 4.2).
- Maximum PECsw values (i.e. peak levels) for methiocarb and its major metabolites methiocarb sulphoxide (M01), methiocarb sulphoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10) calculated for a drainflow event (data gap identified after the evaluation meeting in April 2006, relevant for use in oilseed rape and maize; submission date unknown; refer to point 4.2)
- Quantification of the risk to key species of farmland birds from representative use of "Mesurol RB4" (data gap identified at the EPCO experts' meeting in June 2005, relevant for the use in rape; submission date unknown; refer to point 5.1)
- The refinement of the risk assessment for predatory birds needs some further justification (data gap identified at the EPCO experts' meeting in June 2005, relevant for the use in rape; data submitted in March; refer to point 5.1)
- Some information/data is required to address the risk to small earthworm-eating mammals such as the common shrew (*Sorex araneus*). (relevant for the representative use in rape, data gap identified by EFSA, not peer reviewed; submission date unknown; refer to point 5.1)

CONCLUSIONS AND RECOMMENDATIONS

Overall conclusions

The conclusion was reached on the basis of the evaluation of the representative uses as molluscicide, repellent and insecticide as proposed by the applicant. The use as molluscicide comprises spreading the bait to control slugs and snails in oilseed rape at an application rate of 120 g methiocarb per hectare with maximal 2 applications resulting in a maximum total dose of 240 g/hectare. The use as seed treatment in maize at an application rate of 500 g/dt (≡ 150 g/ha at a seeding rate of 30 kg/ha) is intended to control frit flys and repel pheasants. Methiocarb can be used as molluscicide, insecticide, repellent and acaricide.

The representative formulated products for the evaluation were "Mesurol RB 4", a bait ready for use (RB) and "Mesurol FS 500", a flowable concentrate for seed trweatment (FS), both are registered in most of the EU Member States.

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.

Methiocarb is acutely very toxic by oral route and toxic after inhalation in rats. It is not a skin or eye irritant nor a skin sensitiser. The following classification was therefore proposed: **T+ Very toxic**, **R28 Very toxic if swallowed**, **R23 Toxic on inhalation**.

Methiocarb was clastogenic in the chromosomal aberration assay in CHO cells but this was not confirmed in cytological analysis in a micronucleus test. There was no evidence of genotoxicity in other in vitro and in vivo studies. There was no evidence of carcinogenicity in mice and rats. Methiocarb did not affect reproductive and developmental parameters and did not show any potential to cause delayed neurotoxicity. The ADI, ArfD and AOEL of 0.013 mg/kg bw/day were proposed. The operator, worker and bystander exposure is below the AOEL for the use of FS formulation (maize seed treatment), while the AOEL is likely to be exceeded when the RB formulation (oilseed rape) is considered.

The metabolism of methiocarb was investigated in tomato, lettuce, rice and oilseed rape following a soil application or a seed treatment. In tomato, lettuce, rice methiocarb and methiocarb sulphoxid (M01) were identified as major components. Methiocarb phenol (M03) and methiocarb sulfoxide phenol (M04) could be released at significant levels upon hydrolysis of lettuce extracts. In oilseed rape the metabolic pattern at harvest was different. A major part of the radioactivity was associated with fatty acids in the seeds. Methiocarb sulphoxide phenol (M04) and methiocarb sulphone phenol (M05) and their glucose conjugates were identified as main constituents in rape matrices. These compounds were also present at significant levels in crops planted as succeeding crops. The experts'

meeting for residues concluded that there is currently insufficient information available to have a firm view on the plant residue definition and proposed that either all phenol metabolites should be included in the plant residue definition and hence more information on suitable methods and appropriate residue trials is needed or alternatively that the toxicity of the phenol metabolites should be further addressed. Consequently a final consumer risk assessment is currently not possible and MRLs cannot be proposed.

Sufficient satisfactory information on the fate and behaviour of methiocarb in environmental matrices is available to complete an appropriate EU level environmental exposure assessment. Methiocarb can be considered not persistent in the environment. The available groundwater FOCUS modelling indicated no potential exposure vulnerable groundwater. Potential risk for surface water contamination was performed considering drainflow as the main route of entry into the water body, and was considered acceptable by the experts. However, for the representative uses notified (pellets and seed treatment), Member States in Southern Europe need to address the runoff route of entry to surface water for methiocarb and for soil metabolites methiocarb sulfoxide, (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10). It should be noted that a new water/sediment study would be needed at Member State level if the applicant seeks authorisation for a spray formulation. Likewise, residue definitions in water and sediment and PECsw would need to be revised if approval for a spray formulation is sought in the future.

The first tier risk assessment for birds and mammals for the use of “Mesurol FS 500” as a seed treatment resulted in a high risk to birds and mammals from uptake of treated maize seeds. Avoidance studies and field studies were conducted to refine the risk to seed-eating birds. The study results suggest that freshly drilled maize fields are not attractive to small seed-eating birds. Due to their inability to ingest whole seeds, small birds may only ingest pieces of methiocarb treated maize seeds. Encounters between small birds and small pieces of treated maize seed on an arable field in spring were considered to be very low. The acceptance studies did not investigate small seed-eating birds but the studies provide some evidence of a general repellency of treated seeds. Therefore the rapporteur Member State considered the risk to small seed eating birds as low. In the avoidance and field studies it was shown that maize treated with “Mesurol FS 500” had a strong repellent effect to larger seed-eating birds potentially feeding on maize. No treatment related mortalities were observed in the tests even under severe feeding pressure. Therefore it was concluded that the risk to birds from the representative use of “Mesurol FS 500” is low. Avoidance studies revealed the repellent effect of “Mesurol FS 500” to mammals. The availability of treated maize seeds on the soil surface is low. Furthermore, field studies showed relatively low abundance of small rodents in maize fields. Therefore it was concluded by the rapporteur Member State that the representative use of “Mesurol FS 500” poses a low risk to small mammals. The assessment relates only to the use as a seed treatment in maize if other seed treatment uses are to be requested, then additional crop relevant studies will be required. The risk from the representative use of “Mesurol RB4” was assessed as potentially high for birds (including secondary poisoning of predatory birds). Further data are needed

to quantify the risk to key species of farmland birds and predatory birds. Short-term effects on small mammal populations are expected for the representative use of "Mesurol RB4" but based on the presented data it is assumed that the populations will recover fast. Data are needed to address the risk to small earthworm-eating mammals such as the common shrew (*Sorex araneus*). The risk to aquatic organisms was assessed as low based on entry into surface water via drainage. A risk assessment for run-off scenarios should be considered at Member State level. The representative use of "Mesurol RB4" poses a high in-field risk to certain species of carabid beetles. Off field exposure and risk should be determined at Member State level. In a field study reduced abundance of earthworms was observed but earthworm numbers recovered within one year after application. Only the biomass of tanylobus earthworm species was still reduced after 12 months. Since the importance of these species depends on the type of agricultural system (e.g. low tillage situations) the expert meeting concluded that risk mitigation measures such as restricting the number of applications should be considered at Member State level.

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

- To mitigate the risk to birds and mammals from the use of slug pellets "Mesurol RB4" the expert meeting suggested measures such as restriction of the application to 1 per crop, product stewardship, post-approval monitoring including migratory species, the use of bird scarers, admixture and labelling (e.g. to ensure correct application and the removal of spillages) (refer to point 5.1.).
- Labelling is suggested for "Mesurol FS 500" to ensure removal of spills of treated seeds to minimise the risk to birds and mammals (refer to point 5.1).
- Risk mitigation measures to protect sensitive non-target arthropods from use of "Mesurol RB4" should be considered at Member State level.
- Risk mitigation measures such as restricting the number of applications to 1 are suggested for the representative use of "Mesurol RB4" to mitigate the risk to tanylobus earthworm species in agricultural systems where these species are important (e.g. in low tillage situations).

Critical areas of concern

- A dermal absorption value of 100% has been considered for the RB formulation according to the Guidance Document on dermal absorption, leading to exceedence of the AOEL for both operators and bystanders.
- The risk to birds and mammals from the representative use of "Mesurol RB4".
- A conclusion on the plant residue definition for risk assessment and monitoring was unable to be reached in the peer review procedure. There is currently insufficient information available to have a firm view on the residue definition. Thus, a final consumer risk assessment and secured MRL proposals are currently not possible.

