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

diazinon

finalised: 23 June 2006

(public version of 3 August 2006 has undergone editorial changes since its finalisation)

SUMMARY

Diazinon 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.

Portugal being the designated rapporteur Member State submitted the DAR on diazinon in accordance with the provisions of Article 8(1) of the amended Regulation (EC) No 451/2000, which was received by the EFSA on 8 July 2005. Following a quality check on the DAR, the peer review was initiated on 9 September 2004 by dispatching the DAR for consultation of the Member States and the sole applicant Makhteshim Agan. Subsequently, the comments received on the DAR were examined by the rapporteur Member State and the need for additional data was agreed in an evaluation meeting on 18 May 2005. Remaining issues as well as further data made available by the notifier upon request were evaluated in a series of scientific meetings with Member State experts in September 2005.

A final discussion of the outcome of the consultation of experts took place with representatives from the Member States on 6-7 June 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 in Southern Europe as an insecticide and acaricide as proposed by the applicant with application via orchard air blast sprayers and tractor mounted hydraulic sprayers. Application is made to apples and pears with a maximum total dose of 2.7 kg diazinon per hectare and to sugar beet with a maximum total dose of 0.72 kg diazinon per hectare. It should be noted that the use in apples and pears were withdrawn during the EU peer review process. The representative formulated product for the evaluation was Diazol 60 EC, an emulsifiable concentrate (EC).

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

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. However, it should be noted that full validation of the method of analysis for food commodities is not available as no independent laboratory validation data are available. As well as this further validation data are required for the method of analysis for air.
Some 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. There are still some outstanding data gaps for the relevant impurities.

Acute toxicity during oral exposure is higher than by dermal application or inhalation. Therefore the proposed classification is Xn; R22 "Harmful if swallowed". The main effect observed during short term or long term exposure is the inhibition of acetyl cholinesterase activity. Based on this, the relevant oral short term NOAEL is 0.02 mg/kg bw/day in the dog studies.
There is no genotoxic potential for diazinon, no carcinogenic effect in rats and mice, and no reproductive or developmental toxicity in rats and rabbits. No delayed neurotoxicity was observed in hens, and the NOAEL in the subchronic neurotoxicity study with rats is the same as the short term NOAEL, based on acetyl cholinesterase inhibition. The groundwater metabolites G 27550[3] and GS 31144[4] are not considered toxicologically significant, having no phosphate group susceptible to produce acetyl cholinesterase inhibition. They were concluded not relevant. The three impurities TEPP[5], O,S-TEP[6] and S,S-TEPP[7] were very toxic in acute oral studies and considered of toxicological concern. Acute and subchronic human studies were submitted, but were either not acceptable, or had scientific deficiencies.
The Acceptable Daily Intake (ADI) and Acceptable Operator Exposure Level (AOEL) are 0.0002 mg/kg bw/day and the Acute Reference Dose (ARfD) is 0.025 mg/kg bw, with the use of the safety factor 100. For the supported use on sugar beets, the estimated operator exposure according to the German or the UK models is largely above the AOEL, with or without the use of personal protective equipment (PPE) (2700% of the AOEL with the use of PPE and respiratory protective equipment (RPE) according to the German model).

The metabolism of diazinon in plants is clearly elucidated. The degradation pathway proceeds first through hydrolysis of the phosphorothioate ester link, leading to metabolite G 27550, which given its chemical structure has no cholinesterase activity. This compound is further hydroxylated and conjugated to glucose. Diazoxon is not observed. The amount of metabolites in comparison to the parent level is variable from crop to crop, but the residue definition can be restricted to parent compound only for monitoring and risk assessment as no other compound expected to add a

[3] G 27550: 2-isopropyl-4-methyl-6-hydroxpyrimidine
[4] GS 31144: 2-(1-hydroxy-1-methyl)-ethyl-4-methyl-6-hydroxpyrimidine
[5] TEPP: tetraethyl pyrophosphate
[6] O,S-TEPP: O,O,O,O-tetraethyl-thiopyrophosphate
[7] S,S-TEPP: O,O,O,O-tetraethyl-dithiopyrophosphate

contribution to the toxicological effects of diazinon was identified. Supervised residue trials were conducted suggesting the setting of a MRL at 0.5 mg/kg in pome fruits, and indicating that residues in sugar beet roots are below 0.01 mg/kg. No residues are expected in following crops and no plant-back restriction is needed.

Processing of apples leads to a clear reduction of the diazinon levels in juice and sauce. However, the formation of a degradation product (desethyl diazinon), identified under specific hydrolysis conditions, was not investigated in practical conditions. This compound is recommended for inclusion in the residue definition for risk assessment in processed commodities.

The metabolism of diazinon in livestock has been investigated and parent compound was found to be the major compound of toxicological relevance in animal tissues. Diazinon exhibits a lipophilic behaviour. Two metabolites, diazoxon and a hydroxylated form of diazinon were also present. The residue definition in animal commodities can be restricted to diazinon on the basis of the representative uses considered in this peer-review, leading to a low livestock dietary exposure and non significant transfer of residues to animal tissues, as demonstrated by feeding studies.

The short and long term exposure assessments were conducted and indicated potential exceedences of the ADI and ARfD, which in some cases appear to be severe, in particular for infants and toddlers, with high consumption levels of pome fruits.

In soil diazinon exhibited low to moderate persistence. Significant sinks for the pyridine ring-^{14}C-radiolabel used in the aerobic laboratory studies were residue not extracted by acetonitrile:water or methanol/water (9-38% of applied radioactivity (AR) after 76-119 days) and mineralisation to CO_2 5.8-86%AR at 76-119 days. The major (>10%AR) metabolite in soil extracts was G 27550 accounting for up to 82%AR which exhibited high soil persistence. This metabolite may have the potential to accumulate in soil if applications are made to the same field in successive years. Diazinon exhibited medium to low soil mobility and G 27550 exhibited very high mobility based on the results of guideline batch laboratory adsorption experiments. The minor soil degradation product (max. 4.7%AR) GS 31144 was also characterised as exhibiting very high soil mobility on the basis of quantitative structure activity relationships (QSAR) computer modelling.

In aerobic laboratory natural sediment water system experiments, diazinon exhibited low persistence (dissipation DT_{50} in water 3.9-4.7 days) as a consequence of a combination of partitioning to sediment (accounting for up to 77%AR at 0 days) and biodegradation. In the water phase the metabolite G 27550 accounted for a maximum of 47%AR 30 days after application, levels subsequently declined (DT_{50} in water estimated at 87 days). G 27550 was also present in sediment (maximum 22.7%AR). Residues not extracted from sediment by acetonitrile and acetonitrile:water represented 22-49%AR at study end (100 days). Mineralisation to CO_2 of the pyridine ring-^{14}C-radiolabel used accounted for only 4.7-5.1 % AR by 100 days. The available surface water exposure assessment just considered the spray drift route of entry to surface water. The potential exposure of surface water with parent diazinon and the soil metabolite G 27550 via the drainage and runoff routes of entry has not been assessed in the available EU level exposure assessment. Member States should therefore carry out a surface water exposure and consequent aquatic risk assessment for diazinon and

G 27550 from the runoff and drainage routes of exposure at the national level, should diazinon be included in Annex 1.
Appropriate FOCUS groundwater modelling is not available. This is required. Based on the available FOCUS PEARL modelling that utilised too favourable input parameters, annual average recharge concentrations leaving the top 1m soil column >0.75µg/L are already indicated for G 27550. For GS 31144 these concentrations are indicated to be >0.1µg/L. Based on current information it cannot be excluded that these concentrations for GS 31144 may be shown by appropriate modelling to be >0.75µg/L. Non relevance assessments are therefore required for both these potential groundwater contaminants. A significant dissipation route of diazinon from plants and soil will be volatilisation to the atmosphere. However calculated relatively rapid photooxidation through reaction with the hydroxyl radicals present in the upper atmosphere, indicate that diazinon is unlikely to be subject to long range atmospheric transport.

A high acute, short and long term risk for insectivorous birds was identified in the first tier assessment for both evaluated uses. Based on actual measured concentrations of diazinon and degradation of residues in orchards the short and long term risk in apples/pears is considered low. However, the high acute risk remains. For sugar beet no valid residue data are available to refine the assessment. A high long term risk to insectivorous mammals was identified in both sugar beet and orchards. A risk for secondary poisoning was identified for earthworm- and fish-eating birds and mammals for the use in orchards and for earthworm-eating mammals for the use in sugar beet. Diazinon is very toxic to aquatic organisms. Risk mitigation measures comparable to 30 m buffer zones are required in orchards, and to 5 m in sugar beet. The toxicity to bees is high. Sugar beet is however not attractive to bees and application in orchards is late in the season after flowering. The risk to bees is therefore considered to be low. Non-target arthropods outside the field would be affected from the treatment in orchards. A potential for recolonisation has been shown in an aged residue study. However, a prerequisite for recolonisation from off-field non-target arthropod populations is that off-field populations are not affected. Therefore the risk to off-field non-target arthropods needs to be further addressed for the use in orchards. The acute risk to earthworms from diazinon and the soil metabolites is low and long term studies are not considered necessary. However, the risk to earthworms and other soil macro-organisms from the more persistent metabolite G 27550 needs to be addressed for a full conclusion. The risk to soil micro-organisms, non-target plants and biological methods of sewage treatment is considered to be low.

Key words: diazinon, peer review, risk assessment, pesticide, insecticide 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. Diazinon is one of the 52 substances of the second stage covered by the amended Regulation (EC) No 451/2000 designating Portugal as rapporteur Member State.

In accordance with the provisions of Article 8(1) of the amended Regulation (EC) No 451/2000, Portugal submitted the report of its initial evaluation of the dossier on diazinon, hereafter referred to as the draft assessment report, to the EFSA on 8 July 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 9 September 2005 to the Member States and the main applicant Makhteshim Agan 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 18 May 2005 on data requirements to be addressed by the notifier as well as issues for further detailed discussion at expert level. A representative of the notifier attended this meeting.

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

A final discussion of the outcome of the consultation of experts took place with representatives from Member States on 6-7 June 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 7 June 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 19 June 2006)

Given the importance of the draft assessment report including its addendum (compiled version of February 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

Diazinon is the ISO common name for *O*,*O*-diethyl *O*-(2-isopropyl-6-methylpyrimidin-4-yl)phosphorothioate (IUPAC).

Diazinon, belongs to the class of organothiophosphate insecticides and acaricides such as dimethoate and phosmet. It is a non-systemic insecticide/acaricide which works by contact, stomach and respiratory action. Its mode of action is cholinesterase inhibition after conversion to the oxygen analogue diazoxon.

The representative formulated product for the evaluation was Diazol 60EC, an emulsifiable concentrate (EC).

The evaluation of the representative uses is as an insecticide and acaricide with application via orchard air blast sprayers and tractor mounted hydraulic sprayers. Application is made to apples and pears with a maximum total dose of 2.7 kg diazinon per hectare and to sugar beet with a maximum total dose of 0.72 kg diazinon per hectare. It should be noted that the use in apples and pears were withdrawn during the EU peer review process.

SPECIFIC CONCLUSIONS OF THE EVALUATION

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

The minimum purity of diazinon as manufactured should not be less than 950 g/kg excluding the stabilizer, which is higher than the minimum purity given in the FAO specification 15/TC/S (1988) of 925 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. No data was available in the batch analysis data to show that this material can meet the FAO specification for acetone insolubles.

However, since clarification is required with respect to the specificity of the methods used for the analysis of the batch data and also TEPP and diazoxon are not in the current specification the specification for the technical material as a whole should be regarded as provisional.

The technical material contains O,S-TEPP[8]) and S,S-TEPP[9] which have to be regarded as relevant impurities. The FAO specification states the following maximum levels for technical material 0.2 g/kg O,S-TEPP and 2.5 g/kg S,S-TEPP (FAO 15/TC/S). It should be noted however that it is not clear if the mammalian toxicology data supports these limits see 2 below. In addition to this the technical material contains diazoxon which was detected in the 5 batch study at levels up to 0.07 % w/w and also TEPP[10] was analysed and was found at levels up to 0.007 % w/w. These have also to be considered as relevant impurities however, again it is not clear what maximum limits are supported by the data.

The content of diazinon in the representative formulation is 600 g/L (pure).

Beside the specification and relevant impurities, 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 dichlorvos or the respective formulation. However, the shelf life study where O,S TEPP and S,S-TEPP were analysed has not been to a meeting of experts and has not been peer reviewed. No storage, spectra or methods of analysis have been provided for the other two relevant impurities TEPP and diazoxon. The main data regarding the identity of diazinon and its physical and chemical properties are given in appendix 1.

[8] O,S-TEPP: O,O,O,O-tetraethyl-thiopyrophosphate
[9] S,S-TEPP: O,O,O,O-tetraethyl-dithiopyrophosphate
[10] TEPP: tetraethyl pyrophosphate

Sufficient test methods and data relating to physical, chemical and technical properties are available. Also adequate analytical methods are available for the determination of diazinon in the technical material and in the representative formulation as well as for the determination of the respective impurities in the technical material. Further data on the specificity for the significant non-relevant impurities is required. Methods of analysis in the formulation for TEPP and diazoxon are also required.
Therefore, some data are available to ensure that quality control measurements of the plant protection product are possible.

Adequate methods are available to monitor all compounds given in the respective residue for food of plant origin however, independent laboratory data are not available for pome fruit. GC-NPD/FPD are available to monitor residues of diazinon in products of animal origin.

Residues of diazinon in soil are analysed by LC-MS and GC-MS and GC-NPD methods are available for water. Air is analysed by GC-FPD, however further validation data are required at 35ºC and RH=80%.

The discussion in the meeting of experts (EPCO 35, September 2005) on identity, physical and chemical properties and analytical methods was limited to the specification of the technical material, addendum evaluation for some physchem properties.

2. Mammalian toxicology

Diazinon is an insecticide and acaricide acting by inhibition of the acetyl cholinesterase (AChE) activity. In September 2005 it was discussed at EPCO experts' meeting for mammalian toxicology (EPCO 33).
The purity of diazinon in toxicity batches was variable, ranging from 87 to 98%. The studies with batches of lower purity (MG-8, 87%) gave similar results to studies using higher purity batches. However, very toxic impurities (see 2.8) have been identified in the 5-batch analysis and not analysed in the toxicological batches. Consequently, a maximum level for these impurities cannot be determined in the technical material from the toxicological point of view.
EFSA notes that in order to confirm a threshold level for these impurities, the need of further tests with the current technical material should be considered (bridging studies).

2.1. Absorption, Distribution, Excretion and Metabolism (Toxicokinetics)

Diazinon is rapidly and nearly completely absorbed (>90% are found in urine within 24h). It is widely distributed, at low levels, and the highest concentrations were found in red blood cells, fat and ovaries. There was no evidence of accumulation, and diazinon is extensively metabolised. Hydrolytic and oxidative cleavage of the phosphorus ester bond, leading directly or via diazoxon to the metabolite G 27550[11], is the most significant and important pathway of metabolism. Metabolites maintaining the phosphorus ester (e.g. diazoxon) are of very transient nature and only observed in minor quantities (0.14% of the administered dose in urine). Two major metabolites are found in urine (M1 or G 27550 at 38.2%, and M2 or GS 31144[12] at 17.3% of the administered dose). Further conjugation to glucuronides leads probably to 6 aqueous soluble metabolites.

2.2. Acute toxicity

Diazinon has a higher toxicity after oral exposure than by dermal application or inhalation (oral LD_{50} 1139 mg/kg bw, dermal LD_{50} >2000 mg/kg bw, LC_{50} >5.0 mg/L/4h). The compound is slightly irritating to the skin and the eye, but not a skin sensitizer (Buehler test). Based on this, **the proposed classification is Xn; R22 "Harmful if swallowed".**

2.3. Short term toxicity

The short-term effects of diazinon were studied in one 28-day and one 90-day dietary studies in the rat, one 90-day and one 52-week dietary studies in the dog, one 21-day inhalation study in the rat and one 21-day dermal study in the rabbit. The main effect of diazinon is the inhibition of acetyl cholinesterase (AChE) activity. Secondary target organs are the liver and pancreas.