APPENDIX 1 – LIST OF ENDPOINTS FOR THE ACTIVE SUBSTANCE AND THE REPRESENTATIVE FORMULATION

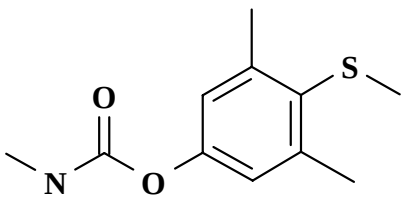
(Abbreviations used in this list are explained in appendix 2)

Appendix 1.1: Identity, Physical and Chemical Properties, Details of Uses, Further Information

Active substance (ISO Common Name) ‡	Methiocarb; mercaptodimethur (both names are approved by ISO)
Function (e.g. fungicide)	Insecticide, molluscicide, repellent, acaricide

Rapporteur Member State	UK
Co-rapporteur Member State	--

Identity (Annex IIA, point 1)

Chemical name (IUPAC) ‡	4-methylthio-3,5-xylyl methylcarbamate
Chemical name (CA) ‡	Phenol, 3,5-dimethyl-4-(methylthio)-, methylcarbamate
CIPAC No ‡	165
CAS No ‡	2032-65-7
EEC No (EINECS or ELINCS) ‡	EINECS: 217-991-2
FAO Specification ‡ (including year of publication)	FAO: 165/TC/S/F (1991) ≥ 950 g/kg Impurity: water: <2 g/kg
Minimum purity of the active substance as manufactured ‡ (g/kg)	980 g/kg
Identity of relevant impurities (of toxicological, environmental and/or other significance) in the active substance as manufactured (g/kg)	None
Molecular formula ‡	$C_{11}H_{15}NO_2S$
Molecular mass ‡	225.3 g/mol
Structural formula ‡	

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Physical-chemical properties (Annex IIA, point 2)

Melting point (state purity) ‡	118-119 °C (purity 99.5%)
Boiling point (state purity) ‡	311 °C (estimate)
Temperature of decomposition	>300 °C (purity 98.3%)
Appearance (state purity) ‡	White solid (purity 98.3%Techn.)
Relative density (state purity) ‡	1.254 g/mL (density was determined)
Surface tension	72 mN/m at 20 °C (purity 90% saturated solution used)
Vapour pressure (in Pa, state temperature) ‡	1.5 x 10^{-5} Pa at 20 °C (extrapolated)
Henry's law constant (Pa m^3 mol^{-1}) ‡	1.2 x 10^{-4} Pa m^3 /mol at 20 °C (purity 99.5%)
Solubility in water ‡ (g/L or mg/L, state temperature)	27 mg/L at an unspecified pH and 20 °C (purity 99.5%)
Solubility in organic solvents ‡ (in g/L or mg/L, state temperature)	2-propanol 42g/L at 20 °C xylene 20g/L at 20 °C 1-octanol 31g/L at 20 °C acetone 144g/L at 20 °C acetonitrile 67g/L at 20 °C ethylacetate 87g/L at 20 °C polyethylene glycol 72g/L at 20 °C
	Dimethylsulfoxide >250g/L at 20 °C (purity 99.5%)
Partition co-efficient (log POW) ‡ (state pH and temperature)	log P_{ow} = 3.11 at pH 4 and 20 °C log P_{ow} = 3.18 at pH 7 and 20 °C (purity 99.5%)
Hydrolytic stability (DT_{50}) ‡ (state pH and temperature)	DT_{50} = 321 days at pH 5 and 25 °C DT_{50} = 24 days at pH 7 and 25 °C DT_{50} = 0.2 days at pH 9 and 25 °C ([^{14}C] phenyl label >97%)
Dissociation constant ‡	No dissociation (purity 99.5%)
UV/VIS absorption (max.) ‡ (if absorption > 290 nm state ε at wavelength)	UV absorb 222 nm (ε = 525 L x mol^{-1} x cm^{-1}) No UV absorbance above 290 nm. (purity 99.1%)
Photostability (DT_{50}) ‡ (aqueous, sunlight, state pH)	128 days at pH 5

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Quantum yield of direct phototransformation in water at Σ > 290 nm ‡	0.2825
Flammability ‡	Non-flammable (purity 99.4%)
Explosive properties ‡	Non-explosive (purity 99.4%)

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

List of representative uses evaluated (methiocarb)*

The following uses can be considered as supported by available data following resolution of the issues raised at Level 3, Volume 1.

Crop and/or situation	Member State or Country	Product name	F G or I	Pests or Group of pests controlled	Formulation		Application				Application rate per treatment			PHI (days)	Remarks:
(a)			(b)	(c)	Type (d-f)	Conc. of a.s. (i)	method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (min)	kg a.s./hl min max	water l/ha min max	kg a.s./ha min max	(l)	(m)
Rape (BRSNN)	Northern Europe Southern Europe.	Mesurol RB 4	F	slugs, snails	RB	40g/kg (4%)	Spread-ding	No later than GS 16 based on residues assessment	1 – 2	14 days	3.0 kg product/ha		0.12 kg a.s./ha		[1][2][3}
Maize (ZEAMX)	Northern Europe Southern Europe	Mesurol FS 500 Mesurol flüssig Mesurol flo	F	pheasant repellent (PHASSP), frit fly (OSCIFR)	FS	500g /L	seed treat-ment	Pre-seeding (first application may be done just before drilling)	1		1.0 L product/dt seed		0.5 kg a.s./dt seed = 0.15 kg a.s./ha at seeding rate of 30 kg/ha		[2]

[1] The operator and bystander estimated exposure is expected to exceed the AOEL.
[2] The consumer risk assessment could not be concluded due to data gaps.
[3] The risk assessment has revealed a risk/data gaps in section 5.

Remarks:				
	*	Uses for which risk assessment could not been concluded due to lack of essential data are marked grey	(h)	Kind, *e.g.* overall, broadcast, aerial spraying, row, individual plant, between the plants – type of equipment used must be indicated
	(a)	For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (*e.g.* fumigation of a structure)	(i)	g/kg or g/L
	(b)	Outdoor or field use (F), glasshouse application (G) or indoor application (I)	(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
	I	*e.g.* biting and suckling insects, soil born insects, foliar fungi, weeds		
	(d)	*e.g.* wettable powder (WP), emulsifiable concentrate (EC), granule (GR)	(k)	The minimum and maximum number of application possible under practical conditions of use must be provided
	(e)	GCPF Codes – GIFAP Technical Monograph No 2, 1989		
	(f)	Method, *e.g.* high volume spraying, low volume spraying, spreading, dusting, drench	(l)	PHI – minimum pre-harvest interval
	(g)	All abbreviations used must be explained	(m)	Remarks may include: Extent of use/economic importance/restrictions

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Appendix 1.2: Methods of Analysis

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

Technical as (principle of method)	Methiocarb in technical material was determined by HPLC-UV
Impurities in technical as (principle of method)	Organic impurities in technical material were determined by HPLC-UV, with the exception of one impurity which was determined by TLC Water content was determined by Karl Fischer titration
Plant protection product (principle of method)	Methiocarb in plant protection products was determined by HPLC-UV

Analytical methods for residues (Annex IIA, point 4.2)

Food/feed of plant origin (principle of method and LOQ for methods for monitoring purposes)	*A conclusion on the residue-def. was unable to be reached.* However, methods are available determining methiocarb and its metabolite sulfoxide and sulfone by HPLC with fluorescence detectection, with an LOQ of 0.04 mg/kg (for each analyte). HPLC-MS/MS can be used as confirmatory method.
Food/feed of animal origin	*No method required since no residue definition is proposed*. Methiocarb and its metabolite sulfoxide and sulfone were determined by GC-FPD, with an LOQ of 0.005 – 0.05 mg/kg.
Soil	Methiocarb and its metabolite sulfoxide and sulfone were determined by HPLC/MS/MS, with an LOQ of 0.02 mg/kg (for each analyte) or by HPLC with fluorescence detectection with an LOQ of 0.01 mg/kg (for each analyte).
Water	Methiocarb and its sulfoxide metabolite were determined by HPLC/MS/MS, with an LOQ of 0.1 µg/L (for each analyte) (surface water). The method was also valiated for other metabolites.
Air	Methiocarb and its sulfoxide metabolite were determined by HPLC with on-line column hydrolysis to form a fluorophore for fluorescence detection, with an LOQ of 0.4 (parent) and 4 (metabolite) µg/m^3

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Body fluids and tissues (Blood only)	Methiocarb was determined by GC-MS, with an LOQ of 50 µg/L. *However, a new method could be required as methiocarb is an inappropriate target analyte.*

Classification and proposed labelling (Annex IIA, point 10)

with regard to physical/chemical data	None

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Appendix 1.3: Impact on Human and Animal Health

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

Rate and extent of absorption ‡	Rapid absorption, Cmax in plasma at 0.5h. Extensively absorbed after oral dose, 84-90%
Distribution ‡	Extensively distributed into organs and tissues
Potential for accumulation ‡	No potential for accumulation T1/2 for elimination 8h–21h.
Rate and extent of excretion ‡	Rapid elimination mainly in urine (84-90%) within 48h. Faeces was 5-10%
Metabolism in animals ‡	Extensively metabolised. Oxidation of the sulphide group, removal of the carbamate group with formation of phenol metabolites and conjugation of phenol hydroxy group with sulphate and glucuronic acid
Toxicologically significant compounds ‡ (animals, plants and environment)	Methiocarb and metabolites (sulfoxide, sulfone, phenol)

Acute toxicity (Annex IIA, point 5.2)

Rat LD_{50} oral ‡	19 mg/kg bw based on weight of evidence of published data with range of 13–135 mg/kg bw. Submitted study showed 33 mg/kg bw (males) and 47 mg/kg bw (females) **R28**
Rat LD_{50} dermal ‡	5000 mg/kg bw
Rat LC_{50} inhalation ‡	585 mg/m^3 in males and 433 mg/L in females **R23**
Skin irritation ‡	Non-irritant
Eye irritation ‡	Non-irritant
Skin sensitization ‡ (test method used and result)	Not sensitizing (Buehler and Magnusson and Kligman methods)

Short term toxicity (Annex IIA, point 5.3)

Target / critical effect ‡	Cholinesterase inhibition, cholinergic signs and reduction in body weight gain
Lowest relevant oral NOAEL / NOEL ‡	1.3 mg/kg bw/day in 90-day dog with investigation of neurofunction
Lowest relevant dermal NOAEL / NOEL ‡	150 mg/kg bw in 21-day study in rabbits
Lowest relevant inhalation NOAEL / NOEL ‡	6 mg/m^3 in 21-day study in rats

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Genotoxicity ‡ (Annex IIA, point 5.4)

….....	Overall not genotoxic in a range of *in vitro* and *in vivo* tests. Clastogenic in chromosomal aberration assay in CHO assay but not in micronucleus study

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

Target/critical effect ‡	Cholinesterase inhibition
Lowest relevant NOAEL / NOEL ‡	2.2 mg/kg bw/day in 2-year dog dietary study
Carcinogenicity ‡	Non-carcinogenic in rats and mice

Reproductive toxicity (Annex IIA, point 5.6)

Reproduction target / critical effect ‡	Reduced number of pups per litter and reduced lactation index in the presence of maternal toxicity
Lowest relevant reproductive NOAEL / NOEL ‡	Parental, reproductive and offspring: 4.3 mg/kg bw/day
Developmental target / critical effect ‡	No developmental toxicity observed
Lowest relevant developmental NOAEL / NOEL ‡	Parental: 0.5 mg/kg bw/day Developmental: 10 mg/kg bw/day, the highest dose tested

Neurotoxicity / Delayed neurotoxicity ‡ (Annex IIA, point 5.7)

….....	No evidence of delayed neurotoxicity in hens. No neurofunctional effects seen in rats and dogs.

Other toxicological studies ‡ (Annex IIA, point 5.8)

….....	Cholinesterase inhibition: Gavage studies in rats and capsule administration in dogs showed significantly greater cholinesterase inhibition than observed by dietary dosing Metabolite toxicity : Methiocarb sulfoxide was shown to have greater toxicity than parent

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Medical data ‡ (Annex IIA, point 5.9)

….....	No adverse effects observed in workers at two manufacturing plants. Human poisoning was reported to be limited. Atropine was stated by Notifier to be appropriate treatment in the event of poisoning; oximes are contraindicated.

Summary (Annex IIA, point 5.10)	Value	Study	Safety factor
ADI ‡	0.013 mg/kg bw/day	90-day dietary study in dogs	100-fold
AOEL ‡	0.013 mg/kg bw/day	90-day dietary study in dogs	100-fold
ARfD ‡ (acute reference dose)	0.013 mg/kg bw/day	90-day dietary study in dogs	100-fold

Dermal absorption (Annex IIIA, point 7.3)

Mesurol FS 500 formulation	2% (formulation is applied undiluted)
Mesurol RB4 formulation	Default value: 100%

Acceptable exposure scenarios (including method of calculation)

Operator	Mesurol FS 500 **2% dermal absorption** Exposure is below the AOEL (5%-84% of the AOEL for seed plants and 1% to 10% AOEL for on-farm treatment); based on surrogate exposure data (PHED), operator exposure is 70% of the AOEL Mesurol RB4 **100% dermal absorption** Estimated exposure is expected to exceed the AOEL

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Workers	Mesurol FS 500 As the only representative use of 'Mesurol FS 500' is treating seeds prior to sowing, exposure to methiocarb for workers performing crop inspections is expected to be negligible. Mesurol RB 4 Exposure to methiocarb for workers performing crop inspections is expected to be negligible.
Bystanders	Mesurol FS 500 **2% dermal absorption** Bystanders are not expected to be present during the dressing of seeds with 'Mesurol FS 500' at seed treatment plants or during the loading/sowing of treated seed. Levels of total systemic exposure to methiocarb for a bystander arising during on-farm seed treatment are not expected to exceed to operator exposure levels. Mesurol RB 4 **100% dermal absorption** Estimated exposure might exceed the AOEL.

Classification and proposed labelling (Annex IIA, point 10)

with regard to toxicological data	T+ Very toxic R23 Toxic on inhalation R28 Very toxic if swallowed

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Appendix 1.4: Residues

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

Plant groups covered	Tomato (F), lettuce (L), rice (C) –soil treatment oilseed rape (P/O)- seed treatment
Rotational crops	Swiss chard, wheat and turnip
Plant residue definition for monitoring	A conclusion was unable to be reached in the peer review procedure.
Plant residue definition for risk assessment	A conclusion was unable to be reached in the peer review procedure
Conversion factor (monitoring to risk assessment)	None

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

Animals covered	No acceptable studies submitted.
Animal residue definition for monitoring	None proposed, residues in animal products would not be significant (<0.01 mg/kg) for evaluated uses based on plant residue definition proposed by RMS in the DAR
Animal residue definition for risk assessment	None proposed, residues in animal products would not be significant (<0.01 mg/kg)) for evaluated uses based on plant residue definition proposed by RMS in the DAR
Conversion factor (monitoring to risk assessment)	None
Metabolism in rat and ruminant similar (yes/no)	Yes
Fat soluble residue: (yes/no)	Log P_{ow} result at pH 7 indicates the potential for methiocarb to be fat soluble

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

….....	Rotational crop metabolism study indicates that a cold rotational crop study is not required.

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

….....	Freezer storage stability study indicated that residues of methiocarb in grape, pea, potato and

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

canola seed are stable for up to 24 months.

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

Intakes by animals are less than 0.1 mg/kg diet/day (based on plant residue definition proposed by RMS).

Intakes by livestock ≥ 0.1 mg/kg diet/day:	Ruminant: no	Poultry: no	Pig: no
Muscle	n/a	n/a	n/a
Liver	n/a	n/a	n/a
Kidney	n/a	n/a	n/a
Fat	n/a	n/a	n/a
Milk	n/a	n/a	n/a
Eggs	n/a	n/a	n/a

n/a not applicable

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Summary of critical residues data[1] (Annex IIA, point 6.3, Annex IIIA, point 8.2)

Crop	Northern or Mediterranean Region	Trials results relevant to the critical GAP (a)	Recommendation/ comments	MRL	STMR (b)
Oilseed rape	N	Four further trials are available which support a latest time of application of GS 16, residues in seed below the limit of determination (0.03 mg/kg).		0.03	0.03
	S	No data were submitted to support this use, however due to the nature and timing of the application, Northern Europe residues trials data can be used to support this use in Southern Europe.			
Maize	N	Eight trials support the proposed critical GAP with residues in forage, cobs and kernels below the limit of determination (0.03 mg/kg).		0.03	0.03
	S	Eight trials support the proposed critical GAP with residues in forage, cobs and kernels below the limit of determination (0.03 mg/kg).			

[1] Not agreed on, presented assessment based on residue definition proposed by RMS in the DAR

(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 critical GAP

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

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

ADI	0.013 (mg/kg bw/day)
Total NEDI (% ADI)	Not possible to conclude on without an agreed residue definition
ARfD	0.013 (mg/kg bw)
Acute exposure (% ARfD)	Not possible to conclude on without an agreed residue definition

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

Crop/processed crop	Number of studies	Transfer factor	% Transference
No data were submitted or required because residues in the crops at harvest were less than 0.1 mg/kg based on residue definition proposed by RMS in the DAR.			

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

Not possible to conclude on without an agreed residue definition

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Appendix 1.5: Fate and Behaviour in the Environment

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

Mineralization after 100 days ‡	23.5 – 58.0% at 120 d, median: 36.95% (n=4), [phenyl-1-^{14}C]methiocarb. Note: minimum value of 23.5% is an underestimate due to losses in the experiment 17% after 91 days (n=1), [phenyl-1-^{14}C]methiocarb
Non-extractable residues after 100 days ‡	31.2 – 49.9% at 120 d, median: 41.3% (n=4), [phenyl-1-^{14}C]methiocarb 39% after 91 d (n=1), [phenyl-1-^{14}C]methiocarb
Relevant metabolites – name and/or code, % of applied ‡ (range and maximum)	methiocarb sulfoxide (M01), phenyl label: max 30.0 – 58.8%, at 1 – 29 d. methiocarb sulfoxide phenol (M04), phenyl label max 18.0 – 36.0%, at 7 – 64 d methiocarb sulfone phenol (M05), phenyl label max 6.1 – 19.8% at 17 – 91 d methiocarb methoxy sulfone (M10), phenyl label max 3.3 – 13.2%, at 17 – 217d