Thus, the relevant oral NOAEL is 0.02 mg/kg bw/day, based on a significant inhibition of the red blood cell AChE activity in the dog and rat studies.

For the inhalation study, the experts considered that the decreased brain AChE activity at the low dose level, even if not dose-related and in the absence of plasma AChE inhibition, could not be dismissed. Consequently no NOAEL by inhalation could be derived (< 0.00005 mg/L).

Considering the cut-off of 20% for brain cholinesterase inhibition as adverse effect, the experts agreed on a dermal NOAEL of 5 mg/kg bw/day in the rabbit study.

2.4. Genotoxicity

The purity of the test substance used in the genotoxic studies ranged from 88% to 97%. This was not discussed by the experts since the RMS indicated that they had checked the toxicological batches used in genotoxicity studies.

The mutagenic potential of diazinon was studied in bacteria and mammalian cells *in vitro* using two gene mutation assays and a chromosome aberration assay, and *in vivo* with a micronucleus test. Unscheduled DNA synthesis was also investigated *in vitro* with rat hepatocytes. Equivocal results were obtained in the *in vitro* mammalian chromosome aberration study with human lymphocytes, but were considered related to the cytotoxicity of the test material rather than to a direct genotoxic mechanism. The overall conclusion is that there is no genotoxic potential for diazinon.

[11] G 27550: 2-isopropyl-4-methyl-6-hydroxpyrimidine
[12] GS 31144: 2-(1-hydroxy-1-methyl)-ethyl-4-methyl-6-hydroxpyrimidine

2.5. LONG TERM TOXICITY

In the 2-year rat study, there was no clear evidence of treatment related gross or microscopic lesions and no evidence of treatment related carcinogenicity. The proposed NOAEL is 0.06 mg/kg bw/day, based on the inhibition of RBC and brain AChE.

A supplementary study with rats and mice is presented in the DAR as additional information, due to several deviations from the guideline (only two dose levels, no measurement of food consumption, no haematology data). In this study, the occurrence of haematopoietic tumours in the male rat and of liver tumours in male mice cannot be clearly related to the administration of diazinon in the diet. In addition, no tumour occurred at significant incidences in either female rats or female mice.

In conclusion, diazinon did not show any evidence of a carcinogenic effect.

2.6. REPRODUCTIVE TOXICITY

One two-generation study in the rat is presented in the DAR. The relevant parental and offspring NOAEL is 0.65 mg/kg bw/day, based on systemic effects at 7 mg/kg bw/day (decreased body weight and food consumption). The relevant reproductive NOAEL is 7 mg/kg bw/day, based on a reduced number of pregnancies and viable pups, as well as 2 females with dystocia at 35 mg/kg bw/day.

Two teratology studies in rat and rabbit are presented in the DAR. In the rat study, an increased incidence of a skeletal variant (rudimentary 14^{th} ribs) at 100 mg/kg bw/day was considered secondary to the maternal toxicity (reduced body weight gain). In the rabbit study, with a reduced number of litters available for assessment at 100 mg/kg bw/day due to maternal deaths, there was no evidence of teratogenicity. The overall relevant NOAEL for maternal and foetal toxicity is 20 mg/kg bw/day, from the rat study.

2.7. NEUROTOXICITY

Two acute delayed neurotoxicity studies with hens were performed with diazinon. In the first study, there was no clinical or histopathological evidence of delayed neurotoxicity at a dose exceeding the LD_{50} of 28 mg/kg bw. In the second study, diazinon does not inhibit the neuropathy target esterase (NTE) nor induce histopathological or behavioural changes indicative of organo-phosphorus induced delayed neuropathy (OPIDN), even at doses exceeding the LD_{50} of 50 mg/kg bw.

In an acute oral rat study, the proposed overall NOAEL is 2.5 mg/kg bw, based on brain/RBC/plasma AChE inhibition in females at 25 mg/kg bw.

In an acute cholinesterase inhibition study with rats, clinical signs of cholinergic poisoning were observed 3 h after oral administration of 600 mg/kg bw. The proposed overall NOAEL is 2.5 mg/kg bw, based on brain and RBC AChE inhibition.

In an acute oral neurotoxicity study with rats, the proposed overall NOAEL is 2.5 mg/kg bw, based on reversible neurotoxic effects (behavioural and physiological) and RBC AChE inhibition at doses $\geq$ 150 mg/kg bw.

In a 90-day neurotoxicity study with rats, the proposed NOAEL is 0.017 mg/kg bw/day, based on the inhibition of serum, RBC and brain AChE activity at doses $\geq$ 2 mg/kg bw/day.

2.8. FURTHER STUDIES

Metabolites

The toxicological significance of the groundwater metabolites G 27550 and GS 31144 was discussed by the experts. **G 27550** is a rat metabolite (M1, 38.2% identified in urine). In a rat acute inhalation study, the LC_{50} is >5.32 mg/L. In a 5-week oral study in rats, the proposed NOEL is <20 mg/kg bw/day, based on a decreased bodyweight gain. As regards **GS 31144**, it is also a rat metabolite (M2, 17.3% identified in urine), but no supplementary studies have been provided.
As both metabolites have no phosphate group, the experts considered that none of them will be AChE inhibitor. Since the inhibition of the AChE activity is the most sensitive endpoint, these metabolites are not considered toxicologically relevant.

Impurities

Three impurities were identified as of toxicological concern. Formed during prolonged storage under certain conditions, TEPP, O,S-TEPP and S,S,-TEPP are all very toxic in acute rat studies (respective oral LD_{50} are 0.8, 0.5 and 4.1 mg/kg bw).
In addition, it should be noted that diazoxon (rat metabolite) has also been identified in the 5-batch analysis of technical diazinon up to 0.07%. As oxons are generally more potent than the parent compound, diazoxon can be assumed to be of at least the same toxicity than diazinon which is considered to be harmful (Xn, R22 “Harmful if swallowed”). Diazoxon is therefore to be considered a relevant impurity.
As none of the four impurities were analysed in the toxicological batches, it is not demonstrated that the new technical specification is covered by the performed toxicological studies.
EFSA notes: the need of further tests with the current technical material should be considered in order to confirm a threshold level for these impurities (bridging studies).

Human studies

Four human studies were presented in the DAR and discussed by the experts. Two studies were considered as non acceptable, and the other two had scientific deficiencies. The issue within one acute human study was the inadequate technical specification (8% w/v diazinon was used). However, no clinically significant changes were observed in the 40 volunteers of the study. In addition, the proposed NOELs for plasma and RBC AChE inhibition were respectively 0.03 and 0.20 mg/kg bw.
In a second subchronic human study, four volunteers were administered 0.03 mg/kg bw/day for up to 31 days. No clinical signs were observed, the only effect was a decrease in plasma AChE activity to ca 50%, reversible within 2 weeks after treatment termination. Treatment did not affect erythrocyte AChE. As inhibition of plasma AChE is interpreted as a marker of exposure and not of toxicity, the proposed NOAEL is 0.03 mg/kg bw/day.
Both studies were considered as non acceptable for the derivation of reference values due to drawbacks.

2.9. MEDICAL DATA

No data on the monitoring of plant personnel were submitted in the DAR.
Reviews of poisoning incidents were published in the scientific literature and included in the dossier. General symptoms and signs of poisoning are typical of AChE inhibition.

2.10. ACCEPTABLE DAILY INTAKE (ADI), ACCEPTABLE OPERATOR EXPOSURE LEVEL (AOEL) AND ACUTE REFERENCE DOSE (ARFD)

The human studies were not considered appropriate for the derivation of reference values (see section 2.8).

ADI
For the derivation of the ADI, the experts confirmed the use of the NOAEL from the 90-day and 1-year dog studies (0.02 mg/kg bw/day) due to the higher sensitivity of this species, with the application of the safety factor 100. Therefore **the agreed ADI is 0.0002 mg/kg bw/day**.
AOEL
For the derivation of the AOEL, the experts confirmed the use of the NOAEL from the 90-day and 1-year dog studies (0.02 mg/kg bw/day) due to the higher sensitivity of this species. Initially in the DAR, the proposed safety factor was 50 due to the similar cholinesterase inhibitory response in humans compared to other animal species. However, the experts considered that a safety factor of 100 was more appropriate to derive the AOEL. As a result, **the agreed AOEL is 0.0002 mg/kg bw/day**.
ARfD
Based on the acute toxicity and neurotoxicity studies in rats, with a NOAEL of 2.5 mg/kg bw, **the agreed ARfD is 0.025 mg/kg bw**, with the use of a safety factor of 100.

2.11. DERMAL ABSORPTION

In the DAR, two *in vivo* studies with rats and humans were presented. The human study was considered not acceptable for calculation of skin absorption in man; the results of the rat study were used to derive the dermal absorption value. The initial proposal of the RMS included the skin rinse and the amount into the skin, which resulted in a value of ~70% as a worst-case. In the meantime, new *in vitro* rat/human and *in vivo* rat dermal absorption studies were performed and submitted in an addendum for the experts' meeting.
In both experiments, the formulation Diazol 60EC was applied at two concentrations, equivalent to the commercially supplied concentrate and to the in-use application rate of the product. The proposed dermal absorption of 1.7% for the concentrate was confirmed by the experts. For the dilution, the proposed value of 6.5% was increased to 40% in order to compensate for the low recovery of radioactivity.
EFSA notes: A study demonstrating that this loss was due to volatilisation of diazinon has not been submitted to the RMS. It can be provided at a member state level, but it will probably be insufficient to demonstrate an exposure below the AOEL (see 2.12).

2.12. EXPOSURE TO OPERATORS, WORKERS AND BYSTANDERS

The representative plant protection product Diazol 60EC is an emulsifiable concentrate (EC) containing 600 g diazinon/L. The uses supported initially were sugar beets, apples and pears, but the use in pome fruit was no longer supported during the peer-review. The estimations were presented for both uses, but were not discussed by the experts for the application in apples and pears.

Operator exposure

During the **use on sugar beet**, the maximum applied dose is 360 g a.s./ha and the minimum volume 500 L/ha. The mode of application is tractor mounted/trailed boom sprayer (for field crop).
According to the results presented in a corrigendum (February 2006), the estimated operator exposure is above the AOEL, with or without PPE, according to the German model (work rate 20 ha/day) as well as the UK POEM model (work rate 50 ha/day).

Estimated exposure presented as % of AOEL (0.0002 mg/kg bw/day), according to calculations with the German and UK POEM model. The default for body weight of operator is 70 kg in the German model and 60 kg in the UK-POEM model.

Model	No PPE	With PPE:	With PPE+RPE:
German	44,145	not applicable	2,700
UK POEM	88,500	13,710	not applicable

PPE (personal protective equipment): gloves during mix/loading and application.
PPE+RPE (respiratory protective equipment): gloves during mixing/loading and application, standard protective garment and sturdy footwear during mix/loading and application, broad-brimmed headgear of sturdy fabric during application and half-mask with combination filter A1P2 during mix/loading and application.

The results of exposure estimates for the **use on apples and pears** were not discussed by the experts, but also presented by the RMS in the corrigendum (February 2006). The maximum applied dose is 900 g a.s./ha and the application volume 1500 L/ha. The mode of application is tractor mounted/trailed broadcast air-assisted sprayer (for high crop). The results are presented in the following table:

Estimated exposure presented as % of AOEL (0.0002 mg/kg bw/day), according to calculations with the German and UK POEM model. The default for body weight of operator is 70 kg in the German model and 60 kg in the UK-POEM model.

Model	No PPE	With PPE:	With PPE+RPE:
German	239,625	not applicable	29,865
UK POEM	248,150	172,325	not applicable

PPE (personal protective equipment): gloves during mix/loading and application.
PPE+RPE (respiratory protective equipment): gloves during mixing/loading and application, standard protective garment and sturdy footwear during mix/loading and application, broad-brimmed headgear of sturdy fabric during application and half-mask with combination filter A1P2 during mix/loading and application.

Pesticide exposure studies to mixers/loaders and applicators during typical application of Diazol 60EC in Spain were performed in 2001. The applications were made to apple and pear orchards, with a limited number of test subjects, and confirmed a level of exposure above the AOEL (9,000% of the AOEL with closed cabin applications, and 36,000% of the AOEL with open cabin applications).
A field study with application of liquid diazinon to residential turf was considered as additional since the type of application (hand-held) is far from the usual diazinon applications.

Worker exposure
According to the exposure model proposed by Krebs et al (1996), the estimated exposure for workers entering sugar beet crops would be approximately 353% of the AOEL when no PPE are used; and 108.5% of the AOEL when gloves, long sleeved shirt and long trousers are worn.
For the use on pome fruits crops, not discussed by the experts, the estimated worker exposure is 2221.7% of the AOEL when no PPE are worn, and 111% of the AOEL with gloves, long sleeved shirt and long trousers (cfr corrigendum, February 2006).

Bystander exposure
Estimated exposure to bystanders was made according to an UK model[13] for field crop sprayers. Based on the 40% dermal absorption and assuming a body weight of 70 kg the estimated acute exposure of a bystander is approximately 126.5% of the AOEL from a treatment in sugar beet (and 3913.57% of the AOEL from a treatment in apple and pears).
Since the predicted air concentration of diazinon was estimated to be greater than concentrations at which effects were seen in repeat dose studies, a new data requirement was set for the notifier to address potential risks to bystanders through inhalation exposure.
EFSA notes: As the NOAEL by inhalation is low (<0.00005 mg/L), the predicted exposure levels of bystanders by inhalation will probably be above the AOEL.

3. Residues

Diazinon was discussed at the EPCO experts' meeting for residues (EPCO 34) in September 2006.

3.1. Nature and magnitude of residues in plant

3.1.1. Primary crops

The metabolism of diazinon has been investigated in apples, potatoes, sweet corn, lettuce and green beans, after foliar spraying. In all crops but apples, an initial treatment consisting in soil broadcast pre-emergence spraying had been performed. In all plant species the main biotransformation pathways were qualitatively similar and consisted in a cleavage of the phosphorothioate ester bond of the parent compound leading to G 27550, followed by oxidation of the isopropyl and methyl

[13] Lloyd and Bell, 1983. Hydraulic nozzles: comparative spray drift study.

functional groups leading to the corresponding alcohols: CL-XIX-29[14], GS 31144, JAK-III-57[15], further conjugated to glucose. Diazoxon was not observed. All the identified metabolites were present in the rat metabolism, and, given their structure, are supposed to have lost the anticholinesterase activity of the parent compound. The amount of metabolites present was quite variable from crop to crop. Only in apples diazinon was clearly the major constituent of the residue, while in other crops individual metabolites were present in similar or higher amounts than the parent compound. The proposed residue definition for both monitoring and risk assessment is diazinon.

A sufficient number of supervised residue trials were submitted in accordance with the supported representative uses. In pome fruits, 6 trials on apples and 2 trials and pears were conducted in Southern Europe leading to a STMR (Supervised Trial Median Residue) of 0.12 mg/kg and a HR (Highest Residue) of 0.4 mg/kg. In sugar beets, 4 trials were available, with all results below the LOQ (Limit of Quantification) of the method of analysis used (0.01 mg/kg). residues in tops and leaves ranged from 0.02 to 0.06 mg/kg. These results are supported by storage stability studies demonstrating that diazinon is stable in various crop substrates (corn grains, corn oil, tomatoes, potatoes, apples, lettuce, soybean, tomato paste, sugar beet molasse) for at least 24 months. Only in strawberries a progressive degradation was observed along time.