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

Anaerobic degradation ‡	Mineralisation – 4% at 64 d (n=1), phenyl label Non-extractable residues – 12% at 64 d (n=1), phenyl label. Study carried out with 14 days under anaerobic conditions followed by 64 days anaerobic conditions after flooding. Methiocarb sulfoxide (M01), phenyl label: 1% at 64 d (n=1). Max: 24% at 0 d [considered to be residual from aerobic phase of study] (n=1) methiocarb phenol (M03), phenyl label max 47% at 64 d (n=1)

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Soil photolysis ‡	Mineralisation – 7.6% at 9 d (n=1, study 'a'), phenyl label Non-extractable residues – 12.6% at 9 d (n=1, study 'a', phenyl label), 16.4% at day 20 (n=1, study 'b', phenyl label) methiocarb sulfoxide (M01), phenyl label: max 57.2% at 1 d, 28.9% at 9 d (n=1, study 'a') max 42.8% at 15 d, 23.1% at 30d (n=1, study 'b') methiocarb sulfoxide phenol (M04), phenyl label max 28.8% at 7 d, 26.4% at 9 d (n=1, study 'a')

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

Method of calculation	Laboratory: 1st order kinetics (ModelMaker, MS-Excel, ACSL Optimize)
Laboratory studies ‡ (range or median, with n value, with r^2 value)	$DT50_{lab}$ soil, aerobic methiocarb 0.7 – 1.5 d, median 1.35 d (n=4), 20°C, 40% WHC r^2 range: 0.993 – 1.000 15 d (n=1), 24°C, 75% 1/3 bar moisture. R^2 = 0.996 mean value used in rapporteur PELMOgw modeling: 2.8 days (n=5), values normalised to 20°C, 100% FC. Methiocarb sulfoxide (M01) 1.6 – 6.1 d, median 3.7 d (n=4), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 15.1 d (n=1), 24°C, 75% 1/3 bar moisture. R^2 = 0.962 mean value used in rapporteur PELMOgw modelling: 4.22 days (n=5), values normalised to 20°C, 100% FC. Methiocarb sulfoxide phenol (M04) 1.9 – 5.0 d, median 3.45 d (n=4), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 mean value used in PELMOgw modelling: 2.1 days

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

(n=4), values normalised to 20°C, 100% FC. Methiocarb sulfone phenol (M05) 8.3 – 14.9 d, median 8.6 (n=3), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 mean value used in PELMOgw modelling: 6.6 days (n=4), values normalised to 20°C, 100% FC. Methiocarb methoxy sulfone (M10) 6.5 – 26.3 d, median 16.7 (n=3), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 mean value used in PELMOgw modelling: 9.2 days (n=4), values normalised to 20°C, 100% FC.
$DT90_{lab}$ soil, aerobic methiocarb 2.5 – 4.9 d, median 4.4 d (n=4), 20°C, 40% WHC r^2 range: 0.993 – 1.000 49.8 d (n=1), 24°C, 75% 1/3 bar moisture. R^2 = 0.996 methiocarb sulfoxide (M01) 5.2 – 20.1 d, median 12.7 d (n=4), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 50.2 d (n=1), 24°C, 75% 1/3 bar moisture. R^2 = 0.962 methiocarb sulfoxide phenol (M04) 6.3 – 16.5 d, median 11.4 d (n=4), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 methiocarb sulfone phenol (M05) 27.4 – 49.2 d, median 28.4 (n=3), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886 methiocarb methoxy sulfone (M10) 21.5 – 86.8 d, median 55.1 (n=3), 20°C, 40% WHC r^2 range: 0.9647 – 0.9886
Estimated DT_{50lab} (20°C, anaerobic): *greater than study duration*

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

	Degradation in the saturated zone: no data submitted and no data required.
Field studies ‡ (state location, range or median with n value)	no data submitted and no data required.
Soil accumulation and plateau concentration ‡	no data submitted and no data required.

Soil adsorption/desorption (Annex IIA, point 7.1.2)

active substance

K_{oc} ‡	K_{oc}: Adsorption: 408 – 1000 mL/g (n=4), mean = 660. Mean value used for PELMOgw modelling: Desorption: 675 – 1547 mL/g (n=4), mean = 1071.75
K_d ‡	K_d: Adsorption: 4.3 – 9.0 mL/g (n=4), mean = 5.875 Desorption: 6.7 – 16.2-mL /g (n=4), mean = 9.8 1/n: Adsorption: 0.81 – 0.87 mL /g (n=4), mean = 0.83. Mean value used for PELMOgw modelling
pH dependence ‡ (yes / no)	No pH dependence.

Methiocarb sulfoxide (M01)

K_{oc} ‡	K_{oc}: Adsorption: 31.26 mL /g, estimated by HPLC. Used for PELMOgw modeling with default 1/n = 0.90.
pH dependence ‡ (yes / no)	Not tested. pH dependence unlikely due to structural similarity to the parent, which shows neither basic nor acidic properties in aqueous systems.

Methiocarb sulfoxide phenol (M04)

K_{oc} ‡	K_{oc}: Adsorption: 26.7 – 101.0 mL /g (n=4), mean = 50.7. Mean value used for PELMOgw modeling. Desorption: 61.5 – 256.8 mL /g (n=4), mean = 144.35

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

K_d ‡	K_d: Adsorption: 0.1885 – 0.6611 mL /g (n=4), mean = 0.4826 Desorption: 0.7384 – 1.6438 mL /g (n=4), mean = 1.3223 1/n: Adsorption: 0.8902 – 0.9099 mL /g (n=4), mean = 0.90. Mean value used for PELMOgw modelling
pH dependence ‡ (yes / no)	No pH dependence.

Methiocarb sulfone phenol (M05)

K_{oc} ‡	K_{oc}: Adsorption: 86.3 – 163.0 mL/g (n=4), mean = 123. Mean value used for PELMOgw modelling. Desorption: 96.8 – 200.4 mL/g (n=4), mean = 143.93
K_d ‡	K_d: Adsorption: 0.6195 – 1.5386 mL/g (n=4), mean = 0.9943 Desorption: 0.7615 – 1.7420 mL/g (n=4), mean = 1.2647 1/n: Adsorption: 0.8431 – 0.9023 mL/g (n=4), mean = 0.88. Mean value used for PELMOgw modelling
pH dependence ‡ (yes / no)	No pH dependence.

Methiocarb methoxy sulfone (M10)

K_{oc} ‡	K_{oc}: Adsorption: 123.2 – 252.0 mL/g (n=4), mean = 189. Mean value used for PELMOgw modelling. Desorption: 144.5 – 295.3 mL/g (n=4), mean = 222.68

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

K_d ‡	K_d: Adsorption: 0.9027 – 2.5700 mL/g (n=4), mean = 1.7922 Desorption: 1.0762 – 3.0122 mL/g (n=4), mean = 2.0259 1/n: Adsorption: 0.8405 – 0.8620 mL/g (n=4), mean = 0.88. Mean value used for PELMOgw modelling
pH dependence ‡ (yes / no)	No pH dependence.

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

Column leaching ‡	No information submitted. None required.
Aged residues leaching ‡	Guideline: BBA Part IV, 4-2, with various deviations due to use of pelleted formulation (therefore non-radiolabelled study): Aged in the columns 12 weeks, and simultaneously irrigated weekly with two different irrigation scenarios – 75ml and 225 ml per column per week. Leachate: cold study 0.00 – 0.03% applied active substance, 0.00 – 0.20% methiocarb sulfoxide (M01)
Lysimeter/ field leaching studies ‡	No data submitted, none required.

PEC (soil) (Annex IIIA, point 9.1.3) – Aerobic conditions

Method of calculation	**(used for calculation for parent in oilseed rape only) pellet precursor:** Mean DT_{50lab} (derived from water/sediment study) 5.7d (20°C) **parent** DT_{50} (d): 10.6days Kinetics: 1st order Lab: worst case DT_{50} from laboratory studies, normalized to 100% FC and 20°C. **methiocarb sulfoxide (M01)** DT_{50} (d): 10.7 days Kinetics: 1st order Lab: worst case DT_{50} from laboratory studies,

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

	normalised to 100% FC and 20°C. Conversion 54.92% based on maximum detection corrected for molecular weight **methiocarb sulfoxide phenol (M04)** DT_{50} (d): 3.4 days Kinetics: 1st order Lab: worst case DT_{50} from laboratory studies, normalised to 100% FC and 20°C. Conversion 29.29% based on maximum detection corrected for molecular weight **methiocarb sulfone phenol (M05)** DT_{50} (d): 11.4 days Kinetics: 1st order Lab: worst case DT_{50} from laboratory studies, normalized to 100% FC and 20°C. Conversion 17.6% based on maximum detection corrected for molecular weight **methiocarb methoxy sulfone (M10)** DT_{50} (d): 20.2 days Kinetics: 1st order Lab: worst case DT_{50} from laboratory studies, normalised to 100% FC and 20°C. Conversion 12.63% based on maximum detection corrected for molecular weight
Application rate	Crops: (a) seed treatment in maize and (b) pellet treatment in oilseed rape % plant interception: (a) seed and (b) pellet treatments therefore no crop interception Number of applications: (a) 1 (b) 2 applications at 14 day interval Application rate(s): (a) 150 g a.s./ha (b) 2 x 120 g a.s./ha