The effects of processing on the nature of the residues were investigated through hydrolysis studies simulating sterilisation, baking, boiling and pasteurisation. These studies showed that diazinon is significantly degraded under processing, to an extent depending on the severity of the conditions (40% under pasteurisation, 60% under boiling, 90% under sterilisation). The degradation products formed were identified as G 27550 and desethyl diazinon. Given its structure, desethyl diazinon needs to be considered as a cholinesterase inhibitor. Its relative amount in comparison to the parent compound is significant in case of processing involving sterilisation. Its inclusion in the residue definition for risk assessment is recommended for processed commodities.

One study was conducted in order to determine the transfer of residues in apple processed commodities. In this study only residues of diazinon were analysed in raw apples and processed fractions. It was shown that no residues of diazinon were to be found in canned juice and apple sauce, suggesting very low transfer factors (less than 0.01) for the parent compound in these commodities. In the same study, the transfer factor of diazinon into dry apple pomace was 0.5. The levels of desethyl diazinon were not determined in this study, and the presence of this compound in significant amounts in juice and sauce cannot be excluded, given the information provided by the hydrolysis studies. Therefore, the relevance of this study for conducting risk assessment is very limited, and in the absence of adequate information on the transfer and presence of residues of diazinon and desethyl diazinon in processed commodities (at least 1 balance and 3 follow-up studies are in principle needed), no processing factor should be used for refinement of intake calculations.

3.1.2. SUCCEEDING AND ROTATIONAL CROPS

The DT_{90} of diazinon in soil under field conditions is shorter than 100 days. In addition its main metabolite is G 27550, resulting from the hydrolysis of the phosphorothioate ester bond, with no

[14] CL-XIX-29: 2-(1-hydroxymethyl)-ethyl-4-methyl-6-hydroxypyrimidine

[15] JAK-III-57: 2-isopropyl-4-hydroxymethyl-6-hydroxypyrimidine

expected anticholinesterase inhibition potential. Therefore, no studies investigating the transfer of residue from soil to following crop is necessary. However a field study conducted under climatic conditions in the USA was submitted. Rotational crops of lettuce, turnips and wheat were planted 30, 60 and 180 days after the last of 1 broadcast/preplant and 5 on crop foliar applications of a primary crop. Under these conditions which are much more critical than the representative use on sugar beets, no residues of diazinon, diazoxon and CGA 14128[16] were found in any of the rotational crops (LOQ was 0.01 mg/kg).

Therefore, no MRL for following crops and no plant-back restriction are needed for the supported representative uses of diazinon.

3.2. NATURE AND MAGNITUDE OF RESIDUES IN LIVESTOCK

Metabolism studies of diazinon in lactating goats and laying hens were submitted.

In lactating goat the compound is extensively metabolised and the main metabolic pathway proceeds through cleavage of the ester bond leading to GS 31144 and G 27550, found as the major metabolites in edible tissues. Only fat presented a specific residue pattern, with diazinon, due to its fat solubility, representing 60-70% of the TRR. Minor amounts of 2 metabolites with intact ester bound and to be considered as cholinesterase inhibitors were found in most tissues (diazoxon and CGA 14128). Diazinon behaves as a fat soluble compound but no sign of accumulation was observed.

An extensive degradation of diazinon also occurs in laying hens, and major metabolites identified were GS 31144, G 27550 and CL-XIX-29. Low amounts of parent compounds and of its structurally closely related metabolites diazoxon and CGA 14128 were observed. In meat and egg yolks in particular, diazoxon was present at significantly higher levels than diazinon.

The proposed residue definition for animal matrices is diazinon, for both monitoring and risk assessment purposes. This proposal does not apply to poultry as the exposure of poultry is below the trigger value justifying the establishment of a residue definition. The inclusion of diazoxon and CGA 14128 in the residue definition for risk assessment to take into account their contribution to the toxicological burden does not seem justified given that, based on the representative uses, the actual consumer exposure is expected to be extremely low. This should be reconsidered in case of higher exposure of livestock resulting from other uses of diazinon.

The potential exposure of livestock, taking into account possible use levels of apple pomace and sugar beets by-products in livestock diet, was estimated to range between 0.1 to 0.5 mg/kg dry diet for cattle and pigs, and around 0.01 mg/kg dry diet for poultry. A feeding study in diary cows is available, conducted with an exposure rate of 40 mg diazinon/kg which is about 2 orders of magnitude higher than the actual exposure rate. Under these conditions, measurable levels of diazinon were present in fat only (0.02 to 0.04 mg/kg). Residues in other tissues and in milk were below 0.01 mg/kg. Therefore it can be concluded that under practical conditions, no residues of diazinon above a LOQ of 0.01 mg/kg are expected in any animal commodities.

[16] CGA 14128: *O*,*O*-diethyl-*O*-(2-[2-hydroxy-2-isopropyl]-6-methyl-4-pyrimidyl)phosphorothioate

3.3. CONSUMER RISK ASSESSMENT

Chronic exposure

The chronic dietary exposure assessment has been carried out according to the WHO guidelines for calculating International or National Estimated Daily Intakes (I(N)EDI). Three consumption patterns were considered: the WHO European typical diet for adult consumers, the diets of UK for infants, toddlers, child and adult populations, which take into consideration high individual consumption levels (at the 97.5th percentile of the distribution of consumptions in the respective populations) and the Portuguese diet for adult consumers.

For these calculations, residues in apples and pears were assumed to be at the level of STMR determined on the basis of the supervised residue trials. No processing factor was used for the reasons mentioned under point 3.1.1. Potential residues resulting from the use in sugar beets were not considered by the RMS as they are below the LOQ of 0.01 mg/kg in roots, and therefore not expected to be of significance for the consumer through the consumption of sugar. No exposure resulting from the consumption of animal commodities was considered as the exposure of animals to diazinon residues is low and the resulting transfer to edible animal commodities as determined by feeding studies is not significant.

These calculations indicated that the chronic exposure to diazinon residues was below the ADI only for adults with an average consumption of pome fruits. For other groups of consumers, the ADI is exceeded. In particular, for toddlers in UK, with a high consumption of pome fruits, the exposure reaches 900% of the ADI.

Acute exposure

The acute exposure to residues of diazinon in apples and pears has been assessed according to the WHO model for estimates of short term intakes. Large portion consumption data for various population groups (infants, toddlers, children, adults) in UK were used. Calculations were carried out by the RMS considering residues in composite samples of treated apples and pears at the level of the HR of the supervised residue trials (0.4 mg/kg) as well as high unit to unit variability (variability factor of 7). Other calculations using the same methodology were carried out by the EFSA, considering the level proposed as MRL (0.5 mg/kg). Both calculations showed exceedence of the ARfD (between 140 and 200 % of the ARfD) for toddlers and infants consuming apples and pears.

3.4. PROPOSED MRLS

Based on the results of supervised residue trials on apples and pears and their analysis according to statistical tools recommended by current guidelines a MRL of 0.5 mg/kg for residues of diazinon on pome fruits would be needed to accommodate the representative use. For animal products (except poultry) it is proposed to set the MRL at the level of the LOQ (0.01* mg/kg).

However, as indicated under point 3.3, the use in apples causes a concern for the safety of the consumer on both chronic and acute levels.

4. Environmental fate and behaviour

The fate and behaviour in the environment of diazinon was discussed in the experts' meeting (EPCO 31) of September 2005 on basis of the addendum to the DAR and corrigendum to the DAR both dated July 2005.

4.1. Fate and behaviour in soil

4.1.1. Route of degradation in soil

Soil experiments (5 different soils) were carried out under aerobic conditions in the laboratory (20-25°C 30-75% field capacity (FC) or pF 2 (-10kPa) soil moisture content in the dark. The formation of residues not extracted by acetonitrile:water or methanol:water were a sink for the applied pyridine ring-^{14}C-radiolabel (9-38% of the applied radiolabel (AR) after 76-119 days). Mineralisation to carbon dioxide of the radiolabel accounted for 5.8-86 % AR after 76-119 days. The major (>10AR) extractable breakdown product present was G 27550 (max. 49-82%AR at 14-65 days. Another extracted identified breakdown product GS 31144 accounted for a maximum of 4.7 %AR though in the soils were it was present concentrations were still increasing at the end of the studies (76-119 days).

Under dark laboratory anaerobic conditions in soil, the degradate pattern was the same as described above for aerobic conditions. In a laboratory soil photolysis study no novel photodegradation products were identified, though the degradation of parent diazinon was ca. four times faster in irradiated samples (autumn sunlight 39 or 43°N) than in the dark controls.

4.1.2. Persistence of the active substance and their metabolites, degradation or reaction products

The rate of degradation of diazinon was estimated from the results of the studies described in 4.1.2 above. DT_{50} were: 8-23 days (single first order 20°C -10kPa soil moisture 3 different soils), 4.5-5 days (2 compartment model 20°C 60%FC soil moisture 1 soil, first order non linear regression value estimated by the EFSA 5.5 days (r^2=0.98-0.99)) and 11 days (graphical estimate 25°C 75%FC soil moisture 1 soil). Excluding the graphically estimated value that the experts from Member States agreed had high uncertainty due to the sampling interval in the study design, after normalisation to FOCUS reference conditions[17] (20°C and -10kPa soil moisture content) this range of single first order DT_{50} (from 4 different soils) becomes 3.8-23 days (arithmetic mean 11.2 days geometric mean that is appropriate for use in FOCUS modelling 9.1 days).

The major (> 10 %AR) degradation product, G 27550 was applied as test substance to 3 soils and incubated in the laboratory (aerobic dark 20°C pF 2 (-10kPa) soil moisture content conditions). Single first-order DT_{50} values from these studies were calculated to be 124, 124 and 131 days. In one of the soils where parent diazinon was dosed (20°C 60%FC soil moisture) a single first order DT_{50} of 20 days was calculated for G 27550 by the applicant, from the 4 available data points in the decline

[17] Using section 2.4.2 of the generic guidance for FOCUS groundwater scenarios, version 1.1 dated April 2002.

phase of the metabolite (days 21, 35, 65 and 119). The EFSA considers this estimate unreliable as there were too few data points in the decline phase available to carry out this estimation. The value was not used in subsequent exposure assessments. The appropriate value to use for this metabolite in FOCUS modelling is a geometric mean value of 126.3 days (studies were carried out under FOCUS reference conditions).

In this laboratory study where G 27550 was applied as test substance to 3 soils levels of the metabolite GS 31144 were determined and a kinetic analysis using ModelMaker (v. 4) with a 3 compartment model was used (G 27550 to GS 31144 and sink + GS 31144 to sink) to calculated single first order DT_{50} values for this minor metabolite. These values for 2 of the soils were 155 and 179 days (r^2=0.998 and 0.999) with the associated calculated kinetic formation fractions from G 27550 being 11.3 and 16.6% respectively. For the third soil the model could not find a solution. The appropriate values to use for this metabolite in FOCUS modelling is the longest value of 179 days with its associated kinetic formation fraction of 16.6%. (The study was carried out under FOCUS reference conditions).

Field soil dissipation studies were provided from 4 sites in Germany. Using the residue levels of parent diazinon determined in the 0-20cm deep soil layer, single first order DT_{50} calculated by the EFSA using non linear regression were 7.5-29.3 days (r^2=0.92-0.98)

The longest available laboratory diazinon single first order soil DT_{50} of 23 days was used in PEC soil calculations. Experts from the Member States did not object to the use of this value, although usually when reliable field studies are available (as is the case for diazinon) the longest field value would be used as the basis for calculations. For the major soil metabolite G 27550 PEC soil calculations were carried out using the appropriate (longest) laboratory single first order DT_{50} of 131 days, however the calculation presented did not take into account potential accumulation (DT_{90} 435 days) from use in successive years. There is therefore a data gap for this calculation for the intended uses on pome fruit. For sugar beet this accumulated PEC soil would need to be made in national assessments if there are any Member States where crops of sugar beet can be grown in the same field in successive years. (Usual good agricultural practice is for sugar beet to be grown in rotation with other crops, in this situation accumulation of G 27550 will not occur).

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

The adsorption / desorption of diazinon was investigated in four soils in satisfactory guideline batch adsorptions experiments. Calculated adsorption $K_f$oc values varied from 413 to 760 mL/g, (mean 643 mL/g) (1/n 0.82 – 0.90, mean 0.86). There was no evidence of a correlation of adsorption with pH.

The adsorption / desorption of G 27550 was investigated in three soils in guideline batch adsorptions experiments. Calculated adsorption $K_f$oc values were 6.3 mL/g (1/n= 0.86) and 6.7 mL/g, (1/n= 0.86), in the third soil as the 1/n calculated was 0.36 ($K_f$oc 4.1 mL/g) this value was excluded from use in

FOCUS modelling and the most conservative of the remaining values (6.3 mL/g, 1/n= 0.86) was agreed for use as modelling input. There was no evidence of a correlation of adsorption with pH.

As a minor metabolite experimental adsorption data were not provided for GS 3114. An estimate of adsorption was made using quantitative structure activity relationship (QSAR) software PCKOC (v1.66;US EPA, 2001). The value calculated was K_{doc} of 10.2mL/g.

The available column leaching studies and aged soil column leaching studies confirmed the picture of potential soil mobility of the batch adsorption studies with parent diazinon being a minor component column leachate with a large proportion of radioactivity in leachate identified as G 27550.

An outdoor lysimeter study carried out in Germany (northern Europe) with an amount of applied diazinon reaching the soil higher (4N, 4x0.24 kg a.s./ha with [18]70% crop interception) than the applied for intended use (2 x 0.36 kg a.s./ha that is only in southern Europe late in the season (after BBCH 39) when 90%crop canopy interception is expected) is available. In this experiment that may represent more worst case conditions than the applied for intended use (exaggerated dosing rate and possibly lower soil temperatures than occur in southern Europe) annual average leachate concentrations of parent diazinon were up to 0.07 µg/L in one of the duplicate lysimeters and not detected in the other one. Maximum annual averages for G 27550 and GS 31144 were 1.02 and 0.27 µg/L respectively. The experts from Member States did not necessarily agree with the position of the applicant and the view of the RMS that because of the atypical rainfall pattern over the duration of the lysimeter study, the results of the study were not relevant for use in a groundwater exposure assessment for the applied for intended use on sugar beet in southern Europe. The experts agreed a more detailed assessment of rainfall patterns across southern Europe and a detailed modelling of the lysimeter study would be required before the position of the applicant could be confirmed. Member state experts agreed the results of the lysimeter study (noting an exaggerated soil dose was probably achieved, ca. 4N in the study) should be considered in combination with the outcome of appropriately carried out FOCUS groundwater modelling. At this stage it could not be agreed that the climate (in particular precipitation + irrigation and recharge) over the duration of the study was not representative of southern European conditions.

4.2. FATE AND BEHAVIOUR IN WATER

4.2.1. SURFACE WATER AND SEDIMENT

Diazinon was essentially stable under sterile hydrolysis conditions at 25°C at pH 7 and 9. At pH 5 a single first order DT_{50} of 12 days was calculated. The metabolite G 27550 was the major breakdown product formed and this was stable to further hydrolysis.

[18] Using table 1.6 of the generic guidance for FOCUS groundwater scenarios, version 1.1 dated April 2002 for BBCH 31-35.

The aqueous photolysis of diazinon investigated under sterile pH 7 conditions, indicated the rate of degradation was slower than under dark microbially active conditions (single first order laboratory DT_{50} equated to summer sunlight at 39°N with a 12 hour photoperiod was 50 days. The only major (>10%AR) metabolite formed in the study was G 27550. Photolysis is not expected to be a significant route of dissipation of diazinon in the environment as biodegradation is more rapid.

A ready biodegradability test (OECD 301B) indicated that diazinon is 'not readily biodegradeable' using the criteria defined by the test.

In water-sediment studies (2 systems studied at 20°C in the laboratory, sediment pH 7.1-7.9, water pH 7.7-8.4) diazinon demonstrated low persistence in both the water phase (single first order DT_{50} 3.9-4.7 days) and in the total system (single first order DT_{50} 8.9-11.8 days). The metabolite G 27550 (max. 20.2-47 % AR at 30 days after treatment) was detected in the water phase and was estimated to dissipate with a single first order DT_{50} of 87 days. The terminal metabolite, CO_2, accounted for only 4.7-5.1 %AR by 100 days. Residues not extracted from sediment by acetonitrile and acetonitrile:water were a significant sink representing 23-49%AR at study end (100 days). The major (>10%AR) residue in sediment extracts were parent diazinon (max. 37.8-42%AR at 3 days) and G 27550 (max. 17.4-22.7%AR at 30-59 days) for which single first order DT_{50} in sediment of 11.6-15.2 days and 49 days respectively were estimated.

The available surface water exposure assessment just considered the spray drift route of entry to surface water. The potential exposure of surface water from parent diazinon and the major soil metabolite G 27550 via the drainage and runoff routes of entry has not been assessed in the available EU level exposure assessment. Member States should therefore carry out a surface water exposure and consequent aquatic risk assessment for diazinon and G 27550 from the runoff and drainage routes of exposure at the national level, should diazinon be included in Annex 1.

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

A satisfactory FOCUS groundwater assessment is not available for diazinon. This is therefore a data gap. In any new modelling that is provided the following substance properties should be used: diazinon single first order DT_{50} 9.1 days, K_{foc} 643 mL/g (K_{fom} 373 mL/g), 1/n=0.86; G 27550 single first order DT_{50} 126.3 days, formation fraction from diazinon 100%, K_{foc} 6.3 mL/g (K_{fom} 3.65 mL/g), 1/n=0.86; GS 31144 single first order DT_{50} 179 days, formation fraction from G 27550 16.6%, K_{foc} 10.2 mL/g (K_{fom} 5.9 mL/g), 1/n=1.0.

Based on the available FOCUS PEARL 1.1.1 modelling where just the applied for use on sugar beet was considered, where the K_{fom} values used as input were completely inappropriate (provide a too favourable assessment) it is clear that the metabolite G 27550 will be present in leachate leaving the top 1m soil layer at annual average concentrations above 0.75µg/L. For GS 31144 it is clear these concentrations will be > 0.1µg/L and it cannot be excluded that concentrations could be >75µg/L. Parent diazinon is unlikely to exceed 0.1µg/L, however this need to be confirmed.

Modelling should have been provided for all the applied for intended uses.

4.3. FATE AND BEHAVIOUR IN AIR

The vapour pressure of diazinon (1.197×10^{-2} Pa at 25°C) means that diazinon would be classified under the national scheme of The Netherlands as moderately volatile, indicating losses due to volatilisation would be expected. Based on the results of a laboratory study on 2 soils, it was estimated that 3-10% of diazinon present in the 0.5-1cm depth soil layer would evaporate from wet soil in 24 hours. Based on the results of a controlled atmosphere experiment on maize plants, it was estimated that up to 50% of the measured radioactivity (from the radiolabelled diazinon applied) on the plants 15 minutes after application was lost within 24 hours. This loss is the sum of volatilisation and any potential plant metabolism. Therefore losses of diazinon to the atmosphere will occur. Calculations using the method of Atkinson for indirect photooxidation in the atmosphere through reaction with hydroxyl radicals resulted in an atmospheric half life estimated at 1.33 hours (assuming an atmospheric hydroxyl radical concentration of 1.5×10^{6} radicals cm^{-3}) indicating the volatilised diazinon would be unlikely to be subject to long range atmospheric transport.

5. Ecotoxicology

Diazinon was discussed at the EPCO experts' meeting for ecotoxicology (EPCO 32) in September 2005.

It should be noted that the actual concentration of the toxicologically relevant impurities TEPP, O,S-TEPP, S,S,-TEPP and diazoxon in the batches used in the ecotoxicological tests is unknown.

5.1. RISK TO TERRESTRIAL VERTEBRATES

Studies with the technical material are available to assess the acute, short term and long term risk to birds. However, no bird acute toxicity study with the formulation is available. This is required when TER_a or TER_{st} is between 10 and 100. Studies on mammalian toxicology do however not indicate that the formulation is significantly more acutely toxic than what is expected from the content of diazinon. Therefore, and for animal welfare reasons, no further studies with birds were required.

The representative evaluated use of diazinon is as insecticide and acaricide in apple/pear orchards or in sugar beet in southern Europe. It was agreed by the Member State experts that due to the late application in sugar beet only insectivorous birds were of concern for both uses.

The first tier risk to a generic insectivorous species in sugar beet and orchards was calculated in the DAR with endpoints for short and long term based on concentration in food. All TER values were below the relevant Annex VI triggers. In addendum 1 of July 2005 TER values based on endpoints calculated as daily dose according to SANCO/ 4145/2000 are presented. The TER values are 0.07, 0.74 and 0.11 for acute, short term and long term respectively in sugar beet and hence clearly below the Annex VI trigger values. Corresponding TER values calculated in the same way for orchards are 0.03, 0.29 and 0.04. Only one application was considered since it is assumed that residues would have degraded before next treatment.

For orchards the assessment was refined based on measured residues in field trials in apple orchards. The resulting TER values are 6.8, 38 and 6 for acute, short- and long-term respectively, thus still indicating an acute risk.

The RMS proposed to refine also the assessment for birds in sugar beet based on residue data from the field trials conducted in apple orchards in Pennsylvania and Washington. The meeting did not accept the residue data. The extrapolation of residues on insects in orchards to that in sugar beet was questioned. There was also concern that the data were from bird crops, and hence would have been biased by the choice of bird species as well as the habitat treated. Hence the risk to insectivorous birds in sugar beet need to be further addressed.

Since application in sugar beet is at a late growth stage only insectivorous mammal were considered as relevant and assessed in the DAR, although insectivorous mammals is not a standard scenario for orchards. The acute risk to insectivorous mammals is considered to be low both in sugar beet and orchards. The long-term TER values for insectivorous mammals were calculated in DAR by comparing with the NOEC (ppm in food) obtained in the rat multigeneration study. The TER for sugar beet was 9, while the TER for orchards was 3.5, indicating a potential risk. However, if the TER values are calculated by using the toxicity endpoint recalculated to a daily dose, values clearly below the trigger are obtained (0.56 for sugar beet and 0.22 for orchards). Thus the long-term risk to insectivorous mammals needs to be further addressed. It should be noted that in a terrestrial mesocosm study[19], that was not part of the dossier for the diazinon, effects on ecological relationships and reproduction in both herbivorous and omnivorous small mammals were observed at an application rate of 0.56 kg a.s./ha..

The risk to birds via exposure to contaminated drinking water was assessed based on the PEC in surface water. All TER values were $>10^6$. The assessment was discussed by the member state experts and it was concluded that for the evaluated uses in southern MS exposure via contaminated drinking water is not an issue. No assessment of risk from exposure via drinking water was presented for mammals but it can be assumed that as for birds the risk is low if surface water is considered.

[19] Sheffield SR and Lochmiller RL, ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY 20, 284-296 (2001). Effects of field exposure to **diazinon** on small mammals inhabiting a semienclosed prairie grassland ecosystem. I. Ecological and reproductive effects

The $logP_{ow}$ for diazinon is 3.3 - 3.8 and hence the potential for bioaccumulation and secondary poisoning was estimated according to SANCO/4145/200. In addendum 1 (July 2005) an incorrect NOEL value for birds was used in the calculation. If the correct value of 1.2 mg/kg bw/day is used TER values of 1.7 and 11.3 are obtained for earthworm eating birds in orchards and sugar beet respectively. For earthworm eating mammals the TER values are 0.74 and 4.9. For fish eating birds the TER values are 0.95 and 11.4 in orchards and sugar beet respectively, and for fish eating mammals the values are 0.82 and 10. Thus the risk to earthworm- and fish-eating birds and mammals in orchards and to earthworm-eating mammals in sugar beet is considered as high and needs to be further addressed.

5.2. Risk to aquatic organisms

Based on the available acute toxicity data, diazinon is classified as very toxic to aquatic organisms, with an EC_{50} of 0.41 µg/L for *Ceriodaphnia dubia*, the most sensitive species tested. The formulations 'Diazol 60 EC' was not more toxic to *Daphnia magna* than expected based on the content of diazinon.

The first tier acute TER values, based on PEC_{sw} from spray drift of one application, are far below the Annex VI trigger for aquatic invertebrates even considering buffer zones of 40 m for orchards and 10 m for sugar beet.

One mesocosm and one microcosm study, both including fish, were discussed in the experts' meeting. It was noted that no NOEC was derived from any of the studies. Recovery occurred within 10 weeks in the mesocosm study but there was no recovery of Cladocerans and fish in the microcosm study. The mesocosm study was seen as worst case since six applications were done as opposed to two for sugar beet and 3 for orchards. The meeting therefore proposed an uncertainty factor of 1 for the NOAEAC of 2.4 µg/L. However, the meeting requested that the recovery of Cladocerans to control levels within 8 weeks should be confirmed with graphical data. It was pointed out that in northern Europe species may not recover in the time period of the study and hence the conclusion from the mesocosm study only applies to southern MS. Concerns were also expressed about exposure due to run-off at times of peak rainfall in southern MS, an assessment for this situation is not available (see section 4.2.1).

Based on the NOAEC and PEC_{sw} from spray drift of one application TER values of 3.5 and 1.5 were derived for sugar beet and orchards respectively, with 5 and 30 m buffer zones. This means that for the use in orchards risk mitigation measures have to be applied to protect aquatic organisms.

Diazinon and the metabolite G 2755 were detected in sediment at concentrations >10% of applied in the water/sediment studies. The impact on sediment dwelling organisms is considered to be covered by the micro- and mesocosm studies.

The BCF for diazinon was estimated to 500. Residues after 14 days were however ≤1%.

The metabolites G 27550 and G 31144 are of low toxicity to fish, *Daphnia* and algae

5.3. RISK TO BEES

The oral and contact toxicity to bees is high. HQ values for sugar beet are 4000 and 2769, and for apples/pears 10000 and 6923. An aged foliar residue study where Diazol 60 EC was applied to broad beans is summarised in addendum 1 of July 2005. No effects were observed on foraging bees directly after spraying 468 g a.s./ha. Following application of 1170 g a.s./ha mortality was 73.6%. After three days of ageing the effect of the residues had decreased to 15%.

The risk to bees from the evaluated uses was discussed by the Member State experts. Sugar beet does not flower and is therefore not attractive to bees. Application in orchards is late in the season after flowering. The meeting therefore agreed that the risk to bees is low.

5.4. RISK TO OTHER ARTHROPOD SPECIES

Tests on terrestrial arthropods were conducted with the formulations Diazol 60EC. Of the two standard species *Aphidius rhopalosiphi* was the most sensitive. Effects on *Typhlodromus pyri* were significantly lower. First tier hazard quotients (HQ) for in-field and off-field, calculated according to ESCORT II for *A. rhopalosiphi* are 7647 and 842 in orchards, and 3059 and 72.8 in sugar beet. The HQ values for *T. pyri* were below the ESCORT II trigger of 2 for both in-field and off-field.

Extended laboratory studies are available with the standard species *A. rhopalosiphi*, *T. pyri*, the leaf dwelling *Chrysoperla carnea* and the soil dwelling *Aleochara bilineata*. For all species tested except *T. pyri* 100% mortality was observed at dose rates corresponding to in field dose rates for field crops (2 applications of 0.36 kg a.s./ha with 14 days interval) and for orchards (3 applications of 0.9 kg a.s./ha with 14 days interval). At dose rates corresponding to drift at 1 m from a treated sugar beet field and 10 m from a treated orchard, effects on mortality and fecundity were <50% for all species tested. Effects on mortality and fecundity decreased to <50% after 14 days ageing of residues for *A. rhopalosiphi* and *T. pyri*. Effects were <50% for *C. carnea* if residues had been aged for 28 days before exposure. It can be concluded that potential for recovery in-field exists. However, a prerequisite for recolonisation from off-field non-target arthropods populations is that off-field populations are not affected. Therefore the risk to off-field non-target arthropods from the use in orchards needs to be further addressed.

5.5. RISK TO EARTHWORMS

Acute toxicity studies with earthworms are available for diazinon, the major soil metabolite G 27550 and the minor soil metabolite GS 31144. The LC_{50} values obtained in the studies were compared to maximum PEC in soil. For orchards 3 applications of 0.9 kg a.s./ha with 80% plant interception was assumed, and for sugar beet 2 applications of 0.36 kg a.s./ha with 90% plant interception. Corrections for degradation between applications were made based on a diazinon DT_{50} of 23 days. The acute TER values obtained for diazinon are 124 and 812 for orchards and sugar beet respectively, hence indicating a low risk. In field studies slightly longer diazinon soil DT_{50}, up to 29 days were estimated, even taking this slightly longer DT_{50} into account the risk would still be considered low. The metabolites are less acutely toxic compared to diazinon.

No long-term/reproductive studies are available. The DT_{90} in soil for diazinon is <90 days and since a maximum of three application per season are proposed no long-term study is required. For the metabolite G 27550 with a field DT_{90} of 435 days, a long-term/reproduction study is required.

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

Since the DT_{90} in soil for diazinon is <100 days, additional studies on soil macro-organisms are not required according to the Guidance Document on Terrestrial Ecotoxicology (SANCO/10329/2002). In case of the more persistent metabolite G 27550 (field DT_{90} of 435 days) the toxicity to other soil macro-organisms needs to be addressed, preferably with studies on Collembola and soil mites.

5.7. RISK TO SOIL NON-TARGET MICRO-ORGANISMS

Diazinon (Basudin®) (considered as equivalent to the lead formulation by the RMS) had no significant effect on soil respiration and nitrogen transformation in a 28- day study at a concentration equivalent to an application rate of 60 kg a.s./ha. No study is available with the metabolite G 27550. It can however be assumed that this metabolite was present in the study with diazinon given the high application rate and that peak levels were detected after 21 days in the aerobic soil degradation study and 60% of the applied amount was present as the metabolite after 7 days.

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

Diazinon technical was tested for its effects on seed germination, seedling emergence and vegetative vigour with 10 species at an application rate over ten times the intended. No effects >50% were observed. Non-target plants outside the treated field will be contaminated by drift only, hence exposure will be much lower and no adverse effects are expected.

5.9. RISK TO BIOLOGICAL METHODS OF SEWAGE TREATMENT

Data from a test with technical diazinon on inhibition of respiratory activity of micro-organisms in sewage sludge is available. The results indicate that diazinon will pose a low risk to biological methods of sewage treatment at concentration predicted for surface water.

6. Residue definitions

Soil

Definitions for risk assessment: diazinon, G 27550[20]

[20] G 27550: 2-isopropyl-4-methyl-6-hydroxpyrimidine

Definitions for monitoring: At least diazinon. An identified data gap for ecotoxicological information for G 27550 needs to be filled before a proposal can be finalised.

Water

Ground water
Definitions for exposure assessment: diazinon, G 27550 and GS 31144[21]
Definitions for monitoring: diazinon

Surface water
Definitions for risk assessment: surface water: diazinon and G 27550
sediment: diazinon and G 27550
Definitions for monitoring: diazinon

Air
Definitions for risk assessment: diazinon
Definitions for monitoring: diazinon

Food of plant origin
Definitions for risk assessment: diazinon (raw commodities); sum of diazinon and desethyl diazinon expressed as diazinon (processed commodities)
Definitions for monitoring: diazinon

Food of animal origin
Definitions for risk assessment: diazinon
Definitions for monitoring: diazinon

[21] GS 31144: 2-(1-hydroxy-1-methyl)-ethyl-4-methyl-6-hydroxpyrimidine

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

Soil

Compound (name and/or code)	Persistence	Ecotoxicology
Ddiazinon	Low to moderate persistence Single first order DT_{50} 3.8-23 days (20°C -10kPa soil moisture) Single first order DT_{50} 7.5-29.3 days (German field studies)	See 5.5 – 5.7
G 27550	High persistence Single first order DT_{50} 124-131 days (20°C -10kPa soil moisture)	The chronic risk to earthworms and other soil non-target organisms needs to be addressed.