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Methiocarb

PECsoil for methiocarb following application of slug pellets (2 x 120 g/ha, 14 day interval) in oilseed rape. Pellet degradation accounted for, all of the active substance assumed to be available immediately after application

Days after last appl'n	PECsoil (mg/kg)
0	0.023
1	0.037
2	0.046
4	0.053
7	0.050
14	0.028
28	0.006
50	0.000
100	0.000

Max concentration = 0.053 mg/kg 4.6 days after second application (18.6 DAT1)

PECsoil for methiocarb following application of seed treatment (1 x 150 g/ha, 14 day interval) in maize

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.200	0.200
1	0.187	0.194
2	0.175	0.187
4	0.154	0.176
7	0.127	0.160
14	0.080	0.131
28	0.032	0.092
50	0.008	0.059
100	0.000	0.031

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Metabolite: methiocarb sulfoxide (M01)

PECsoil for methiocarb sulfoxide (M01) following application of slug pellets (2 x 120 g/ha, 14 day interval) in oilseed rape

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.176	0.176
1	0.165	0.170
2	0.154	0.165
4	0.136	0.155
7	0.112	0.141
14	0.071	0.116
28	0.029	0.081
50	0.007	0.052
100	0.000	0.027

PECsoil for methiocarb sulfoxide (M01) following application of seed treatment (1 x 150 g/ha, 14 day interval) in maize

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.096	0.096
1	0.090	0.093
2	0.084	0.090
4	0.074	0.085
7	0.061	0.077
14	0.039	0.063
28	0.016	0.044
50	0.004	0.028
100	0.000	0.015

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Metabolite – methiocarb sulfoxide Phenol (M04)

PECsoil for methiocarb sulfoxide phenol (M04) following application of slug pellets (2 x 120 g/ha, 14 day interval) in oilseed rape

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.094	0.094
1	0.076	0.085
2	0.062	0.077
4	0.041	0.064
7	0.022	0.050
14	0.005	0.031
28	0.000	0.016
50	0.000	0.009
100	0.000	0.005

PECsoil for methiocarb sulfoxide phenol (M04) following application of seed treatment (1 x 150 g/ha, 14 day interval) in maize

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.059	0.059
1	0.048	0.053
2	0.039	0.048
4	0.026	0.040
7	0.014	0.031
14	0.003	0.019
28	0.000	0.010
50	0.000	0.006
100	0.000	0.003

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Metabolite: methiocarb sulfone phenol (M05)

PECsoil for methiocarb sulfone phenol (M05) following application of slug pellets (2 x 120 g/ha, 14 day interval) in oilseed rape

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.056	0.056
1	0.053	0.055
2	0.050	0.053
4	0.044	0.050
7	0.037	0.046
14	0.024	0.038
28	0.010	0.027
50	0.003	0.018
100	0.000	0.009

PECsoil for methiocarb sulfone phenol (M05) following application of seed treatment (1 x 150 g/ha, 14 day interval) in maize

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.035	0.035
1	0.033	0.034
2	0.031	0.033
4	0.028	0.031
7	0.023	0.029
14	0.015	0.024
28	0.006	0.017
50	0.002	0.011
100	0.000	0.006

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Metabolite: methiocarb methoxy sulfone (M10)

PECsoil for methiocarb methoxy sulfone (M10) following application of slug pellets (2 x 120 g/ha, 14 day interval) in oilseed rape

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.040	0.040
1	0.039	0.040
2	0.038	0.039
4	0.035	0.038
7	0.032	0.036
14	0.025	0.032
28	0.015	0.026
50	0.007	0.019
100	0.001	0.011

PECsoil for methiocarb methoxy sulfone (M10) following application of seed treatment (1 x 150 g/ha, 14 day interval) in maize

Days after appl'n	PECsoil (mg/kg)	Time weighted average (mg/kg)
0	0.025	0.025
1	0.024	0.025
2	0.024	0.024
4	0.022	0.024
7	0.020	0.022
14	0.016	0.020
28	0.010	0.016
50	0.005	0.012
100	0.001	0.007

PEC (soil) (Annex IIIA, point 9.1.3) – anaerobic conditions

Method of calculation	The use as a pellet formulation in winter oilseed rape could result in anaerobic degradation of the active substance. In the anaerobic study on sandy loam soil (Section B.8.1.1.2) the major metabolites observed under anaerobic conditions were methiocarb sulfoxide (M01, max 24%) and

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

	methiocarb phenol (M03, max 47%). However, the results indicated that M01 was probably only generated in significant quantities during the aerobic phase of the study. This is because the maximum of level of 24% was detected on the first day of anaerobic conditions being established, which was followed by rapid degradation. Therefore an anaerobic PECsoil was calculated for metabolite M03. The calculations assumed standard soil parameters of 5cm depth and 1.5 g/cm^3 density. As a worst case scenario the two oilseed rape slug pellet treatments were assumed to be applied simultaneously with no degradation. Transformation from the parent to M03 was based on the maximum formation in the anaerobic study, corrected for molecular weight (47% formation, molecular weight 168.26:225.3 g/mol; 35.10%). Maximum PECsoil for methiocarb phenol (M03) is 0.1123 mg/kg soil.

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

Hydrolysis of active substance and relevant metabolites (DT_{50}) ‡ (state pH and temperature)	pH5: 25°C DT_{50} 321d (1st order) pH7: 25°C DT_{50} 24 days (1st order) Metabolite methiocarb phenol max. 46% AR (30 d) pH9: 25°C DT_{50} 0.21 days (1st order) Metabolite methiocarb phenol max. 82.0% AR (3 d) Metabolite methiocarb sulfoxide phenol max. 10.5% AR (1 d)
Photolytic degradation of active substance and relevant metabolites ‡	A quantum yield Φ of 0.2828 was calculated. The quantum yield and UV absorption were used to estimate the environmental half-life of methiocarb in water by two simulation models (GC-SOLAR and Frank & Klöpffer). The estimates based on these models resulted in environmental direct photolysis half-lives of about 6 to 16 days for all relevant scenarios investigated (ie. Spring and summer application at the 50th degree of latitude). The direct photodegradation in water was concluded only to contribute to a small proportion of the elimination of methiocarb from the environment. DT_{50} at pH 5 (acetate buffer), exposed to simulated sunlight (xenon lamp, 290 nm UV filter)at 25^{o}C:

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

	experimental half-life: 8.17 days, corresponding to a predicted environmental half-life of 31 solar summer days at Phoenix, Arizona and 48 solar summer days at Athens, Greece. DT_{50} at pH 5 (acetate buffer), exposed to natural sunlight (Kentucky, USA, 38.05°N, 84.30°W) in January and February, mean temperature of solutions 24.9 °C: experimental half-life: >30 days in both the irradiated (88 days) and dark control samples (238 days)
Readily biodegradable (yes/no)	No data submitted, none required. In the absence of data this compound is considered to be not readily biodegradable.
Degradation in water/sediment	Results from **non-radiolabelled** study, applied as pellet
- DT_{50} water ‡	7.9 – 9.1 days
- DT_{90} water ‡	26.2 – 30.2 days (1^{st} order, n= 1, two different calculation methods)
- DT_{50} whole system ‡	15.3 days
- DT_{90} whole system ‡	50.8 days (1^{st} order, n= 1)
- DT_{50} pellet precursor	5.7 – 7.4 days (1^{st} order, n= 1, two different calculation methods, lower values used in PECgw and drainflow modelling for pellet formulation in oilseed rape)
Mineralization	n/a (non-radiolabelled)
Non-extractable residues	n/a (non-radiolabelled)
Distribution in water / sediment systems (active substance) ‡	18.6% amount applied after 28 days. DT_{50} in sediment 20.1 days (DT_{90} 66.7 days, 1^{st} order, n= 1)
Distribution in water / sediment systems (metabolites) ‡	Water: Methiocarb phenol (M03) maximum 22.5% applied amount (cold study) day 14, 0.2% at study end. Methiocarb sulfoxide phenol (M04) max. 23.6% day 28 56, declining to 8.8% day 98. Sediment: No metabolites > 10%. M03 max. 9.2% day 56, declining to 5.9% at study end.

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

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

Method of calculation	The representative uses notified for methiocarb as slug pellets in oilseed rape and maize seed treatment do not result in a route of entry to surface waters via spray drift. Therefore, PECsw values were calculated for a drainflow event. Predicted environmental concentrations of methiocarb and its major soil metabolites methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05) and methiocarb methoxy sulfone (M10) in surface water under environmental conditions were estimated using the model MACRO (version 4.1b). In oilseed rape methiocarb is used twice per year with a maximum annual application rate of 240 g a.s./ha and a minimum time interval of 14 days between the two applications. Due to application of the product as slug pellets it was assumed that 100% of the amount applied reached the soil. Application in maize by seed dressing with an annual application rate of 150 g a.s./ha is considered to be conducted on planting dates of maize in Europe as given by the FOCUS groundwater scenarios. The time weighted averaged predicted environmental concentrations were calculated for days 0, 1, 2, 4, 7, 28, 50 and 100 after application. The results for the active substance as well as for the metabolites are summarized in below as 90th percentile PECsw values in the ditch.
Application rate	150 g a.s./ha
Main routes of entry	drainflow

Half-lives (geometric mean DT_{50} normalised to 20°C and 100%FC) and K_{oc} values for methiocarb and metabolites

Compound	DT_{50} [days]	K_{oc} [mL/g]
Pellet degradation	5.7	10000
Methiocarb	0.8	660
Methiocarb sulfoxide (M01)	2.2	31
Methiocarb sulfoxide phenol (M04)	2.2	51
Methiocarb sulfone phenol (M05)	6.6	123
Methiocarb methoxy sulfone (M10)	9.2	189

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

90th percentile predicted environmental concentrations (PEC SWI, TWA via drainflow) of methiocarb and metabolites – use in oilseed rape and maize [µg/L]

Crop	Oil Seed Rape			Maize
Application month	April	July	September	April
Methiocarb	<0.01	<0.01	<0.01	<0.01
Methiocarb sulfoxide (M01)	0.39	0.37	0.47	0.43
Methiocarb sulfoxide phenol (M04)	0.02	0.09	0.11	0.08
Methiocarb sulfone phenol (M05)	<0.01	<0.01	<0.01	0.01
Methiocarb methoxy sulfone (M10)	<0.01	<0.01	<0.01	<0.01

Data gap identified for maximum PECsw values.

PEC (sediment)

Method of calculation	The only compound predicted to appear in surface water was metabolite M01. Due to the low sorption potential of metabolite M01, significant partitioning to sediment is not expected.
Application rate	Not relevant

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

RMS calculations

Method of calculation and type of study (*e.g.* modelling, monitoring, lysimeter)	Mean DT_{50} values used in the notifier's groundwater modelling did not take account of the higher DT_{50} values for methiocarb and methiocarb sulfoxide (M01), which were observed in a soil laboratory degradation study (Minor and Freeseman, 1989). Therefore, further groundwater modelling was carried out by the Rapporteur using FOCUS-PELMO (v3.3.2). The assumptions and input parameters were identical to those used by the notifier, with the exception that the geometric mean DT_{50} for methiocarb was increased from 0.8 to 2.8 days, and the geometric mean DT_{50} from methiocarb sulfoxide (M01) was increased from 2.2 to 4.22 days. The 6-scenarios identified in FOCUS as relevant to oilseed rape were modelled. Note that this additional modelling was only done for the

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

	parent and M01. The modelling only evaluated the use of pellets in winter oilseed rape in the autumn (ie. September 16th and 30th), this use being the critical GAP in terms of the likelihood of groundwater contamination. **(oilseed rape only) pellet precursor:** Mean DT_{50lab} (derived from water/sediment study) 5.7d (20°C) K_{oc} set to 10000 to ensure immobility of the pellet precursor, $^1/_n$= 0.90 FOCUS default. **Parent:** Mean DT_{50lab} 2.8 d (normalisation to 10kPa or pF2, 20°C with Q10 of 2.2). K_{oc}: mean 660 ml/g, $^1/_n$= 0.83. **methiocarb sulfoxide (M01):** Mean DT_{50lab} 4.22 d (normalisation to 10kPa or pF2, 20°C with Q10 of 2.2). K_{oc}: (HPLC) 31 ml/g, $^1/_n$= 0.90 FOCUS default. **Methiocarb sulfoxide phenol (M04):** Mean DT_{50lab} 2.1 d (normalisation to 10kPa or pF2, 20°C with Q10 of 2.2). K_{oc}: mean 51 ml/g, $^1/_n$= 0.83. **methiocarb sulfone phenol (M05):** Mean DT_{50lab} 6.6 d (normalisation to 10kPa or pF2, 20°C with Q10 of 2.2). K_{oc}: mean 123 ml/g, $^1/_n$= 0.88. **methiocarb methoxy sulfone (M10):** Mean DT_{50lab} 9.2 d (normalisation to 10kPa or pF2, 20°C with Q10 of 2.2). K_{oc}: mean 189 ml/g, $^1/_n$= 0.84.
Application rate	Simulations based on slug pellets in oil seed rape at application rate of 0.24 kg a.s./ha (two applications of 0.12 kg/ha).
$PEC_{(gw)}$	
Maximum concentration	No data available

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Average annual concentration (Results quoted for modelling with FOCUS gw scenarios, according to FOCUS guidance)	The modeling predicted 80th percentile concentrations to be <0.031 µg/L for all compounds in all of the 6 scenarios used.

PEC(gw) – FOCUS modelling results

80th percentile predicted environmental concentrations in groundwater

Model /Crop	Scenario	Parent (µg/L)	Metabolites (µg/L)			
		methiocarb	methiocarb sulfoxide (M01)	methiocarb sulfoxide phenol (M04)	methiocarb sulfone phenol (M05)	methiocarb methoxy sulfone (M10)
	Châteaudun	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Hamburg	< 0.001	0.001	< 0.001	< 0.001	< 0.001
	Kremsmünster	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Okehampton	< 0.001	0.001	< 0.001	< 0.001	< 0.001
	Piacenza	< 0.001	0.031	0.011	0.003	0.002
	Porto	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

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
Quantum yield of direct phototransformation	No data available
Photochemical oxidative degradation in air ‡	DT_{50}: 9.5 hours (1.5 x 10^6 OH radicals cm^{-1})
Volatilization ‡	Laboratory route and rate of degradation studies indicated that volatilization is unlikely because no volatiles were detected at above 0.1% AR. Henry's Law Constant 1.2 x 10^{-4} Pa x m^3 x Mol^{-1}

PEC (air)

Method of calculation	Expert judgement, based on vapour pressure (extrapolated: <1.5 x 10^{-5} Pa at 20°C), Henry's Law Constant (1.2 x 10^{-4} Pa x m^3 x Mol^{-1}) and information on volatilisation.

$PEC_{(a)}$

Maximum concentration	Negligible

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Definition of the Residue (Annex IIA, point 7.3)

Relevant to the environment	Soil Methiocarb, methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05), methiocarb methoxy sulfone (M10), methiocarb phenol (M03) (anaerobic metabolite) Groundwater Methiocarb, methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05), methiocarb methoxy sulfone (M10) Surface water and sediment* Methiocarb, methiocarb sulfoxide (M01), methiocarb sulfoxide phenol (M04), methiocarb sulfone phenol (M05), methiocarb methoxy sulfone (M10) Air Methiocarb

* Residue definitions in water and sediment would need to be updated if approval for a spray formulation was sought in the future.

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

Soil (indicate location and type of study)	No data provided – none requested
Surface water (indicate location and type of study)	No data provided – none requested
Ground water (indicate location and type of study)	No data provided – none requested
Air (indicate location and type of study)	No data provided – none requested

Classification and proposed labelling (Annex IIA, point 10)

with regard to fate and behaviour data	Possibly a candidate for R53 May cause long-term adverse effects in the aquatic envirionment

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Appendix 1.6: Effects on non-target Species

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

Acute toxicity to mammals ‡	LD_{50}: 19 mg a.s./kg bw (rat)*
Long-term reproductive toxicity to	300 mg a.s./kg feed (ppm)* (rat, 2 generations) (15 mg a.s./kg bw as daily dose)
Acute toxicity to birds ‡	LD_{50}: 5 mg a.s./kg bw (Japanese quail)
Dietary toxicity to birds ‡	1071 mg a.s./kg feed (ppm)[#] (mallard duck)
Reproductive toxicity to birds ‡	NOEC: 50 mg a.s./kg feed (bobwhite quail) (4.51 mg a.s./kg bw as daily dose)

* Figures not lowest from mammalian toxicity data package but considered most appropriate for use in wild mammal risk assessment

[#] It was not possible to convert the 5-day dietary LC_{50} value into a daily dose figure.

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

The following are theoretical worst case Tier I calculations for completeness only – the assessment of risk relies largely upon use of higher tier acceptance/repellency and field studies.