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
Diazinon	Medium to low mobility K_{foc} 413-760 mL/g	Satisfactory modelling not available but probably no.	Yes	Relevant	Relevant

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**
G 27550	Very high mobility K_{foc} 6.3-6.7 mL/g	Satisfactory modelling not available but based on the available modelling with too favourable input parameters concentrations>0.75µg/L at all 9 FOCUS scenarios	No	Not relevant	Not relevant
GS 31144	Very high mobility K_{foc} 10.2 mL/g	Satisfactory modelling not available but based on the available modelling with too favourable input parameters concentrations>0.1µg/L at 6 out of 9 FOCUS scenarios. Based on current information it cannot be excluded that concentrations are >0.75µg/L	No	Not relevant	Not relevant

Surface water and sediment

Compound (name and/or code)	**Ecotoxicology**
Diazinon	See section 5.2
G 27550	Low toxicity to fish, Daphnids and algae

Air

Compound (name and/or code)	**Toxicology**
Diazinon	Not acutely toxic, 28-day NOAEL <0.00005 mg/L

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

- For significant non-relevant impurities in the technical material the specificity of the analytical method must be demonstrated (data gap identified by EPCO 35, September 2005; date of submission unknown; refer to section 1).
- Independent laboratory validation for the method of analysis of residues in pome fruit (data gap identified in the DAR; date of submission unknown; refer to section 1).
- Further validation data for the air method at 35ºC and 80 % RH (data requirement identified by EPCO 35 September 2005; date of submission unknown; refer to section 1).
- Shelf life study to include analysis of TEPP and diazoxon (data gap identified by EFSA March 2006; date of submission unknown; refer to section 1).
- Technical specification to include the relevant impurities TEPP and diazoxon (data gap identified by EFSA March 2006; date of submission unknown; refer to section 1).
- Validated methods of analysis for the relevant impurities TEPP and diazoxon in the formulation (data gap identified EFSA March 2006; date of submission unknown; refer to section 1)
- Spectra of the relevant impurities TEPP and diazoxon (data gap identified EFSA March 2006; date of submission unknown; refer to section 1).
- As the impurities of concern were not analysed in the toxicological/ecotoxicological batches, the need of further tests with the current technical material should be considered in order to confirm a maximum level for the relevant impurities in the technical material (data gap identified after the experts' meeting by EFSA; date of submission unknown; refer to sections 2 and 5).
- Due to the fact that the predicted air concentration was greater than concentrations at which effects were seen in repeat dose studies, the notifier is required to address potential risk to bystanders through inhalation exposure (data gap identified by EPCO 33 September 2005; date of submission unknown; refer to point 2.12).
- FOCUS groundwater modelling is required using the substance input parameters listed in section 4.2.2, for the use on sugar beet (data gap identified by EPCO 31, September 2005; submission date unknown; refer to point 4.2.2).
- The acute, short and long term risk to insectivorous birds need to be further addressed (relevant for the use in sugar beet; submission date unknown; refer to point 5.1)
- The long-term risk to insectivorous mammals needs to be further addressed (relevant for all representative uses; submission date unknown; refer to point 5.1)
- The risk to earthworm-eating mammals needs to be further addressed (relevant for all representative uses; submission date unknown; refer to point 5.1)
- Recovery of Cladocerans within 8 weeks in the mesocosm study should be confirmed with graphical presentation of data (relevant for all representative uses; submission date unknown; refer to point 5.2)
- The risk to non-target arthropods off-field and the potential for recolonisation and recovery needs to be further addressed (relevant for the use in orchards; submission date unknown; refer to point 5.4)

- A long-term/reproduction study with earthworm is required for the metabolite G 27550 with a laboratory DT_{90} of 435 days (relevant for all representative uses, data gap identified by EFSA; no submission date proposed by the applicant; refer to point 5.5)
- The risk to other soil macro-organism from the soil metabolite G 27550 needs to be addressed, preferably with studies on collembolan and soil mites (relevant for all representative uses; data gap identified by EFSA; submission date unknown; refer to point 5.6)

Requirements as far as identified for the uses withdrawn by the applicant for the EU peer review process (i.e. with respect to Annex I inclusion)

- One balance study and 3 follow up studies about the processing of apples, with analysis of diazinon and desethyl diazinon in raw apples and processed commodities, in case processing factors would be necessary/useful for refining the risk assessment (relevant for representative use on apples, data gap identified by EPCO 34, September 2005; refer to point 3.1.1).
- PEC soil modelling is required using calculated accumulated concentrations from applications in successive years for the soil metabolite 2-isopropyl-4-methyl-6-hydroxpyrimidine (G 27550) for the uses on pome fruit (data gap identified by EFSA; refer to point 4.1.2).
- FOCUS groundwater modelling is required using the substance input parameters listed in section 4.2.2, for the uses on pome fruit (data gap identified by EFSA; the applicant has stated these uses are no longer supported; refer to point 4.2.2).
- The risk to earthworm-eating birds needs to be further addressed (relevant for the use in orchards; no submission date proposed by the applicant; refer to point 5.1)
- The risk to fish-eating birds needs to be further addressed (relevant for the use in orchards; submission date unknown; refer to point 5.1).
- The risk to non-target arthropods off-field and the potential for recolonisation and recovery needs to be further addressed (relevant for the use in orchards; submission date unknown; refer to point 5.4).

Conclusions and Recommendations

Overall conclusions

The conclusion was reached on the basis of the evaluation of the representative uses in Southern Europe as an insecticide and acaricide as proposed by the applicant with application via orchard air blast sprayers and tractor mounted hydraulic sprayers. Application is made to apples and pears with a maximum total dose of 2.7 kg diazinon per hectare and to sugar beet with a maximum total dose of 0.72 kg diazinon per hectare. It should be noted that the use in apples and pears were withdrawn during the EU peer review process. The representative formulated product for the evaluation was Diazol 60 EC, an emulsifiable concentrate (EC), registered under different trade names in Europe.

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. However, it should be noted that full validation of the method of analysis for food commodities is not available as no independent laboratory validation data are available. As well as this further validation data are required for the method of analysis for air.
Some 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. There are still some outstanding data gaps for the relevant impurities.

Acute toxicity during oral exposure is higher than by dermal application or inhalation. Therefore the proposed classification is Xn; R22 "Harmful if swallowed". The main effect observed during short term or long term exposure is the inhibition of acetyl cholinesterase activity. Based on this, the relevant oral short term NOAEL is 0.02 mg/kg bw/day in the dog studies.
There is no genotoxic potential for diazinon, no carcinogenic effect in rats and mice, and no reproductive or developmental toxicity in rats and rabbits. No delayed neurotoxicity was observed in hens, and the NOAEL in the subchronic neurotoxicity study with rats is the same as the short term NOAEL, based on acetyl cholinesterase inhibition. The groundwater metabolites G 27550 and GS 31144 are not considered toxicologically significant, having no phosphate group susceptible to produce acetyl cholinesterase inhibition. They were concluded not relevant. The three impurities TEPP, O,S-TEP and S,S-TEPP were very toxic in acute oral studies and considered of toxicological concern. Acute and subchronic human studies with diazinon were submitted, but were either not acceptable, or had scientific deficiencies.
The Acceptable Daily Intake (ADI) and Acceptable Operator Exposure Level (AOEL) is 0.0002 mg/kg bw/day and the Acute Reference Dose (ARfD) is 0.025 mg/kg bw, with the use of the safety factor 100. For the supported use on sugar beets, the estimated operator exposure according to the German or the UK models is largely above the AOEL, with or without the use of personal protective equipment (PPE) (2700% of the AOEL with the use of PPE and respiratory protective equipment (RPE) according to the German model).

The metabolism of diazinon in plants is clearly elucidated. The degradation pathway proceeds first through hydrolysis of the phosphorothioate ester link, leading to metabolite G 27550 (2-isopropyl-4-methyl-6-hydroxypyrimidine), which given its chemical structure has no cholinesterase activity. This compound is further hydroxylated and conjugated to glucose. Diazoxon is not observed. The amount of metabolites in comparison to the parent level is variable from crop to crop, but the residue definition can be restricted to parent compound only for monitoring and risk assessment as no other compound expected to add a contribution to the toxicological effects of diazinon was identified. Supervised residue trials were conducted suggesting the setting of a MRL at 0.5 mg/kg in pome fruits, and indicating that residues in sugar beet roots are below 0.01 mg/kg. No residues are expected in following crops and no plant-back restriction is needed.
Processing of apples leads to a clear reduction of the diazinon levels in juice and sauce. However, the formation of a degradation product (desethyl diazinon), identified under specific hydrolysis

conditions, was not investigated in practical conditions. This compound is recommended for inclusion in the residue definition for risk assessment in processed commodities.
The metabolism of diazinon in livestock has been investigated and parent compound was found to be the major compound of toxicological relevance in animal tissues. Diazinon exhibits a lipophilic behaviour. Two metabolites, diazoxon and a hydroxylated form of diazinon were also present. The residue definition in animal commodities can be restricted to diazinon on the basis of the representative uses considered in this peer-review, leading to a low livestock dietary exposure and non significant transfer of residues to animal tissues, as demonstrated by feeding studies.
The short and long term exposure assessments were conducted and indicated potential exceedences of the ADI and ARfD, which in some cases appear to be severe, in particular for infants and toddlers, with high consumption levels of pome fruits.

With the exception of the groundwater exposure assessment, the available information on the fate and behaviour of diazinon in the environment is considered sufficient to complete an appropriate EU level environmental exposure assessment for the applied for use on sugar beet. With the available data it cannot be excluded that the soil metabolite G 27550 might accumulate in soil if applications were made to the same field in consecutive years. The available surface water exposure assessment just considered the spray drift route of entry to surface water. The potential exposure of surface water with parent diazinon and its major soil metabolite G 27550 via the drainage and runoff routes of entry has not been assessed in the available EU level exposure assessment. Member States should therefore carry out a surface water exposure and consequent aquatic risk assessment for diazinon and G 27550 from the runoff and drainage routes of exposure to surface water at the national level, should diazinon be included in Annex 1.
Appropriate FOCUS groundwater modelling is not available. This is a data gap. Even taking into account the available groundwater modelling that used too favourable input parameters, it is clear the soil metabolites G 27550 and GS 31144 have the potential to leach to groundwater under vulnerable situations above the trigger of 0.1µg/L and therefore required non relevance assessments. These assessments confirmed both metabolites were not relevant.

A high acute, short and long term risk for insectivorous birds was identified in the first tier assessment for both evaluated uses. Based on actual measured concentrations of diazinon and degradation of residues in orchards the short and long term risk in apples/pears is considered low. However, the high acute risk remains. For sugar beet no valid residue data are available to refine the assessment. A high long term risk to insectivorous mammals was identified in both sugar beet and orchards. A risk for secondary poisoning was identified for earthworm- and fish-eating birds and mammals for the use in orchards and for earthworm-eating mammals for the use in sugar beet. Diazinon is very toxic to aquatic organisms. Risk mitigation measures comparable to 30 m buffer zones are required in orchards, and to 5 m in sugar beet. The toxicity to bees is high. Sugar beet is however not attractive to bees and application in orchards is late in the season after flowering. The risk to bees is therefore considered to be low. Non-target arthropods outside the field would be affected from the treatment in orchards. A potential for recolonisation has been shown in an aged residue study. However, a prerequisite for recolonisation from off-field non-target arthropod populations is that off-field populations are not affected. Therefore the risk to off-field non-target arthropods needs to be further addressed for the use in orchards. The acute risk to earthworms from diazinon and the soil metabolites is low and long term studies are not considered necessary. However, the risk to earthworms and other soil macro-organisms from the more persistent metabolite G 27550 needs to be addressed for a full conclusion. The risk to soil micro-organisms, non-target plants and biological methods of sewage treatment is considered to be low.

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

- Risk mitigation measures comparable to 5 and 30 m buffer zones are required for the use in sugar beet and orchards, respectively, in order to protect aquatic organism.

Critical areas of concern

- There is no data available to demonstrate that levels of TEPP and diazoxon are not increasing on storage of the formulation and data gaps have been identified for methods of analysis in the formulation and spectra for these relevant impurities.
- Very toxic impurities (see 2.8 and 5) have not been analysed in the toxicological/ecotoxicological batches. Thus, a maximum level for these impurities cannot be set from a toxicological or ecotoxicological point of view in the technical material.
- The operator, worker and bystander exposure estimates are above the AOEL, with or without personal protective equipment, according to both German (2,700 and 44,145% of the AOEL) and UK (13,710 and 88,500% of the AOEL) models, for the supported use on sugar beets.
- A first tier acute, short and long term risk to insectivorous birds was identified for the use in sugar beet.
- A long term risk to insectivorous mammals was identified for the use in sugar beet as well as orchards.
- A risk for secondary poisoning of earthworm-eating mammals in sugar beet.
- Diazinon is very toxic for aquatic organisms. Risk mitigation measures comparable to 5 and 30 m buffer zones are required for the use in sugar beet and orchards respectively.

Critical areas of concern as far as identified for the uses withdrawn by the applicant for the EU peer review process (i.e. with respect to Annex I inclusion)

- Chronic and short term dietary exposures of consumer resulting from the representative use in pome fruits exceed the ADI and ARfD of diazinon.
- An acute risk to insectivorous birds in orchards was identified based on measured residues.
- A risk for secondary poisoning of earthworm-eating birds and mammals was identified for the use in orchards.
- A risk for secondary poisoning of fish-eating birds was identified for the use in orchards.
- A risk to non-target arthropods 10 m outside the treated field was identified for the use in orchards.

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) ‡	Diazinon
Function (e.g. fungicide)	Insecticide, acaricide, nematicide

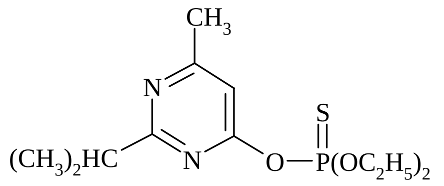
Rapporteur Member State	Portugal
Co-rapporteur Member State	--

Identity (Annex IIA, point 1)

Chemical name (IUPAC) ‡	O,O-diethyl O-(2-isopropyl-6-methylpyrimidin-4-yl)phosphorothioate
Chemical name (CA) ‡	O,O-diethyl O-[6-methyl-2-(1-methylethyl)-4-pyrimidinyl] phosphorothioate
CIPAC No ‡	15
CAS No ‡	333-41-5
EEC No (EINECS or ELINCS) ‡	206-373-8
FAO Specification ‡ (including year of publication)	AGP: CP/223 (1988): Diazinon: 950 g/kg ± 25 g/kg (without stabilizer) the minimum content including the stabilizer is calculated as 830 g/kg. O,S-TEPP[22]: max 0.2 g/kg S,S-TEPP[23]: max 2.5 g/kg Water: max 0.6 g/kg Acetone insolubles: max 1.5g/kg
Minimum purity of the active substance as manufactured ‡ (g/kg)	950g /kg (without stabiliser) 880 g/kg (with stabilizer
Identity of relevant impurities (of toxicological, environmental and/or other significance) in the active substance as manufactured (g/kg)	O,S-TEPP, S,S-TEPP, TEPP[24] and diazoxon. No conclusion on the maximum acceptable level has been made.
Molecular formula ‡	$C_{12} H_{21} N_2 O_3 P S$
Molecular mass ‡	304.3 g/mol

[22] O,S-TEP: O,O,O,O-tetraethyl-thiopyrophosphate
[23] S,S-TEPP: O,O,O,O-tetraethyl-dithiopyrophosphate
[24] TEPP: tetraethyl pyrophosphate

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

Structural formula ‡	

Physical-chemical properties (Annex IIA, point 2)

Melting point (state purity) ‡	Freezing point < -25ºC (993 g/kg)
Boiling point (state purity) ‡	Not relevant
Temperature of decomposition	140ºC
Appearance (state purity) ‡	Pale yellow liquid with organic phosphate odour (993 g/kg and 960 g/kg)
Relative density (state purity) ‡	1.11 (984 g/kg) 1.11 (963.9 g/kg)
Surface tension	49.5 mN/m (90% saturated solution.; 20ºC)
Vapour pressure (in Pa, state temperature) ‡	1.197×10^{-2} (25ºC)
Henry's law constant (Pa m^3 mol^{-1}) ‡	6.1×10^{-2}
Solubility in water ‡ (g/L or mg/L, state temperature)	pH 6: 0.060 g/L (22ºC) solubility in water is not pH dependent
Solubility in organic solvents ‡ (in g/L or mg/L, state temperature)	> 900 g/100 mL in n-hexane, toluene, acetone, ethyl acetate, carbon tetrachloride, methanol, acetonitrile and n-octanol (25ºC) > 250 g/L ethyl acetate (20ºC)
Partition co-efficient (log POW) ‡ (state pH and temperature)	pH_unbuffered_____: 3.69 (24ºC) 3.86 (estimation) not pH dependent
Hydrolytic stability (DT_{50}) ‡ (state pH and temperature)	pH___5___: 12 days at 25ºC
	pH___7___: 138 days at 25ºC
	pH___9___: 77 days at 25ºC
Dissociation constant ‡	pKa: 2.60
UV/VIS absorption (max.) ‡ (if absorption > 290 nm state ε at wavelength)	ε max = 4050 $L.cm^{-1}.mol^{-1}$ at λ = 246 nm ε = 20.859 $L.cm^{-1}.mol^{-1}$ at λ = 290 nm
Photostability (DT_{50}) ‡ (aqueous, sunlight, state pH)	DT_{50} = 50 days (600h) at pH 7
Quantum yield of direct phototransformation in water at λ > 290 nm ‡	$\Phi \leq 0.3$
Flammability ‡	Not flammable
Explosive properties ‡	Not explosive

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

List of representative uses evaluated*

Crop and/or situation (a)	Member State or Country	Product name	F G or I (b)	Pests or Group of pests controlled (c)	Formulation		Application				Application rate per treatment			PHI (days) (l)	Remarks: (m)
					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 as/hL min max	water L/ha min max	kg as/ha min max		
Apples	Greece Italy Portugal Spain	Diazol 60 EC	F	Insects and mites	EC	600g/L	Airblast sprayer	Late season (summer)	3	14 +/- 2	0.06	1200-1500	0.72-0.9	15 +/- 1	[1] [2] [3] [4] [5}
Pear	Greece Italy Portugal Spain	Diazol 60 EC	F	Insects and mites	EC	600g/L	Airblast sprayer	Late season (summer)	3	14 +/- 2	0.06	1200-1500	0.72-0.9	15 +/- 1	[1] [2] [3] [4] [5}
Sugar beet	Greece Italy Portugal Spain	Diazol 60 EC	F	Insects and mites	EC	600g/L	Tractor boom	Late season (summer)	2	15 +/- 2	0.06 - 0.07	500-600	0.36	15 +/- 1	[2] [3] [4]

[1] Acute and long term dietary exposures of consumers exceed the ARfD and the ADI.
[2] Groundwater exposure assessment could not be finalised.
[3] Estimated operator/worker/bystander exposures are above the AOEL.
[4] A high risk to birds and mammals
[5] The risk assessment was not completed since the applicant does not further support this use for review at EU-level.

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

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
	(c)	*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)	a) GLC-FID b) CIPAC MT 15/TC/M3
Impurities in technical as (principle of method)	GLC–FID and GLC–NPD Specifity needs to be demonstrated for impurities ≥ 0.1%
Plant protection product (principle of method)	a) HPLC-UV b) CIPAC MT 15/TC/M3

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) MRM (PAM AG-550A) – GLC-NPD/FPD LOQ 0.01 mg/kg (various crops) b) MRM (BS EN 12393:1999) – GLC-MS/FPD LOQ 0.01 mg/kg (various crops) c) HPLC-MS – LOQ 0.01 mg/kg (apples, pears, sugar beet) (ILV is missing)
Food/feed of animal origin (principle of method and LOQ for methods for monitoring purposes)	MRM (PAM AG-550A) – GLC-NPD/FPD LOQ 0.005 mg/kg (meat, liver, kidney) LOQ 0.01 mg/kg (beef fat, milk, eggs)
Soil (principle of method and LOQ)	HPLC–MS/MS – LOQ 0.05 mg/kg
Water (principle of method and LOQ)	a) MRM (US Geological Survey) – GLC-MS LOQ 0.1 µg/L (surface water and ground water) b) MRM (UK/UE standardisation method) – GLC-MS LOQ 0.002 µg/L (surface water and ground c) GLC-NPD – LOQ 0.1 µg/L (potable water)
Air (principle of method and LOQ)	GC-FPD – LOQ 0.07 µg/m^3 *Data gap for validation data at 35ºC and RH=80% conditions.*
Body fluids and tissues (principle of method and LOQ)	Not relevant

Classification and proposed labelling (Annex IIA, point 10)

with regard to physical/chemical data	Not classified

‡ 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 ‡	>90% within 24 h (based on amount in urine) (rat, 11 or 104 mg/kg bw)
Distribution ‡	Widely distributed but low levels; highest residues in RBC, fat and ovaries
Potential for accumulation ‡	No evidence of accumulation
Rate and extent of excretion ‡	>90 % after 24 h; mainly via urine (rat, 11 and 104 mg/kg bw)
Metabolism in animals ‡	Extensive metabolism. Mainly by hydrolytic and oxidative cleavage of the phosphorus ester bond. 5 identified metabolites, 2 major ones found in urine: G 27550 (M1) and GS 31144 (M2). Conjugation to glucuronides leading probably to 6 aqueous soluble metabolites.
Toxicologically significant compounds ‡ (animals, plants and environment)	Diazinon Impurities TEPP; O,S-TEPP; S,S-TEPP; diazoxon

Acute toxicity (Annex IIA, point 5.2)

Rat LD_{50} oral ‡	1139 mg/kg bw **Xn, R22**
Rat LD_{50} dermal ‡	> 2000 mg/kg bw
Rat LC_{50} inhalation ‡	> 5.0 mg/L/4h
Skin irritation ‡	Non-irritant
Eye irritation ‡	Non-irritant
Skin sensitization ‡ (test method used and result)	Non-sensitiser (Buehler)

Short term toxicity (Annex IIA, point 5.3)

Target / critical effect ‡	Inhibition of RBC and brain ChE in all species	
Lowest relevant oral NOAEL / NOEL ‡	90d & 1y dog:	0.02 mg/kg bw/d
Lowest relevant dermal NOAEL / NOEL ‡	21d rabbit:	5 mg/kg bw/d
Lowest relevant inhalation NOAEL / NOEL ‡	21d rat:	< 0.00005 mg/L

Genotoxicity ‡ (Annex IIA, point 5.4)

……………………………………………	No genotoxic potential

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

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

Target/critical effect ‡	Inhibition of RBC and brain ChE
Lowest relevant NOAEL / NOEL ‡	2y rat: 0.06 mg/kg bw/d
Carcinogenicity ‡	No carcinogenic potential

Reproductive toxicity (Annex IIA, point 5.6)

Reproduction target / critical effect ‡	Mortality and reduction in body weight gain in pups at parental toxic doses; no reproductive toxicity.
Lowest relevant reproductive NOAEL / NOEL‡	7 mg/kg bw/d, reproduction 0.65 mg/kg bw/d, parental and pup development
Developmental target / critical effect ‡	No developmental effects at maternal toxic doses in rats and rabbits.
Lowest relevant developmental NOAEL / NOEL ‡	Rat: 20 mg/kg bw/d, maternal and developmental

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

Acute neurotoxicity (3 studies, rat)	1) NOEL for RBC cholinesterase inhibition 2.5 mg/kg bw 2) NOEL for neurotoxicity 2.5 mg/kg bw/day 3) overall NOAEL 2.5 mg/kg bw/day
Subchronic neurotoxicity (rat)	90-day NOAEL 0.017 mg/kg bw/day
Delayed neurotoxicity (hens)	No delayed neurotoxicity.

Other toxicological studies ‡ (Annex IIA, point 5.8)

Impurities	Acute oral, rats TEPP: LD_{50}(overall) 0.8 mg/kg bw Acute oral, rats O,S-TEPP: LD_{50} (F) 0.46 mg/kg bw Acute oral, rats S,S-TEPP: LD_{50} (M,F) 4.1 mg/kg bw

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

Metabolites	G 27550[25] (M1) and GS 31144[26] (M2), identified as groundwater metabolites, are formed in significant levels in rats (38% and 17% respectively in urine) M1: rat LC_{50} >5.32 mg/L 5-week rat NOEL <20 mg/kg bw/d M1 and M2: no phosphate group, no potential inhibition of acetylcholinesterase activity

Medical data ‡ (Annex IIA, point 5.9)

……………………………………………	General symptoms and signs of poisoning are typical of acetylcholinesterase inhibition. No data on manufacturing plant personnel were submitted

Summary (Annex IIA, point 5.10)	Value	Study	Safety factor
ADI ‡	0.0002 mg/kg bw/d	Dog, 90d & 1y	100
AOEL ‡	0.0002 mg/kg bw/d	Dog, 90d & 1y	100
ARfD ‡ (acute reference dose)	0.025 mg/kg bw	Rat, acute oral, acute AChE inhibition, & acute neurotoxicity	100

Dermal absorption (Annex IIIA, point 7.3)

Diazol 60 EC	*in vitro* human/rat: 1.7% (concentrate) 40% (dilution, corrected for poor recovery)

[25] G 27550: 2-isopropyl-4-methyl-6-hydroxpyrimidine
[26] GS 31144: 2-(1-hydroxy-1-methyl)-ethyl-4-methyl-6-hydroxpyrimidine

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

Acceptable exposure scenarios (including method of calculation)

Operator	Use on sugar beet, 360 g a.s./ha, min 500 L/ha, with tractor mounted application[27] UK model: no PPE 88,500; with PPE 13,710% of AOEL German model: no PPE 44,145; with PPE+RPE 2,700% of AOEL
Workers	Use on sugar beets: no PPE 353; with PPE 108.5% of AOEL
Bystanders	Use on sugar beets: 126.5% of AOEL

Classification and proposed labelling (Annex IIA, point 10)

with regard to toxicological data	Xn; Harmful R22 Harmful if swallowed

[27] Values from the use on apples and pears have been calculated by the RMS but not discussed by the experts since this use was not supported any more (see section 2.12 of the conclusion).

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	Fruits (apples), pulses (green beans), cereals (sweet corn), leaf vegetables (lettuce), root and tuber (potatoes)
Rotational crops	Lettuce, turnips, wheat
Plant residue definition for monitoring	Diazinon
Plant residue definition for risk assessment	Diazinon (raw commodities) ; sum of diazinon and desethyl diazinon (processed commodities)
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	Goats and hens
Animal residue definition for monitoring	Diazinon
Animal residue definition for risk assessment	Diazinon (to be reconsidered for inclusion of diazoxon and CGA 14128[28]) in case of higher animal exposure)
Conversion factor (monitoring to risk assessment)	None
Metabolism in rat and ruminant similar (yes/no)	Yes
Fat soluble residue: (yes/no)	Yes

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

………………………………...…………	No residues above LOQ expected

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

……………………………………………..	Stable in beet roots and leaves for 3 months; corn grain, tomatoes, potatoes, apples and lettuce, for at least 26 months; and in refined corn oil, sugar beet molasses, soybeans (dry-beans) and tomato paste for at least 30 months. For strawberries a significant decline was observed after 3 months.

[28] CGA 14128: *O,O*-diethyl-*O*-(2-[2-hydroxy-2-isopropyl]-6-methyl-4-pyrimidyl)phosphorothioate

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

	Ruminant:	Poultry:	Pig:
	Conditions of requirement of feeding studies		
Expected intakes by livestock ≥ 0.1 mg/kg diet (dry weight basis) (yes/no - If yes, specify the level)	Yes (dairy cattle: 0.1 mg/kg and beef cattle: 0.3 mg/kg)	No	Yes (0.1 mg/kg)
Potential for accumulation (yes/no):	No	No	No
Metabolism studies indicate potential level of residues ≥ 0.01 mg/kg in edible tissues (yes/no)	No	No	No
	Feeding studies in lactating cow (exposure rate: 40 mg/kg diet, dry weight basis, overdosing factor : 2 orders of magnitude) Residue levels in matrices : Mean (max) mg/kg		
Muscle	< 0.01 mg/kg	No study required	No study required
Liver	< 0.01 mg/kg		
Kidney	< 0.01 mg/kg		
Fat	0.02-0.04 mg/kg		
Milk	< 0.01 mg/kg		
Eggs			

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

Crop	Northern or Mediterranean Region	Trials results relevant to the critical GAP (mg diazinon/kg) (a)	Recommendation /comments	MRL	STMR (b)
Apples/pears	S	0.03, 0.05, 0.09, 0.1, 0.14, 0.16, 0.18, 0.4		0.5	0.12
Sugar beet	S	Root 4x<0.01; tops/leaves 0.02, 2x 0.04, 0.06		Not applicable	Not applicable

(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	0.0002 mg/kg bw/day
IEDI (European Diet) (% ADI)	51.3%
NEDI (% ADI)	84.8% (Portuguese diet) 51,3 % (WHO Standard European diet) > 100% for all consumption groups (PSD model-high consumption levels (97,5% percentile): Adults: 150%; Toddlers: 900%.
Factors included in NEDI	STMR, no processing factors
ARfD	0.025 mg/kg bw
NESTI (% ARfD)	HR, variability factor of 7: 157% for infant (apples; PSD model) 123% for toddler (pears; PSD model) Proposed MRL, variability factor of 7: 196% for infant (apples; PSD model) 153% for toddler (pears; PSD model)

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

Crop/processed crop	Number of studies	Transfer factor**	% Transference *
apple /juice - fresh	1	0.02	Not calculated
apple/juice-canned	1	0.01	
apple/slices-canned	1	0.01	
apple sauce	1	0.01	

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

** These figures must be considered as purely indicative and provisional as they rely on only one study. In addition they cannot be used for risk assessment as desethyl diazinon was not analyzed in that study

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

Pome fruit :	0.5 mg/kg
Animal products (except poultry)	0.01* mg/kg (fat soluble residue)

* LOQ

‡ 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 ‡	5.8% - 86% AR at 76-119 d (^{14}C-2nd position pyrimidine ring)
Non-extractable residues after 100 days ‡	9-38% AR at 76-119 d (^{14}C-2nd position pyrimidine ring)
Relevant metabolites - name and/or code, % of applied ‡ (range and maximum)	G 27550[1] - max. 49-81.8% AR at 14-65 d

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

Anaerobic degradation ‡	Degradation pathway similar to the pathway under aerobic conditions. Mineralisation: 0.2% AR after 59 d Non-extractable residues: 25.1% AR after 59 d Metabolites: G 27550 – max. 47.2%AR CO_2 after 59 d (^{14}C-2nd position pyrimidine ring)
Soil photolysis ‡	Mineralisation: Non-extractable residues: 25.8% - 34.3% AR after 35.5 hr Metabolites: G 27550 – max. 64% AR after 4 d (^{14}C-2nd position pyrimidine ring)

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

Method of calculation	1st order kinetics
Laboratory studies ‡ (range or median, with n value, with r2 value)	Parent DT_{50}lab (20ºC, aerobic): 8-23 d (r2 = 0.98-0.99n=4) G 27550 DT_{50}lab (20ºC, aerobic): 124d-131d (n=3, r2 = 0.99) GS 31144 DT_{50}lab (20ºC, aerobic): 159d, 179d (n=2, r2 = 0.99) For FOCUS modelling at FOCUS reference conditions (-10kPa), 1st order kinetics Parent (aerobic,): geometric mean = 9.1d G 27550 (aerobic,): geometric mean = 126.3 d GS 31144 (aerobic,): longest = 179 d

[1] G 27550: 2-isopropyl-4-methyl-6-hydroxpyrimidine

	Parent DT_{90}lab (20°C, aerobic): 27-76d G 27550 DT_{90}lab (20ºC, aerobic): 412d-435d (n=3) GS 31144 DT_{90}lab (20ºC, aerobic): 528d, 594d (n=2,)
	DT_{50}lab (10°C, aerobic): 13.8d, 21-35d, 112d (study) DT_{90}lab (10ºC, aerobic): 46-372d,
	DT_{50}lab (20°C, anaerobic): 24d, n = 1 DT_{90}lab (20°C, anaerobic,): 79d, n=1
	degradation in the saturated zone ‡: No data submitted not required
Field studies ‡ (state location, range or median with n value)	DT_{50f}: ‡ Germany, bare soil: 7.5-29.3d, (n = 4, r^2 = 0.92-0.98), 1st order kinetics
	DT_{90f}: ‡ Germany, bare soil: 24.9-97d, (n = 4,), 1st order kinetics
Soil accumulation and plateau concentration ‡	Not required for parent diazinon. Identified data gap for major metabolite G 27550 for uses where application could occur in consecutive years.