Appl. rate (kg a.s./ha)	Crop	Category (food type)	Time-scale	worst case TER [a)]	Annex VI TER trigger
Birds					
2 x 0.120	oilseed rape	slug pellets	acute	3.3×10^{-4}	10
2 x 0.120	oilseed rape	seedlings	acute	94	10
2 x 0.120	oilseed rape	earthworms (& slugs)	acute	0.073 (slugs <0.073)	10
2 x 0.120	oilseed rape	small mammals	acute	0.54	10
2 x 0.120	oilseed rape	slug pellets	short-term	0.027	10
2 x 0.120	oilseed rape	seedlings	short-term	3927	10
2 x 0.120	oilseed rape	earthworms (& slugs)	short-term	3.87 (slugs <3.87)	10
2 x 0.120	oilseed rape	seedlings	long-term	85	5
2 x 0.120	oilseed rape	earthworms (& slugs)	long-term	0.085 (slugs <0.085)	5
2 x 0.120	oilseed rape	fish	long-term	>23862	5
0.150	maize	treated seeds	acute	2.63×10^{-3}	10
0.150	maize	seedlings	acute	71	10
0.150	maize	treated seeds	short-term	0.21	10

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Appl. rate (kg a.s./ha)	Crop	Category (food type)	Time-scale	worst case TER [a)]	Annex VI TER trigger
0.150	maize	seedlings	short-term	3100	10
0.150	maize	treated seeds	long-term	2.4×10^{-3}	5
0.150	maize	seedlings	long-term	64	5
2 x 0.120	maize	fish	long-term	>23862	5
Mammals					
2 x 0.120	oilseed rape	pellets	acute	2.5×10^{-3}	10
2 x 0.120	oilseed rape	seedlings	acute	1086	10
2 x 0.120	oilseed rape	earthworms (& slugs)	acute	0.28 (slugs <0.28)	10
2 x 0.120	oilseed rape	pellets	long-term	2×10^{-3}	5
2 x 0.120	oilseed rape	seedlings	long-term	1667	5
2 x 0.120	oilseed rape	earthworms (& slugs)	long-term	0.44 (slugs <0.44)	5
0.150	maize	treated seeds	acute	0.02	10
0.150	maize	seedlings	acute	844	10
0.150	maize	treated seeds	long-term	0.02	5
0.150	maize	seedlings	long-term	667	5

For the higher tier assessment of risks identified in the above table – see the relevant refined risk assessments in Vol. 3, Sections B.9.1 & B.9.3.

Mesurol RB 4 (pelleted bait)

The refined acute and longer term risk assessments for small and large birds and mammals are based largely on the results from avoidance and field studies. The risk assessments are reported in the draft assessment report Vol. 3, in Sections B.9.1.6.1 & B.9.3.5.1 for birds and mammals respectively. These refined risk assessments have indicated that the risks to birds are lower under more realistic exposure conditions. The risk assessment was discussed in an expert peer review meeting (EPCO 27) where it was concluded that some mortality is still likely to occur in the field from the proposed use. Although it was concluded that the risk was undoubtedly lower than predicted by the first tier assessment, the need for further data to enable the risk to key species of farmland birds to be quantified was identified. The need for further data to refine the risk to predatory birds was also identified. The meeting also considered various risk mitigation measures to reduce the risk.

The available laboratory data indicates that small and medium sized mammals are repelled by methiocarb slug pellets and contaminated molluscs. However, small rodents have been shown to consume sufficient methiocarb slug pellets/earthworms to lead to mortality under certain circumstances. The refined risk assessment, presented in the draft assessment report ( ), using field data and other information sources have indicated that for small rodents such as wood mice, these circumstances related only to a transient proportion of the population, whereas about 2% of the resident population was considered to be affected. It was considered that the level of mortality seen in

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

this transient group would not adversely affect the overall long term population of small mammals in or surrounding arable fields.

Mesurol FS500 (seed treatment)

The refined acute and longer term risk assessments for small and large birds and mammals are based largely on the results from avoidance studies and the persistence and availability of treated seeds in the field. The risk assessments are reported in the draft assessment report Vol. 3, Sections B.9.1.6.2 & B.9.3.5.2 for birds and mammals respectively. These refined risk assessments have indicated that due largely to limited palatability and availability of drilled treated maize seed, the risks to both birds and mammals are low under more realistic exposure conditions. Other sources of exposure were not considered to increase this risk.

Toxicity data for aquatic species (most sensitive species of each group) (Annex IIA, point 8.2, Annex IIIA, point 10.2)

Methiocarb

Group	Test substance	Time-scale	Endpoint	Toxicity (mg/L)
Laboratory tests				
Fish (*Lepomis macrochirus*)	technical methiocarb	acute	LC_{50}	0.65
Invertebrates (*Daphnia magna*)	technical methiocarb	acute	EC_{50}	0.0077
Algae (*Scenedesmus subspicatus*)	technical methiocarb	acute/ short term	E_rC_{50} E_bC_{50}	2.2 0.82
Fish (*Oncorhynchus mykiss*)	technical methiocarb	chronic	NOEC	0.05
Invertebrates (*Daphnia magna*)	technical methiocarb	chronic	NOEC	0.0001

Metabolite: Methiocarb sulfoxide (MO1)

Group (species)	Test substance	Time-scale	Endpoint	Toxicity (mg met./L)
Fish (*Oncorhynchus mykiss*)	technical metabolite	acute	LC_{50}	6.6
Invertebrates *Daphnia magna*	technical metabolite	acute	EC_{50}	0.056
Algae (*Scenedesmus subspicatus*)	technical metabolite	acute/ short term	E_rC_{50} E_bC_{50}	2.75 1.31

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Metabolite: methiocarb phenol (MO3)

Group (species)	Test substance	Time-scale	Endpoint	Toxicity (mg met./L)
Fish (*Oncorhynchus mykiss*)	technical metabolite	acute	LC_{50}	3.2
Invertebrates *Daphnia magna*	technical metabolite	acute	EC_{50}	6.8
Algae (*Scenedesmus subspicatus*)	technical metabolite	acute/ short term	E_rC_{50} E_bC_{50}	11 6.0

Metabolite: methiocarb sulfoxide phenol (MO4)

Group (species)	Test substance	Time-scale	Endpoint	Toxicity (mg met./L)
Fish (*Oncorhynchus mykiss*)	technical metabolite	acute	LC_{50}	>106
Invertebrates *Daphnia magna*	technical metabolite	acute	EC_{50}	157
Algae (*Scenedesmus subspicatus*)	technical metabolite	acute/ short term	E_rC_{50} E_bC_{50}	>100 >100

Metabolite: methiocarb sulfone phenol (MO5)

Group (species)	Test substance	Time-scale	Endpoint	Toxicity (mg met./L)
Fish (*Oncorhynchus mykiss*)	technical metabolite	acute	LC_{50}	68.7
Invertebrates *Daphnia magna*	technical metabolite	acute	EC_{50}	54
Algae (*Scenedesmus subspicatus*)	technical metabolite	acute/ short term	E_rC_{50} E_bC_{50}	120 105

Metabolite: methiocarb methoxy sulfone (M10)

Group (species)	Test substance	Time-scale	Endpoint	Toxicity (mg met./L)
Fish (*Oncorhynchus mykiss*)	technical metabolite	acute	LC_{50}	26.8
Invertebrates *Daphnia magna*	technical metabolite	acute	EC_{50}	>180

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Group (species)	Test substance	Time-scale	Endpoint	Toxicity (mg met./L)
Algae (*Scenedesmus subspicatus*)	technical metabolite	acute/ short term	ErC50 EbC50	137 97.7

Microcosm or mesocosm tests
None submitted

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

Note: The following example TERs are provided for drainflow of methiocarb and its main soil metabolites. Apart from one peak level modelled for metabolite M01, the PEC_{sw} values are calculated as the 90th percentile of time weighted average concentrations for days 0, 1, 2, 4, 7, 28, 50 and 100 after application and include dilution in the ditch.

Use of 'Mesurol RB 4' in oilseed rape at 2 x 0.120 kg a.s./ha

Acute/short-term drainflow TERs for technical methiocarb:

Aquatic group/ Species	compound	LC/EC_{50} (mg a.s./L)	PEC_{sw} (mg a.s./L)	TER	Annex VI trigger
Fish:					
Lepomis macrochirus	technical methiocarb	0.65	<0.00001	>65000	100
Aquatic invertebrates:					
Daphnia magna	technical methiocarb	0.0077	<0.00001	>770	100
Algae:					
Scenedesmus subspicatus	technical methiocarb	2.2 (E_rC_{50}) 0.82 (E_bC_{50})	<0.00001	>220000 >82000	10

Long-term/chronic drainflow TERs for technical methiocarb:

Aquatic group/ Species	compound	NOEC (mg a.s./L)	PEC_{sw} (mg a.s./L)	TER	Annex VI trigger
Fish:					
Oncorhynchus mykiss	technical methiocarb	0.05	<0.00001	>5000	10
Aquatic invertebrates:					
Daphnia magna	technical methiocarb	0.0001	<0.00001	>10	10

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Acute/short-term drainflow TERs for soil metabolites of methiocarb:

Aquatic group/ Species	metabolite	LC/EC_{50} (mg/L)	PEC_{sw} (mg/L)	TER	Annex VI trigger
Fish:					
Oncorhynchus mykiss	M01	6.6	0.00047 0.0015*	14043 4400	100
Oncorhynchus mykiss	M04	>106	0.00011	>963636	100
Oncorhynchus mykiss	M05	68.7	<0.00001	>6870000	100
Oncorhynchus mykiss	M10	26.8	<0.00001	>2680000	100
Aquatic invertebrates:					
Daphnia magna	M01	0.056	0.00047 0.0015*	119 37.3	100
Daphnia magna	M04	157	0.00011	1427273	100
Daphnia magna	M05	54	<0.00001	>5400000	100
Daphnia magna	M10	>180	<0.00001	>18000000	100
Algae:					
Scenedesmus subspicatus	M01	2.75 r 1.31 b	0.00047 0.0015*	5851 r, 1833 r* 2787 b, 873 b*	10
Scenedesmus subspicatus	M04	>100 r >100 b	0.00011	>909091 r >909091 b	10
Scenedesmus subspicatus	M05	120 r 105 b	<0.00001	>12000000 r >10500000 b	10
Scenedesmus subspicatus	M10	137 r 97.7 b	<0.00001	>13700000 r >9770000 b	10

* = based on peak modelled drainflow PEC_{sw}
r = based on growth rate
b = based on biomass

Use of 'Mesurol FS 500' as a seed treatment on maize at 0.150 kg a.s./ha

As the surface water drainflow PECs for methiocarb and its metabolites resulting from use of 'Mesurol FS 500' as a maize seed treatment were all identical or less than those modelled for 'Mesurol RB 4', the TERs for this use are covered by those above.