Soil adsorption/desorption (Annex IIA, point 7.1.2)

Kf /Koc ‡ Kd ‡ pH dependence (yes / no) (if yes type of dependence) ‡	K_{foc} (a.s.): 700, 700, 413, 760 dm^3/kg; mean Koc: 643 dm^3/kg (1/n = 0.82 – 0.90 mean 0.86, 4 soils) K_f (a.s): 1.4, 4.2, 3.3, 7.6 dm^3/kg K_{foc} (G 27550): 6.7, 6.3dm^3/kg; lowest Koc: 6.3 dm^3/kg (1/n = 0.86, 2 soils) K_f (G 27550): 0.13, 0.18 dm^3/kg K_{doc} GS 31144[2] 10.2 dm^3/kg QSAR estimate no pH dependence

[2] GS 31144: 2-(1-hydroxy-1-methyl)-ethyl-4-methyl-6-hydroxpyrimidine

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

Column leaching ‡	Guideline: US EPA, section 163-1 Guideline Precipitation: 2317ml (total) Leachate:6.04 – 81.25%AR 0.12 – 2.84% a.s.; 5.28 – 71.82% G 27550 Soil: 0.62 – 58.86%AR retained in top 2.5cm Diazinon can leach in soil as function of organic matter and clay content.
Aged residues leaching ‡	Guideline: US EPA , section 163-1 Guideline Aged for (d): 30 days, 4 soil types Precipitation (mm): 508 mm Leachate: 44.6 – 55.7%AR 1.2 – 2.2% a.s.; 41.6 – 51.1% G 27550 Soil: 5.8 – 15.9%AR retained in top 0 - 6cm
Lysimeter/ field leaching studies ‡	Location: 3 year lysimeter study on sandy soil, in Germany. Study Type: lysimeter The lysimeters were cultivated with sugar beet, winter wheat and in the last year with summer rape and winter barley. Number of applications: 3 years, lysimeter 5 one in the 1st and 2nd year - total of two applic., lysimeter 6 one applic. in the 1st year. Application rate: 4 x 240 g/ha/yr. when ca. 70% crop interception occurred. Calculated as 4N compared to the applied for use on sugar beet. Precipitation/irrigation (in mm/mm): 1st year 446/475.8 2nd year 511/371 3rd year 597/226.5 Leachate (mean n=2 in litres): 1st year 219 2nd year 197 3rd year 275 Diazinon was not detected in leachates of the 1st or 3rd years. It was detected in one leachate of the second year with a resulting annual average concentration of 0.07 µg/L.

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

	Average annual Leachate: %radioactivity in Leachate (maximum/year): 1st year: 0.38% G 27550 (lysim. 6); 0.10% GS 31144 (lysim. 6) 2nd year: 0.11% G 27550 (lysim. 6); 0.04% GS 31144 (lysim. 5) 3rd year: 0.0% µg/L G 27550 (lysim. 5 and 6); 0.02% GS 31144 (lysim. 6) Peak annual average concentrations: 1st year: 1.02 µg/L G 27550 (lysim. 6); 0.27 µg/L GS 31144 (lysim. 6) 2nd year: 0.36 µg/L G 27550 (lysim. 6); 0.26 µg/L GS 31144 (lysim. 5) 3rd year: 0.01 µg/L G 27550 (lysim. 5 and 6); 0.07 µg/L GS 31144 (lysim. 6)

PEC (soil) (Annex IIIA, point 9.1.3)

Parent

Method of calculation	First order kinetics, DT_{50} a.s. = 23 days (lab)
Application rate	Crop: apples/pears and sugar beet % plant interception: apples/pears – 80%; sugar beet – 90% Number of applic. and applic. rate: apples/pears – 3 x 900g/ha; sugar beet – 2 x 360g/ha Interval (d): apples/pears – 12 days; sugar beet – 13 days

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

PEC(s) (mg/kg)		Apples/Pears Single application		Apples/Pears Multiple application	
		Actual	Time weighted average	Actual	Time weighted average
Initial		0.239	-	0.524	-
Short term	24h	0.232	0.236	0.508	0.516
	2d	0.225	0.232	0.493	0.508
	4d	0.212	0.226	0.464	0.493
	7d	0.194	0.216	0.424	0.472
	14d	0.157	0.195	0.343	0.427
	28d	0.103	0.162	0.225	0.354
	50d	0.052	0.124	0.116	0.270
	100d	0.012	0.076	0.026	0.165

PEC(s) (mg/kg)		Sugar beet Single application		Sugar beet Multiple application	
		Actual	Time weighted average	Actual	Time weighted average
Initial		0.048	-	0.080	-
Short term	24h	0.046	0.047	0.078	0.079
	2d	0.045	0.046	0.076	0.078
	4d	0.042	0.045	0.071	0.076
	7d	0.039	0.043	0.065	0.073
	14d	0.031	0.039	0.053	0.066
	28d	0.021	0.032	0.035	0.054
	50d	0.011	0.025	0.018	0.042
	100d	0.002	0.015	0.004	0.025

Metabolite – G 27550

Method of calculation	First order kinetics, DT_{50} a.s. = 131 days (lab)
Application rate	Crop: apples/pears and sugar beet % plant interception: apples/pears – 80%; sugar beet – 90% Number of applic. and applic. rate: apples/pears – 3 x 900g/ha; sugar beet – 2 x

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

360g/ha Interval (d): apples/pears – 12 days; sugar beet – 13 days G 27550 is formed at a maximum of 81.8% after 21 days

PEC$_{(s)}$ (mg/kg)	Sugar beet Single application		Sugar beet Multiple application	
	Actual	Time weighted average	Actual	Time weighted average
Initial = 21d after last applic.	0.020	-	0.033	-
21 + 24h	0.019	0.020	0.033	0.033
21 + 2d	0.019	0.019	0.032	0.033
21 + 4d	0.019	0.019	0.032	0.032
21 + 7d	0.019	0.019	0.032	0.032
21 + 14d	0.018	0.019	0.030	0.032
21 + 28d	0.017	0.018	0.028	0.031
21 + 50d	0.015	0.017	0.025	0.029
21 + 100d	0.012	0.015	0.019	0.025

PEC$_{(s)}$ (mg/kg)	Apples/Pears Single application		Apples/Pears Multiple application	
	Actual	Time weighted average	Actual	Time weighted average
Initial	0.098	-	0.214	-
21 + 24h	0.097	0.098	0.213	0.213
21 + 2d	0.097	0.097	0.211	0.213
21 + 4d	0.096	0.097	0.209	0.211
21 + 7d	0.094	0.096	0.206	0.209
21 + 14d	0.091	0.094	0.198	0.206
21 + 28d	0.084	0.091	0.184	0.199
21 + 50d	0.075	0.086	0.164	0.188
21 + 100d	0.058	0.076	0.126	0.166

Note: data gap identified for an accumulated PEC for apples / pears from applications in consecutive years to be calculated as DT$_{90}$ G 27550 is 435 days

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

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)	pH 5, Tº 25ºC: DT_{50} (a.s.) = 12d G 27550 is hydrolytically stable
	pH 7, Tº 25ºC: no significant hydrolysis: DT_{50} (a.s.)= 138d G 27550 is hydrolytically stable
	pH 9, Tº 25ºC: no significant hydrolysis: DT_{50} (a.s.) = 77d G 27550 is hydrolytically stable
Photolytic degradation of active substance and relevant metabolites ‡	Natural light: DT_{50} = 50d (Latitude 39º 25'N; Longitude 77º 24'W) assuming a 12 hour day length G 27550 is photolytically stable
Readily biodegradable (yes/no)	No
Degradation in water/sediment DT_{50} water ‡ DT_{90} water ‡ DT_{50} whole system ‡ DT_{90} whole system ‡	Dissipation from water (a.s.) = 3.9 – 4.7d (1st order kinetics, r^2=0.98 – 0.99) G 27550 = 87d (1st order kinetics, r^2=0.93) (a.s.) = 13.0 – 15.7d G 27550 = 288d (a.s.) = 8.9 – 11.8d (1st order kinetics, r^2=0.99) G 27550 = 65d (1st order kinetics, r^2=0.97) (a.s.) = 29.7 – 39.3d G 27550 = 217d
Mineralization	Max. 5.1% CO_2 (after 100 days, end of the study, n=2)
Non-extractable residues	Max. 48.8% (after 100 days, end of the study, n=2)
Distribution in water / sediment systems (active substance) ‡	Maximum of 37.8 – 42% AR (after 3 days) in sediment, DT_{50} in sediment 11.6 – 15.2d DT_{90} = 38.6 – 50.5d
Distribution in water / sediment systems (metabolites) ‡	Max. Water: 20.2 – 47.0%AR (after 30 days) max. sediment: 17.4 - 22.7%AR (after 30 days) DT_{50} sed.=49d (1st order kinetics, r^2=0.83) DT_{90} sed.=163d

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

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

Parent

Application rate	Apples/pears: 0.900 kg a.s./ha, 3 appl., 12 days interval between appl., 11.01% drift at 3 m distance; single appl., 15.73%drift at 3m. Sugar beet: 0.360 kg a.s./ha, 2 appl., 13 days interval between appl., 2.38% drift at 1 m distance; single appl., 2.77%drift at 1m.
Main routes of entry	Drift

PEC(sw) (µg / L)		Apples/Pears Single application		Apples/Pears Multiple application	
		Actual	Time weighted average	Actual	Time weighted average
Initial		47.190	-	39.616	-
Short term	24h	40.719	43.875	34.184	36.833
	2d	35.136	40.867	29.497	34.308
	4d	26.161	35.648	21.962	29.926
Long term	7d	16.808	29.430	14.110	24.707
	14d	5.986	19.956	5.026	16.753
	28d	0.759	11.244	0.638	9.439
	42d	0.096	7.603	0.081	6.383

Initial PECsw for a single application with 0.54% drift at 30m 1.62µg/L

PEC(sw) (µg / L)		Sugar beet Single application		Sugar beet Multiple application	
		Actual	Time weighted average	Actual	Time weighted average
Initial		3.324	-	3.276	-
Short term	24h	2.868	3.091	2.827	3.046
	2d	2.475	2.879	2.439	2.837
	4d	1.843	2.511	1.816	2.475
Long term	7d	1.184	2.073	1.167	2.043
	14d	0.422	1.406	0.416	1.385
	28d	0.053	0.792	0.053	0.781
	42d	0.007	0.536	0.007	0.528

Initial PECsw for a single application with 0.57% drift at 5m 0.68µg/L

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

Metabolite – G 27550

Method of calculation	First order kinetics, $DT_{50water}$ = 87 days
Application rate	Apples/pears: 0.900 kg a.s./ha, 3 appl., 12 days interval between appl., 11.01% drift at 3 m distance; single appl., 15.73%drift at 3m. Sugar beet: 0.360 kg a.s./ha, 2 appl., 13 days interval between appl., 2.38% drift at 1 m distance; single appl., 2.77%drift at 1m. G 27550 is formed at a maximum of 47% after 30 days
Main routes of entry	Drift

PEC$_{(sw)}$ (µg / L)	Sugar beet Single application		Sugar beet Multiple application	
	Actual	Time weighted average	Actual	Time weighted average
Initial = 30d after last applic.	0.785	-	1.282	-
30 + 24h	0.779	0.782	1.272	1.277
30 + 2d	0.773	0.779	1.262	1.272
30 + 4d	0.760	0.773	1.242	1.262
30 + 7d	0.742	0.764	1.212	1.247
30 + 14d	0.702	0.743	1.147	1.213
30 + 28d	0.628	0.704	1.026	1.149
30 + 42d	0.562	0.667	0.917	1.090

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

PEC (sediment)

Parent

Method of calculation	Method used according to 'Guidance document on aquatic ecotoxicity' (European Commission, working document, Sanco/3268/2001. Highest levels of diazinon (42%AR) and G 27550 (22.7%AR) were found in sediment occurred after three days for a.s. and 30 days for G 27550. The highest exposure of sediment to diazinon should therefore occur 3 days after last application and for G 27550 occur 30 days after exposure. PECsed was determined with the two different values of Bulk density 0.8 g/m^3 and 1.3 g/m^3. For apples, pears and sugar beet drift from 3, 10, 30 and 40 meter distance were used. DT_{50} (a.s.) = 15.2d (1st order kinetics) DT_{50}(G 27550) = 49d (1st order kinetics)
Application rate	Apples and pears: 900 g a.s./ha, 3 applications. Sugar beet: 360 g a.s/ha, 2 applications.

PEC$_{(sed)}$ (mg / kg) (Bulk density = 1.3 g/m^3) Distance (m)	Parent		G 27550	
	3 days after 1 application	3 days after final application*	3 days after 1 application	3 days after final application*
Apples and pears				
3	0.0915	0.1225	0.0057	0.0101
10	0.0209	0.0297	-	-
30	0.0031	0.0040	-	-
40	0.0019	0.0023	-	-
Sugar beet				
3	0.0064	0.0086	0.0004	0.0006
10	0.0007	0.0009	-	-
30	0.0002	0.0003	-	-
40	0.0002	0.0002	-	-

*For pome fruit this is the third application and the second application for sugar beet

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

$PEC_{(sed)}$ (mg / kg) (Bulk density = 0.8 g/m^3)	**Parent**		**G 27550**	
	3 days after 1 application	3 days after final application*	3 days after 1 application	3 days after final application*
Distance (m)	Apples and pears			
3	0.1487	0.1991	0.0092	0.0164
10	0.0340	0.0483	-	-
30	0.0050	0.0065	-	-
40	0.0031	0.0037	-	-
	Sugar beet			
3	0.0104	0.0140	0.0007	0.0010
10	0.0011	0.0015	-	-
30	0.0003	0.0005	-	-
40	0.0003	0.0003	-	-

*For pome fruit this is the third application and the second application for sugar beet

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

Method of calculation and type of study (e.g. modelling, monitoring, lysimeter)	Acceptable simulations not available, data required
Application rate	Acceptable simulations not available, data required
PEC(gw)	
Maximum concentration	Acceptable simulations not available, data required
Average annual concentration (Results quoted for modelling with FOCUS gw scenarios, according to FOCUS guidance)	Acceptable simulations not available, data required

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

Direct photolysis in air ‡	No data submitted
Quantum yield of direct phototransformation	Quantum yield ≤ 0.3 (a.s.)
Photochemical oxidative degradation in air ‡	DT_{50} (a.s.) = 1.3 hours Computer program “ Atmospheric Oxidation Program Version 1.88” - ref. Syraccuse Reserch Corporation Merrill Lane - Syracuse New York 13210 USA) assuming an atmospheric OH concentration of 1.5×10^6 radicles/cm^3.
Volatilization ‡	From plant surfaces: ‡ (BBA Guideline): 49.6% (after 24h)

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

	from soil: ‡ 10.4% (sandy soil) in the initial 24 hours 3.0% (silty loam soil) in the initial 24 hours
	from plants and soil: 23.6% in the initial 24 hours
	from water: no data

PEC (air)

Method of calculation	Agreed assumptions and calculation method not available. Therefore it was not possible to agree an EU endpoint

PEC$_{(a)}$

Maximum concentration	Air residues will occur. An EU agreed endpoint is not available. Such a level is not necessary to conclude on the risk to operators workers and bystanders.

Definition of the Residue (Annex IIA, point 7.3)

Relevant to the environment	<u>Definitions for risk assessment:</u> Soil surface water and sediment: diazinon and G 27550 Groundwater: diazinon, G 27550 and GS 31144 Air: diazinon <u>Definitions for monitoring</u> Air, surface water sediment and groundwater: Diazinon Soil definition cannot be finalised due to an identified ecotoxicology data gap.

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

Soil (indicate location and type of study)	Not available

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

Surface water (indicate location and type of study)	Pond water in US, Pennsylvania: max. of 113.0 µg/L after 6 applic. of diazinon at an applic. rate of 3.36 kg/ha. Surface water in USA: from rivers Mississippi, Colorado, Columbia and Rio Grande. Maximum level of Diazinon (1995-1997) 0.102 ppb, mean of all stations 0.001-0.009 ppb. Majority of levels were ≅ 0.001 ppb. (*ca* 74%)
Ground water (indicate location and type of study)	Raw water monitoring – wells and water stations around Switzerland. All levels of diazinon and G 27550 <0.05µg/dm^3.
Air (indicate location and type of study)	--

Classification and proposed labelling (Annex IIA, point 10)

with regard to fate and behaviour data	Potential for R53 – May cause long-term adverse effects to the aquatic environment

‡ 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 ‡	Rat LD_{50} = 1129 mg/kg bw/day
Acute toxicity to birds ‡	14-Day LD_{50} = 1.44 mg a.s./kg (Mallard Duck) 7-Day LD_{50} = 3.9 mg 60EC form./kg (Peking Duck)
Dietary toxicity to birds ‡	8-Day LC_{50} = 8 mg a.s./kg bw/day (Mallard Duck)
Reproductive toxicity to birds ‡	NOEL = 1.2 mg/kg bw/day (Mallard Duck)
Reproductive toxicity to mammals ‡	NOEC = 0.65 mg/kg bw/day (rat)

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

Application rate (kg as/ha)	Crop	Category (*e.g.* insectivorous bird)	Time-scale	TER	Annex VI Trigger
0.360	Sugar beet	Insectivorous bird (passerines)	Acute	**0.07**	10
			Short-term	**0.74**	5
			Long-term	**0.11**	5
		Insectivorous mammal	Acute	355	10
			Long term	**0.56**	5
0.900	Apples/Pears	Insectivorous bird (passerines)	Acute	**0.03**	10
			Short-term	**1.29**	5
			Long-term	**0.04**	5
		Insectivorous mammal	Acute	142	10
			Long term	**0.22**	5

Revised Toxicity/exposure ratios for terrestrial vertebrates with residues from field trials in orchards (Annex IIIA, points 10.1 and 10.3)

Application rate (kg as/ha)	Crop	Category (*e.g.* insectivorous bird)	Time-scale	TER Higher Tier	Annex VI Trigger
0.900	Apples/Pears	Insectivorous bird (passerines)	Acute	**6.8**	10
			Short-term	38	5
			Long-term	6	5

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

Risk of secondary poisoning to earthworm eating birds and mammals (Annex IIIA, points 10.1 and 10.3)

	Orchards	Sugar-beet
PECsoil (mg/kg)	0.387	0.059
PECworm(mg/kg)	0.627	0.096
Daily dose (mg as/kg bw/day) for birds	0.690	0.106
Daily dose (mg as/kg bw/day) for mammals	0.878	0.134
NOEL birds mammals	 1.2 0.65	 1.2 0.65
TERlt birds mammals	 **1.74** **0.74**	 11.32 **4.9**

Risk of secondary poisoning to fish eating birds and mammals (Annex IIIA, points 10.1 and 10.3)

	Orchards	Sugar-beet
PECsoil (mg/kg)	0.012	0.001
PECfish(mg/kg)	6	0.5
Daily dose (mg as/kg bw/day) for birds	1.26	0.105
Daily dose (mg as/kg bw/day) for mammals	0.78	0.065
NOEL birds mammals	 1.2 0.65	 1.2 0.65
TERlt birds mammals	 **0.95** **0.82**	 11.43 10

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

Group	Test substance	Time-scale	Endpoint	Toxicity (mg/L)
Laboratory tests ‡				
‡Rainbow trout	Diazinon tech.	96 hours	96-hr LC_{50} 96-hr NOEC	3.1 0.7
Bluegill sunfish	Diazinon tech.	96 hours	96-hr LC_{50} 96-hr NOEC	0.27 < 0.1

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

Group	Test substance	Time-scale	Endpoint	Toxicity (mg/L)
‡Rainbow trout	G 27550 (environmental degradate)	96 hours	96-hr LC_{50} 96-hr NOEC	>100 58
‡Rainbow trout	G31144 (environmental degradate)	96 hours	96-hr LC_{50} 96-hr NOEC	>100 100
‡Fathead minnow	Diazinon tech.	34 days	34-d NOEC (larval growth)	0.092
‡Daphnia	Diazinon tech.	48 hours	48-hr EC_{50} NOEC	0.00096 0.00056
‡Cerodaphnids	Diazinon tech.	48 hours	48-hr EC_{50} NOEC	0.00041 0.00008
‡*Mysidopsis bahia*	Diazinon tech.	96 hours	96-hr EC_{50} NOEC	0.0042 0.0027
‡*Crassostrea virginica*	Diazinon tech.	96 hours	96-hr EC_{50} NOEC	0.880 0.210
‡Daphnia	G 27550 (environmental degradate)	48 hours	48-hr EC_{50}	>100
‡Daphnia	G 31144 (environmental degradate)	48 hours	48-hr EC_{50}	>100
‡Daphnia	Diazol 60 EC	48 hours	48-hr EC_{50} NOEC	0.0014 0.00094
‡Daphnia	Diazinon tech.	21 days	21-d NOEC	0.00017
‡Algae	Diazinon tech.	7 days	7-d EC_{50}	6.4
‡Algae	G 27550 (environmental degradate)	72 hours	72-hr EbC_{50}	>100
‡Algae	G31144 (environmental degradate)	72 hours	72-hr EbC_{50} $NOEbC_{50}$	>100 =100

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

Microcosm or mesocosm tests				
Group	Test substance	Time-scale	Endpoint	Toxicity (mg/L)
Mesocosm 6 applications over a six week period simulating spray drift and runoff	Diazinon AG 500	6 months	NOAEAC	0.0024*
Microcosm 3 applications with 7 days interval	Diazinon	84 days	LOEC NOEC	0.002 < 0.002

* provisional value pending confirmation of time and scale of recovery as agreed in EPCO 32, September 2005

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

Application rate (kg as/ha)	Crop	Organism	Time-scale	Distance (m)	TER		Annex VI Trigger
					a.s.	G 27550	
1 x 900 g/ha	Apples/Pears	Rainbow trout	acute	10	287	> 19380	100
		Bluegill sunfish	acute	30	167	> 100	100
		Fathead minnow	chronic	10	35.8	-	10
		Daphnia	acute	40	**1.0**	> 142857	100
		Daphnia	chronic	40	**0.567**	-	10
		S. capricornutum	acute	3	136	> 4699	100
1 x 360 g/ha	Sugar beet	Rainbow trout	acute	1	934	> 78125	100
		Bluegill sunfish	acute	5	397	> 100	100
		Fathead minnow	chronic	1	116	-	10
		Daphnia	acute	10	**2.74**	> 400000	100
		Daphnia	chronic	10	**1.545**	-	10
		S. capricornutum	acute	1	1928	> 78125	100

Higher tier evaluations

Study type	End point	Value (µg a.s./L)	PEC_{SW} (µg a.s./L)	Higher Tier TER
Microcosm/ Mesocosm study: Recovery studies	NOAEAC	2.4	Sugar beet 1m: 3.3 Sugar beet 5 m: 0.683	0.72 3.5
			Apples/pears: 1m: 47.19 Apples/pears: 30m: 1.62	0.05 1.5

Appropriate risk mitigation should be considered at member state level (acceptability of TER pending confirmation of time and scale of recovery)

Bioconcentration

Bioconcentration factor (BCF) ‡	500
Annex VI Trigger:for the bioconcentration factor	Log Pow = 3.3 – 3.81 (trigger value: Log Pow > 3.0) BCF = 100
Clearance time (CT_{50}) (CT_{90})	1 – 3 days 14 days
Level of residues (%) in organisms after the 14 day depuration phase	≤ 1%

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

Acute oral toxicity ‡	48-hr LD_{50} = 0.09 µg as/bee 48-hr LD_{50} = 0.13 µg as/bee (DIAZOL 60 EC)
Acute contact toxicity ‡	48-hr LD_{50} = 0.13 µg as/bee 48-hr LD_{50} = 0.63 µg as/bee (DIAZOL 60 EC)

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

Application rate (kg as/ha)	Crop	Route	Hazard quotient		Annex VI Trigger
			a.s.	EC	
Laboratory tests					
0.36	Sugarbeet	Oral Contact	4000 2769	2769 571	≥ 50
0.9	Apples/Pears	Oral Contact	10000 6923	6923 1429	

Field or semi-field tests
The effects on bees of residues on crops was been addressed (Gray, 2005) and residues of Diazol 60 EC applied at 468 g a.s./ha (appl. rate equivalent to the appl. rate applied in sugar beet) have no effect on foraging bees immediately after application. Residues of Diazol 60 EC applied at 1170 g a.s./ha (appl. rate equivalent to the appl. rate applied in apples/pears) are toxic to foraging bees immediately after application but not when aged by three days.

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

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

Species	Stage	Test Substance	Dose (kg a.s./ha)	Endpoint	Effect	Escort II Trigger
Laboratory tests						
‡*Aphidius rhopalosiphi*	adult	Diazol 60 EC	0.012 to 1.0	Laboratory study	LR_{50} = 811 g as/ha in 200L/ha	50%
‡*Aphidius rhopalosiphi*	adult	Diazol 60 EC	2.67 to 1170	Extended laboratory study Mortality 48 hr: all rates Fecundity:	**0DAT** **0%** effects on mortality and fecundity for applied rates between 2.67 and 42.12 g a.s./ha in 400 L/ha. **100%** effects on survival and fecundity for applied rates higher than 42.12 g a.s./ha. **14DAT** no effects on survival and fecundity till dose 184.04 g a.s./ha. **28DAT** no effects on survival and fecundity at all doses.	50%
‡*Typhlodromus pyri*	adult	Diazol 60EC	50 to 800	Laboratory study	LR_{50} = 0.153 g a.s./ha in 200L/ha	50%
	Proto-nymphs		2.67 to 1170	Extended laboratory study Mortality all application rates: Fecundity:	**0DAT and 14DAT** no effects on survival and fecundity for rates between 2.67 and 468 g a.s./ha in 400 L/ha. **At 1170 g as/ha** 0DAT Diazol 60 EC had 45.26% effect on the survival and 41% effect on the fecundity**.** 14DAT no effect on survival and fecundity was observed.	50%

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

Species	Stage	Test Substance	Dose (kg a.s./ha)	Endpoint	Effect	Escort II Trigger
‡*Chrysoper-la carnea*	larvae	Diazol 60 EC	2.67 to 1170	Extended laboratory study Mortality all rates: Fecundity control and all except top rate: 1170 g a.s./ha:	No effects at any rate within 28 old residues DAT **0DAT** no effects on survival and fecundity at 2.67 g as/ha; At 12.96 till 184.04 g as/ha no effects on fecundity were observed. % of mortality was 28.52%, 12.12 and 60.6%, respectively for 12.95, 92.12 and 184.04 g a.s./ha.. **28DAT** no effects on fecundity for doses until 468 g a.s./ha; At 2.67 till 468 g a.s./ha % of mortality between 2.5% and 7.5**%;** At 1170 g a.s./ha 5.13**%** mortality. At 1170 g a.s./ha. 35% reduction in eggs laid but no effect on viability	50%
‡*Aleochara bilineata*		Diazol 60 EC	2.67 to 468	Extended laboratory study Fecundity:	No significant effects of fresh, 15 and 36 day aged residues on fecundity at rates up to 184 g a.s./ha. After 36 days ageing, no significant effects were observed on fecundity at 468 g a.s./ha.	50%

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

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

A. rhopalosiphi (Lab.)			*T. pyri* (Lab.)		
Dose (g as/ha)	% mortality	Fecundity % reduction	Dose (g a.s./ha)	% mortality	Fecundity % reduction
0.012	2.63	52.5	50	5.48	No effects
0.037	21.05	48.3	100	0	
0.11	-2.63	36.5	200	0	
0.33	78.95	-	400	5.48	
1.0	100	-	800	49.32	

HQ values

Suger beet					
Species	dose	MAF	LR_{50} (g a.s./ha)	HQ	Trigger
A. rhopalosiphi	360 g a.s./ha	1.3	0.153	**3059**	< 2
T. pyri			811	0.58	< 2
Orchards					
A. rhopalosiphi	900 g a.s./ha	1.3	0.153	**7647**	< 2
T. pyri			811	1.44	< 2

Field or semi-field tests
No data submitted.

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

Acute toxicity ‡	Diazinon: LC_{50}: 65 mg/kg (14 day), NOEL 6.15 mg/kg (toxicity values were corrected for organic matter content of the soil) G 27550: LC_{50} >1000ppm (14 day), NOEC 556 ppm GS 31144: LC_{50} >1000ppm (14 day), NOEC 1000 ppm
Reproductive toxicity ‡	No data submitted. Not required

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

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

Application rate (kg as/ha)	Crop	Time-scale	TER	Annex VI Trigger
2 x 360	Sugar beet	Acute	124[a]	10
3 x 900	Apples/pears	Acute	812.5[a]	10

a) Toxicity value was corrected for organic matter content of the soil

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

Nitrogen mineralization ‡	No effects at rates up to 80 mg a.s./kg (28 day)
Carbon mineralization ‡	No effects at rates up to 80 mg a.s./kg (28 day)

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

Seed germination test (diazinon)	No effects >50% on 10 species tested at 11.2 kg a.s./ha
Seedling emergence test (diazinon)	No effects >50% on 10 species tested at 11.2 kg a.s./ha
Vegetative vigour test (diazinon)	No effects >50% on 9 out of 10 species tested at 11.2 kg a.s./ha

Classification and proposed labelling (Annex IIA, point 10)

with regard to ecotoxicological data	N Harmful to the environment R50/R53 Very toxic to aquatic organisms, may cause long term-adverse effects in the aquatic environment

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