Bioconcentration

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Bioconcentration factor (BCF) ‡	60 to 90 (bluegill sunfish)
Annex VI Trigger:for the bioconcentration factor	100
Clearance time (CT_{50})	<1 day
Level of residues (%) in organisms after the 14 day depuration phase	-

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

Acute oral toxicity ‡	$LD_{50:}$: 0.47 µg a.s./bee (test with active substance)
Acute contact toxicity ‡	LD_{50}: 0.23 µg a.s./bee (test with active substance)

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

Due to the lack of direct exposure of bees from use of methiocarb in slug pellets and seed treatments, no HQ values have been calculated. Based on low levels of residues in plants, a low risk is anticipated for bees.

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

Test substance	Species	Life stage	Appl. rate in test (g a.s./ha)	Median lethal rate or mortality (corrected for control)	Sublethal effect (relative to control)
Laboratory/extended laboratory tests					
WP50	*Aphidius rhopalosiphi*	adults	0.6 to 20	LR_{50} (48h) = 0.47 g a.s./ha on tomato leaves	
WP50	*Typhlodromus pyri*	mixed	5 to150	LR_{50} (7 d) = 33.7 g a.s./ha on bean leaves	
WP50	*Chrysoperla carnea*	larvae	1 to 20	LR_{50} (28 d) = 9.09 g a.s./ha on tomato leaves	
WP50	*Poecilus cupreus*	adults	10 to 300	LR_{50} (14 d) = 33.1 g a.s./ha on natural soil	
RB 4	*Pterostichus melanarius*	adults	220 /440	-* / 70	*
RB 4	Aleochara bilineata	adults & larvae	90.9	*	reproduction 90.9 %
RB 4	*Calathus fuscipes*	adults	220 /440	55 / 95	*

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

Test substance	Species	Life stage	Appl. rate in test (g a.s./ha)	Median lethal rate or mortality (corrected for control)	Sublethal effect (relative to control)
RB 4	*Pardosa* spp	adults	240	0	feeding capacity 104.5 %
FS 500	*Poecilus cupreus*	adults	114	0	relative feeding rate 96%
FS 500	*Aleochara bilineata*	adults & larvae	2180	*	reproduction 97.3 %
FS 500	*Pardosa* spp	adults	677.25	2.9%	feeding capacity 105.3 %

*not tested

Higher tier semi-field or field tests
No further testing was required for 'Mesurol FS 500'. For 'Mesurol RB 4' a higher tier risk assessment was been conducted based on multi-species field tests. These indicate population recovery for the majority of taxa between cropping seasons but that certain species (as indicated by the carabid beetle *Bembidion obtusum*) may not recover within one year following use of 2 x 'Mesurol RB 4' according to the proposed GAP.

Effects on earthworms (Annex IIA, point 8.4, Annex IIIA, point 10.6)

Acute toxicity	Technical methiocarb LC_{50}: 1322 mg a.s./kg dry wt. soil NOEC: 0.32 mg a.s./kg dry wt. soil Methiocarb-sulfoxide (MO1) LC_{50}: 78 mg/kg dry wt.soil Methiocarb-sulfoxide-phenol (MO4) LC_{50}: >1000 mg/kg dry wt.soil Methiocarb-sulfone-phenol (MO5) LC_{50}: >1000 mg/kg dry wt.soil Methiocarb-methoxy-sulfone (M10) LC_{50}: 562 mg/kg dry wt.soil
Chronic toxicity	NOEC: ≡ 500 000 treated seeds/ha ('Mesurol FS 500')

Toxicity/exposure ratios for earthworms (Annex IIIA, point 10.6)

Technical methiocarb and 'Mesurol FS 500' treated maize seed:

Application rate (kg a.s./ha)	Crop	Time-scale	TER*	Annex VI Trigger

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

2 x 0.120	oilseed rape	acute	2951[#]	10
0.150	maize	acute	3305[#]	10
0.150	maize	long-term	≥3.3 [@]	5

* TER values corrected for log P_{ow} of compound and organic matter content of test soil
[#] Theoretical TER calculations were based on homogeneous distribution of methiocarb in the top 5 cm of soil (PEC_{soil}: 0.224 mg a.s./kg soil) however this was not considered appropriate for use of the compound as a slug pellet, therefore higher tier data were relied upon.
[@] TER based on study conducted with treated seed, TER of 3.3 considered acceptable due to realism of test with treated seed and lack of any toxic effects at highest rate (3N)

Acute TERs for methiocarb metabolites following resulting from use of 'Mesurol RB 4':

Soil metabolite	Acute LC_{50} (mg/kg dry soil)	Max. soil PEC (mg/kg dry soil)	'Acute' TER
M01 methiocarb-sulfoxide	78	0.176	443.2
M04 methiocarb-sulfoxide-phenol	>1000	0.094	>5319*
M05 methiocarb-sulfone-phenol	>1000	0.056	>17857
M10 methiocarb-methoxy-sulfone	562	0.04	14050

* TER value corrected for log P_{ow} of compound and organic matter content of test soil

Acute TERs for methiocarb metabolites following resulting from use of 'Mesurol FS500' seed treatment:

Soil metabolite	Acute LC50 (mg/kg dry soil)	Max. soil PEC (mg/kg dry soil)	'Acute' TER
M01 methiocarb-sulfoxide	78	0.096	812.5
M04 methiocarb-sulfoxide-phenol	>1000	0.059	>8475*
M05 methiocarb-sulfone-phenol	>1000	0.035	>28571
M10 methiocarb-methoxy-sulfone	562	0.025	22480

* TER value corrected for log P_{ow} of compound and organic matter content of test soil

Earthworm field studies

In a 1-year grassland field study, with methiocarb ('Mesurol RB4' and 'RB2') applied according to the proposed GAP (max. 2 x 120 kg/ha), no consistent statistically significant differences were observed between treatment and control plots after one year in terms of populations/number, ages or ecological classes of worms present. However, biomass of the large deep burrowing and surface feeding tanylobous species was statistically significantly reduced at one year with 2 applications of 'Mesurol RB4'.

Effects on other soil macro-organisms involved in organic matter breakdown (Annex IIIA, point 10.6.2)

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

No additional data submitted. A low risk is predicted due to assessment of the levels and persistence of methiocarb and its metabolites in soil, plus consideration of their effects on earthworms, non-target arthropods and soil microbial processes.

Effects on soil micro-organisms (Annex IIA, point 8.5, Annex IIIA, point 10.7)

Carbon mineralization	(test with techn. A.s.)	at least 1.7 mg a.s./kg dry wt. soil: no influence
Nitrogen mineralization	(test with techn. A.s.)	at least 1.7 mg a.s./kg dry wt. soil: no influence
Nitrogen mineralization	methiocarb sulfoxide (M01), tech. metabolite	at least 1.47 mg a.s./kg dry wt. soil: no influence
Nitrogen mineralization	methiocarb sulfoxide phenol (MO4), tech. metabolite	at least 1.09 mg a.s./kg dry wt. soil: no influence
Nitrogen mineralization	methiocarb sulfone phenol (MO5), tech. metabolite	at least 1.2 mg a.s./kg dry wt. soil: no influence
Nitrogen mineralization	methiocarb methoxy sulfone, (M10), tech. metabolite	at least 1.33 mg a.s./kg dry wt. soil: no influence

Effects on other non-target organisms (flora and fauna) believed to be at risk (Annex IIA, point 8.6)

The effects of methiocarb (as 'Methiocarb FS 500') pre- and post-emergence were investigated on a range of monocotyledonous and dicotyledonous plants. None showed any pre-or post-emergence phytotoxic effects up to the highest application rate of 240 g a.s./ha. Also no adverse effects determined for methiocarb on activated sewage sludge – EC_{50} >10000 mg a.s./L.

Classification and proposed labelling (Annex IIA, point 10)

with regard to ecotoxicological data

N;	Harmful
R50/R53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
S60	This material and its container must be disposed of as hazardous waste.
S61	Avoid release to the environment. Refer to special instructions/safety data sheets

‡ Endpoints identified by EU-Commission as relevant for Member States when applying the Uniform Principles

APPENDIX 2 – 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}	letal 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
r2	coefficient of determination
RMS	rapporteur Member State
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